Application System/400™

LY21-0597-2

System Support: Diagnostic Aids (Volume 1)

Third Edition (August 1990)

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About This Manual

This volume and volume 2 of this major revision makes obsolete LY21-0597-1.

The primary purpose of this manual is to provide reference information about error logs, dumps, traces, and other service tools and procedures needed to determine, isolate, and solve programming problems occurring with the OS/400 and vertical licensed internal code (VLIC), and other hardware and software failures. Also, information about problem management, resource and configuration management, and IPL phases of the AS/400 is provided.

The information in this manual is primarily intended to help solve service problems that occur after normal problem analysis and resolution procedures fail.

This manual may refer to products that are announced but not currently available, or products that had not been announced when this manual was printed. IBM makes no commitment to provide any unannounced products referred to herein. The final decision to announce any product is based on IBM's business and technical judgment.

This manual follows the convention that *he* means *he* or *she*.

This manual contains examples of displays that are illustrated as completely as possible; however, they may vary from those that you actually use.

References to includes throughout this manual does not imply that IBM intends to make these available. Contact your next level of support if more assistance is necessary for solving the problems that relate to those includes not shown in this manual or that are not available to you.

Any use of the word microcode or reference to microcode in this manual is for ease of communication only and is intended to mean licensed internal code (LIC) on the AS/400.

The 3422/3430 and 3480/3490 tape units attach to the AS/400 system through a System/370 type multiplexer channel operation in block multiplex mode.

The 3422/3430 and 3480/3490 tape unit attachment uses only the multiplexer channel functions necessary to attach the 3422/3430 and 3480/3490 tape units.

The System/370 type sequences are specifically for the 3422/3430 and 3480/3490 tape units. Therefore, the attachment of other System/370 devices is not valid.

Who Should Use This Manual

This manual is intended to be used primarily by programming service representatives, service providers, or those persons who help solve and diagnose problems, and submit authorized program analysis reports (APARs) or licensed internal code trouble reports (LICTRs).

What You Should Know

You should be familiar with the information contained in the:

- *System Operations: Operator's Guide*
- *CL Reference* manual
- *System Concepts* manual
- *Work Management Guide*
- *Key to Service—Software* manual (available in the United States only)

before using this manual. Also, you should know how to provide fixes for AS/400 licensed internal code and software by diagnosing, isolating, reporting, and resolving problems, making required adjustments, and verifying fixes using the AS/400 maintenance package.

Throughout this manual, the term AS/400 system applies to the 9406 System Unit, the 9404 System Unit, and the AS/400 9402 System Unit.

How This Manual Is Organized

This manual is split in two volumes. This volume has the following parts:

- Part 1. Problem Management Strategy and Procedures
- Part 2. Resource and Configuration Management
- Part 3. AS/400 Service Tools
- Part 4. AS/400 Logs, Dumps, and Traces
- Part 5. IPL and Install Information
- Part 6. General OS/400 Information
- Part 7. General Licensed Internal Code Information
- Part 8. General Internal Mircoprogramming Instructions (IMPI) Information
- Part 9. Appendixes

The second volume contains trace points for the licensed internal code and the major and minor codes for the VLIC log (VLOG).

Part 1. Problem Management Strategy and Procedures

- Chapter 1 contains general information about AS/400 problem management.
- Chapter 2 contains information about the following:

- Problem analysis that includes problem determination and isolation that takes place when a problem is first encountered
- Problem resolution that includes repairing, circumventing, and reporting the problem once a problem has been analyzed

- Chapter 3 contains internal and external symptoms needed to isolate and identify problems.
- Chapter 4 contains:
  - A list of product components and component descriptions.
  - Information needed to isolate and solve problems by component.
- Chapter 5 contains information about diagnostic procedures to solve other licensed internal code and programming problems by loadable code groups.
- Chapter 6 contains information about the following:
  - Creating and submitting authorized program analysis reports (APAR) and licensed internal code trouble reports (LICTR)
  - How to write an APAR or LICTR abstract
  - APAR or LICTR closing and severity codes

Part 2. Resource and Configuration Management

- Chapter 7 contains general information about managing and configuring system resources.
- Chapter 8 contains general information about managing and configuring DASD.
- Chapter 9 contains general information about system upgrades.
- Chapter 10 contains information about how to interpret the resource configuration record.

Part 3. AS/400 Service Tools

- Chapter 11 contains information about the system's problem handling functions. These include:
  - Question-and-answer
  - Copy Screen Image
  - Online problem analysis and resolution
- Chapter 12 contains information about System Service Tools (SST).
- Chapter 13 contains information about Dedicated Service Tools (DST).
- Chapter 14 contains information about the following:
  - Control panel functions, lights, switches, and displays
  - How to initial program load (IPL) the system before and during power-on and for normal and abnormal shutdowns

Part 4. AS/400 Logs, Dumps, and Traces

- Chapter 15 describes the job, error, history, and problem logs.
- Chapter 16 describes how to use and interpret the IOP dump and main storage dumps.
- Chapter 17 describes how to use and interpret the:
  - Trace intersystem communications function (TRCICF)
  - Trace job information (TRCJOB)
  - Trace vertical licensed internal code (VLIC).

Part 5. IPL and Install Information

- Chapter 18 explains the IPL phases beginning with the service processor phase and ending with the VLIC and OS/400 initialization phase.
- Chapter 19 contains information about how the system uses a console during all of the different IPLs.
- Chapter 20 describes the install communications object (ICO) and how to display and print it.
- Chapter 21 describes the start OS/400 data object (QWCSCPF) and how to locate and print it. This chapter also lists the IPL termination codes.

Part 6. General OS/400 Information

- Chapter 22 describes how to identify a job, objects that make up a job, and job status.
- Chapter 23 describes how to debug, add breakpoints, and when to use the OS/400 Program Debug function.
- Chapter 24 lists events that are signaled or handled by OS/400.
- Chapter 25 lists the OS/400 object types and subtypes used by OS/400.
- Chapter 26 contains OS/400 trace points.

Part 7. General Licensed Internal Code Information

- Chapter 27 describes tasks and processes and how to find and identify a task.
- Chapter 28 introduces source/sink.
- Chapter 29 contains VLIC program exceptions and causes.
- Chapter 30 describes the VLIC trace points.
- Chapter 31 describes the VLIC log (VLOG) entries.

Part 8. General Internal Mircoprogramming Instructions (IMPI) Information

- Chapter 32 contains information about IMPI registers and processors.
- Chapter 33 contains the supervisor linkage (SVL) router table.
- Chapter 34 describes the machine check log buffer (MCLB).

Part 9. Appendixes

- Appendix A contains completion codes for DST, SST, and OS/400.
- Appendix B contains a list of AS/400 preassigned addresses.
- Appendix C describes VLIC and OS/400 system reference codes and provides procedures for analyzing and solving problems by their unit reference code.
- Appendix D contains a list of VLIC exception codes (or machine and function checks) that appear at the work station.
- Appendix E contains a list of VLIC SRCs and exception codes (or machine and function checks) in order by their number.

In the back of this volume is a glossary of terms and abbreviations and an index. Use the glossary to find the meaning of an unfamiliar term or abbreviation. Use the index to look up a topic and to see on which pages the topic is covered.

How This Manual Has Changed

Changes since the previous edition of the manual are indicated by a vertical line to the left of the change.

Related Online Information

The following online information is available on the AS/400 system. After pressing the Help key on any menu, you can press the Help key a second time to see an explanation of how the online information works, including the index search function. You can press either the Help key or F1 for help.

Help for Displays

You can press the Help key on any display to see information about the display. There are two types of help available:

Contextual
Extended

Contextual help explains the field on which the cursor is positioned when you press the Help key. For example, it describes the choices available for a prompt. If a system message appears at the bottom of the display, position the cursor on the message and press the Help key to see information about the cause of the message and the appropriate action to take.

Extended help explains the purpose of the display. Extended help appears if you press the Help key when the cursor is outside the areas for which contextual help is available, or if you press F2 (Extended help) when you are looking at the contextual help. Extended help is available only when you are not using SST, DST, PAR, or other service functions.

To exit the online information, press F3 (Exit). You return to the display on which you pressed the Help key.

Index Search

Index search allows you to specify words or phrases that identify the information that you want to see. To use index search, press the Help key, then press F11 (Search index). You can also use index search by entering the Start Index Search (STRIDXSCH) command on any command line or by selecting option 2 on the User Support menu.

To access index search for AS/400 languages that have it available, you must be using source entry utility (SEU) to edit source statements. When the cursor is in the data entry area, press Help and the F11 (Search index). To access index search for Application Development Tools (ADT) when you are using SEU, make sure you cursor is not in the data area, press Help, and then F11 (Search index).

For more information about index search, see page 11-14.

Help for Control Language Commands

To see prompts for parameters for a control language command, type the command, then press F4 (Prompt) instead of the Enter key. To see extended help for the command, type the command and press the Help key. You can see contextual help for CL commands also.

Online Education

AS/400 online education provides training on a wide variety of topics. To use the online education, select option 10 (User support and education) from the main menu or press F13 (User support) on any system menu to show the User Support and Education menu. Then select the option to use online education.

Question-and-Answer Function

The question-and-answer (Q & A) function provides answers to questions you may have about using the AS/400 system. To use the Q & A function, press F13 (User support) on any system menu to show the User Support and Education menu. Then select the option to use the question-and-answer function. You can also use the question-and-answer function by entering the Start Question and Answer (STRQST) command on any command line. For more information about Q & A, see page 11-15.

Related Printed Information

The manuals below are listed with their full title and base order number. When these manuals are referred to in this manual, a shortened version of the title is used.

To use this manual effectively, you may need to refer to other publications for more specific information about a particular topic. For a list of all AS/400 publications, see the *Information Directory*, GC21-9678. The directory gives guidance on how, when, and where to use the online and printed information. For example, the *CL Reference* is listed in the *Information Directory*, GC21-9678. The *CL Reference* contains a detailed description about all the CL commands used in this manual.

See the applicable *Analyzing Problems Guide* for your system to begin problem analysis. The *Analyzing Problems Guide* directs you to other problem handling tools, as necessary. The *Analyzing Problems Guide* helps determine if the system is operational. If the system is not operational (for example, it will not power on or will not perform an initial program load), follow the steps in the *Analyzing Problems Guide* to correct the problem. If the customer has filled out the *Problem Summary Form*, the form may assist you in identifying and correcting the problem.

The following IBM manuals are service related:

- *System Support: Analyzing Problems Guide — AS/400* 9402*, SY31-9074,
  System Support: Analyzing Problems Guide — 9404, SY31-9064 and the
  System Support: Analyzing Problems Guide — 9406, SY31-9063

  These guides are the starting point for all problems. Answering applicable questions in these guides send you to the appropriate place for solving the problem you are working on. You can use these manuals to begin:

  - Analyzing problems with or without a system reference code (SRC)
  - Analyzing initial program load (IPL) problems
  - Analyzing power problems
  - Copy main storage dump from disk to tape or diskette
  - Do a main storage dump
  - Perform error recovery procedures for dump problems

- *System Support: Processor I/O Card Unit Service Guide — 9406*, SY31-9067,
  System Support: Unit Reference Code Guide — 9404, SY31-9062 and the
  System Support: Unit Reference Code Guide — 9406, SY31-9061

  These guides point out the initial list of field replaceable units (FRUs) in the unit reference code (URC). If you are not familiar with the service libary, it is recommended that you do not start with these guides to start solving problems. You can use these guides to:

  - Find a reference code by subsystem
  - Find part numbers for a failing FRU
  - Determine probable cause percent of failure
  - Find a description of a reference code
  - Begin problem recovery action

- *System Support: Service Guide — AS/400* 9402*, SY31-9075,
  System Support: Service Guide — 9404, SY31-9051 and the
  System Support: Service Guide — 9406, SY31-0683

  These guides provide problem isolation procedures (PIPs) that isolate the final FRUs from the initial FRU list. You can use these guides to:

  - Isolate a problem
  - Remove and install FRUs
  - Perform disk recovery procedures
  - Complete a safety inspection

- *AS/400 System Support: Diagnostic Aids Addendum*, ZW82-9335[1]

  This manual shows some key includes. Contact your next level of support if more assistance is necessary for solving the problems that relate to those includes not shown in this manual or that are not available to you.

Some other manuals you may want to refer to are:

- *AS/400, System/36, System/38 Key to Service—Software*, GA21-9992 (available in the United States only)

  This manual describes how the National Service Division (NSD) supports software for the AS/400, System/36, and System/38.

- *System Operations: Operator's Guide*, SC21-8082

[1] Object Code Only (OCO)—IBM Confidential Restricted.

This guide provides you with information about how to use the system unit operator display, send and receive messages, respond to error messages, start and stop the system, use control devices, work with program temporary fixes (PTFs) and process and manage jobs on the system.

- *System Operations: Systems Management Utilities User's Guide*, SC21-8201

  This guide provides information about the commands and functions available when you install the AS/400 System Management Utilities on one or more AS/400 systems in a network. This publication also provides setup procedures information when planning for and maintaining a network of Application System/400 systems.

- *System Concepts*, GC21-9802

  This manual describes the overall design and use of the AS/400 system and its operating system. This manual includes general information about AS/400 features such as user interface, object, work, and system management, data management, database, communications, environments, Office and PC Support, system support and recovery, and an overview of the system architecture.

- *Programming: Work Management Guide*, SC21-8078

  This guide provides information about how to create and change a work management environment. Other topics include:

  – A description of tuning the system
  – Collecting performance data including information on record formats and contents of the data being collected
  – Working with system values to control or change the overall operation of the system
  – A description of how to gather data to determine who is using the system and what resources are being used

- *System Upgrade Guide — 9404*, SA21-9919 and *System Upgrade Guide — 9406 (Volume 1)*, SA21-9906

  These guides provide information about adding feature equipment, memory cards, devices and racks, and model upgrades.

- *System Installation and Upgrade Guide — 9406*, SY31-0700

  This guide provides help information for the customized instructions printed for an initial install or a system upgrade. It also provides instructions to on how to load and run the System Upgrade Program (SUP) to get the customized instructions for a system upgrade.

- *Device Configuration Guide*, SC21-8106

  This guide provides information about how to do an initial configuration and how to change that configuration. This manual also contains conceptual information about device configuration. This manual includes the following information.

  – Configuration terminology (lines, controllers, and devices)
  – Other conceptual configuration information that helps you understand what configuration is and how it works on the AS/400 system
  – Information on automatic configuration
  – Task information needed to do an initial configuration
  – Task information needed to change a configuration to suit the system needs
  – Task information needed to do local configuration, including configuring ASCII devices
  – Unique double-byte character set (DBCS) configuration information (as a separate appendix)

- *Licensed Programs and New Release Installation Guide*, SC21-9878

  This guide provides the system operator or system administrator with step-by-step procedures for initial install, installing licensed programs, and secondary languages from IBM.

  This manual is also for those who already have *an* AS/400 system with an installed release and want to upgrade to a new release.

- *PC Support: DOS and OS/2 Messages and Problem Analysis Guide*, SC21-8093

  The *PC Support Messages and Problem Analysis Guide for DOS and OS/2* provides information about DOS and OS/2 error messages, recovery, and problem analysis as they relate to AS/400 PC Support functions. This manual also contains customer-related service information such as how to submit an authorized program analysis report (APAR) and how to apply a program temporary fix (PTF).

- *Programming: Backup and Recovery Guide*, SC21-8079

  This manual explains how to replace a failed disk unit in the system auxiliary storage pool (ASP). It also explains when an install is needed for checksums that are active and the load source to replace. It also includes information about installing and restoring licensed internal code.

- *Communications: User's Guide*, SC21-9601

  This guide provides:

  – Communication information that is common among the AS/400 communications support functions, such as:
    - Setting and changing communications values
    - Starting and stopping communications
  – Communications configuration information, such as defining lines, controllers, and devices
  – Information on handling communications errors
  – Information about defining and using display station pass-through
  – Information about the 3270 remote attachment
  – Information about performance

- Information about X.21 short-hold mode multiple port sharing
- Task information needed to do remote configuration, including information on configuring a remote SDLC or X.25 communications line

- *Communications: Remote Job Entry User's Guide and Reference*, SC09-1168

  The *RJE User's Guide/Reference* provides information about using the Communications Utilities remote job entry (RJE) to submit jobs to an IBM host processor. This manual contains information for both the programmer who is using an RJE system and the user who is operating a remote job entry session through the functions of RJE.

- *Communications: Communications and Systems Management User's Guide*, SC21-9661

  This guide provides information for configuring the AS/400 system to use remote management support (distributed host command feature), change management support (distributed systems node executive), and problem management support (alerts).

- *Communications: Advanced Peer-to-Peer Networking User's Guide*, SC21-8188

  This guide provides information about the advanced peer-to-peer networking (APPN) support provided by the AS/400 system. It describes the APPN concepts, functions, and features as implemented on the AS/400 system. It provides information for configuring an APPN network and also presents considerations when using APPN.

- *Languages: FORTRAN/400* User's Guide*, SC21-9845

  This guide provides information about entering and coding a FORTRAN/400 program, compiling a source program, performing input/output operations, running and debugging the program,

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Part 1. Problem Management Strategy and Procedures

Chapter 1. System Problem Management Overview

This chapter provides an overview of how the AS/400* manages problems. The system's problem management functions manage problems on the AS/400. The management functions automate problem analysis, problem logging and tracking, problem notification, problem reporting, and problem correction. Problem management quickly and accurately manages problems occurring on the system at the time of failure.

System failures or problems fall into two groups, those which the:

- System detects and isolates at the time of failure

  These errors are presented to you as a system message if the system is running or displayed in hex on the control panel as a system reference code (SRC).

- User detects and notices

  These errors are usually symptoms or conditions of the system, such as, slow throughput or incorrect output.

Problem management functions are provided for both user and system detected problems.

User-detected problem management is started when the user detects a problem that has not been detected by the system. Online problem analysis guides the user through a series of displays designed to resolve user problems, isolate problems to a failing part of the system (or component) or create a symptom string for reporting the problems. During the definition of a user detected problem, guidance is given to ensure that a procedural error was not made by the user. A procedure is supplied by system components as the entry points from problem analysis. Once the problem is isolated to a component, problem analysis determines which general entry procedure is called, if any. Problem analysis creates a symptom string for a program error. The symptom string is later used by the service support system to determine if the problem with the program already has a fix available.

System-detected problem management starts with a machine or program error that is detected by a device attached to the system. An error notification is reported to the system using the common input/output (I/O) interface.

Software components are provided with the input/output processor (IOP) and with the operating system to support the input/output (I/O) interface between attached I/O devices and the operating system. Each input/output processor includes a component which provides support related functions such as program debug, code down load, vital product data (VPD) collection, configuration management, and data collection. The operating system components provide the error reporting path, an error log, a problem analysis and resolution driver, problem analysis procedures, activation, and configuration services.

The error or problem contains vital product data (VPD) and configuration information, the reference code and the name of the associated reference code translate table (RCTT) for the reporting device, and additional failure information. The error is recorded in the error log and an entry is created in the problem log. A message is also created and sent to the user. From this message, problem analysis can be performed, information about the problem collected, and the problem reported to the service support system for resolution.

The problem log is used to track the problem as it progresses to resolution. Alerts and alert management can extend the local problem management into network problem management. Alerts can be sent from problem analysis. The alert capabilities are flexible and allow various options for participating in network problem management. For more information about alerts, see "Work with Alerts" on page 11-16.

Figure 1-1 on page 1-2 through Figure 1-5 on page 1-6 show the problem management facilities on the AS/400 system. However, these examples show IBM as the service provider. The AS/400 can be a service provider if you have the Systems Management Utilities. For more information about these utilities, see the *Systems Management Utilities User's Guide*.

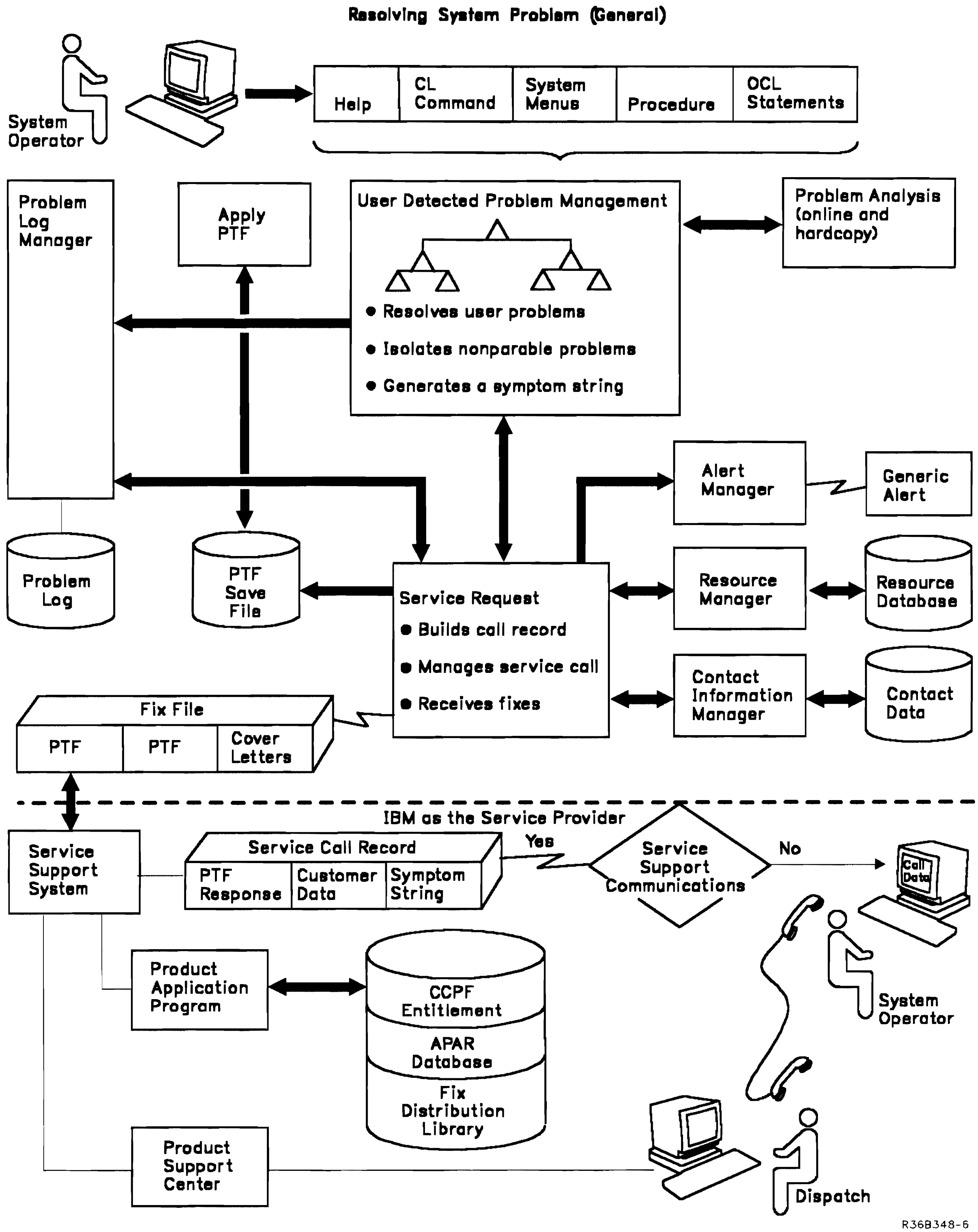

Figure 1-1. Resolving General System Problems

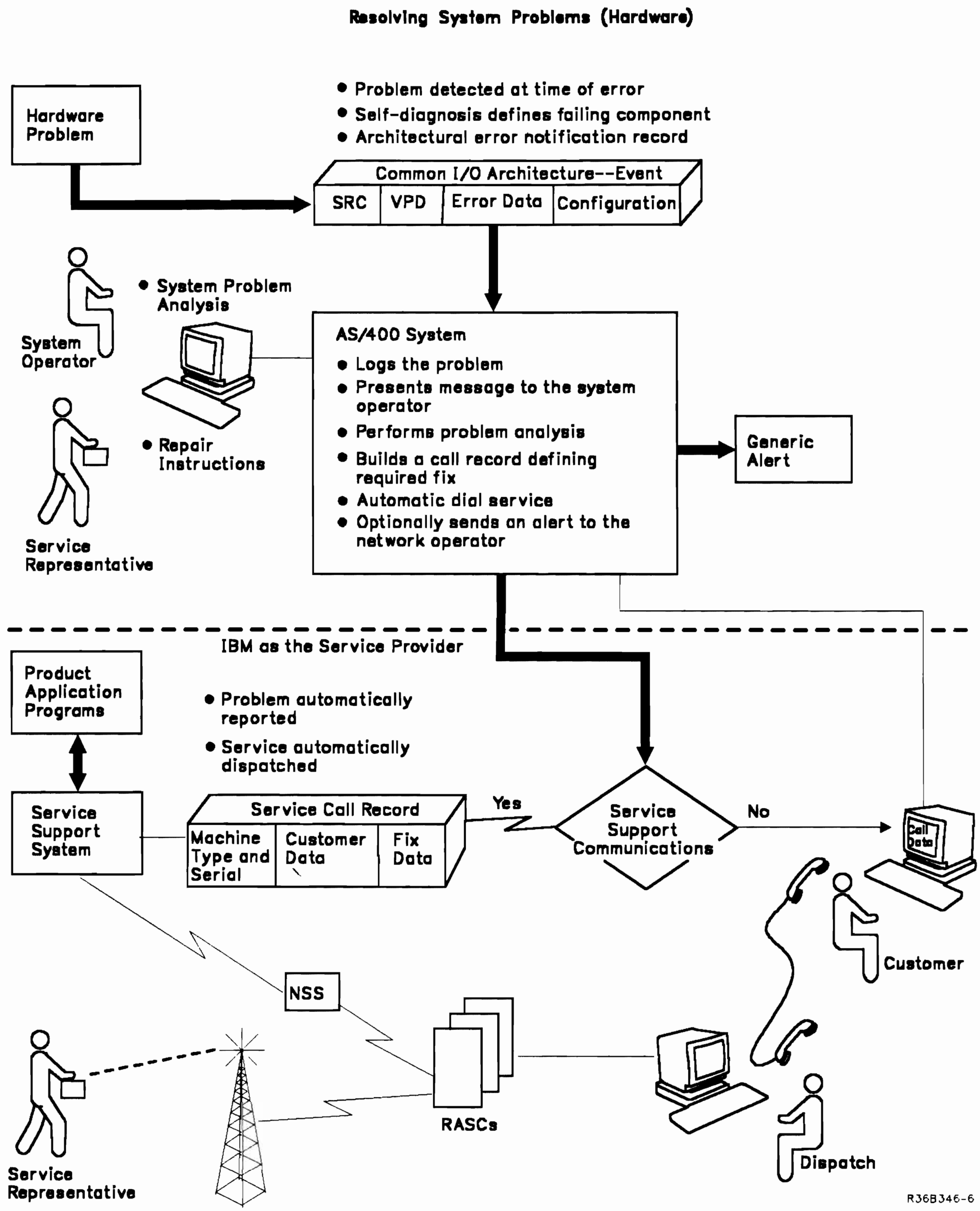

Figure 1-2. Resolving Hardware System Problems

The problem log manager provides the entry point for problem management on the system, guiding the user to the next step of the problem resolution that is to be completed. It also provides online tracking, and data is added to a problem record for each problem as it progresses to resolution.

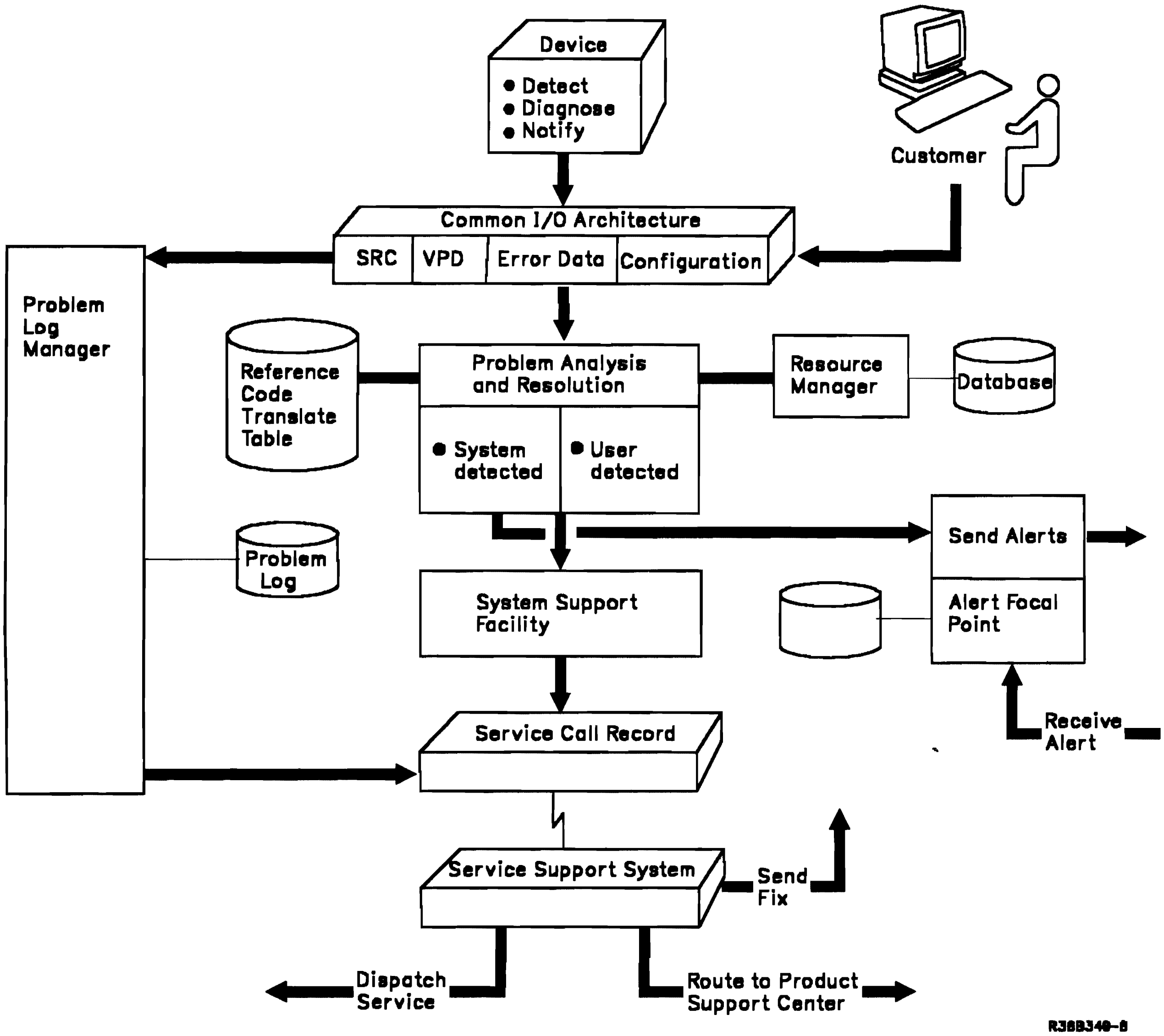

Figure 1-3. Management of Problems Overview

Alerts can be sent from problem analysis. They are important for managing a network. Alerts notify a network of an actual or impending loss of available resource and as much problem analysis data that is available about the problem. For more information about alerts, see "Work with Alerts" on page 11-16.

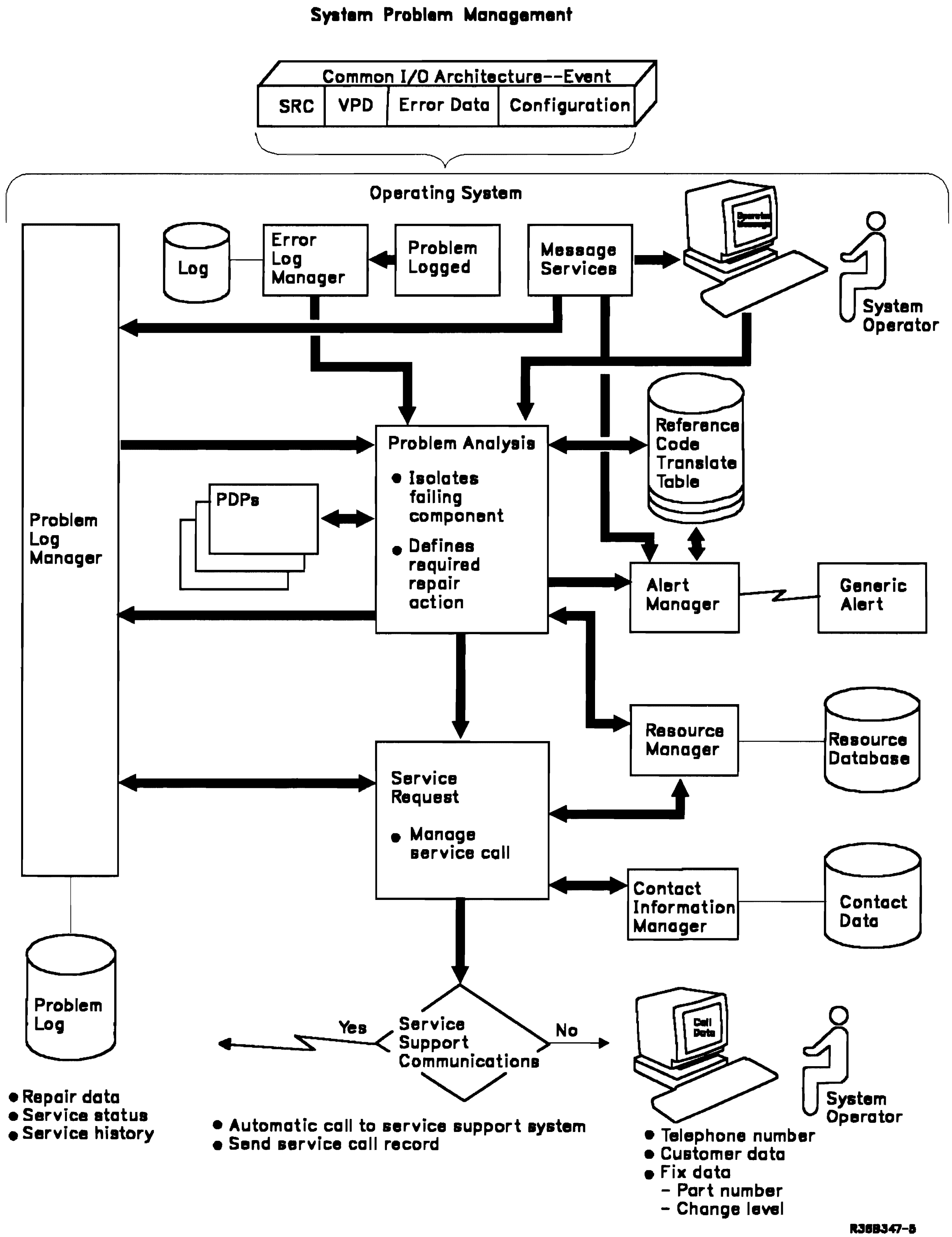

Figure 1-4. System Problem Management

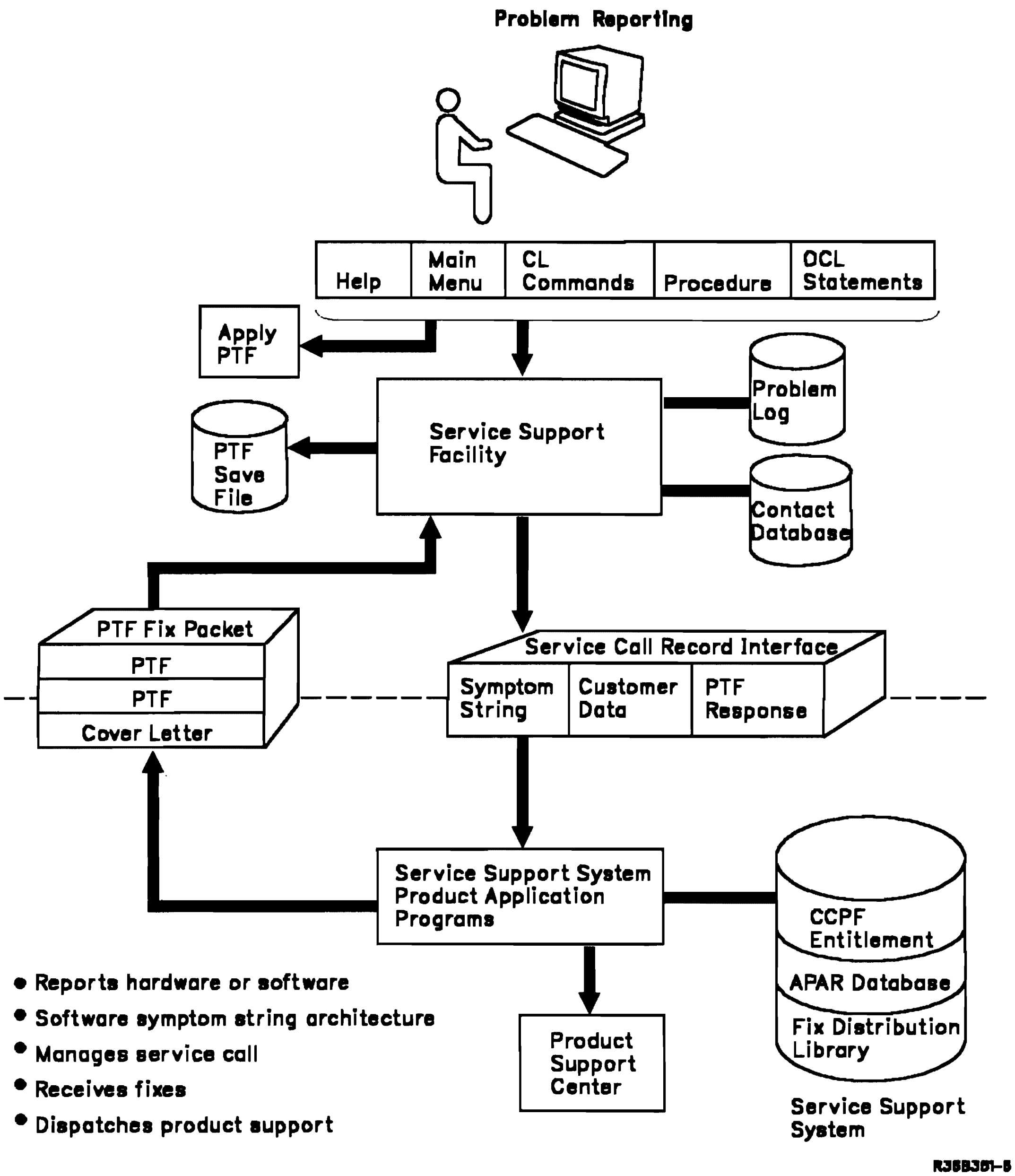

Figure 1-5. System Problem Reporting to the Service Support System

Figure 1-6 on page 1-7 shows how a problem is managed by the system's problem log. For more information about problem logs, see page 15-10.

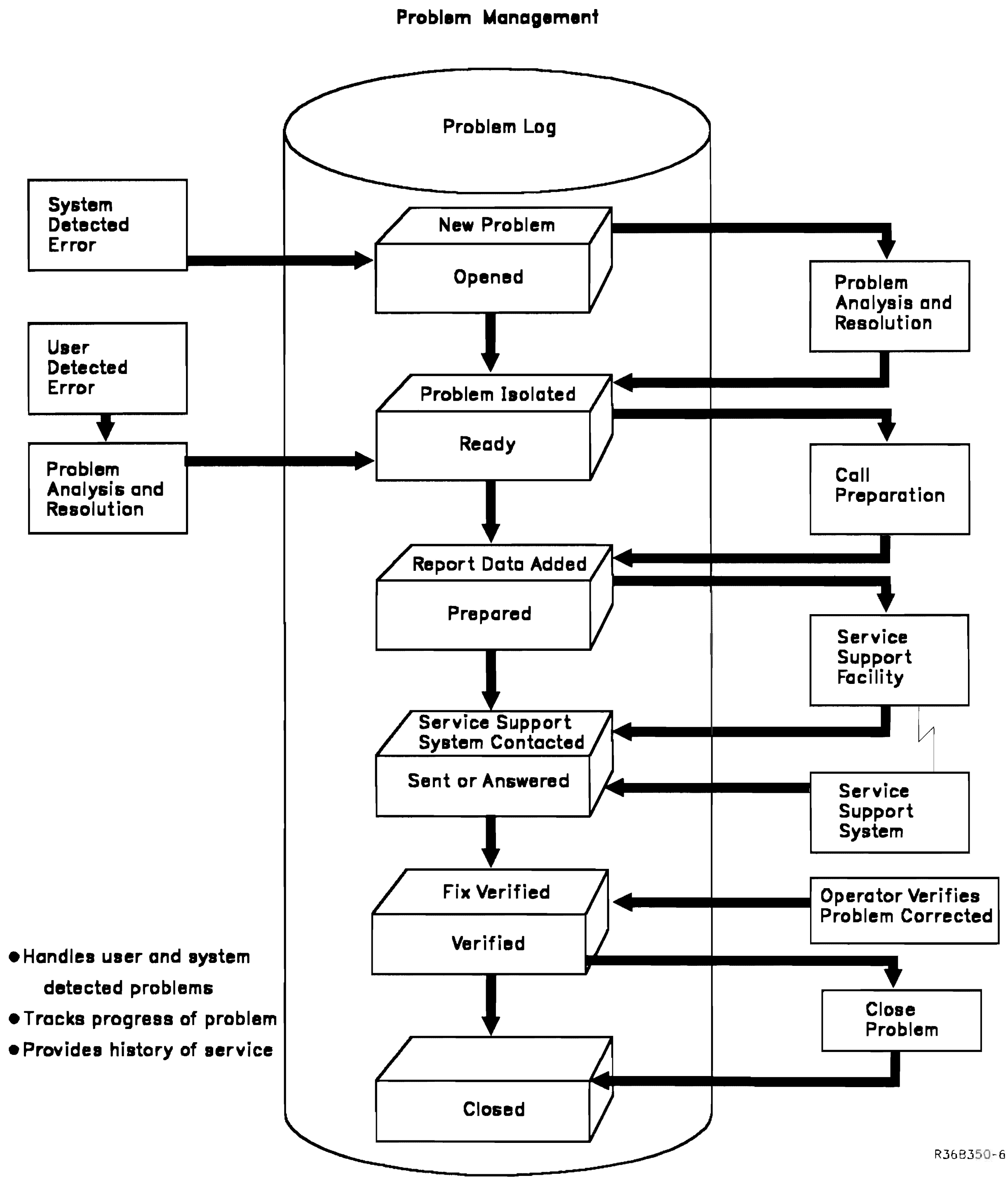

Figure 1-6. Problem Management and Log Overview

Figure 1-7 on page 1-8 shows the AS/400 programming service process from the time a defect is found until the problem is solved.

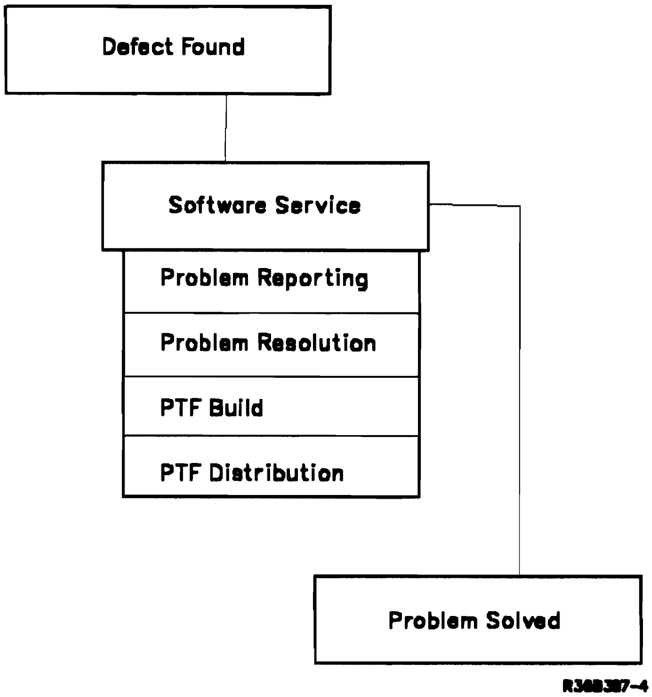

Figure 1-7. Programming Service Process

Problem analysis and resolution is used to prepare problems for reporting either through voice or Electronic Customer Support (ECS) to the service support system. Figure 1-8 shows an overview of ECS.

ECS allows you to access question-and-answer databases, exchange files between AS/400 and other locations, request IBM product information, and exchange technical information. You can provide fast hardware service by placing a service call electronically to order licensed internal code PTFs. For automated software support, ECS provides for online PTF distribution and problem management through the problem log entries. For more information about ECS, see the *Key to Service—Software* manual.

Copy screen image is also a function of ECS. For more information about copy screen image, see page 11-19.

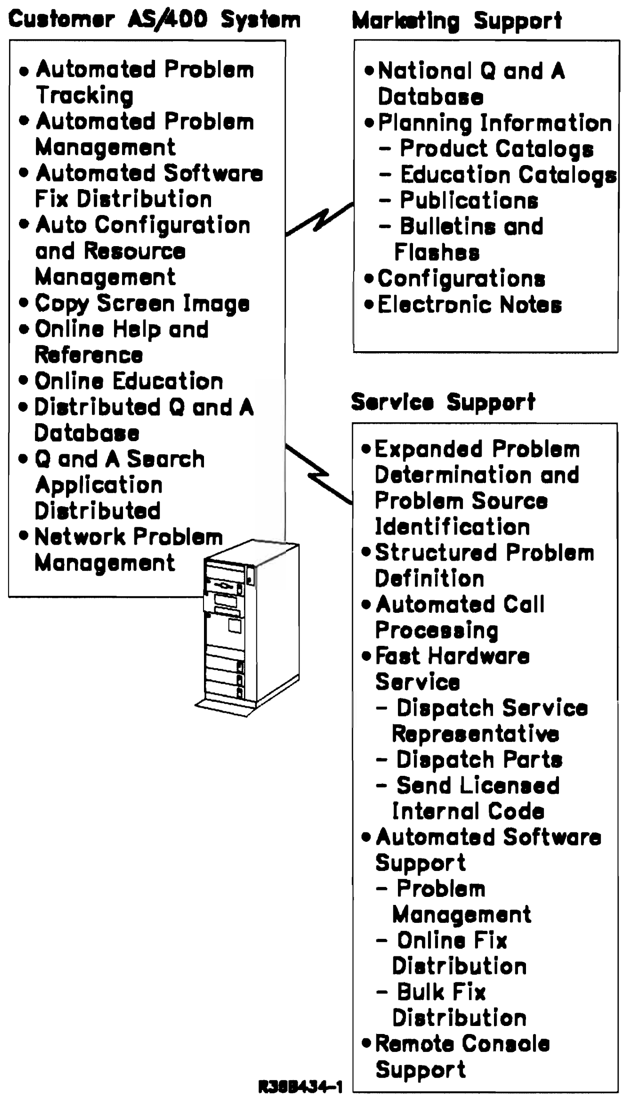

Figure 1-8. Electronic Customer Support Overview

For more information about using online problem analysis and system support facilities and functions in determining, isolating, preventing, repairing, and reporting problems, see "Online Problem Analysis and Resolution" on page 11-7.

Chapter 2. Problem Analysis and Resolution Procedures

Chapter 1 provides information about how problems are managed on the AS/400 system. This chapter describes what procedures you should follow to analyze and solve problems with the AS/400 operating system, licensed internal code, and programs. All problems are primarily handled by using the following procedures:

- Problem analysis, see page 2-1
  - Problem determination, see page 2-2
  - Problem isolation, see page 2-2
    - Internal and external symptoms, see Chapter 3
- Problem resolution, see page 2-3
  - Problem circumvention and repair, see page 2-3
  - Problem reporting, see page 2-6

You can use the Problem Anaylsis and Resolution Form at the back of this chapter as a check list to identify problems and a history file to track and record problems and their resolutions.

Problem Analysis

Problem analysis consists of the following:

- Problem determination

  This is the process by which one identifies if a problem is caused by a machine or program error. For more information about problem determination, see page 2-2.

- Problem isolation

  This is the process by which one identifies the source of the problem (defect) in the system. For more information about problem isolation, see page 2-2.

Before doing any problem analysis, customers should be familiar with the *Operator's Guide* and the service representative should be familiar with the *Analyzing Problems Guide*. You can use online problem analysis if the system detects a problem while the system is operating, an SRC appears on the control panel and a message appears on the display with an asterisk (*) in front of it. To use problem analysis, place the cursor under the message and press the F14 key to start problem analysis. If a user detects a problem or an error occurs that does not have an SRC, you can start online problem analysis by entering the Analyze Problems (ANZPRB) command on any display that has a command line. For more information about online problem handling tools, see page 11-7 or select the *Problem handling tutorial* option from the User Support menu. For more information about messages, see page 3-5.

To resolve problems quickly, the customer is encouraged to do problem determination and isolation. For example, the customer should find out if the problem is the result of a programming error and obtain the correct information for problem resolution before reporting the problem.

When the information needed to solve a problem is not available at first, the analyzing time for that problem increases. To perform successful problem analysis, you may need to assist the customer to do the following:

1. Accurately define the problem and the external symptom. For more information about external symptoms of problems, see Chapter 3.
2. Find out if the problem is a new (not a previously known, or a discovery) problem or an existing (known or a rediscovery) problem. For more information about new or existing problems, see page 2-6.
3. Find out the correct information that needs to be collected to fix the problem from the previous step. For more information about what information to collect for:
   - An identified external or internal symptom, see Chapter 3
   - A failing component, see Chapter 4
   - A problem with a loadable code group (LCG), see Chapter 5
4. Collect the information.

   Note: Steps 3 and 4 are critical to quick problem resolution and must be performed correctly at the time of the failure.
5. Find out who is probably responsible for the problem, and contact the correct person for resolution. If necessary, submit an APAR. For more information about submitting an APAR, see Chapter 6.

Verify that the customer problem determination procedures, steps 1 through 5 above, are done at the time the customer reports a problem or before beginning problem analysis. To complete this process, you usually have to find out (problem isolation) if the problem is new (not a previously known) or an existing (known) problem.

Note: To save time in analyzing and solving problems, collect all the error data possible at the time of failure.

Instructions for Good Problem Analysis: Good problem analysis is important for intermittent problems; therefore, you need to know what actions to take and what information to collect when a failure occurs. The customer or service representative often does not know what information is needed or how to obtain correct information at the time of the failure; however, the customer and service representative are sometimes the only persons who can take the corrective actions. If you need to inform the customer and service representative about how to recognize the special problem and about what information to collect, make sure that your communication is understood. Go into detail and write the instructions down if necessary. Inform the customer:

- What information you need
- How to pull together that information
- What sequence to use for the diagnostic aids
- Why you need that information

Before you can obtain correct information, the problem and its external and internal symptoms need to be accurately defined. Generally, for most problems, you need:

- A display or print of the history log, QHST.
- A display or print of the error log.
- A display or print of the rack configuration.
- A display or print of any QSYSOPR messages.
- The date and time of error or failure.

Use the *Problem Analysis and Resolution Form* at the back of this chapter as a check list to help remind you what things to do or ask for. For specific information about what information can be used or is needed to solve a problem, see Chapter 3 and Chapter 4.

Problem Determination

The first step to analyzing or working with a problem should be problem determination. Simply, problem determination is the process by which one identifies if a problem is caused by a machine or program failure. A user or a system detected error can help identify what caused the failure. The failure can determine who to call for help once the problem is determined to be a machine or program failure.

Some errors and problems are more complex than others; therefore, some problem determination may include problem isolation.

Note: Copy screen image is a tool that may be used to help determine problems. For more information about copy screen image, see page 11-19.

Problem Isolation

This step helps the customer or user to identify where in the system the source of the problem (defect) resides. Usually, customer problem source identification (PSI) or isolation is complete when one of the following is identified as the source of the problem:

- IBM system control programming (operating system)
- Other IBM-supplied programming (languages and utilities)
- Customer/user or non-IBM written program
- System operator error
- Error in the use of a program
- No trouble found

However, the overall objective of more difficult problem isolation is to use the external symptoms to learn about the internal symptoms so that you can decide whether the problem is a discovery or a rediscovery and take the appropriate action or actions toward resolving the problem. The method of isolating a problem is different depending on whether the external symptom is an incorrect output, a message, a loop, or a wait state. For more information about discovery and rediscovery (new or existing) problems, see page 2-6. For more information about symptoms, see Chapter 3.

First, try to match your problem with a reported problem in the service support system. Describe your problem with the same keywords that others would use to describe the same problem and search the service support system for a match. Do a symptom search early in the analysis and more frequently as you learn more about the internal symptoms. Use multiple search arguments to make sure that your search is thorough. For more information about creating a symptom string, see Chapter 6. For more information about the service support system, see page 11-12.

Another early step that you should take in isolating the problem to a specific component is to determine how much of the system appears affected by the problem. This step often allows you to focus on a small part of the programming system. For more information about isolating a problem to its specific component, see Chapter 4.

When the cause of a problem is above the machine interface, few jobs are likely to be affected; when the cause is below the machine interface, many or all jobs are likely to be affected. Figure 3-4 on page 3-12 shows how the machine interface relates to the rest of the system architecture. Notice that OS/400 is above the machine interface and VLIC is below the machine interface.

Problem Isolation Tools: Table 2-1 on page 2-3 shows which problem isolation tools are available from the different system interfaces. For an overview of the AS/400 service tools, see Figure 11-1 on page 11-1. For more information about SST, DST, and the control panel, see Chapter 12, through Chapter 14.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Table 2-1. Problem Isolation Tools

Problems	Commonly Used Tools	Tool Described on Page	Selected from the Control Panel	Selected from SST	Selected from DST	Enter the Command
Common hardware	Work with error log	12-3		Y	Y	PRTERRLOG
	Work with licensed internal code	13-6			Y	DSPPTF
	Display hardware configuration	12-61			Y	WRKHDWPRD
Communications	Communications trace	12-20		Y		
Diskette read errors	Work with Diskette Data Recovery	12-69		Y		
	Trace Intersystem Communication Function (ICF)	17-1				TRCICF
	Verify communications	11-3				VFYCOM
	Work with alerts	11-16				WRKALR
Existing	Work with problems	11-10				WRKPRB
I/O processor	Work with error log	12-3		Y	Y	PRTERRLOG
	Work with I/O debug	12-50		Y	Y	
Licensed internal code	Communications trace	12-20		Y		
	Display/alter/dump	12-27		Y	Y	
	Main storage dump	16-1	Y			
	Print stand-alone dump	12-55		Y	Y	
	Program debug (hidden option)	13-22			Y	
	Trace vertical licensed internal code	12-10		Y	Y	TRCINT
	Work with error log	12-3		Y	Y	PRTERRLOG
	Work with licensed internal code	13-6			Y	DSPPTF
	Work with VLIC log	12-46		Y	Y	PRTINTDTA
Loops, hangs, and waits	Main storage dump	16-1	Y			
	Print stand-alone dump	12-55		Y	Y	
New	Analyze a user-detected problem	11-7				ANZPRB
Operating system	Display/alter/dump	12-27		Y	Y	DMPSYSOBJ
	Job information trace	17-7				TRCJOB
	Job log	15-5				DSPJOBLOG
	Job structure dump or process dump	16-1				DMPJOB
	History log	15-8				DSPLOG QHST
	OS/400 program debug	23-1			Y	ADDTRC
	Problem log	15-10				WRKPRB
Storage	Main storage dump	16-1	Y			
	Print stand-alone dump	12-55		Y	Y	
	Rack configuration record	10-1			Y	
	Work with disk units	12-67 and 13-8		Y	Y	

Note: Chapter 3 provides more information about determining the external and internal symptoms of these problems.

Problem Resolution

The two steps in the problem resolution process discussed in this section are as follows:

1. Problem circumvention and repair, see page 2-3
2. Problem reporting, see page 2-6

A problem is not resolved until it is fixed. More difficult problems are not fixed until all of the problem reporting is done.

Problem Circumvention and Repair

Fixes are applied to the system by completely replacing the defective object. The fix is supplied as a program temporary fix (PTF) or licensed internal code fix. These PTFs can resolve problems reported on one or more (authorized problem analysis reports) APARs or licensed internal code trouble reports (LICTRs). To submit an APAR, see Chapter 6.

The PTF process starts after an APAR is opened and a problem is identified to be with IBM code. The APAR is closed when the problem is resolved. When an APAR is closed, a PTF must be opened to distribute the fixed code. The PTF is made available through and down loaded from ECS, the customer's service support system, or ordered and shipped directly on diskette or tape.

All PTFs can be loaded and later applied to the system. They also can be removed and displayed. The SNDPTFORD command can be used to order PTFs, PTF packages (preventive fixes), PTF summary data, and preventive service package (PSP) information. PSP contains information about installation problems, highly pervasive APARs, and HIPER PTFs (PTFs known to resolve severe problems).

For more information about receiving and managing PTFs using electronic customer support and the system support system, see the *Operator's Guide*.

Loading PTFs: There can be up to 2 versions of licensed internal code on the system. It is the IPL type (A or B) that denotes which licensed internal code version the system runs on the next IPL. When PTFs are applied to the licensed internal code they are applied to the inactive copy of the licensed internal code. They must be temporarily applied while the system is IPLed on the A side only. The IPL type is automatically switched by the system. For more information about the system switching IPL types, see the *Operator's Guide*.

All PTFs are loaded into the system using the Load Program Temporary Fix (LODPTF) command. The LODPTF command loads the new objects from a tape, diskette, or a save file into the library for the licensed program. The tape, diskette, or save file contains PTFs, and you have the option of loading all of them or selecting one or a few of them.

A PTF must be loaded before it can be applied. As a PTF is loaded, the proper release and modification level of the licensed program library is verified. As each PTF is loaded onto the system, a check is made for prerequisite PTFs. If the prerequisites are not on the system, the loading of that PTF is ended. A prerequisite satisfies the check if it is temporarily applied or removed, permanently applied, or is being loaded at the same time that its dependency is being loaded.

Each PTF being loaded also identifies the PTFs it supersedes and the following considerations apply:

- If the superseded PTFs are permanently applied, they are considered to be a part of the base system, the load is completed, and the new PTF can be applied or removed.
- If the superseded PTFs are not applied to the system, the load is completed and the new PTF can be applied or removed.
- If the superseded PTFs are temporarily applied and if SPRPTF(*APYPERM) is specified, the superseded PTFs are permanently applied automatically before loading the superseded PTFs. If SPRPTF(*NOAPY) is specified, the load of the new PTF stops; however, the superseded PTFs must first be removed or applied permanently.

The master programming temporary fix index (MPTFI) reflects the status of loaded PTFs. The MPTFI stored in each product library tracks the products PTFs. MPTFI stored in QGPL tracks licensed internal code fixes.

A PTF is not made active at the time it is loaded into a library. The Apply Program Temporary Fix (APYPTF) command must be used to make it active.

Applying PTFs: For more information about automatically loading and/or applying PTFs and packaging PTFs for sending to another system, see the *Operator's Guide*.

PTFs are applied (made active) by the Apply Program Temporary Fix (APYPTF) command after the PTF is loaded.

Licensed internal code fixes are also handled like software fixes. The operating system recognizes the PTF as being licensed internal code and passes the PTF to the link/loader (work with licensed internal code) to apply the new code to the licensed internal code.

There are two versions (types A and B) of some licensed internal code on the load-source disk device. The IPL type (A or B) makes known which licensed internal code level your system runs with.

To apply licensed internal code PTFs, you must perform an IPL type A. Then load and apply the PTFs. When PTFs are applied to the licensed internal code, they are applied to the inactive copy of the licensed internal code. The system automatically switches the IPL type.

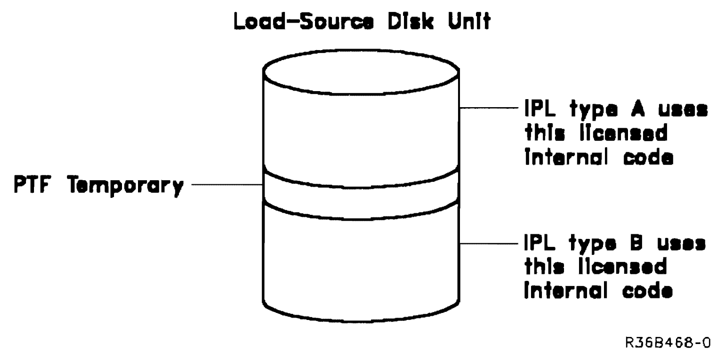

Figure 2-1. Applying PTFs to the A or B Side

To run with the PTFs, you must perform an IPL type B. These PTFs can now be made permanent.

PTFs can be applied on the system either permanently or temporarily. All licensed internal code fixes are first applied to the B version of the licensed internal code. An IPL type B must be done to apply the PTF permanently. You cannot apply a PTF to the side you performed the IPL on. For more information about IPL types, see Chapter 18.

OS/400 PTFs are not applied until an IPL is performed. During an attended IPL, the Work with PTFs display appears. You can use this display to select the PTFs you want to apply. If a PTF is applied permanently, the replaced objects are destroyed. If they are applied temporarily, the replaced object or a copy of the old version of the object is saved and managed by the service component of OS/400. Any temporary PTF can be removed, and the original version of the object can be restored to the system.

As PTFs are applied, prerequisite checking is performed to ensure that any PTFs that are prerequisites to the one being applied are also applied to the system.

Immediate Fixes: To make a PTF active while the system is running, use the APYPTF command. Licensed internal code fixes are applied as immediate fixes, but are made active after the next IPL. If desired, immediate fixes can be identified for a delayed apply. These fixes are applied during the next unattended IPL.

Delayed Fixes: Some fixes are made to critical areas of the system and cannot be applied while the system is running. These are delayed PTFs and they can only be applied during an IPL. Only during an attended IPL, a display is presented to the console operator so that any delayed PTFs can be applied or temporarily applied fixes can be removed.

Removing PTFs: Use the Remove Program Temporary Fix (RMVPTF) command to remove program fixes for a specified licensed program. The PTF that depends on the prerequisite must be removed before the prerequisite may be removed.

When a temporary PTF is removed, the original version of the objects that were replaced in the PTF are restored to the library and system.

PTFs can be removed either temporarily or permanently. When a PTF is to be removed permanently (the PTF objects are destroyed), it should first be removed temporarily. When a PTF is removed temporarily, the objects are saved and the fix can be applied again later. Licensed internal code fixes can only be permanently removed.

When a temporary PTF is removed, prerequisite checking is again performed to ensure that the fix being removed is not a prerequisite to any other applied PTF. If the fix being removed is found to be a prerequisite, the dependency must be removed first.

Displaying PTFs: Use the Display Program Temporary Fix (DSPPTF) command to display program fixes for a specified program product. This command displays the status and attributes of PTFs on the system.

To display PTFs for OS/400, use:

```
DSPPTF LICPGM(5728SS1)
```

To display PTFs for licensed internal code, use:

```
DSPPTF LICPGM(5728999)
```

Notes:

1. The DSPPTF command displays which version (A or B) of the licensed internal code the system is *currently* operating from.
2. The A or B shown in the Data display on the control panel indicates which side the *next* IPL occurs from.

DST may be also used to display licensed internal code fixes.

Whenever a fix is loaded, applied, or removed temporarily or permanently to the system, a message is sent to the history log to record the change.

Note: A copy of the history log and a listing from the Display Program Temporary Fix (DSPPTF) command should be submitted with every APAR or LICTR.

For more information about the history log, see page 15-8.

Ordering PTFs: PTFs can be ordered by telephone or by using ECS. When ordering by phone, specify a shipping priority. The priorities for shipping a PTF are:

Priority	Description
1	The next day, a 3-day turnaround.
2	Within 3 days.
3	Within 1 week.

When using ECS, you can receive a PTF immediately. When ordering, specify the PTF by name using the SNDPTFORD command. To determine the PTF number, submit a search request to the service support system using the Analyzing Problems (ANZPRB) command.

Preventive Service Planning (PSP): PSP is a repository for information about the program that runs on the AS/400 system. PTF information, such as: bad PTFs (PEs) and HIPER PTFs (PTFs known to resolve severe problems) could be found there. Information about installing the current release and cumulative tapes could also be found.

To order PSP, use: SNDPTFORD SF98xxx. Replace xxx with the release number for the information you need.

PTF Summary List: The PTF summary list is a listing of all the current PTFs available for the AS/400 system. Each PTF has a brief description for the problem it fixes.

To order a summary list, use: SNDPTFORD SF97xxx. Replace xxx with the release number for the list you need.

Cumulative PTF Tape (CUM.Tape): The cumulative tape is a collection of all PTFs released after the base release.

To order cumulative PTF tapes, use: SNDPTFORD SF99xxx. Replace xxx with the release number needed for the system.

PTF Authorization Considerations

- When reading, loading, applying, and removing PTFs, the user must have object management authority to the library affected by the PTF.
- When a PTF tape is created, each object's authorization is saved on the tape with the object. This includes the name of the owning user profile and any public authorizations to the object. Private authorizations (rights of use granted to particular user profiles) are not saved.
- When a PTF is loaded, the owner of each object is located on the system and given ownership of the PTF object. If the owner of an object is not found, ownership is given to QSECOFR (the security officer user profile). Private authorizations to the PTF object are not granted.
- When the PTF is applied, each PTF object is granted the same private authorizations as the object it replaces. If the PTF object does not replace an object, no private authorizations are granted.
- When a PTF is removed, each object replacing a PTF object is granted the same private authorizations as the PTF object. This ensures that changes to private authorizations granted or revoked while the PTF was applied remain in effect.

For more information about any PTFs, see the *Operator's Guide*.

Problem Reporting

Often, there is a series of internal symptoms and the first symptom you find may be several symptoms away from the cause of the problem. Your objective, of course, is to find the cause. However, with many problems, it is difficult to find out whether you are looking at the cause or just an internal symptom. You might find an APAR in the service support system that seems to describe your problem exactly, and you may find out later that what you were looking at was only an internal symptom and that it was some distance away from the actual cause of the problem. Therefore, it is important that you learn as much as possible concerning the internal symptoms before deciding that a reported problem is the same as the one you are solving. For more information about internal and external symptoms, see Chapter 3.

The correct action to take depends on if you can match the internal symptoms of your problem with the internal symptoms of a reported problem or symptoms that are in the service support system.

Discovery or Rediscovery (New or Existing)

Problem: A **discovery** is a new programming error that has not yet been reported by an Authorized Programming Analysis Report (APAR) or a licensed internal code error that has not yet been reported by a Licensed Internal Code Trouble Report (LICTR). LICTRs are to be used to report suspected licensed internal code defects in VLIC. APARs and LICTRs are submitted to obtain a fix.

A **rediscovery** is an existing error that has been (or is being) reported by an APAR. If the customer has not, search the service support system to find out if the problem has been reported. APARs and LICTRs are submitted to obtain a fix similar to or the same as a problem already solved.

To solve online new or existing system or user-detected problems, see "How to Work with Problems" on page 11-10.

Resolving a Discovery (or New Problem): If you cannot find a reported problem that is the same as the one that you are working on or if you are trying to report a new problem, you should do the following.

- Learn as much as possible concerning the problem.
- Try to identify the module that is causing the failure.
- Collect enough information to ensure that another person can identify the problem.
- Report the problem by an APAR using the CRTAPAR command.

Describe the internal and external symptoms so that the next person can recognize the problem if it is found. For more information about internal and external symptoms, see Chapter 3.

The problem is not solved until a fix is applied. For more information about any PTF, see "Problem Circumvention and Repair" on page 2-3.

Resolving a Rediscovery (or Existing Problem): If you decide your problem is a rediscovery, use the programming temporary fix (PTF) that solved the original APAR. If a fix is not available, one may be requested through IBM. For more information about any PTFs, see "Problem Circumvention and Repair" on page 2-3.

Resolving an Unreported Problem: Determine if the problem is a new or an existing problem; then submit an APAR or LICTR. Submit an APAR when a problem has been determined to be an unreported OS/400 programming error. Submit a LICTR to report unreported licensed internal code defects in VLIC. The information necessary to resolve the problem, either directly from the information or by creating the problem again, must accompany the APAR or LICTR. For more information about what information to collect for internal and external symptoms, see Chapter 4. For more information about creating and submitting an APAR or LICTR, see Chapter 6.

Required Information: Refer to Chapter 4 for information needed to diagnose and solve problems for components of OS/400, VLIC, and other licensed program products.

9406 Problem Analysis and Resolution Form

Use this form as a check list to help identify problems. Also, use it to track and record problems and their resolutions.

Page 1 of 4

```
Initial Problem Date  ___/___/___       Who Handled Call ____________________
Initial Problem Time  ___:___ AM/PM     Time Spent On Problem/Call __________

Contact Information:                    Branch Office Information:
Contact Name     __________________     Branch Office Number ________________
Phone Number     __________________     CE's Name ___________________________
Alt Phone Number __________________     CE's Phone Number (_____)-_____-_____
PMR Ref Number   __________________     Alt Phone Number (_____)-_____-______
Other Contacts (name, phone number, and address): ___________________________
_____________________________________________________________________________

Account Information:                    Problem with Machine Type(s):
Account Name       _________________    2440 ________________________________
Address            _________________    3422/3490 ___________________________
City, State        _________________    9309 ________________________________
Install Date       ___-___-___          9331 M1 M2 __________________________
Phone Number       (_____)-_____-_____  9332 200 400 600 ____________________
Account CE Name    _________________    9335 A B ____________________________
System Serial No.  _________________    9336 ________________________________
System Number      _________________    9346 ________________________________
Plant Order Number _________________    9347 ________________________________
System Model       _________________    9406 ________________________________
Customer Number    _________________    Other _______________________________
Release            _________________    _____________________________________
PTF Level          _________________    _____________________________________

SRC History:
Date ___-___-___            Date ___-___-___            Date ___-___-___
IPL Manual  Normal A  B     IPL Manual  Normal A  B     IPL Manual  Normal A  B
SRC 11 ______ ______        SRC 11 ______ ______        SRC 11 ______ ______
SRC 12 ______ ______        SRC 12 ______ ______        SRC 12 ______ ______
SRC 13 ______ ______        SRC 13 ______ ______        SRC 13 ______ ______
SRC 14 ______ ______        SRC 14 ______ ______        SRC 14 ______ ______
SRC 15 ______ ______        SRC 15 ______ ______        SRC 15 ______ ______
SRC 16 ______ ______        SRC 16 ______ ______        SRC 16 ______ ______
SRC 17 ______ ______        SRC 17 ______ ______        SRC 17 ______ ______
SRC 18 ______ ______        SRC 18 ______ ______        SRC 18 ______ ______

Error Log Information (MSG ID, SRC, URC, Time, Date): _______________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Other Problem Information: __________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
```

PAR Procedures

Replaced 9406 Parts		Replacement Sequence	P/N
32 MB (B70)	3109	_ _ _	______
16 MB (B70)	3061	_ _ _	______
16 MB Main storage	3060	_ _ _	______
8 MB Main Storage	3055	_ _ _	______
4 MB Main Storage	3054	_ _ _	______
Processor P/B30	2500	_ _ _	______
Processor P/B40	2501	_ _ _	______
Processor P/B50	2502	_ _ _	______
Processor P/B60	2503	_ _ _	______
Service Processor 1	2504	_ _ _	______
Service Processor 2	2505	_ _ _	______
Bus Adapter	2506	_ _ _	______
Processor P/B30	2510	_ _ _	______
Processor P/B40	2511	_ _ _	______
Service Processor 1	2514	_ _ _	______
Processor B70	2518	_ _ _	______
Service Processor 2	2521	_ _ _	______
Bus Adapter	2522	_ _ _	______
Tape 1/4 Inch	2601	_ _ _	______
Tape 1/2 Inch	2602	_ _ _	______
Tape 1/2 Inch	2604	_ _ _	______
Tape IOP Hardware Decompress	2608	_ _ _	______
DASD IOP for 9332 or 9335	6110	_ _ _	______
DASD IOP for 9346	6111	_ _ _	______
Communications IOP	6130	_ _ _	______
Communications IOA	6031	_ _ _	______
Communications 4MB LAN	6034	_ _ _	______
Communications 16MB LAN	6134	_ _ _	______
Communications Ethernet	6035	_ _ _	______
Work Station Controller IOP	6040	_ _ _	______
Bus Extension Primary	6018	_ _ _	______
Bus Extension Secondary	6019	_ _ _	______
Power Supply		_ _ _	______
PCC Box		_ _ _	______
Fan Unit		_ _ _	______
DFCI Term		_ _ _	______
DFCI Cable		_ _ _	______
Bus Extension Cable		_ _ _	______
9406 Cage		_ _ _	______
5021 Cage		_ _ _	______
5030 Cage		_ _ _	______
Control Panel		_ _ _	______
Cable			
Power Sense Cable		_ _ _	______
Other: ______________		_ _ _	______
______________		_ _ _	______

Other Recommendations or Actions Taken: ______________________________

____

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____

System Configuration: Model ____________ S/N ______________ Date ___-___-___

9406 Bus 0
1 __________
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
13 __________
14* __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________

9406 Bus 1
1 __________
2 __________
3 __________
4 __________
5 __________
6 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
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7 __________
8 __________
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10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________

6040 ________
Port Device
_0__ ________
_1__ ________
_2__ ________
_3__ ________
_4__ ________
_5__ ________
_6__ ________
_7__ ________

9406 Bus 2
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________
1 6019______
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________

6040 ________
Port Device
_0__ ________
_1__ ________
_2__ ________
_3__ ________
_4__ ________
_5__ ________
_6__ ________
_7__ ________

6110 ________
Addr Device
____ ________
____ ________
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6110 ________
Addr Device
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6110 ________
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6110 ________
Addr Device
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6110 ________
Addr Device
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____ ________
____ ________

System Configuration: Model ________ S/N __________ Date ___-___-___

Other Recommendations for Problem Resolution:

Apply PTF(s): ______________________________

Submit an APAR, No or Yes (APAR Number): ______________________________

See Retain Tip(s): ______________________________

See Q & A (if available): ______________________________

Problem Resolution: ______________________________

Instructions for Completing the Form

- Copy this form and use it as often as you like.
- On page 1 of this form, indicate the machine type when appropriate.
- Circle the IPL type and mode.
- Record the symptoms of the problem or any information you collected that helps identify the problem.
- On the left half of page 2, indicate what is replaced. and the sequence of replacement.
- On the right half of page 2, recommend what should be replaced and the sequence of replacement based on SRC, error log, and message information collected.

Note: Recommendations for solving problem can be based on environment, service representative or customer actions, device emulation and so on.

- On page 3, indicate the feature number on the blank line next to the bus (for example, 3060, 2503, and so on).
- Put the slot number on the blank line next to the 6110 and then fill the physical address setting of the device and the device machine type in the blank lines below in the order they are physically labeled.
- Put the slot number on the blank line next to the 6040 and then fill in the problem device on the port.
- On page 4, track your problem and record how the problem is solved.

9404 Problem Analysis and Resolution Form

Use this form as a check list to help identify problems. Also, use it to track and record problems and their resolutions.

Page 1 of 2

Initial Problem Date ___/___/___
Initial Problem Time ___:___ AM/PM

Who Handled Call ____________
Time Spent On Problem/Call ____________

Contact Information:
Contact Name ____________
Phone Number ____________
Alt Phone Number ____________
PMR Ref Number ____________

Branch Office Information:
Branch Office Number ____________
CE's Name ____________
CE's Phone Number (____)-____-________
Alt Phone Number (____)-____-________

Other Contacts (name, phone number, and address): ____________

Account Information:
Account Name ____________
Address ____________
City, State ____________
Install Date ___-___-___
Phone Number (____)-____-______
Account CE Name ____________
System Serial No. ____________
System Number ____________
Plant Order Number ____________
System Model ____________
Customer Number ____________
Release ____________
PTF Level ____________

System Configuration:
(Bus 0)
Slot 1 ________ ________
Slot 2 ________ ________
Slot 3 ________ ________
Slot 4 ________ ________
Slot 5 ________ ________
Slot 6 ________ ________
Slot 7 ________ ________
Slot 8 ________ ________
Other ____________

Initial Problem/Reason for Call:
__ Install instructions not complete
__ Defective documentation
__ Not able to IPL to DST
__ ECS not registered
__ ECS not working
__ Bus isolation problem
__ Information only
__ Not able to diagnose problem
__ Intermittent problem
__ Not able to fix device
__ Not able to load code
__ Defective replacement parts
__ Other ____________

SRC History:

Date ___-___-___			Date ___-___-___			Date ___-___-___		
IPL	Manual	Normal A B	IPL	Manual	Normal A B	IPL	Manual	Normal A B
SRC 11	______	______	SRC 11	______	______	SRC 11	______	______
SRC 12	______	______	SRC 12	______	______	SRC 12	______	______
SRC 13	______	______	SRC 13	______	______	SRC 13	______	______
SRC 14	______	______	SRC 14	______	______	SRC 14	______	______
SRC 15	______	______	SRC 15	______	______	SRC 15	______	______
SRC 16	______	______	SRC 16	______	______	SRC 16	______	______
SRC 17	______	______	SRC 17	______	______	SRC 17	______	______
SRC 18	______	______	SRC 18	______	______	SRC 18	______	______

Error Log Information (MSG ID, SRC, URC, Time, Date): ____________

Other Problem Information: ____________

Replaced 9404 Parts		Replacement Sequence	P/N
Battery Power	1101	__ __ __	______
4 MB Main Storage	4104	__ __ __	______
8 MB Main Storage	3108	__ __ __	______
4 MB Expansion	4114	__ __ __	______
Feature Power	5133	__ __ __	______
Disk Unit	6100	__ __ __	______
Diskette 5.25 Inch	6131	__ __ __	______
Diskette 8 Inch	6132	__ __ __	______
WSC Twinaxial	6140	__ __ __	______
Twinaxial adapter		__ __ __	______
WSC ASCII	6141	__ __ __	______
ASCII 6 Port Adapter		__ __ __	______
ASCII 12 Port Adapter	6142	__ __ __	______
Communications 3 Line	6150	__ __ __	______
X21 Adapter	6151	__ __ __	______
232 Adapter	6152	__ __ __	______
V35 Adapter	6153	__ __ __	______
Token-Ring	6160	__ __ __	______
Token-Ring	2636	__ __ __	______
Ethernet	2625	__ __ __	______
Tape Utility	6346	__ __ __	______
Multifunction I/O Processor	2507	__ __ __	______
IMPI Processor	2508	__ __ __	______
IMPI Processor	2509	__ __ __	______
IMPI Processor	2515	__ __ __	______
IMPI Processor	2516	__ __ __	______
IMPI Processor	2551	__ __ __	______
Diskette Adapter	2517	__ __ __	______
Tape Controller 1/2 Inch	9348	__ __ __	______
Tape Controller	2647	__ __ __	______
Power Supply		__ __ __	______
Fan Unit		__ __ __	______
Control Panel		__ __ __	______
Cable Assembly		__ __ __	______
Expansion Unit Planar Board		__ __ __	______
System Unit Planar Board		__ __ __	______
Terminator Plug		__ __ __	______
Other: ______________		__ __ __	______
______________		__ __ __	______

Other Recommendations or Actions Taken: ______________________________
____
____
____
____

Other Recommendations for Problem Resolution:

Apply PTF(s): ______________________________
Submit an APAR, No or Yes (APAR Number): ______________________________
See Retain Tip(s): ______________________________
See Q & A (if available): ______________________________

Problem Resolution: ______________________________
____
____
____
____
____

9402 Problem Analysis and Resolution Form

Use this form as a check list to help identify problems. Also, use it to track and record problems and their resolutions.

Page 1 of 2

Initial Problem Date ___/___/___
Initial Problem Time ___:___ AM/PM

Who Handled Call ____________________
Time Spent On Problem/Call ____________

Contact Information:
Contact Name ____________________
Phone Number ____________________
Alt Phone Number ____________________
PMR Ref Number ____________________

Branch Office Information:
Branch Office Number ____________________
CE's Name ____________________
CE's Phone Number (_____)-_____-_________
Alt Phone Number (_____)-_____-_________

Other Contacts (name, phone number, and address): ____________________
____

Account Information:
Account Name ____________________
Address ____________________
City, State ____________________
Install Date ___-___-___
Phone Number (_____)-_____-_______
Account CE Name ____________________
System Serial No. ____________________
System Number ____________________
Plant Order Number ____________________
System Model ____________________
Customer Number ____________________
Release ____________________
PTF Level ____________________

System Configuration:
(Bus 0)
Slot 1 ____________ ____________
Slot 2 ____________ ____________
Slot 3 ____________ ____________
Slot 4 ____________ ____________
Slot 5 ____________ ____________

Initial Problem/Reason for Call:
__ Install instructions not complete
__ Defective documentation
__ Not able to IPL to DST
__ ECS not registered
__ ECS not working
__ Bus isolation problem
__ Information only
__ Not able to diagnose problem
__ Intermittent problem
__ Not able to fix device
__ Not able to load code
__ Defective replacement parts
__ Other ____________________
____

SRC History:

Date ___-___-___			Date ___-___-___			Date ___-___-___		
IPL Manual	Normal A	B	IPL Manual	Normal A	B	IPL Manual	Normal A	B
SRC 11	______	______	SRC 11	______	______	SRC 11	______	______
SRC 12	______	______	SRC 12	______	______	SRC 12	______	______
SRC 13	______	______	SRC 13	______	______	SRC 13	______	______
SRC 14	______	______	SRC 14	______	______	SRC 14	______	______
SRC 15	______	______	SRC 15	______	______	SRC 15	______	______
SRC 16	______	______	SRC 16	______	______	SRC 16	______	______
SRC 17	______	______	SRC 17	______	______	SRC 17	______	______
SRC 18	______	______	SRC 18	______	______	SRC 18	______	______

Error Log Information (MSG ID, SRC, URC, Time, Date): ____________________
____
____
____
____

Other Problem Information: ____________________
____
____
____

PAR Procedures

Replaced 9402 Parts		Replacement Sequence	P/N
4 MB Main Storage	4104	__ __ __	________
4 MB Expansion	4114	__ __ __	________
Disk Unit	6102	__ __ __	________
Diskette Unit	6133	__ __ __	________
Multifunction I/O Processor	2637	__ __ __	________
Multifunction I/O Processor	2638	__ __ __	________
Multifunction I/O Processor	2642	__ __ __	________
Multifunction I/O Processor	2643	__ __ __	________
WSC Twinaxial	6140	__ __ __	________
Twinaxial Adapter		__ __ __	________
WSC ASCII	6141	__ __ __	________
ASCII 6 Port Adapter		__ __ __	________
ASCII 12 Port Adapter	6142	__ __ __	________
Communications 3 Line	6150	__ __ __	________
X21 Adapter	6151	__ __ __	________
232 Adapter	6152	__ __ __	________
V35 Adapter	6153	__ __ __	________
Ethernet	2625	__ __ __	________
Token-Ring	2636	__ __ __	________
Tape Unit 1/4 Inch	6341	__ __ __	________
Tape Unit 1/4 Inch	6342	__ __ __	________
IMPI Processor C04	2558	__ __ __	________
IMPI Processor C06	2552	__ __ __	________
Tape Controller 1/2 Inch	9348	__ __ __	________
Tape Controller	2647	__ __ __	________
Diskette Adapter	2646	__ __ __	________
Battery Power	1102	__ __ __	________
Power Supply		__ __ __	________
DASD Fan Unit		__ __ __	________
Control Panel		__ __ __	________
Cable Assembly		__ __ __	________
Cable Assembly		__ __ __	________
Twinaxial Plate 2 Connector		__ __ __	________
ASCII Plate 6 Connector		__ __ __	________
Feature Cage Planar Board		__ __ __	________
SCSI Terminator		__ __ __	________
Other: ____________________		__ __ __	________
___________________________		__ __ __	________

Other Recommendations or Actions Taken: ____________________________________

Other Recommendations for Problem Resolution:

Apply PTF(s): ____
Submit an APAR, No or Yes (APAR Number): ____________________
See Retain Tip(s): ____________________________________
See Q & A (if available): ______________________________

Problem Resolution: ______________________________________

Chapter 3. External and Internal Symptoms

A problem always has an external symptom; however, a problem may not always have an internal symptom. Sometimes the symptom is the problem. An external symptom is the problem when the external symptom cannot be isolated to a specific internal symptom. An internal symptom is the problem when the internal symptom cannot be isolated to the actual cause of the problem.

Whatever the case, the first objective of problem isolation is to accurately define the external symptoms. To do this, verify that the initial problem analysis procedures were performed correctly. (To review the procedures for problem analysis, see "Problem Analysis" on page 2-1.) As an example, when the system (or part of the system) stops operating, the problem is sometimes described as a **hang** when the program is either in a **wait** or a **loop**. It is important that you know which because the diagnostic method needed by a loop is different from that for a wait.

The second objective of problem isolation is to find one or more internal symptoms. While there are only a few external symptoms (wrong output, message, wait, and loop), each external symptom can be caused by any number of internal symptoms. Each internal symptom has a special diagnostic plan that needs different information.

You must find at least one internal symptom to find out whether the problem is a discovery (new) or a rediscovery (existing). For more information about discovery and rediscovery (new and existing) problems, see page 2-6.

Note: As you learn more concerning the internal symptoms, you may change to a different plan, and you may need to get more information. The remaining chapters of this manual describe the tools and methods to enable you to find out the correct internal symptom.

Determining the External Symptom

Table 3-1 on page 3-2 and Table 3-2 on page 3-2 shows the conditions or attributes of the system that can be used to determine some of the external symptom.

Determining the Internal Symptom

This section describes how to find the internal symptom and obtain the correct information necessary to support the problem or internal symptom.

Table 3-3 on page 3-3 shows (by symptom or problem) the recommended information needed to diagnose and solve a problem. If you cannot solve the problem, then collect and submit this information with an APAR or LICTR. This information is normally available at the time of the failure.

Besides the failure information you may be asked to provide other information, such as an OS/400 or VLIC link map. A link map is a printout equating VLIC program names to their virtual addresses. See Chapter 6 about creating a symptom string and what information to submit with an APAR or LICTR.

See the following external symptoms for more detailed information about what information needs to be collected to help determine the internal symptom or isolate a problem to a specific cause:

- Hard stops, see page 3-4
- Incorrect output, see page 3-4
- Messages, see page 3-5
- Hangs, see page 3-8
- Loops, see page 3-8
- Waits, see page 3-11
- Card problems, see page 3-14
- Communication problems, see page 3-14
- Data integrity problems, see page 3-14
- Defective diskette or tape, see page 3-14
  - Also, included are 1/4- and 1/2-inch tape drive problems.
- IPL problems, see page 3-15
- Operating system problems, see page 3-16
- Power failures and problems, see page 3-16
- Printer problems, see page 3-16
- System start and stop problems, see page 3-18
- Vertical licensed internal code problems, see page 3-18
- Work station locks, see page 3-19

Table 3-1. Indicators of External Symptoms (Part 1 of 2)

Hard Stops	**Incorrect Output**	**Job Loops**	**Job Waits**
• The system attention light is On and an SRC is shown in the Data display on the control panel. • Work stations are input inhibited and cannot be signed on. • Dedicated service tools (DST) is not available and function 21 on the control panel does not work. To determine the internal symptom, see page 3-4.	• The system continues to run. • The job completes normally (the wrong output is found later). • The problem usually has to be created again under controlled conditions before good problem determination can be performed. • The wrong data was obtained. • Something happened that should not have happened. • Something *did* not happen that should have happened. To determine the internal symptom, see page 3-4.	• The processor active light is on all (or almost all) the time. • The system attention light is usually off. • System performance is degraded. • The Display Job (DSPJOB) command shows the job as active. • Actions that are normally associated with the job stop or do not appear • The job does not end in its expected time frame. • Other jobs continue to run, but their performance may be very poor or nothing is completed. To determine the internal symptom, see page 3-8.	• The processor light is almost always off. • The system attention light is off. • System performance improves. • Displaying the job shows it as active. • Job activity ceases or nothing is completed. • Action associated with one or more job stops. • The Work with Active Jobs (WRKACTJOB) command shows that the job has a status of DEQW, EVTW, LCKW, MSGW, DSPW, PRTW, CMNW, TAPW, DKTW, BSCW, MXDW, EOFW, DLYW, or TIMW. Requesting the *Display job locks* option on the Display Job menu shows lists of locks that are held by the job and a list of the remaining lock requests for the job. The Work with Object Locks (WRKOBJLCK) command can be used to find out which jobs hold locks on an object. • The performance of other jobs may appear normal or even better than normal. To determine the internal symptom, see page 3-11.

Table 3-2. Indicators of External Symptoms (Part 2 of 2)

System Loops	**System Waits**	**Card Problems**	**Power Problems**
• The processor active light is on all (or almost all) of the time. • The system attention light is off. • All action stops (printers, work stations, and so on). To determine the internal symptom, see page 3-8.	• The processor active light is off all (or almost all) of the time. • The system attention light is off. • System activity ceases or nothing is completed. • All action stops (printer, work station, and so on). To determine the internal symptom, see page 3-11	• Noise on the communication line. • Logic card failures. • Power failures or problems. • No insulation coating on the signal lines between the card edge tabs. • An open fault on the system I/O bus. • Bus type SRCs appear on the control panel. • On the 9406, SRC 11 0000 EEEE for an IPL failure and SRC 11 0000 000C for undervoltage appear. To determine the internal symptom, see page 3-14.	• Power supply fails when the system is operating. • Common SRCs 11 0000 0000B and 11 0000 000C or occasional SRCs 11 0000 000A, 11 0000 000E, and 11 0000 0001 appear with a 9406 power supply failure. • System is not useable or has limited useability. • No SRC appears with a 5030 Card unit. • SRC 11 B100 D001 appears when a failure occurs during run time. • SRC 11 B100 1020 appears when a failure occurs during IPL. To determine the internal symptom, see page 3-16.

Table 3-3. An Overview of the Information to Collect for Failures (by Symptom or Problem)

Information to Collect	Communications	Incorrect Output	Job Waits	System Waits	Job Loops	System Loops	Messages	Hard Stops	OS/400	VLIC
Communications trace (page 12-20)	X	X	X		X		X			X
Display/alter/dump (page 12-27)		X	X	X	X	X		X	X	X
Error log (page 12-3)		X	X		X		X	X		X
Job information trace (page 17-7)		X	X		X				X	
Job log (see note) (page 15-5)	X	X	X	X	X	X	X	X	X	
History log (page 15-8)		X	X		X				X	
Information from the control panel, such as:				X		X		X		
• OS/400 and VLIC SRCs (page Appendix C), • Display registers (page Chapter 32), and • MCLB (page 34-1)										
Message log (page 3-5)	X	X	X		X					
Main storage dump (page 16-1)				X		X		X	X	
OS/400 program debug (page 23-1)		X	X		X				X	
Print stand-alone dump (page 12-55)				X		X		X		X
Problem log (page 15-10)		X					X		X	
Process storage or job structure dump (page 16-1)		X	X		X		X		X	
PTF listing (page 13-6)	X	X	X	X	X	X	X			X
Sufficient information to create the failure again	X	X	X	X	X	X	X	X	X	X
Trace vertical licensed internal code (page 12-10)	X	X	X		X					X
VLOG entries (page 12-46)	X	X	X	X	X	X	X	X		X
Work with I/O debug utility (page 12-50)		X	X		X		X	X		

Notes:

1. The job log is recommended for all types of failures; but, if the logging level is too low, only high-level messages are logged. The message logged may not support the problem. For more information about changing log levels, see page 3-8.
2. If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Hard Stops

See Table 3-2 on page 3-2 to see how hard stops are indicated on the system.

For hard stops, it may be beneficial to diagnose the problem before initiating a main storage dump. The following functions are available for these situations:

Control Panel Function	Use
21	This function starts DST on the machine default console terminal (first locally attached work station on bus zero).
22	This function automatically stops the processor and dumps the main storage contents to DASD.
50	This function stops the CPU.
51	CPU status, base register zero, and current task dispatching element (TDE) are displayed.

Information that is needed or the actions to be taken are as follows:

- With the Keylock switch in the Manual position, use the Select key to select function 11 and press the Enter key. Write down the numbers shown on the control panel for functions 11 through 18 and 20 until 20 'FFFF ' on the 9406 System Unit and 9404 System Unit and '20 FF' on the AS/400 9402 System Unit is reached.

  Note: If you need help with the control panel, see Chapter 14.

- Find the system reference code (SRC) in the *Analyzing Problems Guide*, *Operator's Guide* and in the *Unit Reference Code Guide* and follow the procedures listed for the particular SRC.
- View IMPI base register 0 (B0) using the functions 50 through 52 on the control panel. For more information about these control functions, see Chapter 14.
- If instructed by the *Analyzing Problems Guide*, *Operator's Guide*, or *Unit Reference Code Guide* and if a main storage dump was taken and the print stand-alone dump function has been started, then display main storage and go to the current task dispatching element (TDE) which is taken from the registers display. Look at the machine check log buffer (MCLB), the current TDE and its associated call/return elements (CREs). This combination of data should lead to the failure. For more information about machine check log buffer (MCLB), see page 34-1.
- When the listing is printed, look at the TDE to see the failing task's name. Look down the CREs and note the exceptions listed for the different modules. The bottom CRE (`status = 6400`) is usually the problem. Check for an exception in this CRE (listed at the top of its section), note the module name and offset on the right hand side of the display. (For an example, see "Print Stand-Alone Dump Task Summary" on page 12-59.) Most of this data has been formatted out on the listing created for you. Contact your next level of support to get more help in explaining the data.
- There may be cases where the TDE does not show much of anything, then check the listing of the MCLB against the description given. For more information about machine check log buffer (MCLB), see page 34-1. Look for offsets 82 and 86. Offsets 82 and 86 tell what caused the machine to put up the failure. Contact your next level of support to get more help in explaining the data.
- Check for VLIC logs after you have started the IPL; then dump them for analysis. For more information about the VLIC log, see "Work with Vertical Licensed Internal Code (VLIC) Log" on page 12-46. Contact your next level of support to get more help in explaining the contents.
- Finally, you may need to take a main storage dump to gather information. For more information about main storage dumps, see page 16-1.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Summary of Debug Tips for Hard Stops:

- Obtain the SRC from the control panel.
- See the applicable *Analyzing Problems Guide* for the SRC.
- Select function 22 from the control panel to perform a main storage dump.
- Perform an IPL.
- Print the print stand-alone dump using DST.
- Display/alter/dump for the CRE or MCLB.
- Enter the PRTINTDTA command using DST or SST to obtain the VLOG entries.
- Enter the TRCINT command using DST or SST to trace the licensed internal code.
- Enter the PRTERRLOG command using DST or SST to obtain the error log.

Incorrect Output

In most cases, this problem or symptom points to a failing program or component. See Table 3-2 on page 3-2 to see how incorrect output is indicated on the system.

Actions to be taken are as follows:

- Verify that the input data is valid and in the correct format. Manually verify the data if it is from a work station; dump it to the printer if it resides in the database.
- Use the Trace Job (TRCJOB) command to determine the module flow. Compare the module flow against

the program listings (as made available and provided by IBM) to verify that the flow is correct. If the problem is not an OS/400 problem, refer to "Vertical Licensed Internal Code Problems" on page 3-18.

- Check the job log using the Display Job (DSPJOB) or Display Job Log (DSPJOBLOG) command for any error messages.
- Check the QSYSOPR message queue using the Display Message (DSPMSG) command with QSYSOPR specified with the MSGQ parameter for any related messages.
- Check the job log for the arbiter process (QSYSARB) for error messages. Use the Display Job Log (DSPJOBLOG) command.
- Check the history log. Use the Display Log (DSPLOG) command for any related messages.
- For customer programs only, check the job trace using the Trace Job (TRCJOB) command or the program trace using the Start Debug (STRDBG) or Add Trace (ADDTRC) commands.

  Use the Enter Debug (ENTDBG) command or the OS/400 Program Debug function to set breakpoints in the customer's program and observe the data at each breakpoint until you have isolated the customer instruction where the data goes from good to bad. Verify that the customer instructions are correct. For more information about the OS/400 Program Debug function, see page 23-1.
- Use VLIC trace to capture data. For more information about trace vertical licensed internal code, see page 12-10.
- Check the VLIC logs for the time of the failure, then dump them to a printer for analysis. For more information about VLIC logs, see page 12-46 and Chapter 31. Contact your next level of support to get more help in explaining the log's data.

Collect or use the following information to help diagnose problems:

- A printing of the job log, which shows all messages that were displayed or printed.
- If any unusual messages appeared in the job log, obtain a printing of the history or problem log for the time in question.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Summary of Debug Tips for Incorrect Output:

- DSPJOB
- DSPMSG QSYSOPR
- DSPJOBLOG
- DSPLOG QHST
- TRCJOB
- ADDTRC (program debug)
- Enter the TRCINT command using DST or SST to trace the licensed internal code
- Enter the PRTINTDTA command using DST or SST to obtain the VLOG entries

Summary of Commands for Debugging Incorrect Output:

Command	Description
ADDBKP	Add Breakpoints
ADDPGM	Add Program
ADDTRC	Add Trace
CHGDBG	Change Debug
CHGHLLPTR	Change High Level Language Pointer
CHGPGMVAR	Change Program Variable
CHGPTR	Change Pointer
CHGSYSLIBL	Change System Library List
CLRTRCDTA	Clear Trace Data
CPYF *PRINT	Copy Print File
DMPOBJ	Dump Object
DSPBKP	Display Breakpoint
DSPCMD	Display Command
DSPDBG	Display Debug
DSPDTAARA	Display Data Area
DSPJOB	Display Job
DSPOBJD	Display Object Description
DSPPFM	Display Physical File Member
DSPPGMVAR	Display Program Variable
DSPTRCDTA	Display Trace Data
ENDDBG	End Debug
RMVBKP	Remove Breakpoint
RMVPGM	Remove Program
RMVTRC	Remove Trace
RSMBKP	Resume Breakpoint
STRDBG	Start Debug
WRKJOB	Work with Job

Messages

A message does much of the problem isolation for you. When the system detects an error, the result is usually a message that describes the problem and the actions that should be taken to solve it. Many times you have the module name and instruction number where the error was detected, and that is usually a good internal symptom for a search through the service support system. The message help text for AS/400 messages provides key information for many problems.

There are several types of messages and several levels of severity that are associated with them.

If the error is of low severity and the job continues, an informational or diagnostic message is displayed or printed. The customer then notices the problem and can take action later.

If the job ended because of the error, an escape message follows the diagnostic messages. Many escape messages cause a record of the problem, the problem's status, and other information concerning the problem to be automatically written to the job log. Also, escape messages may cause dumps to be automatically written to disk. The escape message also contains special information concerning the internal symptoms of the problem.

An error message is shown on the display or in a dump generated by a job. Many errors are detected by the system and result in escape messages. Usually, the system collects information concerning the problem (including a job structure dump), and writes it to the job, history, or problem log. For more information about these logs, see Chapter 15.

The operating system displays failure information as messages. Each message has a message identifier. The first three letters of the message identifier indicate the message category. The following list shows some message identifiers for failures:

Identifier	**Description**
CPA	Messages that need system operator action
CPD	Diagnostic messages
CPF	Escape, status, or notify messages that the customer should monitor
CPI	Informational messages
CPZ	OS/400 install termination message
MCH	Machine interface messages
RPG	Report program generator language messages
SYS	System/36 environment messages

The remaining four digits indicate the number of the message. If an error condition occurs, you receive an error message that briefly identifies the error.

Messages that begin with CPZ cannot be displayed because they are part of the licensed internal code and are not contained in an operating system message file. For more information about CPZ messages, see page 18-13.

To display the message number and identifier for each message, place the cursor on the message and press the Help key. The Additional Message Information display appears. For examples of messages that appear in a history log, see Figure 15-3 on page 15-9. For an example of IPL messages that are contained in this log, see Figure 19-1 on page 19-8.

Some problems cause information to be recorded in the VLIC log. When that occurs, the dump identifier (name), which is sometimes referred to as the VLIC log ID, is returned in the message. Use the dump identifier to print or retrieve the dump data. For more information about the VLIC log, see Chapter 31.

To aid in problem resolution, the AS/400 message handler identifies the origin and the recipient of the message by program name and instruction number. For machine interface (MI) exceptions, the message includes the name or internal address of the licensed internal code module and the source of the signaling instruction.

The system:

- Automatically creates a symptom search argument for hardware errors only.
- Automatically gathers dump and other information to be used if the search argument does not result in a rediscovery match.

Since it is not always possible to automatically gather all of the information to determine the cause of the problem, or in those cases where the system cannot detect the problem (wrong output, loops, waits, and design defects), the user may select to run problem analysis.

While the system makes an entry in the problem log for each system-detected problem, it also sends a message to the QSYSOPR message queue. Messages that are associated with system-detected problems are marked with an asterisk (*).

The following is an example of a message display:

```
                              Display Messages
                                                       System:   RCH38SA1
Queue . . . . . :   QSYSOPR               Program . . . . :   *DSPMSG
  Library . . . :     QSYS                  Library . . . :
Severity  . . . :   50                    Delivery  . . . :   *HOLD
Press Enter to continue.
    responding.
  Line *N failed, recovery stopped.
* Line *N failed, recovery stopped.
  Line SDLC1 varied on successfully.
  Line SDLC2 varied on successfully.
  Controller SDLC1 contacted on line SDLC1.
  Controller SDLC2 contacted on line SDLC2.
  Communications device SDLC1 was allocated to subsystem QCMN.
  Communications device SDLC2 was allocated to subsystem IVIHE.
  Device TAP01 not ready.
* Load failure occurred on device TAP01.
  Device TAP01 no longer in ready status.
  Device ISDHCF01 no longer communicating.

F3=Exit              F11=Remove a message                  F12=Cancel
F13=Remove all       F16=Remove all except unanswered      F24=More keys
  * - Program analysis allowed for message.
```

Figure 3-1. An Example of a Display Messages Display

Press the F24 (More) key to display the F14 (Problem Analysis) key.

An asterisk is located at the left side of the message to indicate that there is an associated SRC. To start problem analysis for any hardware or software errors with an SRC (errors detected by the system), press the F14 (Problem Analysis) key with the cursor anywhere on a message that has an asterisk. After problem analysis ran, the asterisk is removed and the results are placed in the problem log. You can use the Work with Problems (WRKPRB) command or select the *Work with problems option* from the Problem Handling menu to get the problem in the problem log. After the command is entered or the option is selected, the Select Problem display appears. The following is an example of the Select Problems display:

```
                              Work with Problems
                                                        System:   RCH38SA1
Position to . . . . . . .  _________          Problem ID

Type options, press Enter.
  4=Delete   5=Display details   6=Print details   8=Work with problem
  9=Work with alerts   12=Enter notes

Opt  Problem ID  Status        Problem Description
 __  9005046647  ANSWERED      Fix request
 __  9005046559  PREPARIED     User detected a software problem on a different
 __  9005045633  ANSWERED      Fix request
 __  9005045433  OPENED        Time limit reached while tyring to call control
 __  9005043630  SENT          User detected a software problem on a different
 __  9005043399  SENT          User detected a software problem on a different
 __  9005038288  SENT          User detected a software problem on a different
 __  9005038211  OPENED        Media error found on volume  on device .
 __  9005038175  OPENED        Media error found on volume  on device .
 __  9005036331  ANSWERED      Fix request
 __  9005036017  SENT          User detected a software problem on a different
                                                                       More...
F3=Exit      F5=Refresh   F6=Print list     F11=Display dates and times
F12=Cancel   F16=Report prepared problems   F24=More keys
```

Figure 3-2. An Example of a Select Problem Display

This display allows you to work with problems in the problem log. For more information about the problem log, see page 15-10.

If the user detects an error and the error has no SRC (a problem is not detected by the system), you can enter Analyze Problem (ANZPRB) command to start problem analysis. The following is an example of the Analyze a New Problem display:

```
                              Analyze a New Problem
                                                        System:   RCH38SA1
Select one of the following:
  Problem Is Occurring on this AS/400 at this Time
     1. Job or program problem (application or system)
     2. System performance problem
     3. Hardware or communications problem
  Problem Is Not Occurring on this AS/400 at this Time
     4. Problem made a re-IPL of this AS/400 necessary
     5. Problem not on this AS/400 or attached devices

Selection or command
===>
F3=Exit   F4=Prompt    F9=Retrieve   F12=Cancel
```

Figure 3-3. An Example of an Analyze a New Problem Display

Use this display or the ANZPRB command to start your questions that build your symptom string used in reporting the problem. Follow the menus and the problem record that has the keywords to help you find known problems in the Service Support System. When this is complete, a problem log entry is created. The problem can now be worked from the problem log like a problem that was detected by the system. For more information about online problem analysis and resolution, see page 11-7. Also, see the *Operator's Guide* for more information about sending messages, displaying and receiving messages, changing message queues, responding to and handling error messages, handling a damaged message queue, and interpreting the Display Messages display.

Actions to be taken are as follows:

- To display the message queue every time a message is logged, put the queue in Break mode. To put the queue in Break mode, type: in

  `CHGMSGQ QSYSOPR * BREAK`

  Putting the QSYSOPR message queue in Break mode lets the customer know immediately when the system detects a problem. The customer may then choose to analyze the problem or to delay analysis until a later time. System-detected problems may be analyzed later by displaying QSYSOPR or using the WRKPRB command.

- On the display containing the error message, move the cursor to the command that has failed and press the Command (Cmd) key to display detailed messages. This displays the messages that occurred during command processing. By placing the cursor anywhere on the message and pressing the Help key, the Additional Message Information display appears and contains the message identifier (for example, `MCH0601`), the programs that sent and received the message, their respective instruction numbers, the message type, the second level text, and any recovery options that you may have. For solving communications problems, the Additional Message Information display may have configuration data.

- Read the additional message information about the error or the description of the corrective action and take the corrective action.

- Generally, you look at the top few messages for the statement `Function check unmonitored by ...`, and look to see what module is named in the TO PGM field. Contact your next level of support to get more help in explaining the problem.

- You can also look in other places for more data. Display the QSYSOPR message queue and look for any related messages there.

- Look at the job logs of the job with the failing command, the subsystem in which the job is running, and possibly the QSYSARB (arbiter job) log if this is device related. Use the Display Job Log (DSPJOBLOG) command here.

- Check the history log (QHST) for the failing time frame. Use the DSPLOG QHST command.

- Display the output produced by the job to see if any associated dump data has been taken.

- Some online messages allow you to start problem analysis for various types of error conditions. These procedures may help resolve an error that you could not resolve from the message or the Additional Message Information display for that error message. An asterisk is located at the left side of the message to indicate that there is an associated SRC. Before pressing the F14 key to start problem analysis, position the cursor on the message with the asterisk and press the Help key. Review the additional message information for possible recovery actions that would solve the problem before doing problem analysis. If their is no recovery actions, press F14 from the additional message information display to begin isolating the problem. Once problem analysis is started for a message, F14 is disabled. If problem analysis needs to be started again, then go to the problem log to select a problem to analyze using the WRKPRB command.

Collect or use the following information to help diagnose problems:

- A copy of the history log for the time in question using the Display Log (DSPLOG) command.
- Any entry made in the VLIC log, using the VLIC log service function or the Print Internal Data (PRTINTDTA) command.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Changing the Logging Level: You may have to change the logging level for the job log to ensure that all pertinent messages are sent to the job log. To change the logging level, use the Change Job (CHGJOB) command. Sometimes the second-level message text contains the key to problem resolution.

The LOG parameter on the CHGJOB command can be used to change the logging level. This permits the user to vary the number of messages logged. To get everything except CL programs, set the logging level at four, severity at zero, and text to *SECLVL.

Changing a Message Description: If the symptom is an unmonitored escape message and enough information is not provided automatically, you can change the DMPLST parameter in the message description so that more information is provided for the next time the message appears. You can specify that:

- Up to 20 specific data fields be dumped
- An OS/400 job structure dump be taken
- An internal process dump be taken

To change the DMPLST parameter, use the Add Message Description (ADDMSGD) command to create the message description again; then place the new message description in an override file. See the message help text for:

- Creating message descriptions from message explanations
- Describing how to create a modified message
- Describing how to override files

Summary of Debug Tips for Messages:

- Press the Help key.
- Press the F10 (Additional Data) key to display messages.
- Enter DSPMSG QSYSOPR.
  - Press the F14 (Problem Analysis) key
  - Enter the TRCINTDTA command using SST or DST to look at the VLOG entries
  - Check the error logs using the PRTERRLOG command using DST or SST.
- Enter DSPJOBLOG.
- Enter DSPLOG QHST.
- Enter WRKJOB to look through spooled files.

Summary of Commands for Error Messages:

Command	Description
CHGJOB	Change Job
CHGMSGQ	Change Message Queue
DSPJOB	Display Job
DSPJOBLOG	Display Job Log
DSPLOG	Display Log
DSPMSG	Display Messages
DSPMSG QSYSOPR	Display System Operator's Messages
Help function key	
PAR messages	
SIGNOFF LOG(*LIST)	Sign Off
SYSREQ	System Request
WRKACTJOB	Work with Active Jobs
WRKJOB	Work with Job
WRKMSGD	Work with Message Descriptions
WRKMSGQ	Work with Message Queues
WRKSBMJOB	Work with Submitted Jobs
WRKSBSJOB	Work with Subsystem Jobs
WRKUSRJOB	Work with User Jobs

Hangs

A hang is either a wait or a loop, and you have to know which it is. Waits and loops are diagnosed differently and it may be difficult later to find out which type of failure occurred. Frequently, you cannot continue finding the problem until the failure is accurately determined to be a wait or a loop so that the correct procedures can be followed.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Loops

Two kinds of loops are as follows:

- Job, see page 3-9
- System, see page 3-10

Loops can be difficult to resolve if the correct information is not obtained at the time of the failure. Remember that the system is still running. Usually, the cause of the loop (not necessarily the cause of the problem) is connected with *one* of the instructions being executed in the loop.

When you find that single key instruction, you find one of two possible causes of the loop. They are as follows:

- The instruction was coded incorrectly. If this is the case, you have found the cause of the problem.
- The data that the instruction is working on is invalid or has been damaged. If this is the case, you have only found an internal symptom of the problem.

The efforts needed to find a key instruction depend on the size of the loop; some loops are large and can involve more than one module and many instructions. When that is the case, finding the key instruction may be very difficult. Some problems, like loops, have to be serviced in this *remote* manner. For more information about remote job service, see page 11-12.

Summary of Commands for Debugging Loops:

Command	Description
CHGJOB	Change Job
DMPJOB	Dump Job
DMPOBJ	Dump Object
DMPSYSOBJ	Dump System Object
DSPACTJOB	Display Active Jobs
DSPJOB	Display Job
ENDJOB	End Job
ENDJOBABN	End Job Abnormal
ENDSRVJOB	End Service Job
STRSRVJOB	Start Service Job
SYSREQ	System Request
TRCJOB *END	Trace Job
TRCJOB *OFF	Trace Job
TRCJOB *ON	Trace Job
WRKACTJOB	Work with Active Jobs
WRKJOB	Work with Job

Job Loops: A job loop is usually one job using large amounts of system resource. See Table 3-2 on page 3-2 to see how job loops are indicated on the system.

If the problem is a job loop, do the following to obtain the internal symptom:

- Use the WRKACTJOB command to see which job is actually looping. The job that is looping is the one using most of the CPU resources. Refresh the display to show the looping job's statistics.
- Check the invocation stack of the looping job to see what program is looping. The invocation stack can be displayed using the option on the WRKACTJOB display. The high level statement numbers may aid you if there is a user program loop.
- Check the job message queue if the job is active or check the job log if the job is ended for messages that may help explain the problem.
- If you know which job it is and you can use another work station, enter the Start Service Job (STRSRVJOB) command with the looping job's name and then enter the Trace Job (TRCJOB) command. This traces the programs being called. After the trace has been running for a short time, use TRCJOB *OFF to turn off the trace and dump it to an output queue. For more information about trace job, see page 17-7. Contact your next level of support to get more help in explaining the trace data.
- If you know which job it is and you can use another work station, enter the STRSRVJOB command with the looping job's name and then enter the Dump Job (DMPJOB) command to dump all of the job's control blocks and spaces, program stack, and job data structures. This is a rather large dump, but it contains good data. Find the module in the trace output to find out which component is indicated. For more information about modules and their IDs, see Chapter 4. Dump the objects associated with the component for problem resolution. Contact your next level of support to get more help in explaining the data. The data is dumped to the requesting job's output queue. For an example of the process dump, see the *AS/400 System Support: Diagnostic Aids Addendum*[1].
- If you know the looping program and the program is observable, trace it using the STRDBG and ADDTRC commands to see how the program is running. See the *CL Reference* for more information about these commands.
- If observable, use the OS/400 Program Debug function to add breakpoints in a program and look at the actual data being used. For more information about the OS/400 Program Debug function, see page 23-1.
- Check for VLIC logs from the time of the failure; then dump the logs to a printer for analysis. For more information about VLIC logs, see page 12-46 and Chapter 31. Contact your next level of support to get more help in explaining the data.

If the loop was in one module (no external calls and returns), you may have to use the test component to define the loop. Before you attempt to use the test component, check that you can do the following or that these conditions exist:

- You can create the failure again.
- The problem is not in the test component.
- The problem is not in the instruction path used to start the test component.

[1] Object Code Only (OCO)—IBM Confidential Restricted.

Symptoms

- The program must be compiled as observable. The operating system programs are not observable.

If these conditions are met, then:

1. Enter the Start Debug (STRDBG) command for the failing job before the looping program is started. Use the TRCFULL parameter and specify the trace to wrap.
2. Enter the Add Trace (ADDTRC) command to start an instruction trace; specify all instructions.
3. Enter the Add Breakpoint (ADDBKP) command to set a breakpoint in the looping program where control is to be returned to you. Use the instruction number from the invocation stack entry in the job structure dump that you obtained earlier.

To ensure a complete loop, the breakpoint should be reached at least twice:

1. When the breakpoint is reached the first time, enter the Resume Breakpoint (RSMBKP) command.
2. When the breakpoint is reached a second time:
   a. Enter the Remove Breakpoint (RMVBKP) command to remove the breakpoint.
   b. Enter the Remove Trace (RMVTRC) command to remove the trace.
   c. Request a dump of the trace data by entering the Display Trace Data (DSPTRCDTA) command.
   d. Enter the End Debug (ENDDBG) command to end the debug function.

Summary of Debug Tips for Job Loops:

- Enter the WRKACTJOB command to find out what is using up most of the resources
- Enter the DSPJOB command to look at the invocation stack for finding the current program
- STRSRVJOB
  - TRCJOB
  - DMPJOB
- STRDBG
  - ADDTRC
  - ADDBKP
  - DSPPGMVAR
- Enter the PRTINTDTA command using DST or SST to obtain VLOG entries

System Loops: A system loop does not handle user jobs. See Table 3-2 on page 3-2 to see how system loops are indicated on the system.

For system loops, it may be beneficial to diagnose the problem before initiating a main storage dump. The following functions are available for these situations:

Control Panel Function	Use
21	This function starts DST on the machine default console terminal (first locally attached work station on bus zero).
22	This function automatically stops the processor and dumps the main storage contents to DASD.
50	This function stops the CPU.
51	CPU status, base register zero, and current task dispatching element (TDE) are displayed.

If the problem is a system or tight loop, do the following to obtain the internal symptom:

1. Look for things that have changed recently, for example:
   - Has a new release been installed?
   - Has a new PTF just been added?
   - Has a new type of equipment been added to the system or has their been a change in the system configuration?

   If any of the preceding events has recently happened, the problem most likely occurred during the implementation of one or more of these events. Otherwise, the problem occurs with an event that is not listed here. Whatever the case, continue with the following steps.
2. If other work stations cannot be used, use functions 50 through 52 on the control panel to display the IMPI registers. The address of the program that is running is in register 0. Step through the loop, recording the IAR field numbers to see what instructions are looping. Continue to record register 0 and the IAR field numbers using functions 50 through 52 until the looping pattern is established. The program may be interrupted by one of the system timer tasks. When this happens, start IMPI interpretation again (function 52), stop it (function 50), and look at the registers again (function 51). Function 51 shows you where register 0 points. For more information about these functions, see the "Service Panel Functions" on page 14-8.
3. Select function 21 from the control panel to force DST. to display information obtained in the previous step.
4. Take a main storage dump. Select function 22 from the control panel and do a main storage dump to DASD. For more information on main storage dump, see page 16-1. The dump is complete in about 3 to 60 minutes or when `A100 300X` appears on the control panel. If `B1XX` or `25XX` codes appear, refer to the error recovery procedures on page 16-6.
5. After the dump completes, IPL again and use the print stand-alone dump service function to save the dump image. For more information on print stand-alone dumps, see page 12-55.
6. After an IPL has been done, print the history log from that time frame (DSPLOG QHST) and job logs from the jobs that were active at the time of the loop. Get all of

the history, problem, and job logs for all active jobs in the system to analyze for failure symptoms.

7. Check for VLIC logs after you have completed the IPL, then dump them to a printer for analysis. For more information about VLIC logs, see page 12-46.

For more information about main storage dumps, see page 16-1. Contact your next level of support to get more help in explaining the contents of the main storage dump.

Summary of Debug Tips for System Loops:

- Obtain the SRC and register 0 or TDE from the control panel.
- Perform a main storage dump.
- Perform an IPL.
- Print the print stand-alone dump using DST.
- Display/alter/dump using DST using the TDE obtained from the control panel.
- Enter the PRTINTDTA command using DST or SST to obtain the VLOG entries.

Waits

Two types of waits are as follows:

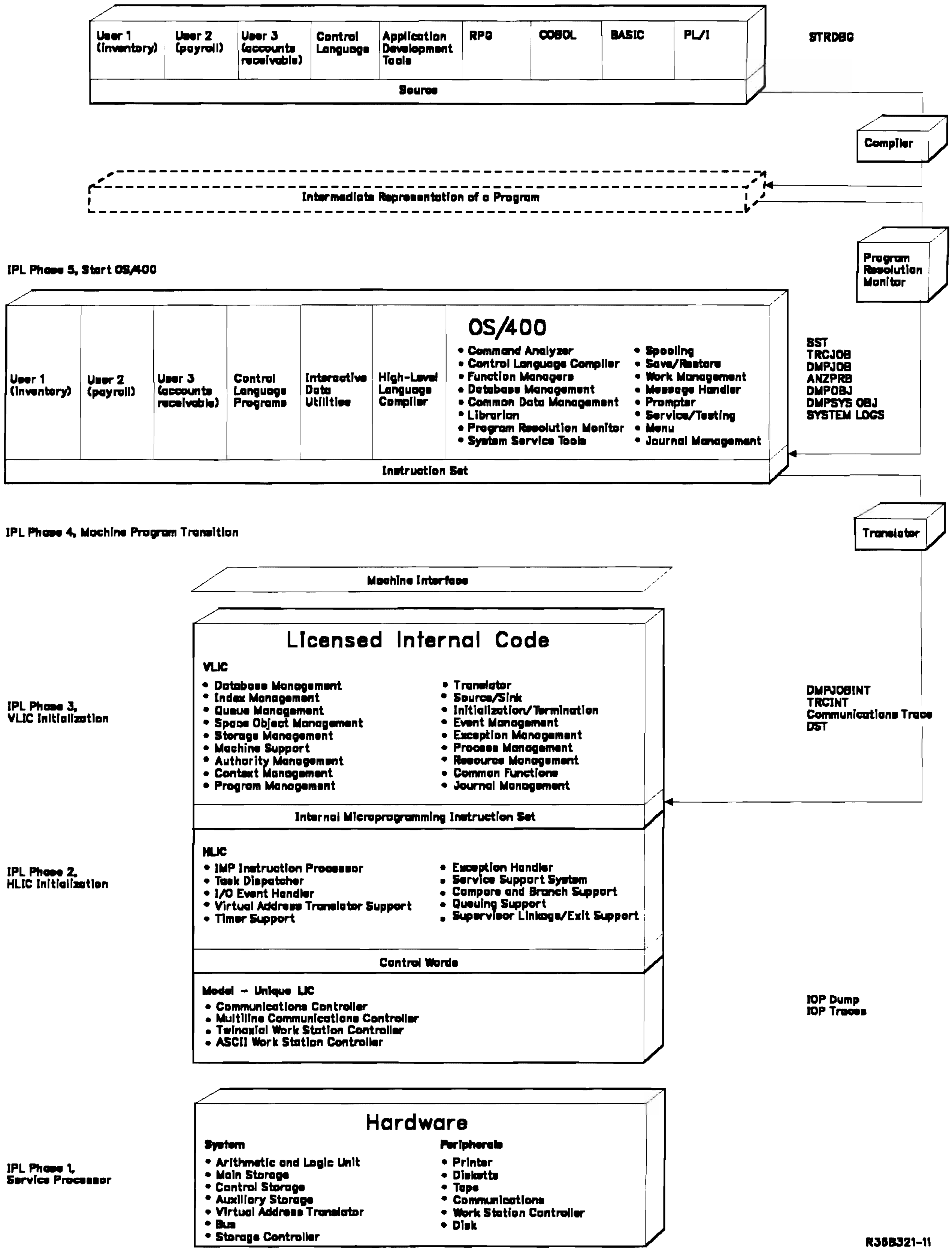
- Job, see page 3-13
- System, see page 3-13

In the wait state, all or a part of the system is not running. A wait state can be difficult to resolve because the internal symptom can be difficult to find. Often, you have the entire system to analyze and no apparent internal symptoms. Figure 3-4 on page 3-12 shows the different components of the system.

First, determine the scope of the problem. If the entire system is not in a wait state, you need to know which part is running and which part is waiting. The part that is still running could be the cause of the problem. If only one or two jobs are waiting, you want to know what they have in common and what operation they did last. They both may have requested a resource of some kind and could not get it. (One of the running jobs may be using the resource exclusively.)

Summary of Commands for Debugging Waits:

Command	Description
CHGJOB	Change Job
CHGMSGQ	Change Message Queue
DSPJOB	Display Job
DSPMSG	Display Messages
DSPMSG QSYSOPR	Display System Operator's Messages
SYSREQ	System Request
WRKJOB	Work with Job
WRKOBJLCK	Work with Object Lock
WRKWTR	Work with Writers



Some of the tools and commands that you can use to diagnose problems for each layer in architecture are shown to the right of that layer. For more information about the IPL phases associated with each layer, see Chapter 18.

Figure 3-4. AS/400 Layered Architecture

Symptoms

Job Waits: A job wait is one job that has stopped while other jobs on the system run normally. See Table 3-2 on page 3-2 to see how job waits are indicated on the system. If the problem is a job wait, do the following to obtain the internal symptom:

- Display the waiting job's invocation stack using the Display Job (DSPJOB) command to see which module is at the bottom of the stack.
- Display the waiting job's job log using the Display Job (DSPJOB) or Display Job Log (DSPJOBLOG) command. Review the job log for problem symptoms.
- Check for VLIC logs taken in the current time frame and dump them to a printer for analysis. For more information about VLIC logs, see page 12-46 and Chapter 31. Contact your next level of support to get more help in explaining the data.
- Check for messages that have not been responded to; if there are no messages, use the End Job (ENDJOB) command with the *IMMED option. The ENDJOB command removes the failing job from the system. If this is successful, it should produce a job log for that job. Review the job log for problem symptoms. You may have to use the ENDJOBABN command, but it cannot be used until 10 minutes after the ENDJOB *IMMED command has been entered.
- If you know which job it is, the job is not removed from the system, and you can use another work station, do the following to obtain the internal symptom:
  1. Enter the Start Service Job (STRSRVJOB) command for the failing job to start the service mode.
  2. Enter the Dump Job (DMPJOB) command to dump all of the job's control blocks and spaces at that time and, if possible, print a job structure dump for the failing job. Contact your next level of support to get more help in explaining the data. The data is dumped to the requesting job's output queue.
  3. Enter the Dump Job Internal (DMPJOBINT) command to write the internal data structures for the job to the VLIC log. (A dump identifier, name, returns so that the internal dump can be gotten and printed later using the PRTINTDTA command.)

Summary of Debug Tips for Job Waits:

- Enter the DSPJOB command to look at the last program in the invocation stack
- DSPJOBLOG
- Look for messages
- Look for locks
- Enter the PRTINTDTA command using DST or SST to obtain the VLOG entries
- DSPMSG QSYSOPR
- ENDJOB *IMMED
- ENDJOBABN
- STRSRVJOB
  - DMPJOB

System Waits: A system wait is difficult to analyze because the problem could be anywhere in the system. See Table 3-2 on page 3-2 to see how system waits are indicated on the system.

For system waits, it may be beneficial to diagnose the problem before initiating a main storage dump. The following functions are available for these situations:

Control Panel Function	Use
21	This function starts DST on the machine default console terminal (first locally attached work station on bus zero).
22	This function automatically stops the processor and dumps the main storage contents to DASD.
50	This function stops the CPU.
51	CPU status, base register zero, and current task dispatching element (TDE) are displayed.

If the problem is a system wait, do the following to obtain the internal symptom:

1. Look for things the system is waiting on, for example:
   - Unanswered messages.
   - Things that have changed recently or have been added to the system.

   These preceding items may reveal your problem. If not, continue on with the following items.
2. Select function 22 from the control panel and do a main storage dump to disk. For more information about main storage dumps, see page 16-1. Function 22 is described in Chapter 14.
3. After the dump completes, IPL again and use the print stand-alone dump service function to save the dump image. For more information about print stand-alone dump, see page 12-55.
4. After an IPL has been done, print the history log from that time frame (DSPLOG QHST) and job logs from the jobs that were active at the time of the hang. Get all of the history, problem, and job logs for all active jobs in the system to analyze for failure symptoms.
5. Check for VLIC logs after you have completed the IPL, then dump them to a printer for analysis. For more information about VLIC logs, see page 12-46 and Chapter 31. Contact your next level of support to get more help in explaining the data.

Summary of Debug Tips for System Waits:

- Select option 22 on the control panel to perform a main storage dump
- Perform an IPL
- Enter the PRTINTDTA command using DST or SST to obtain the VLOG entries
- Print the history log using the DSPLOG QHST command
- DSPJOBLOG
- WRKPRB

Card Problems

See Table 3-2 on page 3-2 to see how job waits are indicated on the system.

Actions to be taken are as follows:

- Make sure the ZIF connectors are tight and re-ZIF the cards 3 times.

  The card should be removed from the connector during this action. Follow all safety precautions as listed in the *System Support: Service Guide — 9406*. An IPL is necessary to determine if the problem is corrected.
- Make sure the system is grounded properly.
- Make sure the cards are plugged in correctly.

  If the service representative manages to short -12V to A/D bus (27), then all IOBUs on a power domain fail since the A/D bus (27) driver is burned out on every FRU.

To correctly install the cards, see the *Service Guide* and the instruction sheet being shipped with every new card. Also, see "Power Problems" on page 3-16 and Figure 7-6 on page 7-8.

Communication Problems

For communication problems most of the data in this chapter may apply. In addition, the external symptom may be unexpected for undesirable requests of or responses to a remote system controller or device. Communications trace can be run during the problem, to create and capture the sequences of messages sent to and/or from the remote system controller or devices. Analysis of these exchanges may help determine the cause of the problem. For more information about communications verification, see page 11-3. For more information about communications trace, see page 12-20.

The following information is needed for a communications problem at the IOP level for a SDLC protocol:

- An IOP dump using the I/O debug utility
- An error log
- The line, controller, device descriptions for the failing subsystem

More information may be needed depending on the specific problem. For example:

- A communications trace
- A history log
- PT-2 or PT-3 trace

For more information about collecting information for IOP communications problems, see "AJGJ001 and AJGJF01 Procedures for the Communications Controllers" on page 5-4.

Data Integrity Problems

Journaling can be used to analyze data integrity problems. Use the STRJRNPF command to begin journaling a file, and then use the DSPJRN command to display the information in the journal to analyze where the data integrity problem exists. See page 8-1 and the *Programming: Backup and Recovery Guide* for more information about journaling.

Defective Diskette or Tape

You may want to use the Print Error Log (PRTERRLOG) command or the work with error log function to verify that no errors occurred on the diskette or magnetic tape that was used to save system objects. For more information about the work with error log function, see page 12-3.

Use the Verify Tape (VFYTAP) command as an aid when you are trying to correct hardware problems that the ANZPRB command does not diagnose. For more information about verifying tape problems, see the Verify Tape (VFYTAP) command in the *CL Reference*.

You can use the ANZPRB command to perform tape media analysis. For more information about problem analysis, see page 11-7.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

For 1/4-Inch Tape Drive Problems:

Read or Write Errors: To avoid replacing parts whenever possible, do the following:

- Clean the tape heads:
  - Using the tape head cleaning kit (part number 21F8570). Instructions for using the kit are in the kit.
  - After 2 hours of tape movement for new 1/4-inch tape cartridges.
  - After 8 hours of tape movement for tape cartridges that have been read or written several times.
  - Before an initial software install or release upgrade.
  - When the cartridge tape operation has stopped or is slow.

  Note: The SRC contains:

For System Unit	Leftmost 4 Digits In Function 11	Rightmost 4 Digits In Function 12
9404	6346 and 6347	FFFF
9406	9346	FFFF
9402	6341 and 6342	FFFF

- Exchange tape cartridges that have excessive data errors with new cartridges.

For 1/2-Inch Tape Drive Problems: These tape drives can experience:

- Read or write errors

  These errors are indicated by a CPF message that appears on the system console. The message indicates a media or hardware failure. An SRC may appear in the error log.

- Loading problems

  These problems are indicated by a CPF message that appears on the message console. The message indicates that a device is not ready, an equipment check, or a load failure. An SRC may appear in the error log.

- Power or heat problems

  These problems you may be obvious to you when no SRC appears in the error log.

Note: Thin tapes are more susceptible to media damage and load failures. These failures may not be caused by the tape drive but rather by the media. Check any tape that exceeds 2400 feet on a reel so that it meets the thickness requirements for the 1/2-inch tape units.

Tape Read or Write Errors: To avoid replacing parts whenever possible, do the following:

- Clean the tape head by doing one or more of the following:
  - Clean the tape path thoroughly every 8 hours if less than 10 reels are used in 8 hours.
  - Clean the tape path thoroughly every 1 to 2 hours of continous running if more than 10 reels are used in 8 hours.
  - Clean the tape path thoroughly after each reel of tape if:
    - Particles appear in the tape path.
    - You are using tapes from outside your computer center.
    - You are using new or seldom used tapes.
  - Clean the tape path immediately if:
    - There is excessive dust in the computer center.
    - The tape unit has not been used in several days.

  See the device documentation for proper cleaning procedures applicable for the device.

- Use a different tape reel and try the operation again.

  If the tape drive has a problem reading a tape, copy the data from the defective tape to a known good tape. Try the read operation again.

- Use the ANZPRB command to perform tape media analysis on the tape volume the customer is using.

  Note: When performing a tape operation that needs more than one reel, make sure the tapes are initialized with a different volume ID.

- Using a known good scratch tape, verify the tape drive hardware by running VRYTAP command or by running offline diagnostics on the tape drive.

  Note: IBM tape drives only support 1-1/2 mill thick tape reels with a maximum length of 2400 feet.

Loading Problems: To avoid replacing parts whenever possible, do the following:

- Load problems could occur when the tape leader is damaged, there is no beginning-of-tape (BOT) marker, a tape reel upside down, or a tape reel is missing. Correct the problem and try the operation again.
- For an autoload tape device, check the following:
  - Tape path is clean.
  - Tape leader is not damaged.

    Tapes that are not properly trimmed may not load properly. A tape leader trimming tool, PN 2512063, should be used to round off the tape leader. Press hard on the tape leader when cutting the tape. This tool cuts the end of the tape with a smooth, round cut and puts small indentions on the tape. The indentions allow the air to blow the tape off the reel if it sticks.

    Wipe tapes that have static discharge build up with an antistatic material.

Tape Power or Heat Problems: Measure the line voltage going to the tape drive and properly set the correct voltage setting on the tape unit. See the device documentation for the location of the voltage settings.

IPL Problems

For information about debugging IPL problems using DST, see "How to Start DST Debug Mode" on page 13-20. To force full storage management directory recovery to run:

1. IPL in step mode to storage management recovery.
2. While recovery is running, force an IPL by selecting function 3 on the control panel.
3. Press the Enter switch on the control panel.

Operating System Problems

If you are able to diagnose the problem to the failing component, the following information (by component) is helpful and can speed problem or APAR resolution. This is true if you can obtain the documentation instead of material to create the failure again.

A job structure dump, sometimes referred to as a process storage dump, (described in the *AS/400 System Support: Diagnostic Aids Addendum*, ZW82-9335[2]) is automatically taken for some unmonitored escape messages. You can also obtain a job structure dump by using the Dump Job (DMPJOB) command.

Be aware, however, that a dump must generally be taken at, or very near, the time of failure in order for the information to be of value. Therefore, the DMPJOB command may not provide suitable information unless you can stop the job very near the error before issuing the command. For example, if the symptom is a job wait or job loop, the DMPJOB command is probably useful; if the symptom is incorrect output, the DMPJOB command is probably not useful.

Note, also, that while the display commands (for example, DSPPGMVAR) produce formatted output, the dump commands (for example, DMPSYSOBJ) are preferred because they usually provide additional information.

Notes:

1. If the problem is in or is associated with a display command, obtain a copy of the command and a copy of the file used. Refer to the *CL Reference* for a list of the files used.
2. For the Work with Subsystems (WRKSBS) command, dump all subsystem descriptions using the Dump Systems Object (DMPSYSOBJ) command.
3. If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Remote Job Service: The dump trace (DMPTRC) command usually applies to the job specified with the command. To have a dump or trace apply to some other job, use the Start Service Job (STRSRVJOB) command and specify the name of the job that you want to service. You can use the Work with Subsystems (WRKSBS) command or dump the work control block table (WCBT) using the Dump System Object (DMPSYSOBJ) command to find the name of the job. Some problems, like loops, have to be serviced in this *remote* manner. For more information about loops, see page 3-8.

To end remote servicing, enter the End Service Job (ENDSRVJOB) command. To display the current status of the service mode for a specified job, enter the Display Service Status (DSPSRVSTS) command.

For more information about remote job service, see page 11-12. For a list of OS/400 components, see Chapter 4.

Power Problems

Power failures can cause IOPs to reset and power on reset (POR) to glitch. Many power failures appear as system I/O bus problems. See Table 3-2 on page 3-2 to see how job waits are indicated on the system.

Actions to be taken are as follows:

- On the 9406 System Unit, replace the power supplies with serial numbers 4500 through 7295.
- Make sure the system is properly grounded.
- Make sure the connection between the power supply and interposer is not weak.
- Make sure that the power supplies are not bad.
- Make sure the mainline circuit breaker is set to the on position.
- Make sure the main ac power cable is connected.
- Make sure that all system power is properly phase balanced.

To solve power problems, see the *Service Guide*. Also, see "Card Problems" on page 3-14.

Printer Problems

Note: You can use the VFYPRT command to indicate a problem with the configuration or line; however, this command is not valid for AFP(*YES) printers.

Consider asking the following questions to help analyze and solve printer problems:

1. What is the printer being printed to? Is the printer type SCS or IPDS?

   Note: When dealing with problems that involve 3812, 3816, or 4234 Printers, the device type of the printer must be determined. All of these printers may be configured as *SCS or IPDS. The device type of 3812 and 3816 can be determined by looking at the licensed internal code diskette in the printer. The device type of the 4234 is determined by the model number. Model 2 is SCS and model 12 is IPDS.
2. If the printer is IPDS, is it AFP(*YES) or (*NO)?
3. What is the device type of the file being printed? Use the WRKSPLFA command to determine the device type.
4. Does the printer fail every time, occasionally, just for one particular file or document, or for certain files or documents?

[2] Object Code Only (OCO)—IBM Confidential Restricted.

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5. What generated the output? For example, was system output generated by the Display Library (DSPLIBL) command using the OUTPUT(*PRINT) parameter, or was OfficeVision/400 or an RPG program used to generate output?
6. What messages are in the spool writer's job log? What messages are in the spool writer's message queue? Use WRKSPLF QSPLJOB to view the writer's job logs.

   Note: If the device has advanced printer function enabled, the print driver's job log should also be checked.
7. What messages are in the history log? Use DSPLOG QHST to view the history or QHST log. For more information about this log, see page 15-8.
8. What is the order of the files in the output queue? Does the order of files in the output queue cause a problem? For example, does the error occur when printing a OfficeVision/400 file, followed by a system generated file, followed by a COBOL generated file?
9. What values are shown on the Display Spool File Attributes display? For example, are the PAGESIZE, SCHEDULE, FONT, PAGRTT, CHRID, and device requirements shown on the Display Spool File Attributes display?
10. Is the PAGESIZE value specified correctly? What font value is being used?
11. Does the problem occur using another printer or on a printer of a different type?
12. What other printers are available for printing? For example, is a 5225, 4224, or 3812 Printer available for printing?

To solve a printer problem, attempt to do the following:

1. Power the printer off and on. This usually solves IPDS printer problems.
2. Vary the printer off and on. This usually solves IPDS printer problems.
3. Print to a different type of printer. For example, print to a 5225 Printer instead of a 5262 Printer.
4. Print to a different printer of the same type. This helps determine if the problem is a hardware problem.
5. If applicable, change the device type of the file being printed. Generate the output again and print to an appropriate printer. For example:
   - If the file that has a device type of *SCS is printing on a IPDS Printer, attempt to override or change the device type to *IPDS. Generate the output and print again to the IPDS Printer.
   - If the file that has a device type of *IPDS is printing on a 4224 IPDS Printer, attempt to override or change the device type to *SCS. Generate the output again and print to a 5219 or 5225 Printer.

To help solve or debug a printer problem, include (as applicable) the following information with an APAR:

- All programs, files, and information necessary to create the problem again. Put the objects in a temporary library. Verify that the problem can be created again using the objects in the temporary library. Save the library on a diskette or tape using the SAVLIB command. Also, include instructions on how to run the program.
- A dump of the failing spool file. For more information about this dump, see "Spool File Dump."
- Samples of correct and incorrect output. Show how the incorrect output should be corrected.
- A copy of the current job or writer's job log.
- A copy of the job logs for both tasks, the problem is with an attached advanced function printing (AFP) printer.
- Job trace of either the writer's job or the job producing the output. Use the SRVJOB command to get a trace of the writer's job. For more information about the SRVJOB command, see "Tracing Writer Jobs" on page 17-11.
- A VLIC trace. For more information about trace vertical licensed internal code (or VLIC trace), see page 12-10.
- When applicable, a device description for failing printer.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Spool File Dump: At the time when output is viewed on an output queue, a printer data stream is generated and stored in a database file. The database file name begins with a Q. By dumping out the data in that database member, the OS/400 work station print support (WP) component can see the data stream that was generated at intercept time. Use the following steps to get a spool file dump:

1. Display the failing spool file from the work spool file displays using the *Display* option.
2. While displaying the spool file, press the System Request key and press the Enter key.
3. Enter the *Display job* option.
4. Enter the *Display locks* option.
5. If you are creating an APAR, use the CRTAPAR command and specify the database files or the copied spooled files you want to include with the APAR; otherwise, scroll up to a physical file object QXXXX, where XXXX is the rest of the object name, in library QSPL with a member locks of YES. Write down the name of this file. Enter the *Display member locks* option by this file and press the Enter key.
6. Write down the name of the locked member. The number begins with a Q.
7. Press F3 to return to the System Request menu. Press the Enter key to return to the display spool file. Press F3 to exit to the Command Entry display.
8. Enter the Copy File (CPYF) command. For example:

```
CPYF FROMFILE(QSPL/filename) TOFILE(*PRINT)
FROMMBR(membername) OUTFMT(*HEX)
```

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Note that this command requires security officer authority.

9. The output of the Copy File (CPYF) command is a dump of the spool file.

For more information about working with spool files, see the *Operator's Guide*.

Converting a Spool File to a Physical File: For spool files greater than 10 pages, convert a spool file to a physical file so that the file can be saved on magnetic media. The magnetic media can then be sent to your next level of support in place of sending a printed spool file. Use the following procedures to convert the spool file:

1. Enter the WRKJOB or DSPSPLF commands to get the spool file attributes of the job, file, and file number.
2. Create the library using the following command:

```
CRTLIB LIB(IBMAPAR) TEXT('APAR data')
```

3. Create the physical file for each spool file greater than 10 pages using the following command:

```
CRTPF FILE(IBMAPAR/pf_name) RCDLEN(133) SIZE(*NOMAX)
```

4. Copy the spool file using the following command:

```
CPYSPLF FILE(spoolfile_name)
  TOFILE(IBMAPAR/pf_name)
  JOB(number/user/job_name)
  SPLNBR(spool_number)
  CTLCHAR(*FCFC)
```

5. Save the library after all spool files have been copied using the following command:

```
SAVLIB LIB(IBMAPAR) DEV(mag_media_device)
```

Summary of Commands for Finding Spooled Output Files:

Command	Description
DSPJOB	Display Job
WRKJOB	Work with Job
WRKSPLF	Work with Spooled Files
WRKUSRJOB	Work with User Jobs
WRKWTR	Work with Writers

System Start and Stop Problems

When the system is started again after system waits or system loops, other pertinent information, such as VLIC log entries, may be obtained.

Problems that occur during system start or system stop may be difficult to describe and fix. It is difficult because the period between a system stop and start is not structured the same internally as it is during normal operation.

The following is a list of information that you should supply about the current IPL (for an end problem) or about the previous IPL (for a start problem):

- The value in the condition indicators.
- List the subsystems that were active.
- List special jobs that were running (such as spooling readers and/or spooling writers).
- List the history log.
- Dump the QWCSCPF (start OS/400 data object) message space. For information about the contents and the location of QWCSCPF, see page 21-1.
- Use the *Display/alter/dump* option to dump the following:

Type/Subtype	Object	Description
19/D0	QWCBT	Work control block table
19/D3	QWMSYSCB	System control block
19/D2	QWMSYSVAL	System values object
19/EE	QWCRMCB	Resource management control block

Pointers to these can be found in the dump of QWCSCPF; use Figure 21-1 on page 21-2 to find the offsets of the pointers. The pointers are system pointers; therefore, replace the last 2 bytes of the addresses with zeros.

To find the length to dump, find the length of the objects at offset hex 48 in the object header. The object header occupies the first hex A0 bytes of the object.

Vertical Licensed Internal Code Problems

This topic shows information used for solving problems with the vertical licensed internal code. The most commonly used tools used in gathering the information are as follows:

- Storage dumps taken by any one of several service tools that service VLIC, for example, print stand-alone dump or display/alter/dump
- Error log
- VLIC log

Dumps, Logs, and Traces: VLIC dumps are taken by any VLIC component requiring specific information to be dumped to the VLIC log. When processing is ended by a VLIC component, a main storage dump is taken. VLIC dumps are retrieved by the following service functions:

- Display/alter/dump

  For more information, see "Display/Alter/Dump" on page 12-27.

- Print stand-alone dump

  For more information, see "Main Storage Dump" on page 16-1 and "Print Stand-Alone Dump" on page 12-55.

- Error log

  For more information, see "Error Log" on page 15-1 and "Work with Error Log" on page 12-3.

- VLIC log

  For more information, see "Work with Vertical Licensed Internal Code (VLIC) Log" on page 12-46 and Chapter 31.

- VLIC trace

  For more information, see page "Tracing VLIC Using the TRCINT Command" on page 17-12 "Trace Vertical Licensed Internal Code" on page 12-10 and Chapter 30.

The dumps are taken and formatted consistently by all of the VLIC service functions and, therefore, the output always looks the same. For a list of VLIC components, see Chapter 4.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Work Station Locks

When a work station has no sign on display or appears to be blank, use the job log to determine why the work station is not varied on. If the job log is not avaialable or does not show the reason why the work station is not varied then issue the TRCJOB command. For more information about job logs, see page 15-5. For more information about trace job information, see page 17-7.

A locking strategy is necessary to prevent multiple processes from simultaneously performing a device-related operation (for example, PUT, GET, or VARY-OFF) to the same device. The strategy requires the work station to have a LEAR lock to perform a device-related operation on that work station.

When the subsystem starts, a subsystem monitor attempts to allocate each work station whose work station entry specifies AT(*SIGNON). For work stations that are not allocated, the subsystem monitor requests an asynchronous lock so that the work station will be allocated to the subsystem when it is available. For work stations whose entry specifies AT(*ENTER), the subsystem monitor does not request allocation. The work station is passed to that subsystem monitor as part of the transfer job function. When the subsystem ends, the monitor unlocks those work stations.

During the time the subsystem is active, work stations become available for use after being varied on, being powered on, and/or being freed up by other subsystems or applications. Work stations become unavailable by being allocated to applications or other subsystems or by being powered off or running into hardware errors which results in the work station being varied off.

A work station must be in the **varied-on** state before any input or output operation (for example, PUT and GET) can be done on the work station. A work station may be automatically varied on during IPL (because of the way the work station was configured to the system), or may be explicitly varied on with the VRYCFG command. A work station does not reach the varied-on state until it is varied on and has its connection to the AS/400 established. Connection is established when the AS/400 is able to communicate with the work station. This means that there must be a physical connection (for example, direct cable, direct line, or switched line) between the AS/400 and the work station, and that the work station must be able to communicate (for example, be physically powered on and working correctly). A work station which has been varied-on, but has not had its connection established, is in the **vary-on-pending** state.

To synchronize the varying on of a work station with the state of related objects (for example, controller descriptions or line descriptions) a work station is always varied on from the system arbiter process. (For more information the system arbiter process see page 18-22.) The VRYCFG CPP does not actually perform a vary-on; the CPP requests the system arbiter to perform the vary-on. Since work stations are varied on from the system arbiter process, and because I/O cannot be done on a work station until the work station reaches the varied-on state, the strategy is to keep a work station locked (LEAR) to the system arbiter process until the work station reaches the varied-on state. When a work station reaches the varied-on state it is unlocked by the system arbiter. Whenever a work station is varied-off, a LEAR lock on the work station is transferred back to the system arbiter process.

The only exception to this strategy is for switched line work stations, which a user job may obtain away from the system arbiter while the work station is in the vary-on-pending state. This is necessary for a switched line work station, because a work station does not reach the varied-on state until the connection is established, and a dial may have to be done to establish the connection. When a work station in this condition is obtained from the system arbiter, the system arbiter issues a pending lock request (LEAR) for the work station so that the system arbiter receives the lock on the work station when it is available.

Throughout this subsection, OBTAIN will refer to the process of having a LEAR lock on a work station transferred from a process which has the work station locked LEAR (but is not currently using the work station) to a process which is attempting to allocate the LEAR lock on the work station.

A job OBTAINs a work station through the LOCK macro which invokes QDMLOCK which attempts an immediate lock and, if that fails and the device is marked obtainable, signals an event to the job that has the device allocated. A subsystem attempts to OBTAIN a work station during subsystem startup.

A subsystem issues a pending allocation for a work station by invoking ?WTELOCKD to issue a pending lock request (LEAR) so that the work station is allocated when it is able to be locked. There is no such thing as a pending obtain. If a job attempts an OBTAIN which fails, there is no way for

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the job to specify that it wants the work station allocated when it becomes obtainable.

An interactive user job automatically receives allocation of the work station at which the user signs on. Any user job (batch or interactive) may attempt to allocate a work station either explicitly through the ALCOBJ command, or implicitly because of doing an OPEN to the work station.

When a subsystem is started, the subsystem monitor attempts to allocate those work stations which the subsystem description shows should be allocated and, if successful, displays the signon prompt on them. When a user signs on a work station, the user's interactive job will be initiated into the subsystem which had the work station allocated while the signon prompt is displayed.

To allow a work station which has the signon prompt displayed to be allocated without having to terminate the subsystem to which it is currently allocated, a work station which is not signed on is obtainable from the subsystem monitor which has it allocated. Therefore, if a work station is defined to more than one active subsystem, which subsystem has the work station allocated is dependent on whether the work station was signed on at the time that the additional subsystem(s) were started. Therefore, the only way to maintain complete predictability, for which subsystem a user signing on will be initiated, is to not concurrently start more than one subsystem which will attempt to allocate the same work station.

The conditions under which a subsystem monitor allocates, de-allocates, or transfers its lock on a work station are as follows:

During a Subsystem Monitor Startup, the subsystem monitor attempts an immediate allocate for all work stations that are indicated by a work station entry of type *SIGNON. If a work station cannot be allocated immediately during Monitor Startup, but does exist, the subsystem monitor issues a pending allocate so that the work station will be allocated when it becomes available. When such a pending allocate is satisfied, the subsystem monitor must perform the functions which it would have performed if the work station had been allocated during a Subsystem Monitor Startup. If there is a work station entry in the subsystem description for the work station but the work station does not exist during Monitor Startup, the subsytem will attempt to allocate it when it is created.

Normally, a work station is deallocated by a subsystem monitor whenever the subsystem terminates. Because of a device-related problem, a subsystem monitor may vary-off the work station, and may or may not issue a pending allocate for the work station. For some device-related errors, the subsystem will keep the work station and request notification when the work station becomes useable.

A subsystem monitor will transfer allocation of an obtainable work station to a process that is attempting to obtain it. A work station is obtainable from the subsystem monitor which has it allocated if the work station is not signed on. This includes the case where the signon prompt is displayed on the work station and it is not the signon prompt for a system request attempt to start a second job when the work station is held pending notification that it has become useable again.

Whenever a subsystem monitor transfers a work station to the process that is attempting to obtain the work station, the subsystem monitor issues a pending allocation request for the work station so that it will be re-allocated when it becomes available. Whenever a subsystem monitor has a work station allocated which is obtainable, the subsystem monitor's PCS pointer should be maintained in the associated space of the work station's LUD.

When a subsystem monitor initiates a process for an interactive job or reconnect a disconnected job, the subsystem monitor transfers the LEAR lock it holds on the work station to the interactive job's process. When the interactive job's process terminates or disconnects, the LEAR lock on the work station is transferred back to the subsystem monitor which initiated the interactive job. Before initiating the process for an interactive job, the subsystem monitor invokes the ADDDMCQE (add DMCQ entry) macro to place an entry on an interactive job's DMCQ which indicates that the work station is the requesting device for the job and that the work station should be transferred back to the subsystem monitor when the process terminates. The TERMCLSE macro, which is invoked as part of routing step termination, is responsible for transferring the work station back to the subsystem monitor.

A subsystem monitor will transfer allocation of a work station to another subsystem, because of an interactive job transferring (TFRJOB command) to a job queue which is allocated to an active subsystem. If an interactive job transfers from a subsystem, and the work station was defined to the subsystem through a work station entry of type *SIGNON, then the subsystem monitor issues a pending allocation request for the work station so that it will be reallocated when it becomes available.

When an interactive job terminates and the work station was defined to the subsystem through a work station entry of type *ENTER, then the subsystem monitor will deallocate the work station.

Work station locks will be transferred among a subsystem monitor and the interactive jobs which it initiated because of system request processing or group job processing.

The controlling subsystem may temporarily allocate a free-floating work station to handle a test request from the work station.

The subsystem monitor is required to perform special processing for work stations which are switched line capable (for example, switched line work stations and work stations with the switched network backup feature).

- A subsystem monitor is required to inform the switched line component which switched line capable work stations the subsystem monitor accepts into the subsystem. (This includes work stations the subsystem attempts to allocate, and those that may transfer into the subsystem.) This requirement must be met for a switched line capable work station before the subsystem monitor attempts to allocate the work station and before the work station is allowed to transfer into the subsystem.

- A subsystem monitor is required to inform the switched line component whenever the subsystem monitor will no longer accept a switched line capable work station which the subsystem monitor previously indicated that it would accept.
- A subsystem monitor is required to inform the switched line component to have the line dropped (if the line is not in use) after a user signs off a switched line capable work station. The determination whether the line should be dropped is based on a default option which is part of the definition of the work station description and on an optional parameter (DROP) on the SIGNOFF command.

A subsystem monitor meets all of these requirements by signalling the Switched Lines Request event (hex 81003502) directly to the system arbiter process with the necessary information contained in the event-related data.

Lock Summary

Table 3-4. Where is the Lock?

	Arbiter	Sub-system	Job	Nowhere
Vary off	Here			
Sign On display shown		Here		
Signon acquired			Here	
Vary on but no subsystem wants it				Here
Vary on pending (try to vary on when the power is not on)	Here			
Vary on pending (power off device after vary on)		Here		
Recovery pending		Here		
Not recoverable	Here			

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Chapter 4. Gathering Information for or Solving Problems by Component

Chapter 3 described how to diagnose a problem by symptom. This chapter describes how to diagnose a problem by a failing component. The AS/400 system components can detect and analyze problems at the time of failure.

If you know the failing component, the information in this chapter can be used to find the exact cause of a problem when all other procedures and instructions in the *Analyzing Problems Guide*, *Unit Reference Code Guide*, *Service Guide*, system messages, and SRCs have failed. You may be able to use the information in this chapter to solve problems without having to send an APAR and LICTR; otherwise, you can use the information in this chapter to help speed problem or APAR resolution.

If necessary and only after you determined that you cannot solve the problem, submit the information listed in this chapter to your next level of support accompanying your APAR or LICTR. The information that is needed to isolate and solve a problem is separated by product. Then, each product is separated by component.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Module Naming Conventions for OS/400 and VLIC

Module naming conventions are used to make the system, the component, and often, the function of the module easily identified. The modules naming conventions are:

```
ACCNNNNN
```

where:

- **A** Is the module type. The module type consists of one character. The character can be:
  - Q OS/400
  - # VLIC
- **CC** Is the module ID that is referred to as component. The component can be four characters long.
- **NNNNN** Is the remaining portion of the unique name.

Notes:

1. The module QCL belongs to the MH component, not the CL component. This is an exception to the naming convention.
2. The modules QPZRXXXXXX are PTF objects which have been temporarily removed or loaded and have not been applied.
3. The modules QPZAXXXXXX are saved modules that have been replaced by temporarily applied PTF objects.

Use the Display Command (DSPCMD) command to display the module called by any CL command. See the *CL Reference* manual or use online help to get more information about the DSPCMD command.

List of Component Descriptions

Table 4-1 on page 4-2 lists the *component descriptions* in alphabetical order under their associated product.

Components

Table 4-1 (Page 1 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
Advanced DBCS printer support	5728AP100	AW	Advanced printer writer	4-14
		KP	Kanji printer facility	
		PF	Printer function control	
		PP	Advanced printer service	
Advanced function printing fonts	5728FNT00	FT	Common functions	4-14
		FTAG	ITC Avant Garde Gothic	
		FTAP	APL2	
		FTCS	Century schoolbook	
		FTDA	DATA1	
		FTMG	Monotype garmond	
		FTMS	Math and science	
		FTOC	OCR-A and OCR-B	
		FTPI	PI and specials	
		FTSA	Sonoran sans serif	
		FTSC	Sonoran sans serif condensed	
		FTSE	Sonoran sans serif expanded	
		FTSH	Sonoran sans serif headliner	
		FTSS	Sonoran serif	
		FTST	Sonoran serif headliner	
		FTSV	ITC souvenir	
Advanced printer function	5728PW100	AU	Documentation or publications	4-14
		AUCL	CL command help text	
		FG	Advanced printer function utility	
Application Development Tools	5728PW100		See *Advanced printer function* on page 4-2, *Character generator utility* on page 4-2, *Data file utility* on page 4-3, *Multiple object manager* on page 4-3, *Screen design aid* on page 4-11, and *Source entry utility* on page 4-11.	4-14
BASIC	5728BA100	BA	Component 1 of BASIC	4-14
		CF	Component 2 of BASIC	
		ID	Documentation or publications	
		IF	Component 3 of BASIC	
		PD	Component 4 of BASIC	
		PR	Component 5 of BASIC	
Business graphics utility	5728DS100	BG	Business graphics utility	4-14
		ID	Documentation or publications	
Character generator utility	5728PW100	CG	Character generator utility	4-14
		IDC	Documentation or publications	
COBOL/400	5728CB100	CB	CBL38 compiler	4-14
		CR	CBL38 run-time	
		CX	CBL38 syntax checker	
		IDC	CBL38 documentation or publications	
		IDL	CBL400 documentation or publications	
		IDS	CBL36 documentation or publications	
		LA	CBL400 preprocessor	
		LB	CBL400 compiler	
		LR	CBL400 run-time	
		LX	CBL400 syntax checker	
		SB	CBL36 compiler	
		SR	CBL36 run-time	
		SX	CBL36 syntax checker	
Communi-cations utilities	5728CM100	CV	Documentation or publications	4-14
		CVCL	CL command help text	
		GT	RSCS/PROFs bridge transforms	
		GW	RSCS/PROFs bridge	
		RJE	Remote job entry facility	

Components

Table 4-1 (Page 2 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
Cryptography (CRP)	5728CR100	CK	Documentation or publications	
		CKCL	CL command help text	
		CKHT	Cryptographic help text	
		CKIS	Cryptographic index search	
		CR	Cryptography support	4-14
		8080	*Programming: Cryptographic User's Guide*, SC21-8080	
C execution time subroutines	5799XAY00	CLIB	C library	4-14
		CX	C compiler run-time routines	
		XX	C common use back end runtime routines	
C language	5728CX100	OI	C optimizer and translater	4-15
		PLNK	C Prelinker	
		CDEB	C debugger	
		CFE	C compiler	
		ID	Documentation or publications	
		C	C related changes	
Data file utility	5728PW100	DF	DFU definition phase, obsolete	4-15
		DK	Data file utility migration from	
		DL	Data file utility list function	
		DY	Data file utility/36 view code	
		DZ	Data file utility	
		IDD	Documentation or publications	
DBCS font	5730FN100	KD0	Base	4-15
		KD1	Japanese	
		KD2	Korean	
		KD3	Traditional Chinese	
		KD4	Simplified Chinese	
		KD5	Thai	
Dictionary	5728DCT00	DS	Dictionary services	4-15
FORTRAN/400	5730FTN100	FO	FORTRAN compiler	4-15
Interactive data utilities	5728DB100	DE	IDU data entry	4-15
		ID	IDU common function	
		QU	IDU query	
Knowledge tool	5799DCK00	KI	Knowledge tool compiler	4-15
	5799DCK00	KT	Knowledge tool external application program interface (API)	
	5799DCT00	KT	Knowledge tool translator	
Multiple object manager	5728PW100	IDM	Documentation or publications	4-15
		UO	Multiple object manager	
Office Vision/400	5728WP100	NNOH	Office help text	
		NNOI	Office index search	
		OE	Office editor	4-15
		OF	Personal services	4-15
		OM	Office editor (adapted)	4-15
		OO	Office calendar	4-15
		OU	Documentation or publications	
		OUCL	CL command help text	
		OW	PC text assist	4-15
		OZ	Personal services and office administration	4-15
		9615	*Office: Learning about OfficeVision/400*, SC21-9615	
		9616	*Office: Using OfficeVision/400*, SC21-9616	
		9617	*Office: Learning about OfficeVision/400 Word Processing*, SC21-9617	
		9618	*Office: Using OfficeVision/400 Word Processing*, SC21-9618	
		9626	*Office: Planning For and Setting Up OfficeVision/400*, SC21-9626	
		9627	*Office: Managing OfficeVision/400*, SC21-9627	
		9868	*Office: OfficeVision/400 Common Tasks*, GX21-9868	
		9879	*Office: Using OfficeVision/400 Adapted Word Processing Function*, SC21-9879	

Components

Table 4-1 (Page 3 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
OS/400	5728SS100	AL	Alerts in network management	4-16
		AR	Test request key function	4-16
		CA	Command analyzer	4-16
		CD	Command definition	4-16
		CI	System/36 environment support	4-16
		CJ	SAA spool print CPI	4-16
		CL	Command language	4-16
		CP	Copy	4-16
		C1	System/36 Environment Cryptographics	4-17
		DB	Database	4-17
		DD	Data description	4-17
		DF	Device file definition	4-17
		DK	Diskette	4-17
		DM	Data management	4-17
		DP	Online problem analysis and resolution displays	4-18
		DR	Diskette repair	4-18
		DZ	Data file utility	4-18
		EA	System delivered education	4-18
		EB	System delivered education courses	4-18
		EC	Edit code	4-18
		ED	ECS contact database	4-18
		EE	System/38 execution environment	4-18
		ES	Service support facility	4-18
		EX	System/36 environment	4-19
		EZ	Operational assistant	4-19
		FA	DBCS compatibility fonts	4-19
		FG	Advance printer function	4-19
		FM	File transfer access method	4-19
		FN	Finance	4-19
		FO	SAA FORTRAN run-time library	4-19
		FR	File restore	4-19
		GA	Generic attach 370 channel	4-19
		GS	AFP printer resource utility	4-19
		HC	PC support host configuraiton	4-19
		IA	Technical information access	4-19
		ID	IDDU support	4-19
		IN	Installation	4-20
		JO	Journal	4-20
		KJ	Kanji	4-20
		LI	Librarian	4-20
		LP	Licensed program install	4-20
		MA	Marketing order process application	4-20
		MH	Message handler	4-20
		MN	Menu	4-21
		NC	Native command definition objects	4-21
		NM	Network management services	4-21
		OC	Office calendar services	4-21
		OD	Office document file manager	4-21
		OE	Office editor	4-21
		OF	Office, System/36 folder restore	4-21
		OG	Personal services (Office)	4-21
		OH	Office mail	4-22
		OJ	Office save/restore	4-22
		OK	Directory services	4-22
		OM	Office editor (adapted)	4-22
		OP	Office DW/SL print function	4-22
		OQ	Document interchange architecture session services	4-23
		OR	PC Support/36 organizer	4-23
		OS	Office systems, DIA support	4-23
		OT	Office transformations	4-23
		OW	PC text assist	4-23
		PD	Problem determination	4-24
		PM	Performance monitor	4-24
		PN	Printer support	4-24
		PQ	PSF	4-24
		PR	Program resource monitor	4-24
		PT	Prompter	4-24

Components

Table 4-1 (Page 4 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		PUAI	AI/Communications configuration prototype	
		PUAL	Alert help text	
		PUCL	CL command help text	4-17
		PUCQ	SAA CPI query online information	
		PUDC	Device configuration help	
		PUDU	IDDU online information	
		PUEH	ECS help text	
		PUEI	ECS index search	
		PUFH	Configuration help text	
		PUFI	Configuration index search	
		PUID	DC index search	
		PUIH	Install help text	
		PUIS	Index search	
		PUKI	Help text for knowledge tool	
		PULP	Licensed program install help text	
		PUMH	Primary menu help text	
		PUOH	Office help text	
		PUOI	Office index search	
		PUPH	Problem handling help text	
		PUPI	Programming index search	
		PUPL	Problem log help text	
		PUQH	Q&A help text	
		PUQI	SQL index search	
		PUQT	SQL help text	
		PUSF	Service facility help text	
		PUSH	SDE help text	
		PUSI	SDE index search	
		PUYI	System operations index search	
		PY	Performance RTE	4-24
		PZ	PTF management	4-24
		QA	Questions and answers	4-24
		QQ	Database query	4-25
		QU	AS/400 query run-time	4-25
		QX	SAA query CPI	4-25
		RC	Recovery	4-25
		RM	RM/COBOL run-time library	4-25
		RU	Reference code translate table facility	4-25
		RZ	System resource management	4-25
		SC	Service facility	4-26
		SCA	Service facility, communications	
		SF	Sub file	4-26
		SM	Concurrent service monitor	4-26
		SP	Spool	4-26
		SQ	Structured query language	4-26
		SR	Save/restore	4-27
		SS	Source/sink management	4-27
		SU	System upgrade utility	4-27
		SX	Service activity log (problem log)	4-27
		SY	Security	4-28
		SZ	Software management services	4-28
		TA	Tape	4-28
		TB	Table	4-28
		TD	Transform data	4-28
		TE	Test	4-28
		TI	Technical information exchange	4-28
		TN	Commit	4-28
		TT	Technical tools	4-28
		UC	User customization of the keyboard	4-28
		UH	UIM help facility	4-28
		UI	User interface manager	4-28
		UP	User-perceived problem resolution	4-28
		UR	Library exit routines	4-29
		US	User object support	4-29
		UT	System/36 environment utilities	4-29
		WC	Work control	4-29
		WD	Subsystem description	4-30
		WH	Where used	4-30
		WP	Work station printers	4-30

Components

Table 4-1 (Page 5 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		WS	Work station	4-30
		WT	Work monitor	4-30
		XA	VLIC byte string space component	4-30
		X1	Interactive SQL	4-30
		Y1	System/36 interactive terminal facility	4-31
		Y2	File transfer	4-31
• Migration	5728SS100	BA	BASIC migration AS/400	4-36
		BG	Business graphics utility (BGU)	
		CG	Character generator utility (CGU)	
		DC	Hardware and communications configuration	
		DFM	Migration umbrella	
		DKM	Data file utility migration	
		DZM	Data file utility migration or conversion	
		FE	PC data router	
		FGM	Advanced printer function	
		IDM	Interactive data definition utility (IDDU)	
		IW	Interactive work station (IWS)	
		MG	AS/400 migration utility	
		MM	System/34 to AS/400 migration	
		MR	Remote job entry conversion	
		MSM	MSRJE	
		OTM	Office transforms	
		PS	PS/DIA/FMS	
		QUM	Query	
		RG	RPG	
		SRM	Save/restore	
		SYM	Security	
		TS	Distributed data management	
		WSM	Work station utility	
		WU	Work station utility	
• Operational assistant	5728SS100	0A	Operational assistant	4-36
		0AID	Help text for operational assistant	
• Problem analysis routines	5728SS100	AJS	9404 service processor	4-36
		ALVM	Multifunction IOP	
		ALVN	IOP	
		BSCV	BSC IOM reference code files	
		CCEC	9406	
		CHCM	2507 common code	
		CHRY	2507 common code	
		COCO	2600	
		COML	9404 communications	
		COMM	Communications	
		CPP	CPP message documentation	
		DCTL	6110	
		DI	Diskette functional manager	
		DSD1	9332	
		DSD2	9335	
		DSD3	9335 'B'	
		DSKT	9331	
		EXPB	5021 and 5030 feature	
		IMPI	IMPI	
		LEED	6100 file	
		LNXA	ASCII work station controller	
		LTNG	6105 DASD	
		LOPT	9404 optical devices	
		LUGE	1/4 inch cartridge tape 6346 or 6341	
		MNXA	Asynchronous work station	
		MNXT	Twinaxial work station	
		OPAN	Control panel	
		OPNL	Control panel	
		PNL2	Function 2 on the control panel	
		PVMC	VLIC	
		PWRS	System or feature power	
		PXPF	OS/400	
		RDKT	6331 or 6332 diskette	

Table 4-1 (Page 6 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		RMWS	Remote work station PAR component	
		REPB		
		SDKT	6332 diskette drive	
		SRVP	9406 service processor	
		SPTY	SPC entry document	
		TAPT	9347	
		TAP1	9347	
		TAP3	2440	
		TAP4	9346	
		TAP5	3422	
		TAP6	3430	
		TAP8	9347 9348	
		TCSE		
		TCTL		
		TCT2		
		TC03		
		TC04		
		TC06		
		THEM	Multifunction IOP	
		THEO	IOP	
		TOBG		
		WCTL		
		WKST	Work station controller	
		34BL	3480 tape cartridge	
		34GL	3490 tape	
• Publications	5728SS100	0481	*Programming: Control Language Reference*, SBOF-0481	
		0597	*System Support: Diagnostic Aids*, LY21-0597	
		8076	*Programming: Command Reference Summary*, SC21-8076	
		8077	*Programming: Control Language Programmer's Guide*, SC21-8077	
		8078	*Programming: Work Management Guide*, SC21-8078	
		8079	*Programming: Backup and Recovery Guide*, SC21-8079	
		8082	*System Operations: Operator's Guide*, SC21-8082	
		8083	*Programming: Security Concepts and Planning*, SC21-8083	
		8086	*System Operations: Question-and-Answer Database Coordinator's Guide*, SC21-8086	
		8104	*Programming: System Reference Summary*, SC21-8104	
		8106	*Device Configuration Guide*, SC21-8106	
		9062	*System Support: Unit Reference Code Guide — 9404*, SY31-9062	
		9064	*System Support: Analyzing Problems Guide — 9404*, SY31-9064	
		9588	*Communications: Distribution Services Network Administrator's Guide*, SC21-9588	
		9620	*Programming: Data Description Specifications Reference*, SC21-9620	
		9657	*Utilities: Interactive Data Definition Utility User's Guide*, SC21-9657	
		9658	*Programming: Data Management Guide*, SC21-9658	
		9659	*Programming: Database Guide*, SC21-9659	
		9662	*Programming: System Reference for the System/36 Environment*, SC21-9662	
		9663	*Programming: Concepts and Programmer's Guide for the System/36 Environment*, SC21-9663	
		9678	*Information Directory*, GC21-9678	
		9744	*System Operations: New User's Guide*, GC21-8211	
		9755	*Programming: System/38 Environment Programmer's Guide and Reference*, SC21-9755	
		9758	*Programming: Office Services Concepts and Programmer's Guide*, SC21-9758	
		9770	*System Operations: Online Education Administering Guide*, SC21-9770	
		9858	*Communications: Retail Communications Programmer's Guide*, SC21-9858	
		9864	*Communications: Intrasystem Communications Programmer's Guide*, SC21-9864	
		9878	*Licensed Programs and New Release Installation Guide*, SC21-9878	

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Table 4-1 (Page 7 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		9890	*Programming: Data Description Specifications Debugging Template*, GX21-9890	
		9891	*Programming: Data Description Specifications Coding Form*, GX21-9891	
— OS/400 communi-cations	5728SS1CM	8099	*Communications: Finance Communications Programmer's Guide*, SC21-8099	
		9590	*Communications: Programmer's Guide*, SC21-9590	
		9592	*Communications: Asynchronous Communications Programmer's Guide*, SC21-9592	
		9593	*Communications: BSC Equivalence Link Programmer's Guide*, SC21-9593	
		9594	*Communications: SNA Upline Facility Programmer's Guide*, SC21-9594	
		9600	*Communications: Distributed Data Management User's Guide*, SC21-9600	
		9601	*Communications: User's Guide*, SC21-9601	
		9602	*Communications: 3270 Device Emulation User's Guide*, SC21-9602	
		9661	*Communications: Communications and Systems Management User's Guide*, SC21-9661	
— OS/400 GDDM	5728SS102	0536	*Programming: GDDM Programming Guide*, SC33-0536	
		0537	*Programming: GDDM Programming Reference*, SC33-0537	
• Execution time subroutines (ETS)	5728SS101	BA	BASIC support in ETS	4-36
		CR	System/38 COBOL run-time routines in ETS	
		CX	C compiler run-time routine	
		DJ	Data file utility/36 view procedures	
		DL	Data file utility list function	
		DQ	Data file utility execution code	
		DU	Debugger	
		DZ	Data file utility	
		HL	Display help component of ETS	
		ID	Documentation or publications	
		LR	S/L COBOL run-time routines in ETS	
		MR	System/36 procedures: MSRJE, RJTABLE, and RJE	
		PE	PL/1 run-time routines in ETS	
		PX	Pascal run-time routine	
		RR	System/36 compatible COBOL run-time routines	
		R2	RPG II run-time routines in ETS	
		R3	RPG III run-time routines in ETS	
		R4	RPG IV run-time routines in ETS	
		SD	Screen design aid (SDA)	
		SR	System/36 COBOL run-time routines in ETS	
		XX	Common use back end run-time routines	
		UY	Common list processing code	
• Sort	5728SS101	IDS	Documentation or publications	4-37
		UN	Reformat	
• OS/400 GDDM	5728SS102	GD	Graphical data dipslay manager (GDDM)	4-36
• DBCS 3270PC	5728SS103	FS	Font management facilities	4-36
		PJ	DBCS 3270PC emulation	
• Online documenta-tion	5728SS104	EG	Online education presentation services	
• Cross system product (CSP)	5728SS105	AD	Cross system product application development	
		AE	Cross system product application execution	4-36
		AG	Cross system product other	4-36
• OS/400 AFP	5728SS106	PK	AFP print command	4-14
		PQ	AFP printer support	4-24

Components

Table 4-1 (Page 8 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
• OS/400 communi-cations	5728SS1CM	AC	Advanced peer communications	4-31
		AP	Access path	4-31
		A1	Intra function manager	4-31
		BI	BSC function manager for ICF-BSCEL	4-31
		BS	BSC FM support for System/38 environment	4-31
		CN	DDM communications	4-31
		DC	Device and communications configuration	4-32
		DX	DSNX	4-32
		EM	3270 device emulation	4-32
		ER	Communications error recovery procedures	4-32
		IC	Intersystem communications function data management	4-32
		IF	Intersystem communications function debug (TRCICF)	4-32
		LC	Low-entry networking control point	4-32
		LM	Token-Ring network manager	4-32
		LNKT	Link test, communication line and control	4-33
		LS	APPN network services	4-33
		MC	Communications error messages	4-33
		NF	Network facilities	4-33
		ON	Open system IOM	4-33
		PA	Work station pass-through	4-33
		PI	3270 pass-through	4-34
		PUCH	Communications help	
		PUCI	Communications index search	
		RA	RA/DHCF	4-34
		RF	ICF retail finance function manager	4-34
		SA	SNUF function manager	4-34
		SI	APPC function manager for System/38 environment	4-34
		SL	Secondary LU-1	4-34
		SW	Switched lines	4-34
		TR	Communications trace CL interface	4-34
		TS	DDM-target source	4-34
		TV	Virtual terminal function manager	4-35
		T1	T1P1 device support	4-35
		T3	SNA-T3 subset	4-35
		YF	Asynchronous function manager	4-35
		ZD	SNA distribution service	4-35
• OS/400 REXX	5728SS107	PURI	REXX index search	4-37
		RE	SAA procedures language	
PAP	5799CZG00	PA	Product application program (PAP) on the service support system	4-37
PASCAL	5728PS100	PASC	Pascal	4-37
		ID	Documentation or publications	
		PAS	Pascal/400 compiler	
		PX	Performance run-time execution	
PC Support	5728PC100	CE	Copy screen image function, host	4-37
		G2	Graphic user interface	
		G4	Graphic user interface OS/400	
		HI	PC host install	
		HP	PC help text	
		HS	Host service	
		HU	Host utilities	
		IOWA	Work station function (WSF) OS/2 LLAPI	
		IOWB	Work station function L3 bringup	
		IOWD	Work station function display and supervisor	
		IOWK	Work station function OS/2 keyboard	
		IOWP	Work station function OS/2 printer	
		IOWR	Work station function OS/2 RAS	
		IU	Documentation or publications	
		IUCL	CL command help text	
		IUPC	Documentation or publications MRI	
		IWAD	New PC adaptors (compatibility)	
		IWAP	New PC applications (compatibility)	
		IWCE	Copy screen image function for PC	

Components

Table 4-1 (Page 9 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		IWCF	Configuration	
		IWCL	Common library	
		IWDY	New PC displays (compatibility)	
		IWID	Documentation or publications	
		IWIN	Installation	
		IWKB	New PC keyboards (compatibility)	
		IWMF	Message facility	
		IWMG	IWS migration	
		IWMN	Product menu	
		IWOR	Organizer	
		IWOS	Compatibility, new PC operating	
		IWPC	Compatibility, new PC system unattended	
		IWPR	Compatibility, new PC printers	
		IWRP	Remove PC support	
		IWRT	Router	
		IWSF	PC support shared folders	
		IWSR	Submit remote command	
		IWTF	Transfer function	
		IWTT	Translate table	
		IWVP	Virtual print	
		IWWA	Work station function LLAPI	
		IWWC	Work station function configuration	
		IWWD	Work station function displays	
		IWWG	Work station function graphics	
		IWWK	Work station function PC DOS keyboard	
		IWWM	Work station function interactive color mapping	
		IWWP	Work station function printers	
		OW	Office PC text assist	
		PUPC	Documentation or publications MRI	
		SM52	5250 session manager	
		XF	PC support file serving	
		UD	PC support update	
		8195	*PC Support: DOS Planning and Installation Guide*, SC21-8195	
		8196	*PC Support: OS/2 Planning and Installation Guide*, SC21-8196	
		8197	*PC Support: DOS Operations Reference*, SC21-8197	
		8198	*PC Support: OS/2 Operations Reference*, SC21-8198	
		8199	*PC Support: DOS User's Guide*, SC21-8199	
		8200	*PC Support: OS/2 User's Guide*, SC21-8200	
		8091	*PC Support: DOS and OS/2 Technical Reference*, SC21-8091	
		8093	*PC Support: DOS and OS/2 Messages and Problem Analysis Guide*, SC21-8093	
		9912	*PC Support: Keyboard Templates*, SX21-9912	
Performance tools	5728PT100	CP	Capacity planner/modeler	4-37
		HT	Command and display help text	
		IP	Install programs	4-37
		IT	Interactive performance analysis	4-37
		MN	Menu support	4-37
		PG	Performance tools graphics	4-37
		PT	Performance tools	4-37
		PUTH	RPFT index search	
		PUTI	RPFT help text	
		RB	Documentation or publications	
		RBCL	CL command help text	
		RBHT	RPFT help text	
		RBIS	RPFT index search	
		TZ	Timing and paging statistics tool	4-37
		8084	*Programming: Performance Tools Guide*, SC21-8084	
PL/1	5728PL100	DG	PL/I native source	4-37
		PC	PL/I compiler	
		PE	PL/I run-time routines	
		PS	PL/I syntax checker	
Point of Sale (POSA)	5728CF100	RT	Retail applications	4-38
		RV	POSA documentation or publications	
		RVCL	CL command help text	
		PTOS	*Point-of-Sale Manual*, SC21-9868	

Components

Table 4-1 (Page 10 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
Programmer tool kit	5799DAG00	TK	Programmer tool kit	4-38
		TK36	Programmer tool kit/36	
		TK38	Programmer tool kit/38	
Query	5728QU100	PO	Documentation or publications	
		POCL	CL command help text	
		POQU	Query help text and index search	
		QU	Query product component	4-38
		9614	*Query: User's Guide*, SC21-9614	
Remote job entry (RJE)	5728CM100	GTR	PROFs bridge	4-38
		ID	Documentation or publications	
		MR	Remote job entry	
RM/COBOL	5730MC100	RM	RM/COBOL run-time library	4-38
RPG/400	5728RG100	ID2	Documentation or publications for RPG II	4-38
		ID3	Documentation or publications for RPG III	
		ID4	Documentation or publications for RPG IV	
		RG2	RPG compiler of RPG II	
		RG3	RPG compiler of RPG III	
		RG4	RPG compiler of RPG IV	
		RP2	Auto report of RPG II	
		RP3	Auto report of RPG III	
		RP4	Auto report of RPG IV	
		RS2	Syntax checker of RPG II	
		RS3	Suntax checker of RPG III	
		RS4	Syntax checker of RPG IV	
		R2	Execution time routines of RPG II	
		R3	Execution time routines of RPG III	
		R4	Execution time routines of RPG IV	
Screen design aid	5728PW100	IDS	Documentation or publications	4-38
		SD	Screen design aid	
Source entry utility	5728PW100	IDRD	Documentation or publications	4-38
		IDSU	Documentation or publications for SEU	
		RD	Source entry utility	
		SU	Source entry utility	
SQL	5728ST100	SG	Documentation or publications	4-38
		SGCL	CL command help text	
		SGGH	SQL help text	
		SGIS	SQL index search	
		SQ	SQL product component	
		S1	Interactive SQL	
		9608	*Programming: Structured Query Language/400 Reference*, SC21-9608	
		9609	*Programming: Structured Query Language/400 Programmer's Guide*, SC21-9609	
System/38 utilities	5728DB100		See *Interactive data utilities* on page 4-3 and *Text management/38* on page 4-12.	4-38
Systems management utilities	5730SM100	NS	Network services	4-38
		NSAL	ECS Alert	
		NSED	ECS contact database	
		NSES	Service provider support	
		NSPZ	ECS PTF	
		NSSZ	ECS software management	
TCP/IP	5728TC100	RI	Documentation or publications	
		RICL	CL command help text	
		RICS	Communications index search	
		RIHT	Communications help text	
		TG	TELNET support	4-39
		TM	Transmission control protocol	4-39

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Table 4-1 (Page 11 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		9875	*Communications: Transmission Control Protocol/Internet Protocol Guide*, SC21-9875	
Telephony	5798RXP00	TL	Telephony application services L	4-38
	5799CZJ00	TL	Telephony application services P	
Text Management/38	5728DB100	TX	AS/400 text management/38	4-38
		9759	*System/38 Compatibility: Text Management/38 User's Guide and Reference*, SC21-9759	
Timing and paging	5799DGQ00	TZ	Timing and paging statistics tool	4-39
Vertical licensed internal code	9400DG300	AI	Activation/invocation	4-39
		AU	Authority management	4-39
		BM	Bus manager	4-39
		BS	Byte string space	4-39
		CC	Computation and control	4-39
		CF	Common functions	4-39
		CO	Commit	4-39
		DB	Database	4-40
		DBCR	Database run-time cursor	
		DBCT	Database create	
		DBFR	Database force	
		DBIP	Database IPL	
		DBLD	Database load dump	
		DBMN	Database maintenance and friends	
		DBMP	Database mapping	
		DBOC	Database open/close	
		DBRG	Database reorganization	
		DBRT	Database run-time	
		DBSL	Database selection	
		DBTL	Database tools	
		DK	Diskette	4-40
		DM	DASD management	4-40
		DO	Debugging and observation	4-40
		DS	Dictionary services	4-40
		EM	Event management	4-40
		EX	Exception management	4-40
		FS	VLIC file server	4-40
		IDE	IMPI device exerciser	
		II	Independent index	4-40
		IO	IO debug	4-40
		IP	Inter-process communications facility	4-40
		IT	IPL termination	4-40
		IX	Machine index	4-41
		JO	Journal management	4-41
		JOIP	Journal IPL	
		JORT	Journal run-time	
		LD	Load/dump	4-41
		LL	Link/loader (work with microcode)	4-41
		MC	Machine check	4-41
		MN	Context management	4-41
		MO	Magneto optical disk	4-41
		M2	Module-2 run-time support	4-41
		NM	Network management services	4-41
		OE	Dictionary object support	4-41
		OX	Optimizing translator	4-41
		PG	Program management	4-41
		PM	Process management	4-41
		PT	Performance tools	4-42
		PU	Publications	
		PUCL	CL command help text	
		PUMP	DASD utilities	4-42
		QM	Queue management	4-42
		RI	RAS and instrumentation	4-42
		RIDA	Display alter dump	
		RIDP	Print stand-alone dump	

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Table 4-1 (Page 12 of 12). List of System Products and Their Components

Product	Component ID	Component	Description	See Page
		RIFL	OS/400 debug	
		RIIN	Install service function	
		RISP	Service processor IOM	
		RITR	VLIC trace	
		RIVL	VLOG interface	
		RIVP	Display VPD	
		RJ	Stand-alone utilities load or restore	4-42
		RM	Resource management	4-42
		SD	Service driver	4-42
		SE	Stand-alone utility driver	4-42
		SI	Source/sink instructions	4-42
		SM	Storage management	4-43
		SO	Space object management	4-43
		SORT	Sort utility	4-43
		SS	Source/sink management	4-43
		SV	SVLS	4-43
		S3	Machine service facility	4-43
		TA	Tape	4-43
		VL	VLIC log	4-43
		WO	Write once optical	4-43
		XC	Translator code generation	4-43
		XL	Translator	4-43
		YY	Common includes	
VLIC com-munications	9400DG3CM	CM	Common class IOM	4-43
		CR	Cryptographic facility	4-44
		CT	Communications trace	4-44
		EL	Error logging	4-44
		EREP	Error record summarization	4-44
		LC	APPC control point	4-44
		LM	Device/location manager	4-44
		LNKT	Link test, communcation line and control	4-45
		MS	Machine services control point	4-45
		OT	Open station IOM	4-45
		PA	Display station pass-through	4-45
		PI	3270 Display Station Passthru	4-45
		RA	RA/DHCF	4-45
		SB	SNUF DFC/SC	4-45
		TB	BSC base IOM	4-46
		TE	3270 emulation (BSC) IOM	4-46
		TEX	3270 emulation translator	4-46
		TG	TCP/IP remote logon support	4-46
		TI	ISDN IOM	4-46
		TL	Local work station controller or SDLC IOM	4-46
		TM	MTAM IOM	4-46
		TN	BSC Network Job Entry IOM	4-46
		TQ	Link Access Protocol ISDN (LAPI) IOM	4-46
		TS	Primary work station	4-46
		TT	LAN IOM	4-47
		TU	SNA DLC common function	4-47
		TX	X.25 IOM	4-47
		T1	T1 P1 line IOM	4-47
		T2	PU type 2 station IOM	4-47
		YI	Asynchronous IOM	4-47

Advanced DBCS Printer Support

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Advanced Function Printing Fonts

For this product, see "Printer Problems" on page 3-16.

PK—AFP Print Command: The information needed for this component is the same as work station display support (WS) on page 4-30.

Advanced Printer Function

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Application Development Tools

To solve problems with this licensed program product, see "Character Generator Utility," "Data File Utility" on page 4-15 , "Multiple Object Manager" on page 4-15, "Screen Design Aid" on page 4-38, and "Source Entry Utility" on page 4-38.

Application Programming Tools

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

BASIC

- The application source code and all referenced files.
- Detailed instructions on how to create the problem again.
- A copy of the job log.

Business Graphics Utility

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Character Generator Utility

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

COBOL

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Communications Utilities

For RSCS/PROFs bridge, see the *Communications: Distribution Services Network Administrator's Guide*, SC21-9588 and for remote job entry (RJE), see the *Communications: Remote Job Entry User's Guide and Reference*, SC09-1168 for problem analysis procedures.

Cryptographic Support

CR—Cryptographic Support: All functions:

- The application source code that uses cryptographic support
- The input parameter values passed to cryptographic support
- The output parameter values returned from cryptographic support
- Any application objects necessary to create the problem again
- A copy of the job log containing second-level text
- Any dumps that were created by the system at the time of the failure
- A listing of the objects in the QCRP library
- A display listing of the QCRP/Q5728CR1 data area
- Sufficient information to create the problem again

C Execution Time Subroutines

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

C Language

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Data File Utility

The information needed for this program product is the same as the OS/400 Data File Utility (DZ) component on page 4-18.

DBCS Font

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Dictionary

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

FORTRAN/400

Provide:

- The CRTFTNPGM command used to create the program.
- The source listing using the command: CRTFTNPGM option (*LIST).
- Include all the other options and parameters specified on the original command. This creates an IRP listing.
- Sufficient information and data to create the problem again.

See the *FORTRAN/400* User's Guide* for debugging FORTRAN/400 programs.

Interactive Data Utilities

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Knowledge Tool

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Multiple Object Manager

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Office Vision/400

For more information about OE, OF, OM, and OW components, see pages 4-21 through 4-23

OO—Office Calendar

- A copy of the job log.
- Sufficient information to create the problem again.
- A copy of files QUSRSYS/QAOF*, QUSRSYS/QAOS*, and QUSRSYS/QAOC*.
- If you can create the problem again, run the failing job after entering the TRCJOB command with parameter TRCTYPE(*ALL).

  Note: Turn the trace on, when possible, before the problem starts and turn the trace off after the problem occurs.
- A copy of the trace QPSRVTRC after the problem occurs.

OZ—Personal Services and Office Administration: Contact your next level of service support to determine what information is needed to diagnose the problem.

OS/400

This topic shows information used for solving problems with a component of the operating system. For a list of the most commonly used tools used in gathering the information for OS/400 problems, see page 3-16.

Notes:

1. If the problem is in or is associated with a display command, obtain a copy of the command and a copy of the file used. Refer to the *CL Reference* for a list of the files used.
2. For the Work with Subsystems (WRKSBS) command, dump all subsystem descriptions using the Dump Systems Object (DMPSYSOBJ) command.

AL — Alerts in Network Management:

- A dump of the QLUS job using the DMPJOB command.
- A copy of the QLUS job log using the command: DSPJOBLOG QLUS OUTPUT(*PRINT).
- If the failure occurred in a user job, a copy of the user's job log using the DSPJOBLOG command.
- A dump of the system objects QUSRSYS/QAALERT using the DMPSYSOBJ command.
- If the problem can be created again, trace QLUS as follows:
  - STRSRVJOB QLUS
  - TRCJOB *ON MAXSTG(999)
  - Create the error again
  - TRCJOB *OFF

AR — Work Station Reliability, Availability, and Serviceability (RAS): All functions:

- An indication of the display image at the time of the failure
- A copy of the logic unit description (LUD), control unit description (CTLD), and network unit description (NUD) objects using the DMPSYSOBJ command
- The 5250 configuration

The following functions are provided by the operating system for the Reliability, Availability, and Serviceability Support (RAS) for the 525X, 319X, and so on.

- Configuration
- Error recording analysis procedure (ERAP)
- Display verification
- Other options

To invoke the test request function for local and remote work stations, see the service guide for that work station.

CA — Command Analyzer: All functions:

- The source listing if the command is CRTCMD or CRTCLPGM
- A copy of the command definition object using the DMPSYSOBJ command
- The command definition object or objects using the SAVOBJ command
- Sufficient information and data to create the problem again

CD — Command Definition: All functions:

- A copy of the command definition source
- A description of the data entered on the work station
- The command definition source output listing
- A copy of the command definition object using the DMPSYSOBJ command
- The command definition object using the SAVOBJ command

CI — System/36 Environment Support: The information needed for this component is the same as System/36 environment (EX)

CJ — SAA Spool Print (CPI): Contact your next level of service support to determine what information is needed to diagnose the problem.

CL — Control Language:

- All functions:
  - The CRTCLPGM command used to create the program
  - The source listing using the command: CRTCLPGM (OPTION(*SOURCE))
  - A printout of generated code using the command: CRTCLPGM (GENOPT(*LIST))
  - The command definition object for the suspect commands using SAVOBJ command
  - The program using the SAVOBJ command
  - Sufficient information and data to create the problem again
- Data area commands DCLDTAARA, SNDDTAARA, and RCVDTAARA
  - A copy of the data area using the DMPSYSOBJ command
  - The command used to create the data area
  - The data area using the SAVOBJ command
- Data manipulation commands DCLF, SNDF, RCVF, SNDRCVF, WAIT, and CNLRCV
  - The source listing from the file creation
  - The command used to create the files
  - Override commands used
  - All the above for any files involved in an override or overrides
  - The files used by the program using the SAVOBJ command
- Convert CL Source (CVTCLSRC) command
  - The orignal and the converted CL source using the SAVOBJ command
  - A copy of the Converted CL Source Report produced from the CVTCLSRC command

CM — Common Programming Interface: Contact your next level of service support to determine what information is needed to diagnose the problem.

CP — Copy: All functions:

- The record formats of files involved in the copy function data description specifications (DDS)
- A copy of the data records, control blocks, and machine interface (MI) objects associated with the files using the DMPSYSOBJ command

Components

- The command as entered
- Any file overrides entered using the DSPOVR command

CU—CPIC Utility: Contact your next level of service support to determine what information is needed to diagnose the problem.

C1—System/36 Environment Cryptographics:

All functions:

- The application source code that uses cryptographic support
- The input parameter values passed to cryptographic support
- The output parameter values returned from cryptographic support
- Any application objects necessary to create the problem again
- A copy of the job log containing second-level text
- Any dumps that were created by the system at the time of the failure
- A listing of the objects in the QCRP library
- A display listing of the QCRP/Q5728CR1 data area
- Sufficient information to create the problem again

DB—Database: All functions:

- A description of the function being performed
- A copy of the file control block using the DMPOBJ command
- A copy of the level 3 VLIC dump of the VLIC logs surrounding the time of the failure

DD—Data Description: All functions:

- A copy of the source data if a source file was used
- All printed output from the job including:
  - A copy of the data descriptions specifications (DDS) source listing, for create operations with source input files, using the command: CRTF OPTION(*SRC *LIST)
  - A copy of the file if it was created using the DMPOBJ command
  - A copy of any associated files using the DMPOBJ command

DF—Device File Definition: The information needed for this component is the same as data description (DD) on page 4-17.

DH—Problem Determination Procedures Help Displays: Contact your next level of service support to determine what information is needed to diagnose the problem.

DK—Diskette Support: The information needed for this component is the same as work station display support (WS) on page 4-30.

DL—DFU/List:

- The command that was used with all its parameters
- The file description used, for example: DFU, IDDU, or RPG
- The data file containing the information used to create the problem again
  - If a logical file is involved, all based on physical files are needed
  - If an IDDU data dictionary is used, provide the instruction on how to link the data file to the dictionary definition
- The DFU program and display device file objects, created by DFU
- The job log with any low level messages
- A list of all PTFs loaded to date
- Any information generated by DFU, for example: audit reports, RPG parser listing, DFU program definition summary reports, and DFU/List printouts
- If DDM files are involved, both the target (remote) system file, the source (local) system file, and the configuration information are needed
- Step-by-step instructions on how to create the problem again

DM—Data Management:

- Any override commands used.
- Any file overrides entered, using the WRKJOB command.
- Any file opened, using the WRKJOB command.
- Any files used by the program, using the SAVOBJ command.
- Any programs used, using the SAVOBJ command.
- A copy of the job logs for the job producing the error.
- If you can create the problem again, run the failing job using the Trace Job (TRCJOB) command. When using the TRCJOB command, specify a maximum storage of 1000 decimal kilobytes.
- A dump of any exception-related data for any unhandled exceptions that occurred
- A copy of messages sent to the history log or the system operator queue about problem and/or failing files.

- A dump of any files used, using the DMPSYSOBJ command
- A print of the displays in error or preceeding the error

DP — Problem Determination Procedures User Interface Displays:

- A copy of the job log.
- A trace of the failing job after running the failing job again using the command: TRCJOB TRCTYPE(*ALL). The error log ID can be found in the problem log entry using the Work with Problems (WRKPRB) command.
- A copy of the error log entry.
- A copy of the problem log entry for the problem using the WRKPRB command.

DR — Diskette Repair: All functions:

- A copy of the messages that were sent to the system operator queue using the DMPSYSOBJ command
- A hard copy of the displays and options that were selected
- A hard copy of the display/alter display before and after alteration of data
- The diskette involved

DZ — Data File Utility (DFU):

- The command that was used with all its parameters
- The file description used, for example: DFU, IDDU, or RPG
- The data file containing the information used to create the problem again
  - If a logical file is involved, all based on physical files are needed
  - If an IDDU data dictionary is used, provide the instruction on how to link the data file to the dictionary definition
- The DFU program and display device file objects created by DFU
- The job log with any low-level messages
- A list of all PTFs loaded to date
- Any information generated by DFU, for example: audit reports, RPG parser listing, DFU program definition summary reports, and DFU/List printouts
- If DDM files are involved, both the target (remote) system file, the source (local) system file, and the configuration information are needed
- Step-by-step instructions on how to create the problem again

EA — Online Education Enablers:

- Any information about the STREDU command used
- A copy of the files in the QUSRSYS library. They are: QAEASTUI, QAEASTUT, QAEASTUS, QAEASTUL, and QAEABKMT.
- A copy of the files in each course library. They are: QAEBAUDI, QAEBAUDL, QAEBMODI, QAEBMODL, and QAEBDSCT.

EB — Online Education Support:

- A copy of the files that support the education modules provided with the OS/400 system.

EC — Edit Code:

- A copy of the edit description object using the DMPSYSOBJ command

ED — Contact Database for Electronic Customer Support:

- A copy of the dump file QAEDCDBF using the DMPOBJ command
- The job log for the job that experienced the failure using the DSPLOG command for a reasonable time interval surrounding the error
- A copy of any dumps that were created from the error

EE — System/38 Environment:

- This component relies on other components. The information needed for this component is the same as the other components running in OS/400 operating system. Identify the other components and mention in the APAR description that the problem was in the System/38 environment.

ES — Service Support Facility:

- All functions:
  - A copy of the user's job log
  - A copy of the operator's job log
  - A copy of the job trace using the TRCJOB command
  - A copy of the contact database QAEDCDBPF using the DMPSYSOBJ command
  - A copy of the problem log using the command: CRTAPARPF PRBLOG 60
- Remote to service support functions:
  - A copy of the communications object QESLINE using the DSPLIND command
  - A copy of the communications object QESCTL using the DSPCTLD command
  - A copy of the communications object QESPAP using the DSPDEVD command
  - A copy of the communications trace

- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device

EX — System/36 Environment: All functions:

- Job log and job structure dump using the DMPJOB command

  Notes:

  1. For MRT jobs there are multiple jobs. There are one or more jobs for each of the requestors of the MRT and one job for the MRT.

     When problems occur in a requestor of an MRT, a DMPJOB of the requestor having the problem and a DMPJOB of the MRT job is required.

     When problems occur in the MRT job, a DMPJOB of the MRT job and any requestor of the MRT is required.

  2. The job name of a job queue, an evoke job, or an MRT job is the name of the procedure.

- A description of how the problem occurred and how to create the problem again (if known)
- A copy of the System/36 environment configuration (object QS36ENV in library #LIBRARY of type *S36) using the SAVOBJ command
- A copy of the procedures and associated objects to create the problem again
- A copy of the screen format generator (SFGR) source if related to a display format problem

EZ — Operational Assistant: Contact your next level of service support to determine what information is needed to diagnose the problem.

FA — DBCS Compatibility Fonts: Contact your next level of service support to determine what information is needed to diagnose the problem.

FG — Advance Printer Function: Contact your next level of service support to determine what information is needed to diagnose the problem.

FM — File Transfer Access Method: Contact your next level of service support to determine what information is needed to diagnose the problem.

FN — Finance:

The information needed for this component is the same as work station display support (WS) on page 4-30.

FO — SAA FORTRAN Run-Time Library: Contact your next level of service support to determine what information is needed to diagnose the problem.

FR — File Restore: Contact your next level of service support to determine what information is needed to diagnose the problem.

GA — Generic Attach 3270 Channel: Contact your next level of service support to determine what information is needed to diagnose the problem.

GC — X.21 Dynamic Facility Registration: Contact your next level of service support to determine what information is needed to diagnose the problem.

GS — AFP Printer Resource Utility: Contact your next level of service support to determine what information is needed to diagnose the problem.

HC — PC Support Host Configuration: Contact your next level of service support to determine what information is needed to diagnose the problem.

IA — Technical Information Access

- A copy of the user's job log
- A copy of the operator's job log
- A copy of the job traced using the TRCJOB command
- A copy of the contact database QAEDCDBPF using the DMPSYSOBJ command
- A copy of the communications object QTILINE using the DSPLIND command
- A copy of the communications object QTICTL using the DSPCTLD command
- A copy of the communications object QIADSP using the DSPDEVD command
- A copy of the communications object QIAPRT using the DSPDEVD command
- A copy of the communications trace
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device

ID — IDDU Data Dictionary Support

- A copy of the job log and a list of steps which produced the error
- Save the dictionary library using the SAVLIB command
- A copy of the following files or objects using the DMPSYSOBJ:

- Data dictionary (*DTADCT) object from the library containing the dictionary
- Database files (*FILE) for each dictionary file (QIDCT*) from the library containing the dictionary if the library could not be saved
- Recovery (edit) space for object *ALL and type/subtype 19EB from the library containing the dictionary
- Data queue for object *ALL and type/subtype 0AC4 from the library containing the dictionary
- System cross reference file QADBXREF in the library QSYS.
- File or files linked to definition in the dictionary if the problem is related to processing the file or if the LNKDTADFN command is being used.

IN — Installation Support: Because the purpose of this component is to load OS/400, little information is available to analyze problems in the component. Any I/O error should be attempted again. If the error occurs again, the following information is needed.

- If any message appears on the console, the message ID and all the other message data
- All SRC data in functions 11 through 18

  Component IN SRCs range from B900 3000 through B900 30FF. For more information about these SRCs, see page C-57.
- If any message appears on the console, the message ID and all the other message data

Gather the following information by partially doing an IPL of the system. IPL past the context rebuild step. This step occurs during the licensed internal code IPL. Immediately return to the DST main menu by pressing F16.

- All abnormal VLIC logs created sometime during the failed install

  For instructions about how to get the VLIC logs, see page 12-10.
- A copy of the install communications object (QSYS/QICO1 19C6) using DST

  For instructions about how to print the this object, see page 20-1.
- If available, the start OS/400 data object (QSYS/QWCSCPF 19DE)

  For instructions about how to print the this object, see page 21-1.
- If available, the installation profile (QINSTALL/QLPAUTO 19F4)
- If available, the job message queue

  Use *Display/Alter Dump* option described on page 12-27 to display QWCBT hex 19D0. Follow the system pointer at offset hex 0430 by using the S command as described on page 12-33. Note the current address and exit. Print the MI space object by address using the previously noted address.

JO — Journal: All functions:

- The input parameter values entered
- A copy of the journal using the DMPSYSOBJ command
- A copy of the attached journal receiver using the DMPSYSOBJ command

KJ — Kanji: All functions:

- The input parameter values
- The double-byte character set (DBCS) font table using the Copy DBCS Font Table (CPYIGCTBL) command
- The DBCS conversion dictionary (using the Save Object (SAVOBJ) command
- Sufficient information to create the problem again

LI — Librarian: All functions:

- A dump of the library using the Dump Object (DMPOBJ) command
- A copy of the library using the (SAVLIB) command
- A printout of the library using the DSPLIB command
- Sufficient information to create the problem again

LP — Licensed Program Install: Contact your next level of service support to determine what information is needed to diagnose the problem.

MA — Marketing Order Process Application: Contact your next level of service support to determine what information is needed to diagnose the problem.

MH — Message Handler:

- Message queuing functions:
  - The command used
  - A dump of the message queue involved
  - A job log of the failing process
- Message file functions:
  - The command used
  - A complete list of the parameters used in the Add Message Description (ADDMSGD) command and Change Message Description (CHGMSGD) command
- Display functions:
  - The command used
  - A description or a copy of the display shown
  - A dump of the message queue or the system log being displayed

MN—Menu Support: All functions:

- A description of the data entered at the work station to be used to create the problem again.
- A list of the job log with a logging level of four. (MSGSEV = 0 should also be specified so that low-level messages are not filtered. Log level, message severity, and message level all work in conjunction.)
- A trace of the error as it occurs

MX—$MAINT X.25 Utility: Contact your next level of service support to determine what information is needed to diagnose the problem.

NC—Native Command Definition Objects (CDO): Contact your next level of service support to determine what information is needed to diagnose the problem.

NM—Network Management Services:

- A copy of the job log for the job that failed
- Sufficient information to create the problem again

OC—Office Calendar Services:

- A copy of the job log.
- Sufficient information to create the problem again.
- A copy of files QUSRSYS/QAOF*, QUSRSYS/QAOS*, and QUSRSYS/QAOC*.
- If you can create the problem again, run the failing job after entering the TRCJOB command with parameter TRCTYPE(*ALL)

  Note: Turn the trace on, when possible, before the problem starts and turn the trace off after the problem occurs.
- A copy of the trace QPSRVTRC after the problem occurs

OD—Office Document/Folder Manager:

- A copy of the job log for the job encountering the error.
- Any dumps generated as a result of the error.
- A copy of the document and/or folder associated with the error using the SAVDLO command.
- A dump of the document and/or folder associated with the error. Use the DMPDLO command or the DMPSYSOBJ command if you only know the system object name of the folder and/or document.
- A dump of the internal system objects (DMPDLO command) if the problem is with internal objects or if there is any uncertainty about the folder existing.
- If the problem is associated with the search data base files:
  - A copy of the physical files QAOSSH10 through QAOSSH15 and QAOSSH17 through QAOSSH19.
  - See the database component (DB) for additional information
- A description of the function being performed.
- Any other information needed to create the problem again.

OE—Office Editor: All functions:

- A copy of the job log using the DSPJOBLOG command
- A copy of the job structure dumps using the DMPJOB command
- A description of how the problem occurred and how to create the problem again
- A copy of the procedures and associated objects needed to create the problem again, for example:
  - The document and folder used when the failure occurred
  - If using spelling and hyphenation functions, the spell aid dictionaries being used and associated source files if available
- If you can create the problem again, run the failing job after entering the TRCJOB command with TRCTYPE(*ALL).
- A copy of the trace QPSRVTRC after the problem occurs.

OF—Office Services:

- Do the following for the job that the command RSTS36FLR failed:

  ```
  CHGJOBD LOG (4 00 *SECLVL)
  ```
- Execute the RSTS36FLR command in a way that shows the failure
- Use the SAVOBJ command to save the input file to tape or diskette, then send in the tape or diskette, if DEL(*PHYFILE) is specified
- Send in the tape or diskette if the input device is tape or diskette
- Send in the job log that includes the RSTS36FLR and SAVOBJ commands, if used
- A description of how the problem occurred and how to create the problem again

OG—Personal Services (Office):

- A copy of the job log
- Sufficient information to create the problem again

OH—DIA Distribution Services

- Information needed by the OD component if this is a folder or document problem
- For office distribution services:
  - A copy of the job log for the failing process (maybe QDIA, QDIALOCAL, or QDIAINDUSR job in QSNADS subsystem
  - A copy of the job structure dump if an error message caused the dump to be taken
  - A dump of the distribution recipient queue (*DRQ) for a user that is having the office distribution problem using the command: DMPSYSOBJ OBJ('user ID address') CONTEXT(QUSRSYS) TYPE(0A) SUBTYPE(C3)
  - If the problem is with a local user sending distribution, a dump of the distribution tracking object (*DTO) for the local distribution using the command:

    ```
    DMPSYSOBJ OBJ('address user ID*')
      CONTEXT(QUSRSYS) TYPE(19) SUBTYPE(E2)
    ```

  - If the problem is with distributions from a remote system, a dump of the distribution tracking objects (*DTO) for the remote distributions using the command:

    ```
    DMPSYSOBJ OBJ('QOSRDIST0YYMMDD*')
      CONTEXT(QUSRSYS) TYPE(19) SUBTYPE(E2)
    ```

    Where YYMMDD is the date when the distributions were received at the local system, for example: 891231 is the YYMMDD for 12/31/89.
- For distribution services application program interface (API) commands (RCVDST, SNDDST, CHGDSTD, DLTDST, and QRYDST):
  - A description of the function being performed.
  - A copy of the job log.
  - If database files are being used, a dump of the database files.
  - A dump of the distribution recipient queue (*DRQ) for that user or the specific distribution (*DTO) if the command used was RCVDST or DLTDST using the DMPSYSOBJ command.

    For *DRQ object
    Internal object type is 0A
    Internal object subtype is C3
    OBJ('user ID address') CONTEXT (QUSRSYS)

    For *DTO object
    Internal object type is 19
    Internal object subtype is E2
    OBJ('address user ID *') CONTEXT (QUSRSYS)
  - A SAVOBJ for any database files that are being used.

OJ—Office Save/Restore:

- A copy of the job log for the job encountering the error.
- A description of the function being performed.
- If you are using the RSTDLO or RSTUSRPRF command and the problem is in a module that begins with QOJ*, a copy of the tape or diskette, or the online save file contents. Use the SAVSAVFDTA command to get a copy of the online save file contents.
- Sufficient information to create the problem again.

OK—Distribution Directory Services: For the directory or distribution list function:

- A dump of database files used by directory and distribution lists QAOKDP* and QAOKLP* in library QUSRSYS
- A print of the display showing the error, if the error occurs with the WRKDIR and WRKDSTL commands.
- A copy of the job log for the failing process
- A copy of the job structure dump if an error message caused the dump to be taken

OM—Office Adapted Word Processing Function: All functions:

- A copy of the job log using the DSPJOBLOG command
- A copy of the job structure dumps using the DMPJOB command
- A description of how the problem occurred and how to create the problem again
- A copy of the procedures and associated objects needed to create the problem again, for example:
  - The document and folder used when the failure occurred
  - If using spelling and hyphenation functions, the spell aid dictionaries being used and associated source files if available
- If you can create the problem again, run the failing job after entering the TRCJOB command with TRCTYPE(*ALL).
- A copy of the trace QPSRVTRC after the problem occurs.

OP—Office Print Functions: All functions:

- A copy of the job log using the DSPJOBLOG command
- A copy of the job structure dumps using the DMPJOB command
- A description of how the problem occurred and how to create the problem again
- A copy of the procedures and associated objects that allow the problem to be created again, for example:

Components

- The document and folder used when the failure occurred
- If using spelling and hyphenation functions, the spell aid dictionaries being used and associated source files if available
- If using the data/text merge function, the files, queries, data dictionaries, documents, and the data description specifications (DDS) needed to perform the merge
- A dump of the spool file (for printer problems). See "Printer Problems" on page 3-16 for instructions on dumping spool files.
- A copy of the source/sink trace of the printer LUD, if a printer is used.

- If you can create the problem again, run the failing job after entering the TRCJOB command with TRCTYPE(*ALL).
- A copy of the trace QPSRVTRC after the problem occurs.

OQ — DIA Session Services:

- A copy of the job log for the failing process
- A copy of the job structure dump if an error message caused the dump to be taken and any other dumps associated with the failing process
- A dump of the active user table using the command:

```
DMPSYSOBJ OBJ('QOQ_ACTIVE_USER_TABLE')
   CONTEXT(QRECOVERY)
```

- When communication requests are rejected, a communications trace of the line with the control unit and device that is experiencing the failure.

OR — AS/400 Organizer:

- Check if PC Support is installed.
- A copy of the job log for the host session.
- The name of the PC Support configuration file being used.

OS — DIA Library Services:

- For library services API commands (FILDOC, RTVDOC, RPLDOC, QRYDOCLIB, and CHGDOCD):
  - A description of the function being performed.
  - A copy of the job log.
  - A dump of the database files, if any.
  - A dump of the document object (*DOC); if the command used was RTVDOC, RPLDOC, QRYDOCLIB, or CHGDOCD; using the DMPSYSOBJ command if you know the system object name:

```
*DOC     OBJ('system object name')
         CONTEXT(QDOC)
         OBJTYPE(*DOC)
*FILE    OBJ('file name')
         CONTEXT(library)
         OBJTYPE(*FILE)
```

  - A SAVOBJ for any database files that are being used.

- A copy of the job log for the job encountering the error.
- Any dumps generated as a result of the error.
- The document and/or folder associated with the error. Use the DMPDLO command or the DMPSYSOBJ command if you know the system object name of the folder and/or document.
- A dump of the internal system objects (DMPDLO command) if the problem is with internal objects or if there is any uncertainty about the folder existing.
- If the problem is associated with the DIA data base files:
  - A copy of the physical files QAOSSH10 through QAOSSH15 and QAOSSH17 through QAOSSH19.
  - See the database component (DB) for additional information
- A description of the function being performed.
- Any other information needed to create the problem again.

OT — Office Transformations: All functions:

- A copy of the job log using the DSPJOBLOG command
- A copy of the job structure dump using the DMPJOB command
- A description of how the problem occurred and how to create the problem again
- A copy of the procedures and associated objects that allow the problem to be created again, for example:
  - The document and folder that was used when the failure occurred
  - A dump of the spool file (for printer problems). See "Printer Problems" on page 3-16 for instructions on dumping spool files.
  - A copy of the source/sink trace of the printer LUD, if a printer is used.
- If you can create the problem again, run the failing job after entering the TRCJOB command with TRCTYPE(*ALL).
- A copy of the trace QPSRVTRC after the problem occurs.

OW — Office Editor Text Assist: All functions:

- A description of how the problem occurred and how to create the problem again
- A copy of the job log QPJOBLOG after the problem occurs
- A copy of the procedures and associated objects that allow the problem to be created again, for example:
  - The document and folder used when the failure occurred

- If using spelling and hyphenation functions, the spell aid dictionaries being used and associated source files if available

- A copy of the job structure dump QPSRVDMP using the DMPJOB command
- If you can create the problem again, run the failing job after entering the TRCJOB command.

  Note: Turn the trace on (TRCJOB *ON *DATA), when possible, before the problem starts and turn the trace off (TRCJOB *OFF) after the problem occurs.

- A copy of the trace QPSRVTRC after the problem occurs

PD — Problem Determination:

- A copy of the job log.
- A trace of the failing job after running the failing job again using the command: TRCJOB TRCTYPE(*ALL). The error log ID can be found in the problem log entry using the Work with Problems (WRKPRB) command.
- A copy of the error log entry that includes the hexadecimal data.
- A copy of the problem log entry for the problem using the WRKPRB command.

PM — Performance Monitor: Contact your next level of service support to determine what information is needed to diagnose the problem.

PN — Printer Support: The information needed for this component is the same as work station display support (WS) on page 4-30.

PQ — PSF: The information needed for this component is the same as work station display support (WS) on page 4-30.

PR — Program Resolution Monitor: All functions:

- The command that was used
- A copy of QPRODT and QPROCT with respective types PRODT and PROCT using the DMPSYSOBJ command
- The PRM source, cross-reference, object summary, and program template listings (create command options: WPRMLST, WPRMCHK, and WPRMTSTI)
- Sufficient information and data to create the problem again

PT — Prompter: All functions:

- A copy of the command definition object using the DMPSYSOBJ command
- The command definition object using the SAVOBJ command
- Sufficient information and data to create the problem again

PY — Performance Run-Time Elements: All functions:

- A copy of the job log and dumps associated with the problem
- A description of how the problem occurred and how to create the problem again
- Save QPFRDATA or the library containing data needed to create the problem again using the SAVLIB command

PZ — PTF Management: For the PTF function:

- A dump of the master programming change index from the licensed program base library (or QGPL for licensed internal code) using the following command:

```
DMPSYSOBJ OBJ(libname) CONTEXT(*MCHCTX)
   OBJTYPE(*LIB) OFFSET(00000040)
```

- The release level of program product
- A copy of the PTFs tape, diskette, or *SAVEFILE
- A copy of the QHST log
- A copy of the printout obtained from the Display Program Temporary Fix (DSPPTF) command
- A copy of the job log

QA — Questions-and-Answers Support:

- All functions:
  - A copy of the user job log
  - A copy of the operator job log
  - A copy of the job trace using the TRCJOB command
  - A copy of the contact database QAEDCDBPF using the DMPSYSOBJ command
  - A copy of all QAQA* file objects in the library in which the database resides using the SAVOBJ command
- Remote to market support functions:
  - A copy of the communications object QTILINE using the DSPLIND command
  - A copy of the communications object QTICTL using the DSPCTLD command
  - A copy of the communications object QQAHOST using the DSPDEVD command
  - A copy of the communications trace
  - A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device
- Remote to AS/400 functions:
  - A copy of the communications objects created by the user using the DSPLIND, DSPCTLD, and DSPDEVD commands

- A copy of the communications trace
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device

QQ — Database Query: All functions:

- A copy of any dumps produced by the failure.
- Sufficient information necessary to create the problem again.

QU — AS/400 Query Run-Time:

- A copy of the query objects saved by using the SAVOBJ command
- A copy of the job log with second level messages using the DSPJOBLOG command
- A copy of the trace job using the TRCJOB command specified with parameter MAXSTG(5000)
- A copy of a the job using the DSPJOB command
- A description of how each of the input and output files were created using QRY, BGU, IDDU, CRTPF, and so on.
- A copy of a DSPDBR for all of the input and output files
- A copy of a DSPFD and DSPFFD for all of the input and output files
- A SAVOBJ ACCPTH(*YES) of all the input files, output files, and any dependent files listed in a DSPDBR
- A copy of all the saved data dictionaries for all of the input files and output files using the SAVLIB command
- A description of how the query was run, to include:
  - Option Run from the Work with Queries display
  - Option Run from the Exit this Query display
  - Option F-Layout from an AS/400 Query display
  - Option F-Report from an AS/400 Query display
  - QRYRUN or RUNQRY and the parameters specified
  - An option from the QUERY menu
- A copy of the PTF 5728SS1 using the DSPPTF command
- Any data requested for the QRY QU component where applicable
- Any data requested for the M3X QU component where applicable
- Sufficient information and data to create the problem again

For output to a printer:

- A copy of a DSPFD QPQUPRFIL
- A copy of a DSPDEVD of the chosen printer device
- A copy of a WRKSPLFA of the created spool file

For output to a display:

- A copy of a DSPDEVD of the display device

For collation and query profile problems:

- A copy of a DSPMSGD QRZ3030 QQRYMSG
- A copy of a DMPOBJ of the user profile that has the problem

For Data/Text merge functions:

- A SAVDLO of the document

QX — SAA Query CPI: Contact your next level of service support to determine what information is needed to diagnose the problem.

RC — Recovery:

- For the Reclaim Storage (RCLSTG) command, a copy of the QHST system log using the Display Log (DSPLOG) command.
- A copy of the QSYSOPR message queue by using the Display Message (DSPMSG) command
- A copy of the job log using the Sign Off (SIGNOFF) command with the *LIST option

RM — RM/COBOL Run-Time Library: Contact your next level of service support to determine what information is needed to diagnose the problem.

RU — Reference Code Translate Table (RCTT) Facility:

- A dump of the RCTT involved
- The message description (DSPMSGD) of the message sent to QSYSOPR, if one is sent
- Sufficient information to create the problem again

RZ — System Resource Management: For the hardware resource manager (HRM):

- The spooled file, taken under the job QSYSARB, that contains dump information generated by HRM when the failure occurred or was detected.

  The system value QSRVDMP must be set to *DMPALLJOB or *DMPSYSJOB before these spool files are produced.
- A copy of the printout obtained by using the DMPSYSOBJ command for the following objects: QRZHELM, QRZHELMI, QRZHVPD, QRZHVPDI, QRZHLOC, QRZHLOCI, QRZTOPL, QRZTOPLI, QRZPTF, QRZPTFI, QRZLCG, QRZLCGI, QRZTRL, QRZTRLI, QRZMATSP, and QRZLSTSP.

  Note: All these objects are in the QSYS context.
- A copy of the RCR printed in logical blocks using the display/alter/dump option under SST. The RCR is

obtained from selecting the VLIC data option on the Select Data Menu.

- A copy of the job log for the QSYSARB system job that was active at the time of the failure.
- A copy of the history log with second level text.

For the system resource manager (SRM):

- A copy of the information required for the hardware resource manager (HRM)
- A copy of the job log for the job that failed at the time of the failure

SC — Service:

- Inter-job servicing:
  - A dump of both SCOs using the command:

    ```
    DMPSYSOBJ OBJ('QSCOjobnameUSERIDjobnumber')
              CONTEXT(QSYS) TYPE(19)
              SUBTYPE(DC) OFFSET(00)
    ```

    where the job name is padded for length of 10, the user ID is padded for length of 10, and the job number is padded for length of 6.
  - A dump of the master service index, using the command:

    ```
    DMPSYSOBJ QSERVICE QSYS 0E 91
    ```

  - A dump of the work control block table (WCBT)
  - A dump of the work control block (WCB) for both jobs
- Trace job function:
  - Same as inter-job servicing, but for one job only
  - A dump of the trace table, using the command:

    ```
    DMPSYSOBJ OBJ('QSCOjobnameUSERIDjobnumber')
              CONTEXT(QSYS) TYPE(19)
              SUBTYPE(DC) OFFSET(00)
    ```

    where the job name is the name of the job being traced padded for length of 10, the user ID is padded for length of 10, and the job number is padded for length of 6.
  - A dump of the remote trace table, using the command:

    ```
    DMPSYSOBJ OBJ('QSCOjobnameUSERIDjobnumber')
              CONTEXT(QSYS) TYPE(19)
              SUBTYPE(DC) OFFSET(10)
    ```

    where the job name is the name of the job being traced padded for length of 10, the user ID is padded for length of 10, and the job number is padded for length of 6.

SF — Subfile Support: The information needed for this component is the same as work station display support (WS) on page 4-30.

SM — System Service Tools (SST): All functions:

- A procedure to create the problem again
- A process dump using the DMPJOB or Dump Internal Job (DMPJOBINT) command
- A copy of the main storage stand-alone dump

SP — Spooling: All functions:

- The QWCBT using the DMPSYSOBJ command
- The SCBs of the jobs involved using the DMPSYSOBJ command and offsets from the QWCBT dump
- Any procedures and objects needed to create the problem again
- Reader:
  - A copy of the job queue to which the job was assigned using the DMPSYSOBJ command
  - QSPFACB using the DMPSYSOBJ command
  - QSPRWCB using the DMPSYSOBJ command
- Writer:
  - A copy of the output queue using the DMPSYSOBJ command
  - QSPRWCB using the DMPSYSOBJ command
  - A copy of the writer's job log
  - A copy of the writer's job using the TRCJOB command
  - A copy of the VLIC logs used to trace the device
  - A copy of the spooled file being written using the Copy File (CPYF) command with parameter OUTFMT(*HEX)
- Spooling queue commands:
  - A copy of the queue referenced using the DMPSYSOBJ command
- Job/file control commands:
  - A copy of the queue or queues involved using the DMPSYSOBJ command
- Open/close/intercepts:
  - The queue involved using the DMPSYSOBJ command
  - The option list and control list, if available
  - A dump of the spooled data using the Copy File (CPYF) command with parameter OUTFMT(*HEX)

SQ — Structured Query Language (SQL): In general, all the information needed to create the problem again should be submitted to facilitate problem analysis. If possible, the size of the program or interactive SQL session should be reduced to include just the information that is needed to create the problem again.

Note: Structure Query Language (SQL) run-time and prompting support comes with the operating system.

The following are needed to analyze problems while using SQL/400:

Components

- If a problem occurs while running SQL statements:
  - A copy of the job log
  - For problems with any SQL data manipulation statements (for example: OPEN, UPDATE, INSERT, and DELETE) use the DSPFD command for each file or table referenced by the failing SQL statement.
    - Provide a printout of DSPFD and DSPFFD for the underlying physical files referenced by the failing SQL statement.
    - Provide a DSPFD and DSPFFD for each keyed logical files associated with the physical files.
  - A copy of the dump for any associated database files and members using the DMPSYSOBJ command for any SQL data definition statements, for example, create and drop
  - A copy of the journal being used for any SQL transaction management statements, for example, commit and rollback
- If a problem occurs while creating or running a program with embedded SQL statements:
  - A copy of the printout created by the SQL precompiler and the host language compiler when the OPTION(*SRC *XREF) keyword is specified on the CRTSQLxxx command
  - A copy of the program associated space and program template using the DMPOBJ command
  - A copy of any source and any referenced files needed to create the program again
  - If possible, provide a job log with the debug active using the STRDBG command.

SR — Save/Restore:

- Save/restore and display functions:
  - A copy of the job log
  - The command as entered and a description of the function being performed
  - A copy of the messages in the QSYSOPR message queue using the Display Messages (DSPMSG) command
  - A copy of the diskettes or tapes involved using the Display Diskette (DSPDKT) or Display Tape (DSPTAP) command with DATA(*LABELS) and with DATA(*SAVRST)
  - A copy of the save files involved using the Display Save File (DSPSAVF) command
  - A copy of the objects being saved or restored using the Work with Objects (WRKOBJ) command
  - A copy of any VLIC log entries
  - If the problem can be created again, a VLIC trace of load/dump (trace table size of at least 256 K)
- High-level language program file operations using save files:
  - A copy of the save file Dump Object (DMPOBJ) or Dump System Object (DMPSYSOBJ) command
  - A description of the function being performed
  - The control list and option list if available
- Other information:
  - The file sizes and block sizes used by the job that failed
  - Any active devices in the system configuration when the job failed, for example, heavily loaded versus lightly loaded
  - The time lapse between the start of the job and the abnormal end of the job
  - The number of media used during the job
  - A copy of the media error logs
  - The status on the last object processed
  - A copy of the I/O debug dump

| **SS — Source/Sink Management:** Contact your next level of service support to determine what information is needed to diagnose the problem.

SU — Work with Hardware Products (WRKHDWPRD): All functions:

- A copy or print file of the system's rack configuration list for the 9406 System Unit or system configuration list for the 9404 System Unit. This listing is obtained by using the Work with rack configuration option of the Work with Hardware Products (WRKHDWPRD) command.
- A copy of a hexadecimal printout of hardware resources from an output file obtained from using the Copy File (CPYF) command. Create an output file by using the Display Local Hardware (DSPLCLHDW) command with option OUTPUT(*OUTFILE).

| If you are replacing the rack configuration on the 9406 System Unit the following information is also needed:

- | A printout of the file being replaced using the CPYF command.

SUPT — Compiler Enhancement Macros: Contact your next level of service support to determine what information is needed to diagnose the problem.

SX — Service Activity Log

- A copy of the job log.
- A trace of the failing job after running the failing job again using the command: TRCJOB TRCTYPE(*ALL). The error log ID can be found in the problem log entry using the Work with Problems (WRKPRB) command.
- A copy of the error log entry.
- A copy of the problem log entry for the problem using the WRKPRB command.
- | A copy of files QASX* using the CPYF command. Specify that you want hex data with the CPYF command.

SY — Security: All functions:

- The input parameter values as entered to be used to create the problem again
- A copy of the level 4 job log (MSGSEV = 0 should also be specified so that low-level messages are not filtered. Log level, message severity, and message level all work in conjunction.)
- The authority on the affected object using the Display Object Authority (DSPOBJAUT) command
- A dump of the user profile using DMPJOB command

SZ — Loadable Code Resource Manager (LCRM):

- A copy of a hexadecimal printout of software resources from an output file obtained from using the Copy File (CPYF) command. Create an output file by using the Display Software Resoures (DSPSFWRSC) command with option OUTPUT(*OUTFILE).
- A copy of the job log for QSYSARB system job that was active when the failure occurred.
- A copy of the job log for the job that incurred the failure.

TA — Tape Support: The information needed for this component is the same as work station display support (WS) on page 4-30.

TB — Table:

- A dump of the table object using the DMPSYSOBJ command

TD — Transform Data: Contact your next level of service support to determine what information is needed to diagnose the problem.

TE — Test/Debug: All functions:

- A listing of programs being debugged
- Sufficient object code, data, and procedures to create the problem again

TI — Technical Information Exchange:

- A copy of the user job log
- A copy of the operator job log
- A copy of the job trace using the TRCJOB command
- A copy of the contact database QAEDCDBPF using the DMPSYSOBJ command
- A copy of the communications object QTILINE using the DSPLIND command
- A copy of the communications object QTICTL using the DSPCTLD command
- A copy of the communications object QTIDA using the DSPDEVD command
- A copy of the communications object QTIDA2 using the DSPDEVD command
- A copy of the communications trace
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device

TN — Commit: All functions:

- A copy of the history log
- A copy of the job log
- A display of journal being used
- Sufficient information to create the problem again

TT — Technical Tools: Contact your next level of service support to determine what information is needed to diagnose the problem.

UC — User Customization of the Keyboard: Contact your next level of service support to determine what information is needed to diagnose the problem.

UH — User Interface Manager (UIM) Help Facility:

- A copy of the job log
- A description or a copy of the display from which help was requested to include the position of the cursor when help was requested
- A description of the actions that led to the error
- A trace of the failure
- If the failure occurs while you are printing the help text, include a description of QSYSPRT using the DSPFD command

UI — User Interface Manager:

- A dump of the panel group or menu object using the DMPSYOBJ command
- A trace of the failure
- A copy of the display if a formatting error is suspected
- A copy of the job log

UP — User Detected Problem Resolution:

- A list of the options used before encountering the problem
- A copy of the QPSRVDMP and QWDSPJOB dumps if they exist
- Any messages including the detailed (low-level) messages associated with the problem
- A copy of the job log

Components

- A description of the user's view of what the problem is and what the corrections should be if the problem pertains to bad information or directions

UR — Library Exit Routines: Contact your next level of service support to determine what information is needed to diagnose the problem.

US — User Object Support:

- A copy of the job log for the job that failed.
- A dump of the user object using the DMPSYSOBJ or DMPOBJ command if the user space, user queue, or user index objects were involved in the failure.
- The API as entered and a description of the function being performed.
- If the API was in a program, include the compiled version of the program, source for the program, and instructions on how to run the program.
- Sufficient information to create the problem again.

UT — System/36 Environment Utilities: The information needed for this component is the same as System/36 environment (EX) on page 4-19.

WC — Work Control:

- All functions:
  - A list of all elements for the subsystem description using the Work with Subsystem Descriptions (WRKSBSD) command. A dump of the objects listed in the subsystem description using the Dump System Object (DMPSYSOBJ) command, to include a dump of QWCBT using the DMPSYSOBJ command, and a dump of WCB using the Dump Job (DMPJOB) command.
  - System value object QWMSYSVAL using the DMPSYSOBJ command.
  - A list of all the active jobs and subsystems that have been started using the WRKACTJOB command. Note that the WRKACTJOB command is used to obtain a list, not to start jobs and subsystems.
  - Sufficient information to create the problem again.
- Problems with active subsystems:
  - A list of all elements of the subsystem description being used by the subsystem. Then, a dump of the objects listed using the DMPSYSOBJ command.
  - For an interactive subsystem, a dump of the device files being used by the subsystem. To dump the device files, use the Work with Subsystem Descriptions (WRKSBSD) command. Find the appropriate work station name. Then, display the detailed description of that work station entry and dump the file listed under the *Display file name* using the DMPSYSOBJ command.
  - A copy of the job descriptions being used by the subsystem using the Work with Subsystem Descriptions (WRKSBSD) command and Display Job Description (DSPJOBD) commands.
  - A copy of the history log using the DSPLOG command.
  - A copy of the monitor process using the Dump Job Internal (DMPJOBINT) command.
  - For each job active in the subsystem, the information requested for problems related to the active job.
  - A copy of the job log for the subsystem monitor using the Display Job Log (DSPJOBLOG) command and/or a dump of the subsystem monitor's job message queue using the DMPSYSOBJ command.
- Problems with active jobs:
  - A copy of the job process using the Dump Job Internal (DMPJOBINT) command
  - A copy of the temporary job structure using the Dump Job (DMPJOB) command
  - A copy of the job log and/or a dump of the job message queue using the DMPSYSOBJ command
  - A copy of the job logs held or pending using the Display Job (DSPJOB) command
- Class commands:
  - A copy of the class object using the DMPSYSOBJ command
- Job description commands:
  - A copy of the job description object using the DMPSYSOBJ command
- Allocate or deallocate commands:
  - The original command
  - Input parameter values
  - Exception data, if any
- Data area or include commands (CHG, CRT, and DSP):
  - The data area object involved using the DMPSYSOBJ command
  - The command syntax of the Create Data Area (CRTDTAARA) command
  - A copy of QWCSCPF
  - A copy of the main storage dump
  - The setting of the control panel lights and switches
  - A description of the control panel setting, if a machine halt
- Start subsystem command:
  - The description of the subsystem to be started
  - For escape message CPF0999, the system arbiter (QSYSARB) job log and the job message queue using the Dump System Object (DMPSYSOBJ) command
  - A copy of QWCRMCB using the DMPSYSOBJ command
- End command:
  - A copy of the main storage dump

- System end functions using the ENDSYS, ENDSBS SBS(*ALL), and PWRDWNSYS commands:
  - Control panel indicator settings, if a machine halt
  - A copy of QWCSCPF (see "System Start and Stop Problems" on page 3-18)
  - A copy of the main storage dump

WD — Subsystem Description (SBSD): The information needed for this component is the same as work control (WC) on page 4-29.

WH — File Reference: All functions:

- A copy of the job log
- A copy of the display in question
- A copy of the file or program you are trying to display using the DMPOBJ command

WP — Work Station Printer Support: The information needed for this component is the same as work station display support (WS).

WS — Work Station Display Support:

- All devices:
  - A copy of the device description (DEVD) using the DMPSYSOBJ command with OBJ(device name) CONTEXT(QSYS) TYPE(*ALL) SUBTYPE(*ALL) OBJTYPE(*DEVD). For example, devname = DSP01.
  - Information about what I/O operation the program was trying to perform and the series of events leading to the problem, including the sequence of I/O operations and record format names for each I/O.
  - The option list and control list for the sequences of I/O operations if available.
- For printer tape, diskette, BSC, and/or APPC, a job structure dump of the source/sink request (SSR).
- For a work station, remote printer, BSC, APPC, and a console, a copy of the device file using the DMPSYSOBJ command and a listing of the source that was used to create the file if available.
- A copy of any tape overrides in effect and listings of the tape files, if default files are not used.
- A copy of the job logs for the job encountering the error, and for the monitor (subsystem) under which the failing job is running. If this is an AFP printer, include a copy of the job log for both the print writer job and the print driver job.
- Dumps of exception-related data for any unhandled exceptions that occurred.
- Dumps of any VLIC log entries made during a failure.
- A copy of the messages relating to the problem/failing device that were sent to the history log or the system operator queue.
- If you can create the problem again, a trace of the failing job after running the failing job using the command: TRCJOB TRCTYPE(*ALL).
- If message (CPF54XX) was signaled by the function manager, rerun the failing job after doing the following:
  - An OS/400 trace using the command: TRCJOB TRCTYPE(*ALL)
  - A trace source/sink system object: ND, CD, and LUD for VLIC messages, source/sink control blocks/error path, protocols, and user data using DST
  - A VLIC trace of the machine services control point (MSCP) using DST
  - A dump of the VLIC log related to the problem
  - For communications, use DST devices

  Note: Turn the trace on, when possible, just before the problem starts, and turn the trace off just after the problem occurs.
- Diskette commands (initialize, delete, and so on)
  - The diskette VTOC using the Display Diskette (DSPDKT) command
  - The options specified on the command
  - A hexadecimal dump of the diskette

WT — Work Monitor: The information needed for this component is the same as work control (WC) on page 4-29.

- The command as entered
- Any file overrides as entered using the Display Override (DSPOVR) command
- A copy of the object specified in the command using the DMPSYSOBJ command

WU — System/38 Interactive Database Utilities: Contact your next level of service support to determine what information is needed to diagnose the problem.

XA — VLIC Byte String Space: Contact your next level of service support to determine what information is needed to diagnose the problem.

X1 — Interactive SQL: If the problem was discovered while entering or running SQL statements using interactive SQL:

- A list of any options set on by the STRSQL command or modified by using Session Services
- A printout or source file of the session using Session Services or on exiting interactive SQL
- Printed copies of any display that contains incorrect data if incorrect data is being shown on any display
- If a problem occurs while selecting items from the library or collection list, use the DSPLIB LIB(X) command where X is *ALL, *ALLUSR, and so on, according to the setting that was in effect for the

LIBOPT parameter of the STRSQL command or from Session Services.

- If a problem occurs while selecting items from the file/table list, use the DSPLIB LIB(X) command where X is the name of the library or collection you were requesting information from. You may have to repeat this command if you were requesting information from more than one library or collection.
- If a problem occurs while selecting items from the field/column list, use the DSPFFD FILE(X) command, where X is the name of the file/table you were requesting information from. You may have to repeat this command if you were requesting information from more than one file/table.
- If a problem occurs while in prompting, provide a copy of displays that may be in error. Also, provide a copy of the second level text from any error messages and sufficient instructions to create the problem again.

Y1—Interactive Terminal Facility: All functions:

- A copy of the messages relating to the problem or failing device that were sent to the history log (QHST) or system operator queue (QSYSOPR)
- A copy of the job logs for the job encountering the error
- If you can create the problem again, a trace of the failing user's job using the command: TRCJOB TRCTYPE(*ALL)
- A copy of the device (LUD) using the DMPSYSOBJ command

Y2—File Transfer Support: All functions:

- A copy of the messages relating to the problem or failing device that were sent to the history log (QHST) or system operator queue (QSYSOPR) on both the local and remote systems.
- A copy of the job logs for the job encountering the error on both the local and remote systems.
- If you can create the problem again, run the failing job using the command: TRCJOB TRCTYPE(*ALL)
- Also any additional information requested by components YF, AC, or BI for the specific protocol that you are using.

OS/400 Advanced Function Printing

PK—AFP Print Command: The information needed for this component is the same as work station display support (WS).

OS/400 Communications

AC—Advanced Program-to-Program Communications (APPC): The information needed for this component is the same as work station display support (WS) on page 4-30.

AP—APPC REQIO Manager: The information needed for this component is the same as work station display support (WS) on page 4-30.

A1—Intrasystem Communications FM: The information needed for this component is the same as work station display support (WS) on page 4-30.

BI—BSC FM Support for OS/400 BSCEL: The information needed for this component is the same as work station display support (WS) on page 4-30.

BS—BSC FM Support for System/38 Environment: The information needed for this component is the same as work station display support (WS) on page 4-30.

CN—DDM Communications: All functions:

- The command as entered, if applicable.
- Any file overrides using the DSPOVR command.
- A copy of the application and data files being used, if possible.
- Print all job logs for DDM jobs running on each AS/400 system involved. Make sure that the job description specifies that second level text is to be logged.
- A copy of the line, controller, device, and mode descriptions for each AS/400 system involved using the DSPLIND, DSPCTLD, DSPDEVD, and DSPMODD commands
- A dump of all DDM jobs on each AS/400 system involved using the DMPJOB command, if the job is stopped For more information about these kinds of jobs, see "Hangs" on page 3-8 or "Waits" on page 3-11.
- If the problem can be created again:
  - Follow the instructions given if a message in the job log instructs to change message CPF9151. Return any dumps which are produced when the problem is created again.
  - Use the TRCJOB and/or SRVJOB commands to obtain an OS/400 trace for all DDM jobs running on each AS/400 system involved.
  - Use DST or the STRSST command and options to obtain a communications trace of the problem. Copy the trace on tape or diskette. For more information about a communications trace, see "Work with Communications Trace" on page 12-20.

  - Use DST or the STRSST command and options to obtain a VLIC source/sink trace of each of the lines, controllers, and devices involved.
- For any non-AS/400 systems involved in the problem:
  - A copy of any job logs, history files, and so on that are available when the problem occurred or is created again.
  - A copy of all communications configuration information available, for example, on a System/36, use the CNFIGICF command and the Print key to obtain the subsystem and line member descriptions.
  - For jobs that are stopped, a copy of any dumps that can be obtained. For more information about these kinds of jobs, see "Hangs" on page 3-8 or "Waits" on page 3-11.

DC — Device and Communications Configuration: All functions:

- A copy of the line, controller, device, mode, or class-of-service description or configuration list as appropriate using the WRKCTLD, WRKDEVD, WRKMODD, or WRKCOSD command with a print option or the DSPLIND, DSPCTLD, DSPDEVD, DSPMODD, or DSPCOSD command with the parameter OUTPUT(*PRINT).
- A copy of the line, controller, device, mode, or class-of-service descriptions as appropriate using the DMPSYSOBJ command.
- A copy of the resource configuration record using the display/alter dump service function.
- A copy of the contents of the QHST log using the DSPLOG command for a reasonable time interval surrounding the error.
- A copy of the job log for the job in which the error occurred and a copy of the system arbiter job log.
- If the error can be created again and the QHST and error logs provide little or no data, run the error-producing function again after entering the Trace Job (TRCJOB) command with the parameter SET(*ON). After the trace is set on, enter TRCJOB SET(*OFF) and print the QPSRVTRC spool file generated from the trace.

DX — Distributed Systems Node Executive (DSNX): All functions:

- A copy of the DSNX journal using the command: DSPJRN QDSNX
- A copy of the host NetView* distribution manager plan which was being transmitted
- A copy of the information obtained from the host system
- A copy of the host NetView distribution manager resource which was being operated on
- For communications problems only, a copy of the communications trace

EM — 3270 Device Emulation Support: All functions:

- A description of how the problem occurred and how to create the problem again
- A copy of the job log
- A trace of the failing job using the command: TRCJOB MAXSTG(16000)
- A VLIC source/sink trace of the emulation controller, device and work station controller, and device descriptions using DST or SST
- A copy of any dumps that were created from the error

Notes:

1. If the job log shows the module #TEXLATE, or if there are work station or printer errors, produce the error again and get a VLIC trace of the machine services control point (MSCP) and the logical unit descriptions (LUD) for communications.
2. If running BSC emulation, collect information under the BS component.
3. If running system network architecture (SNA) emulation, collect the information listed under the secondary logical unit (SL) component.

ER — Communications Error Recovery Procedures: Contact your next level of service support to determine what information is needed to diagnose the problem.

IC — ICF Data Management: The information needed for this component is the same as work station display support (WS). on page 4-30.

IF — Trace Intersystem Communications Function (TRCICF):

- A copy of any messages that pertain to the problem in the job log
- A TRCJOB and/or TRCICF output

LC — LEN Control Point:

- Any messages issued to the system operator
- A copy of the QLUS job log
- Sufficient information to create the problem again, including a description of the network configuration

LM — Token-Ring Manager:

- A copy of the QLUS job log obtained by creating the problem again
- A VLIC trace of the line
- A copy of any VLIC logs or dumps

- A copy of the QHST log using the DSPLOG command

LNKT—Link Test for Communications Line and Controller:

- A trace of the failing job using the command: TRCJOB TRCTYPE(*ALL)
- A source/sink (or VLIC) trace of the network unit description (NUD) for the line and controller unit description (CTLD) for the local work station using DST or SST
- Sufficient information to create the problem again

LS—APPN Network Services:

- The input parameter values
- Any messages issued to the system operator
- Sufficient information to create the problem again, including a description of the network configuration

MC—Communications Error Messages: Contact your next level of service support to determine what information is needed to diagnose the problem.

NF—Network Facilities:

- A copy of the job log for the job QNFTP in subsystem QSNADS at the time the problem occurred. You may to turn job logging on in subsystem QSNADS by entering the command:

  ```
  CHGJOBD QSNADS LOG(4 0 *SECLVL)
  ```

  The security level is needed if problem happens to be between multiple systems.
- A copy of the job log for the user's job at the time the problem occurred.
- A copy of the SNADS configuration using the DSPDSTSRV command.
- A copy of the QSYSOPR messages log at the time the problem occurred.
- A copy of the directory configuration using the WRKDIR command. After the command is entered, press PF15 to print the directory.

ON—Open Station IOM:

- A copy of the job log using the DSPJOBLOG command
- A copy of the job structure dumps using the DMPJOB command
- A copy of the messages that were sent to the history log (QHST) or system operator queue (QSYSOPR) that relate to the problem

PA—Display Station Pass-Through:

- A complete description of how the error looked at the time of failure. For example, was the session hung, did the session end abnormally, or did the session ever start?
- Any information needed by the work station display support (WS) component on page 4-30.
- A VLIC trace of this component with the trace table sizes set at their maximum values.
- A source/sink VLIC trace of the work station controller and display device that pass-through is being run on
- A source/sink VLIC trace of the APPC control unit and device on the target system (the system to which the user was passing through).
- The message ID which was sent to the source job, if any, when the error occurred.
- The job logs associated with the error on the target system.
  - If the error occurred before the user signed on, there will only be the job log for the pass-through batch job.
  - If the error occurred after the user signed on, there will also be a job log for the user's interactive job.
- A copy of the virtual device description which was being used by the pass-through attempt that had the error. Use the following command:

  ```
  DMPSYSOBJ OBJ(device name) CONTEXT(QSYS)
    TYPE(*ALL) SUBTYPE(*ALL) OBJTYPE(*DEVD).
  ```
- A TRCJOB of the source system job when the error occurred.
- If the error occurred after the user signed on the target system, get a TRCJOB of the user's target interactive job.
- If the error occurred before the user signed on the target system, get a TRCJOB of the pass-through batch job as follows:
  - On the target system, use the CRTDTAARA command to create data area QPATRACE in library QSYS, with type *CHAR, length 1, and initial value either 1 or 2. See below to determine which value you need.
  - If the source system is an AS/400, set the QSYS/QPATRACE value to 1 and make sure that TRCJOB is active on the source system when the user passes-through. The value 1 for QSYS/QPATRACE generates a trace for the target pass-through batch job because a TRCJOB was active on the source job.
  - If the source system is not an AS/400, set the QSYS/QPATRACE value to 2. A value of 2 causes a TRCJOB to run for every pass-through session.
  - After you have collected the TRCJOB of the batch pass-through job associated with the error, be certain you do one of the following:
    - DLTDTAARA QSYS/QPATRACE or

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- CHGDTAARA QSYS/QPATRACE VALUE('0')
Otherwise the system continues to generate TRCJOBs for every pass-through session that matches the criteria previously described.

PI — 3270 Data Stream Pass-Through: All functions:

- A description of how the problem occurred and how to create the problem again
- A copy of the job log
- A trace of the failing job using the command:
  `TRCJOB MAXSTG(16000)`
- A VLIC source/sink trace of the emulation controller, device, and work station controller and device descriptions using DST or SST
- A copy of any dumps that were created from the error

Note: The PI component of the vertical licensed internal code requires a trace of the tasks and a copy of the VLOGs.

RA — 3270 Remote Attach/Distributed Host Command Facility (RA/DHCF) Management: This component involves the 3270 keyboard mapping commands only. For problems with this component, see the RA component for the vertical licensed internal code on page 4-45.

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RF — Retail Finance Function Manager:

- The information needed for this component is the same as work station display support (WS) on page 4-30.
- If the problem can be created again, a trace for the monitor (subsystem) that the failing job is running under using the command:
  `TRCJOB TRCTYPE(*ALL)`
- If passthru is running, collect information for the SNUF function manager (FM), component SA.

SA — SNUF Function Manager (FM): The information needed for this component is the same as secondary logical unit (SL) on page 4-34.

SI — APPC for System/38 Environment: The information needed for this component is the same as work station display support (WS) on page 4-30.

SL — Secondary Logical Unit:

- A copy of the logical unit description (LUD)
- A copy of the job log
- A copy of the messages in the QSYSOPR message queue
- A copy of the program stack using the Dump Job (DMPJOB) command
- If you can create the problem again, a trace of the failing job after running the failing job again using the command: TRCJOB MAXSTG(16000)
- A copy of any VLIC log entries made during a failure
- A copy of the communications trace, if possible
- A copy of the VLIC trace for the device, controller, and line descriptions .

SW — Switched Lines Support:

- Include the QHST history log, QLUS and QSYSARB job logs, and QSYSOPR message queue. Use the DMPSYSOBJ command to dump the line, controller, and device description objects (as appropriate) for the following problems:
  - Escape message
  - Incorrect output
  - Job loop or wait
  - System loop or wait

  Note: The line, controller, and device description objects must be dumped before changing the status of the object.
- If the problem can be created again:
  - Use the STRSRVJOB and TRCJOB commands to trace the QLUS and QSYSARB jobs
  - Use the TRCICF command to trace the failing job, if you are using an ICF file
  - Use the STRSST command to trace the vertical licensed internal code MSCP component and the source/sink CTLD, LUD, and NUD objects.

    Note: Start the traces before the detected problem occurs because the problem produced could be an error that did not get detected earlier.

TR — Communications Trace CL Interface: Contact your next level of service support to determine what information is needed to diagnose the problem.

TS — DDM-Target Source: All functions:

- The command as entered, if applicable.
- Any file overrides using the DSPOVR command.
- A copy of the application and data files being used, if possible.
- A copy of all job logs for DDM jobs running on each AS/400 system involved. Make sure that the job description specifies that second-level text is to be logged.
- If the job is stopped, a dump of all DDM jobs on each AS/400 system involved using the DMPJOB command. For more information about these kind of jobs, see "Hangs" on page 3-8 or "Waits" on page 3-11.
- If the problem can be created again:

- Follow the instructions given if a message in the job log instructs to change message CPF9151. Return any dumps which are produced when the problem is created again.
- An OS/400 trace for all DDM jobs running on each AS/400 system involved using the TRCJOB and/or SRVJOB commands.
- A communications trace of the problem using DST or the STRSST command and options. Copy the trace to tape or diskette. For more information about communications trace, see "Work with Communications Trace" on page 12-20.

• For any non-AS/400 systems involved in the problem:
  - A copy of any job logs, history files, and so on available when the problem occurred or is created again.
  - For jobs that are stopped, a copy of any dumps that can be obtained. For more information about these kinds of jobs, see "Hangs" on page 3-8 or "Waits" on page 3-11.

TV — Virtual Terminal Manager Function Manager: All functions:

- A copy of the job logs for the job that failed
- Any dumps of the exception-related data for any unhandled exceptions that occurred at the time of failure
- A copy of the VLIC log entries made during the failure
- A copy of the messages relating to the problem or failing device that were sent to the history log of the system operator queue
- If you can create the problem again, a trace of the failing job using the command: TRCJOB TRCTYPE(*ALL) MAXSTG(4096).

T1 — Twinaxial Data Link Control:

- A dump of the IWS LUD (type 5150)
- A copy of the QLUS and QSYSARB job logs
- A copy of the VLIC log containing major 0700 and minor E3F1
- If the failure can be produced again:
  - An OS/400 trace of QLUS and QSYSARB processes using the service job and trace job commands
  - A VLIC trace of the IWS LUD (type 5150) using SST, the CD associated with the IWS LUD, and the ND of the associated virtual line which would be named QTDLnnnnnn where the n's are numeric digits

For an example of a trace job, see Figure 17-5 on page 17-10. For more information about this component, see Chapter 26.

T3 — SNA-T3: The information needed for this component is the same as work station display support (WS) on page 4-30. Also do the following:

- Run the failing job again after doing the following:
  - An OS/400 trace using the command: TRCJOB TRCTYPE(*ALL).
  - A VLIC trace of source/sink system objects: CD and LUD for VLIC messages, source/sink control blocks/error path, protocols, and user data using SST.
  - Use SST to trace machine services control point (MSCP).
  - A dump of the VLIC log related to the problem.
- For remote work station or work station printer, use SST to run communications trace for the line and control unit to which the device is attached.
- Obtain job log listing for affected job.

For an example of a trace job, see Figure 17-5 on page 17-10. For more information about this component, see Chapter 26.

YF — Asynchronous Communications Function Manager (FM): All functions:

- A copy of the messages relating to the problem or failing device that were sent to the history log (QHST) or system operator queue (QSYSOPR)
- A copy of the device (LUD) using the DMPSYSOBJ command
- A copy of the job logs for the job encountering the error, and for the monitor (subsystem) that the failing job is running under
- If you can create the problem again, a trace of the user's job and for the monitor (subsystem) that the failing job is running under using the command: TRCJOB TRCTYPE(*ALL)
- A copy of any VLIC log entries made during the failure for VLIC component YI

ZD — SNA Distribution Services (SNADS): All functions:

- A copy of the job logs and any dumps pertaining to the problem
- A copy of the SNADS configuration, using the DSPDSTSRV command

Also, see the *Communications: Distribution Services Network Administrator's Guide*, SC21-9588, for more problem analysis procedures.

Components

OS/400 Cross System Product

AE—Cross System Product (CSP) Application Execution:

- A general description of what the Cross System Product application does.
- A description of the execution environment; for example, if and what type of file input/output was the application doing, if commitment control was used, if the application was processed in batch or interactive mode.
- A list of any override commands in effect at the time of the error.
- A copy of any messages or detailed messages returned from the failing application. If you are running the application from the AS/400 Command Entry display, use F10 to display the detailed messages.
- A copy of the job logs for the job causing the error.
- A copy of messages sent to the history log or the system operator queue about the problem or the failing files.
- A copy of the printer file QPAETRC that contains the trace information for the failing application. To get a copy of the printer file, create the problem again while using the command: TRCCSP SET(*ON) TRCTYPE(*ALL).
- If you were running an application that worked with SQL databases, obtain the information listed for the component SQ on page 4-26.
- A copy of the printer file produced if the CRTCSPAPP, CRTCSPMSGF, PRTCSPAPP, QPAECRT, QPAEMSG, or QPAEAPP command was used.
- Sufficient information to create the problem again.
- See the *Programming: Cross System Product/Application Execution User's Guide and Reference*, SH23-0516 for more information about analyzing problems using the TRCCSP command.

AG—CSP Other: The information needed for this component is the same as Cross System Product (CSP) Application Execution (AE) on page 4-36.

OS/400 Double Byte Character Set

FS—Font Management Services:

- All input parameter values
- A description of how the problem occurred and a step-by-step instruction on how to create the problem again
- A copy of the job log with any low-level messages
- A copy of the QGPL/QAFSVDF using the command: CPYF OUTFMT(*HEX)
- A copy of the QTEMP/QAFSVDF using the command: CPYF OUTFMT(*HEX)

OS/400 Execution Time Subroutines

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

OS/400 GDDM

GD—GDDM: All functions:

- A copy of the source program in which the error occurred.
- If you can create the problem again, run the failing job with the Trace Job (TRCJOB) command, with parameter TRCTYPE(*ALL).
- A copy of the output if it is not correct.

OS/400 Migration

QU—Query/36 to AS/400 Query Conversion: All functions:

- A FROMLIBR of any System/36 query that does not successfully migrate
- A SAVOBJ OBJTYPE(*FILE) of the AS/400 file members containing the System/36 query subroutines that do not convert; usually in QS36SBR
- Any data requested for the OS/400 QU component

OS/400 Operational Assistant

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

OS/400 Problem Analysis Routines

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

OS/400 REXX

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

OS/400 Sort

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Pascal

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

PC Support

To solve problems with this licensed program product, see the *PC Support: DOS and OS/2 Messages and Problem Analysis Guide* or contact your next level of service support to determine what information is needed to diagnose the problem.

Product Application Program (PAP) on the Service Support System

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Performance Tools

CP — Capacity Planning: All functions:

- A description of the function being performed
- A copy of the job log

IP — Install Program: All functions:

- A description of the function being performed (indicate the language version and whether it is being installed as a primary or secondary language)
- A copy of the job log

IT — Interactive Displays: All functions:

- A description of the function being performed (indicate which function key is pressed and on what display)
- A copy of the job log
- A copy of the data from the appropriate member of file QAITMON in whatever library the data resides (such as QPFRDATA) obtained by using the CPYPFRDTA command

MN — Menus: All functions:

- A description of the function being performed (indicate what option was selected and on what display the option was selected from)
- A copy of the job log

PG — Performance Graphics: All functions:

- A description of the function being performed (indicate the command that was used and all its parameters and what type of display the command was used on)
- A copy of the job log
- A copy of the data in the appropriate member of the performance files obtained by using the CPYPFRDTA command
- A copy of the historical data files
- A copy of the graph format and functional area files used

PT — Performance Tools: All functions:

- A description of the function being performed (include the command that was used and all its parameters)
- A copy of the job log
- A copy of the data in the appropriate member of the performance files obtained by using the CPYPFRDTA command

TZ — Timing and Paging Statistics Tool: Contact your next level of service support to determine what information is needed to diagnose the problem.

Programming Language 1

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Point of Sale

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Programmer Tool Kit

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Query

QU—AS/400 Query Definition-Time Support: All functions:

- A description of the actions taken on the AS/400 Query displays in the order the actions were taken
- A copy of the unexpected message number from the second level text
- A copy of PTF 5728QU1 using the DSPPTF command
- Any data requested for the OS/400 QU component

Remote Job Entry

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Report Program Generator

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

RM/COBOL

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Screen Design Aid

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Source Entry Utility

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Structured Query Language

The information needed for this program product is the same as the OS/400 Structured Query Language (SQL) component on page 4-26. and OS/400 Interactive Database component on page 4-30.

System/38 Utilities

To solve problems with this licensed program product, see "Interactive Data Utilities" on page 4-15 and "Text Management/38."

System Management Utility

- A copy of the job log for the job that failed
- A copy of the problem log available at the time the failure occurred using the WRKPRB command
- Sufficient information to create the problem again

Telephony

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Text Management/38

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Components

Timing and Paging

To solve problems with this licensed program product, see the publications that relate to this product listed in the *Information Directory* or contact your next level of service support to determine what information is needed to diagnose the problem.

Transmission Control Protocol/Internet Protocol (TCP/IP)

TM — Transmission Control Protocol: All functions:

- A copy of the job logs for the job that failed
- Any dumps of the exception-related data for any unhandled exceptions that occurred at the time of failure
- A copy of the messages relating to the problem or failing device that were sent to the history log of the system operator queue

TG — TELNET Support: All functions:

- A copy of the job logs for the job that failed
- Any dumps of the exception-related data for any unhandled exceptions that occurred at the time of failure
- A copy of the messages relating to the problem or failing device that were sent to the history log of the system operator queue

Vertical Licensed Internal Code

This topic shows information used for solving problems with the vertical licensed internal code. For a list of the most commonly used tools used in gathering the information for VLIC problems, see page 3-18.

AI — Activation or Invocation:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- A copy of the MI program that incurred the error if appropriate
- Sufficient information to create the problem again

AU — Authority Management:

- A copy of any VLIC logs made during failure
- A VLIC trace using DST or SST
- A copy of the user profiles using the DMPOBJ command or the display/alter/dump service function

See Table 30-3 on page 30-4 for the external IDs associated with this component.

BM — Bus Manager:

- A dump of the IWS LUD (type 5150)
- A copy of the QLUS and QSYSARB job logs
- A copy of the VLIC log containing major 0700 and minor E3F1

  See volume 2 of this manual for more information about this major and minor code.
- If the failure can be produced again:
  - An OS/400 trace of QLUS and QSYSARB processes using the service job and trace job commands
  - A VLIC trace of the IWS LUD (type 5150) using SST, the CD associated with the IWS LUD, and the ND of the associated virtual line which would be named QTDLnnnnnn where the n's are numeric digits

BS — Byte String Space Management:

- A copy of the level 3 VLIC dump
- Sufficient information to create the problem again
- A copy of any job logs containing error messages
- A copy of the VLIC trace obtained by using DST or SST

See Table 30-3 on page 30-4 for the external IDs associated with this component.

CC — Computation and Control:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- A copy of the MI program that incurred the error if appropriate
- Sufficient information to create the problem again

CF — Common Functions:

- A copy of the VLIC logs or main storage dump

See Table 30-3 on page 30-4 for the external IDs associated with this component.

CO — Commit:

- A copy of the level 3 VLIC dump
- Sufficient information to create the problem again
- A copy of any job logs containing error messages

See Table 30-3 on page 30-4 for the external IDs associated with this component.

DB — Database:

- A copy of the level 3 VLIC dump
- A copy of any job logs containing error messages
- Sufficient information to create the problem again

See Table 30-3 on page 30-4 for the external IDs associated with this component.

DK — Diskette:

- A VLIC trace of the source/sink system objects: LUD for VLIC messages, control blocks/error path, protocol, user data and messages using DST or SST
- Dumps of any VLIC entries made during the failure

See Table 30-3 on page 30-4 for the external IDs associated with this component.

DM — DASD Management: All functions:

- A procedure to create the problem again
- A dump of the DASD configuration table (DCT)
- A dump of the configured unit table (CUT)
- A dump of the nonconfigured unit table (NUT)
- A dump of the service function task for DASD management (SFDM)

DO — Debugging and Observation:

- An OS/400 job log from the failing job
- A dump of any VLIC logs occurring within 5 minutes before or after the failure
- An OS/400 DSPJOB, DMPJOB, and/or service dump output from failing job (if available)

If the failure can be created again:

- A copy of the data from a VLIC call trace and a VLIC DO component trace

If the failure relates to a particular program:

- A copy of the level 3 VLIC dump of the program using the display/alter/dump function under SST or DST
- A copy of the saved object or library of the program using the SAVOBJ or SAVLIB commands

See Table 30-3 on page 30-4 for the external IDs associated with this component.

DS — Dictionary Services: All functions:

- A copy of any VLIC logs made during the failure
- A copy of QHST log using the DSPLOG command for the time of the failure
- A copy of the error log
- A copy of the spell aid dictionaries being used and associated source files, if available

EM — Event Management:

- A copy of the VLIC logs or main storage dump

See Table 30-3 on page 30-4 for the external IDs associated with this component.

EX — Exception Management:

- A copy of the VLIC logs or main storage dump

See Table 30-3 on page 30-4 for the external IDs associated with this component.

| **FS — File Server:**

| - A copy of the level 3 VLIC dump
| - Sufficient information to create the problem again
| - A copy of any job logs containing error messages
| - A copy of the VLIC trace obtained by using DST or SST

| See Table 30-3 on page 30-4 for the external IDs
| associated with this component.

II — Independent Index:

- A copy of the level 3 VLIC dump
- Sufficient information to create the problem again
- A copy of any job logs containing error messages

IO — Input/Output Debug:

- A copy of a task dump obtained by using display/alter/dump for the problem that occurred at the time of the failure
- Sufficient information to create the problem again

IP — Inter-Process Communication Facility: All functions:

- A copy of any VLIC logs made during the failure
- A copy of the main storage dump if one was taken automatically by the system
- A dump of the system error log
- If the failure can be created again, a VLIC trace of IPCF, CCIOM, MSCP, and any source/sink objects that relate to the failure using SST

See Table 30-3 on page 30-4 for the external IDs associated with this component.

IT — IPL or Termination:

- A copy of the VLIC logs or main storage dump

Components

IX — Machine Index:

- A copy of the level 3 VLIC dump
- Sufficient information to create the problem again
- A copy of any job logs containing error messages

See Table 30-3 on page 30-4 for the external IDs associated with this component.

JO — Journal Management:

- A copy of the level 3 VLIC dump
- Sufficient information to create the problem again
- A copy of any job logs containing error messages

See Table 30-3 on page 30-4 for the external IDs associated with this component.

LD — Load/Dump:

- A VLIC trace of load/dump (500K should be the minimum trace table size) using SST or DST.
- A copy of any VLIC logs made when the failure occurred.
- A list of the device error logs for device being used when the failure occurred.
- A copy of the job log.
- In some cases, the media being used for a restore may help. Check with the programmers before submitting an APAR or LICTR.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

LL — Work with Licensed Internal Code:

- A copy of any VLIC logs of major type 0C00 with minor code BAD4. See volume 2 of this manual for more information about this major and minor code.

MC — Machine Check:

- A copy of the VLIC logs or main storage dump

MN — Context Management:

- A copy of any VLIC logs made during failure
- A VLIC trace using DST or SST
- A copy of the contexts using the DMPOBJ command or the display/alter/dump service function

See Table 30-3 on page 30-4 for the external IDs associated with this component.

MO — Magneto Optical Disk: Contact your next level of service support to determine what information is needed to diagnose the problem.

M2 — Module-2 Run-Time Support: Contact your next level of service support to determine what information is needed to diagnose the problem.

NM — Network Management Services: Contact your next level of service support to determine what information is needed to diagnose the problem.

OE — Dictionary Object Support: All functions:

- A copy of any VLIC log made during the failure
- A copy of QHST log using the DSPLOG command for the time of the failure
- A copy of the error log
- The spell aid dictionaries being used and associated source files if available

OX — Optimizing Translator: Contact your next level of service support to determine what information is needed to diagnose the problem.

PG — Program Management:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- A copy of the MI program that incurred the error if appropriate
- An OS/400 DSPJOB, DMPJOB, and/or service dump output from the failing job (if available)

If the failure can be created again:

- A copy of the VLIC call trace and a trace of the PG component enabled during the failure
- If failure occurs during a save or restore, a copy of the data from a trace of the LD component

If the failure occurs with a particular program:

- A copy of a level 2 VLIC dump of the program from display/alter/dump using DST or SST
- A copy of the program objects or libraries (on tape and diskette) using the SAVOBJ or SAVLIB commands

If the failure occurs during a save or restore:

- Information needed for the VLIC component LD and OS/400 component SR

PM — Process Management:

- A copy of the VLIC logs or main storage dump
- A copy of the process dump obtained by using the DMPJOBINT command or the display/alter/dump service function, if the process dump is not included in the VLIC logs

See Table 30-3 on page 30-4 for the external IDs associated with this component.

PT—Performance Tools: All functions:

- A copy of any reports from the OS/400 or licensed program product (LPP) performance tools showing wrong output to include their job logs
- A copy of any main storage dumps
- A copy of any VLIC logs

PUMP—DASD Utilities:

- For save and restore disk unit data:
  - Sequentially numbered tapes which contain the saved disk unit data
  - A copy of the main storage dump
  - A copy of the error logs of the disk unit being saved or restored
  - A copy of or a description of the information displayed on the display station
  - Sufficient information about the failure to create the problem again
- To analyze disk unit surface:
  - A copy of the main storage dump
  - A copy of the error logs of the disk unit being analyzed
  - A copy of any information associated with the disk unit analyze
  - A copy of or a description of the information displayed on the display station
  - Sufficient information about the failure to create the problem again
- For display or change sector data, recover reassigned sectors, initialize and format disk unit, or reformat diagnostic cylinder:
  - A copy of the main storage dump
  - A copy of or a description of the information displayed on the display station
  - A copy of the error logs of the disk unit being repaired
  - Sufficient information about the failure to create the problem again

QM—Queue Management:

- A copy of the VLIC logs or main storage dump

RI—RAS and Instrumentation: See Table 30-3 on page 30-4 for the external IDs associated with this component.

RJ—Stand-Alone Licensed Internal Code Install or Restore:

- A complete description of steps used to create the problem. This should include the function codes entered and any intervention SRCs (A6XX-RRRR) that were displayed before the error. Also, note any problems or difficulties encountered with the hardware.
- A complete description of the error SRC displayed, if any, for function 11 through 18.
- A complete description of the SRC displayed, if any, for functions 11 through 18.
- A complete description of the hardware and how it is configured. That is the type and model of the system, rack and IOP placements, the IOP type and model, and memory configuration. The order and address settings of the devices chained form each IOP.
- The SAVSYS tapes used.
- If the system can be IPLed from disk to DST then also provide a copy of the dump for segment 00008A.

RM—Resource Management:

- A copy of the VLIC logs or main storage dump

See Table 30-3 on page 30-4 for the external IDs associated with this component.

SD—Service Driver: Contact your next level of service support to determine what information is needed to diagnose the problem.

SE—Stand-Alone Utility Driver:

- Complete description of step used to create the problem. This should include the function codes entered and any intervention SRCs (A6XX-RRRR) that were displayed before the error. Also, note any problems or difficulties encountered with the hardware.
- A complete description of the error SRC displayed, if any, for functions 11 through 18.
- A complete description of the SRC displayed, if any, for functions 11 through 18.
- A complete description of the hardware and how it is configured. That is the type and model of the system, rack and IOP placements, the IOP type and model, and memory configuration. The order and address settings of the devices chained form each IOP.
- The SAVSYS tapes used. If the system can be IPLed from disk to DST then also provide a copy of the dump for segment 00008A.

SI—Source/Sink Instructions:

- A copy of any VLIC logs made during the failure.
- A copy of the QHST log using DSPLOG command for the time of the failure.
- A dump of the error log.
- A dump of the affected object.

- If the problem can be created again, trace the data exchanged using VLIC trace. Trace the following:
  - Affected object type using DST or SST
  - Components SI and MSCP

SM—Storage Management: Contact your next level of service support to determine what information is needed to diagnose the problem.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

SO—Space Object Management:

- A copy of any VLIC logs made during the failure
- If possible, a copy of the space object involved in the failure, obtained by using either the DMPOBJ or DMPSYSOBJ commands or the display/alter/dump service function

See Table 30-3 on page 30-4 for the external IDs associated with this component.

SORT—Sort Utility: Contact your next level of service support to determine what information is needed to diagnose the problem.

SS—Source/Sink Management: The information needed for this component is the same as source/sink instructions (SI) on page 4-42.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

SV—SVLs:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- A copy of the MI program that incurred the error if appropriate
- Sufficient information to create the problem again

See Table 30-3 on page 30-4 for the external IDs associated with this component.

S3—Machine Service Facility (or DST): If DST and SST are not available:

- A copy of the main storage (an IPL is necessary after a main storage dump is taken) using function 22 on the control panel
- IPL the system
- A copy of the main storage dump to tape using SST
- Any VLIC logs of major type 0C00 or 0403 using SST

If SST is available, use SST to:

- Any VLIC logs of major type 0C00 or 0403
- A dump of these tasks: MSF, MSFCON, SFS3, MSFPRT, MSFDKT, MSFTAP

TA—Tape:

- A VLIC trace of source/sink system objects: LUD for VLIC messages, control blocks/error path, protocol, user data and messages using DST or SST
- A dump of any VLIC entries made during the failure

See Table 30-3 on page 30-4 for the external IDs associated with this component.

VL—VLIC Log: Contact your next level of service support to determine what information is needed to diagnose the problem.

WO—Write Once Optical: Contact your next level of service support to determine what information is needed to diagnose the problem.

XC—Translator Code Generation:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- The program source for the program that failed to be created
- Sufficient information to create the problem again

XL—Translator:

- A copy of the job log
- A copy of any VLIC log entries made during the failure
- The program source for the program that failed to be created
- Sufficient information to create the problem again

VLIC Communications

CM—Common Class IOM:

- A copy of the VLIC logs made during failure
- A copy of the dump for the CM task
- A copy of the work with error log hex dump for all records in the error log which happened 10 minutes before the failure (especially any records entered by the CM component)
- If the problem might be with volume statistics, a copy of the display/alter/dump hex dump of the complete segment 00002F00 0000
- If the problem can be created again, a copy of the VLIC trace for CM, IP, EL, and MS components used while the problem was created again

See Table 30-3 on page 30-4 for the external IDs associated with this component.

CR—Cryptographic Support:

- A copy of any VLIC logs made during the failure.
- A copy of the job log of the job that failed.
- A copy of any dumps generated by the system that are related to the problem.
- If the Cryptographic Support Licensed Program (5728-CR1) is used, provide the following:
  - Data passed in parameters to the Cryptographic Support Licensed Program. Provide the data in any of the returned parameters.
  - A copy of the application source code.
- A copy of all program objects, files, other objects, and any special instructions that may be needed to create the problem again.

CT—Communications Trace:

- If the problem can be created again, a VLIC trace of communications trace, machine services control point (MSCP) and a source/sink object trace for the line name object using SST or DST
- A copy of any VLIC logs made during the failure
- A copy of the QHST log using the DSPLOG command for the time of the failure
- A list of the trace options selected, for example, trace buffer size, line name, or stop on buffer full
- A list of the formatting options selected, for example, format SNA data only or format RR/RNR commands
- Protocol of line being traced.

EREP—Work with Error Log:

- A copy of the error logs using VLIC trace under DST or SST.
- A copy of any VLIC logs made during the failure.
- A list of any options selected. For example, subsystem, time range, media type for volume statistics, or report type being requested.
- A dump of the error log SIDs for the subsystem being requested.
- A dump of the error log machine index.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

EL—Error Logging:

- A copy of the VLIC logs made during failure
- A copy of the dump for the EL task
- A copy of the Work with error log hex dump for all records in the error log which happened 3 minutes before the failure (especially any records entered by the EL component.)
- A copy of the display/alter/dump hex dump for the following completed segments:

  000026 0000
  000027 0000
  000028 0000
  000029 0000
  00002A 0000
  000051 0000
  000083 0000
- A copy of the display/alter/dump hex dump for the first 1000 bytes of segment 00005A 0000
- A copy of the formatted machine index dump for 00002B00 0200 by selecting the following options in the order shown:
  1. Display/alter/dump
  2. Dump to printer
  3. VLIC data
  4. Machine index
  5. Address 00002B00 0200
  6. Format index entries
- If the problem can be created again, a copy of the VLIC trace for EL, CM, and IP components during the creating of the problem

See Table 30-3 on page 30-4 for the external IDs associated with this component.

LC—APPN Control Point:

- A trace of the APPN control point using SST.
- A trace of the source/sink system object, controller unit descriptions that are specified with APPN(*YES), and all attached device descriptions using SST. Device descriptions that are automatically created after trace has been activated for the attached controller description are traced automatically.
- A trace of MSCP using SST.
- A copy of VLIC logs related to the problem.
- A copy of any information available using the DSPAPPNINF command.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

LM—Device/Location Manager: All functions:

- A VLIC trace of the location manager component using DST or SST.
- A copy of any VLIC logs made during the failure.
- A copy of the location manager VLIC index by printing the formatted index entries at address 0005900 0200 using DST or SST.
- A copy of the the location manager task using DST or SST. The task name is LOCMGR.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

LNKT—Link Test for Communications Line and Controller:

- A trace of the failing job using the command: TRCJOB TRCTYPE(*ALL)
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device
- Sufficient information to create the problem again

MS—Machine Services Control Point (MSCP): All functions:

- A VLIC trace of MSCP and source/sink objects related to the line, controller, and device descriptions using DST or SST
- A copy of any VLIC logs made during failure
- A copy of the QHST log using the DSPLOG command for the time of the failure

See Table 30-3 on page 30-4 for the external IDs associated with this component.

OT—Open Station IOM:

- A copy of any VLOGs available at the time of failure
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device
- A copy of the messages on the QSYSOPR message queue

PA—Display Station Pass-Through: All functions:

- A VLIC trace, with the trace table sizes set to their maximum values, of pass-through using DST or SST
- A copy of any VLIC log made during failure
- A copy of the QHST log using the DSPLOG command for the time of the failure

See Table 30-3 on page 30-4 for the external IDs associated with this component.

PI—3270 Data Stream Pass-Through: All functions:

- A description of how the problem occurred and how to create the problem again.
- A VLIC source/sink trace of the emulation controller and device descriptions and work station controller and device descriptions using DST or SST.
- A copy of the job log.
- A copy of any VLIC log entries that were created at the time of the error.
- A trace of the failing job using the TRCJOB command. Specify a maximum storage of 16000 decimal kilobytes.
- A copy of any dumps that were created from the error.

Note: If the task is still present, use DST or SST to dump the task.

RA—3270 RA/DHCF Management:

- A source/sink VLIC trace of the control unit or units and device or devices on which the problem is observed
- A copy of the descriptions for the control unit or units and device or devices on which the problem is observed
- A copy of any messages issued
- Sufficient information to create the problem again

  Note: This may include sending libraries of applications or data files with step-by-step instructions.
- If DHCF, a VTAM buffer trace of the two physical *and* two logical units for the HCF-DHCF session
- Any VLIC logs or dumps
- A communications trace of the remote line

Note: If you must create an APAR for this component, the APAR should be opened against the vertical licensed internal code product.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

SB—SNUF Data Flow Control/Session Control (DFC/SC):

- A copy of the logical unit description (LUD)
- A copy of the job log
- A copy of the messages in the QSYSOPR message queue
- The program stack using the Dump Job (DMPJOB) command
- If you can create the problem again, a trace of the failing job using the command: TRCJOB MAXSTG(16000)
- A copy of any VLIC log entries made during a failure
- A copy of the communications trace, if possible
- A copy of the trace for the device, controller, and line descriptions

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TB—BSC Base IOM:

- A VLIC trace of the CCIOM, IPCF, MSCP, and source/sink for the line, controller, and device descriptions using DST or SST.
- A copy of the communications trace used to capture data on the line.
- A copy of any VLIC logs made before, during, or after the failure.
- A dump of the error log.
- A copy of the QHST logs at the time of the failure using the DSPLOG command.

TE—BSC 3270 Emulation IOM:

- A VLIC trace of the CCIOM, IPCF, MSCP, and source/sink for the line, controller, and device descriptions using DST or SST.
- A copy of the communications trace used to capture data on the line.
- A copy of any VLIC logs made during the failure.
- A dump of the error log.
- A copy of the QHST log at the time of the failure using the DSPLOG command.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TEX—3270 Emulation Translate: All functions:

- A VLIC source/sink trace of the emulation device description (LUD) and emulation controller (CUD) using DST or SST.
- A copy of any VLIC logs made during the failure.

TG—Virtual Terminal Manager: All functions:

- A VLIC trace of display station pass-through using DST or SST.
- A VLIC trace of the virtual controller unit description (CTLD) and virtual device description (DEVD) for the virtual controller and virtual device that are associated with the problem using DST or SST.
- A copy of any VLIC logs made during the failure
- A copy of the QHST log using DSPLOG command for the time of the failure

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TI—ISDN IOM: Contact your next level of service support to determine what information is needed to diagnose the problem.

TL—SDLC and Local IOM: All functions:

- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device
- A copy of any VLIC logs made during the failure
- A copy of the QHST log using DSPLOG command for the time of the failure
- A dump of the error log
- If the failure can be created again, a copy of the communication trace to capture the data exchanged on the line

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TM—MRJE IOM:

- A VLIC trace of the CCIOM, IPCF, MSCP, and source/sink for the network unit descriptions (NUD), controller unit descriptions (CTLD), and logical unit descriptions (LUD) using DST or SST.
- A copy of the communications trace to capture data on the line.
- A copy of any VLIC logs made before, during, or after the failure.
- A dump of the error log.
- A copy of the QHST log at the time of the failure using the DSPLOG command.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TN—MTAM IOM: Contact your next level of service support to determine what information is needed to diagnose the problem.

TQ—LAPE IOM: Contact your next level of service support to determine what information is needed to diagnose the problem.

TS—Primary Work Station: All functions:

- A VLIC trace of the controller unit description (CTLD) and device description (DEVD) for the controller and work stations using DST or SST

  Note: If the controller is used by the main console or if the device is the main console, you need to use DST to specify a source/sink trace of the main controller of device objects.
- A copy of any VLIC logs made during the failure
- A copy of the QHST log using the DSPLOG command for the time of failure
- A copy of the error log

- A copy of the controller unit description (CTLD) and the logical unit description (LUD) of the controller and devices

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TT—Local Area Network IOM: The information needed for this component is the same as SDLC and local IOM (TL) on page 4-46.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TU—SNA DLC Common Function: The information needed for this component is the same as SDLC and local IOM (TL) on page 4-46.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

TX—X.25 IOM: The information needed for this component is the same as SDLC and local IOM (TL) on page 4-46.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

T1—Twinaxial Data Link Control:

- A dump of the IWS LUD (type 5150).
- A copy of the QLUS and QSYSARB job logs.
- A copy of the VLIC log containing major 0700 and minor E3F1. See volume 2 of this manual for more information about this major and minor code.
- If the failure can be produced again:
  - An OS/400 trace of QLUS and QSYSARB processes using the service job and trace job commands
  - A VLIC trace of the IWS LUD (type 5150) using SST, the CD associated with the IWS LUD, and the virtual TDLC line (ND) associated with the CD.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

T2—PU Type 2 Station IOM:

- A copy of any VLIC logs during the failure.
- A copy of the source/sink (or VLIC) trace of the network unit description (NUD) for the line, controller unit description (CTLD), for the local work stations, and/or logical unit description (LUD) for the device. Also, trace MSCP at the same time.
- A copy of the messages in the QSYSOPR message queue.
- If the controller is a host controller, a description of the types of devices attached to the PU2 controller matched with their LOCADR parameter from the device description.

See Table 30-3 on page 30-4 for the external IDs associated with this component.

YI—Asynchronous Communications I/O Manager: All functions:

- A VLIC trace of the line, controller, and device descriptions using DST or SST
- A copy of any VLIC logs made during the failure (especially the source/sink logs with an ID of E8C9 or C1E2)
- A copy of the QHST log using the DSPLOG command for the time of the failure
- A copy of the error log
- If the problem can be created again, a copy of the communications trace used to trace the data exchanged on the line

See Table 30-3 on page 30-4 for the external IDs associated with this component.

Chapter 5. Servicing Licensed Internal Code by Loadable Code Group

This chapter is an example of how procedures for problem analysis and resolution are used to fix an internal problem on the system. More specifically, this chapter provides procedures for handling failures of AS/400 loadable code groups. The procedures are:

1. Verify that the problem analysis procedures in the *Analyzing Problems Guide*, and the problem isolation procedures in the *Service Guide* have been performed and have not fixed the problem.
2. Gather and collect any information you may need to analyze the problem. To assist you in what information to collect for possible identifying of the problem, refer to the "9406 Problem Analysis and Resolution Form" on page 2-7.
3. If the problem is still not identified or fixed, ensure that the latest PTF package for the licensed internal code and OS/400 is on the system.
4. If the latest PTF is on the system, then obtain the name of the loadable code group (LCG), for example, AJED001 and the name of the unit or device the LCG is associated with.
5. Go to the list of loadable code groups below and find the procedure for handling the code failure. The following procedures ask you to gather any additional information needed to solve the problem and advises you when to submit a report to your next level of support.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

List of Loadable Code Groups (LCG)

An SRC shows one of the following code groups or modules as failing. For more information about finding and solving problems with the loadable code group:

AJDG001 — See "AJDG001 Procedures for the Horizontal Licensed Internal Code" on page 5-3.

AJDMS000 is the loadable code group for HLIC main storage dump replaceable unit (RU).

AJDG301 — See "AJDG301 Procedures for the Vertical Licensed Internal Code" on page 5-3.

Each code module, referred to as a replaceable unit in this logical code group name, starts with # (for example, #BMIPL or #CMCCIOM).

AJEAA01 — 9336 Disk Cluster

Contact your next level of support if a severe problem occurred on this device.

AJEA001 — 9332 Disk Unit licensed internal code

Contact your next level of support if a severe problem occurred on this device.

AJED001 — Magnetic storage device controller licensed internal code, see "AJED001 Procedures for the Magnetic Storage Device Controller (Feature Number 6110)" on page 5-3.

AJEHB01 — IOP for the System/370 tape

Contact your next level of support if a severe problem occurred on this device.

AJEHM01 — IOP for the 2440 tape unit with compression

Contact your next level of support if a severe problem occurred on this device.

AJEH001 — 2440/9346/9347 Tape Unit licensed internal code.

Contact your next level of support if a severe problem occurred on this device.

AJEH901 — Tape controller licensed internal code, see "AJEH901 Procedures for the 9346 and 2440/9348 Controllers (Feature Numbers 2601 and 2602)" on page 5-3.

AJEH902 — Magnetic tape I/O adapter licensed internal code, see "AJEH902 and AJEH903 Procedures for the 3422/3430/3480/3490 Tape I/O Processor (Feature Number 2604)" on page 5-4.

AJEH903 — See AJEH902 for handling problems with this code group.

AJEH904 — 2440/9348 tape unit controller licensed internal code.

Contact your next level of support if a severe problem occurred on this device.

AJEK001 — 9335 Device Function Controller licensed internal code.

Contact your next level of support if a severe problem occurred on this device.

AJEW001 — 6111 magnetic storage device controller licensed internal code.

Contact your next level of support if a severe problem occurred on this device.

AJEW101 — 9336 Disk Cluster IOP

Contact your next level of support if a severe problem occurred on this device.

AJGJF01 — See AJGJ001 for handling problems with this code group.

AJGJZ01 — 5294/5394 remote work station controller licensed internal code.

Contact your next level of support if a severe problem occurred on this device.

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AJGJ001 — Multiline communications controller licensed internal code, see "AJGJ001 and AJGJF01 Procedures for the Communications Controllers" on page 5-4.

AJLLN01 — ASCII Work Station Controller licensed internal code, see "AJLLN01 Procedures for the ASCII Work Station Controllers (Feature Numbers 2637, 6041, and 6141)" on page 5-5.

AJLMLNB1 is the loadable code group for the ASCII work station controller licensed internal code load replaceable unit (RU).

AJLMNB1 — See AJLLN01 for handling problems with this code group.

AJLMY0B1 — See AJLY001 for handling problems with this code group.

AJLY001 — Twinaxial Work Station Controller licensed internal code, see "AJLY001 Procedures for the Twinaxial Work Station Controllers (Feature Numbers 2638, 6040, and 6140)" on page 5-5.

AJLMY0B1 is the loadable code group for the work station controller licensed internal code load replaceable unit (RU).

AJSG501 — See "AJSG501 Service Processor Code (SPC) Procedures" on page 5-6.

AJSLC01 — See "AJSLC01 Procedures for the Multiple Function I/O Processor" on page 5-5.

This code runs on the 2600, 2601, 2602, 2604, 2637, 2638, 2642, 2643 and 6150. The procedures for the 2507 and 2600 are basically the same.

To solve problems for the:

- 2600, 2637, 2638, 2642, 2643, and 6150, see "AJSLC01 Procedures for the Multiple Function I/O Processor" on page 5-5.
- 2601 and 2602, see "AJEH901 Procedures for the 9346 and 2440/9348 Controllers (Feature Numbers 2601 and 2602)" on page 5-3.
- 2604, see "AJEH902 and AJEH903 Procedures for the 3422/3430/3480/3490 Tape I/O Processor (Feature Number 2604)" on page 5-4.

AJSRLS01 and AJSLLJ00 are also loadable code groups for multiple I/O processors. These code groups use the same procedure for AJSLC01.

AJSLLJ00 — See the procedures for AJSLC01.

AJSRLS01 — See the procedures for AJSLC01

5728SS1 — OS/400 licensed program product.

For these loadable code groups and other vital product data see the component and FESN table on page 6-17.

How to Determine the Level of Loadable Code

Type of Code	Description
Software	For the base operating system and all program products, enter the Display Program Temporary Fix (DSPPTF) command to see any PTF that is loaded to the base release. To see a list of the current levels of code loaded on the system, create the physical file QARZLCG using the DSPSFWRSC command, then display the physical file using the DSPPFM command. To determine driver, release, and modification levels and to display licensed programs, use the GO LICPGM (licensed program) command and select option 10. For more information about PTFs, see "Problem Circumvention and Repair" on page 2-3. To print the licensed internal code and licensed programs, type in DSPSFWRSC. Then, press the Enter key. Press the F4 (Command Prompt) key. Then, type in *PRINT as the output parameter. Figure 5-1 appears.
LIC	Use DST and select the option to work with licensed internal code. Then select the option to display licensed internal code information from the Work with Licensed Internal Code menu under DST. Select the *Display product information* option from the Select LIC Information to Display menu. Fill in the desired loadable code group ID and press Enter on the Specify Product Number display. For more information about this option, see "Work with Licensed Internal Code" on page 13-6.

```
                        Display Software Resources

Resource
   ID      Option  Feature  Description
5728SS1    7        *CODE   OS/400 - Example Tools Library
5728SS1    7        2924    OS/400 - Example Tools Library
5728SS1    8        *CODE   OS/400 - *PRV CL Compiler Support
5728SS1    8        2924    OS/400 - *PRV CL Compiler Support
5728SS1    9        *CODE   OS/400 - AFP Compatibility Fonts
5728SS1    9        2924    OS/400 - AFP Compatibility Fonts
5728BA1    *BASE    *CODE   AS/400 BASIC
5728BA1    *BASE    2924    AS/400 BASIC
5728CB1    *BASE    *CODE   COBOL/400 - Base Support
5728CB1    *BASE    2924    COBOL/400 - Base Support
5728CB1    1        *CODE   COBOL/400 - System/36-compatible COBOL
5728CB1    1        2924    COBOL/400 - System/36-compatible COBOL
5728CB1    2        *CODE   COBOL/400 - System/38-compatible COBOL
5728CB1    2        2924    COBOL/400 - System/38-compatible COBOL
5728CB1    3        *CODE   COBOL/400 - *PRV Base Support
                                                            More...
Press Enter to continue.
F3=Exit   F11=Display libraries/releases   F12=Cancel
                                           C) COPYRIGHT IBM CORP. 1988, 1990
```

Figure 5-1. An Example of a Display Software Resources Display

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Procedures for the System/36 Environment

See components CI, EX, and UT under "CI—System/36 Environment Support" on page 4-16, "EX—System/36 Environment" on page 4-19, and "UT—System/36 Environment Utilities" on page 4-29 for System/36 Environment procedures on finding and solving problems.

AJDG001 Procedures for the Horizontal Licensed Internal Code

If a run loop, a hang, or a system crash with a reference code of hex 80F2 occurs, use the following procedure:

Note: The external symptoms do not identify if a licensed internal code problem is an HLIC error or a VLIC error. Any additional data collection called for by the VLIC procedure should also be done.

1. Record the observable failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
   - This should include the control panel lights and the data for operator panel functions 11, 12, and 13.
2. For a run loop or hang, initiate a main storage dump.
   - The dump will have been taken automatically for a system crash.
   - See "Main Storage Dump" on page 16-1.
3. IPL the system.
4. Consult the service support system for previous reports of this problem.
   - See "Problem Resolution" on page 2-3.
5. Copy the main storage dump from DASD to external media.
   - See "Print Stand-Alone Dump" on page 12-55
6. Send the data with an APAR or LICTR.

AJDG301 Procedures for the Vertical Licensed Internal Code

See "Vertical Licensed Internal Code Problems" on page 3-18 for solving VLIC machine problems, the components associated with VLIC in Chapter 4, the *Work with licensed internal code* option of DST on page 13-6 and the VLIC reference codes on page C-4.

AJED001 Procedures for the Magnetic Storage Device Controller (Feature Number 6110)

When a licensed internal code problem is found with a Magnetic Storage Device Controller (feature number 6110) do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure the latest level of code for the Magnetic Storage Device Controller has been loaded.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*. The loadable code group is AJED001.
4. Copy the dump from DASD to external media.
   - See "Display/Alter/Dump" on page 12-27. Use the Address Range menu with a beginning address of 0000 8700 0000 and a length of C4000.
5. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
6. Copy the traced dump from DASD to external media.
   - See "Display/Alter/Dump" on page 12-27.
7. Select all recent storage device controller error logs and copy them to a diskette, tape, or printer. That is, spool the data and copy the spool file to a diskette, tape, or printer.
   - See "Work with Error Log" on page 12-3.
8. Send the data with an APAR or LICTR.

AJEH901 Procedures for the 9346 and 2440/9348 Controllers (Feature Numbers 2601 and 2602)

When a licensed internal code problem is found with the 9346 Tape Unit Controller (feature 2601) or the 2440/9348 Magnetic Tape Subsystem Controller (feature 2602) do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure the latest level of 9346, 2440, and 9348 code has been loaded. Together, these units have one load code group.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*. The loadable code is AJEH901.
4. Take an IOP dump to capture data pertaining to the original failure.
   - See "Input/Output Debug Utility" on page 12-50.
5. Create the problem again with static trace running.

- To run static trace, see "Input/Output Debug Utility" on page 12-50.

6. Take an IOP dump and copy the dump data to a diskette or tape.
   - See "Input/Output Debug Utility" on page 12-50.
7. Select all recent 9346, 2440, and 9348 error logs and copy them to a diskette or tape.
   - See "Work with Error Log" on page 12-3.
8. Send the data with an APAR or LICTR. You should be sending two IOP dumps and error logs if the problem is to be created again using static trace.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

AJEH902 and AJEH903 Procedures for the 3422/3430/3480/3490 Tape I/O Processor (Feature Number 2604)

When a licensed internal code problem is found with the Magnetic Tape I/O Adapter card (feature 2604), do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure the latest level of code has been loaded.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*. The loadable code is AJEH902 and AJEH903.
4. Take an IOP dump to capture data pertaining to the original failure.
   - See "Input/Output Debug Utility" on page 12-50.
5. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
6. Take an IOP dump and copy the dump data to a diskette or tape.
   - See "Input/Output Debug Utility" on page 12-50.
7. Select all recent error logs for the 3422, 3430, 3480, and 3490 tape drives and copy them to a diskette or tape.
   - See "Work with Error Log" on page 12-3.
8. Send the data with an APAR or LICTR. You should be sending two IOP dumps and error logs if the problem is to be created again using static trace.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

AJGJ001 and AJGJF01 Procedures for the Communications Controllers

Note: Follow steps 1 through 6 for SDLC protocols that have problems at an IOP level.

When a licensed internal code problem is found with a Multiline Communications Controller (feature number 6130) do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure that the latest levels of communications controller protocol code have been loaded.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*. The loadable code group is AJGJ001.
4. Take an IOP dump and copy the dump data to a diskette or tape.
   - See "Input/Output Debug Utility" on page 12-50.
5. Select all recent error logs for the Multiline Communications Controller and copy them to a diskette or tape.
   - See "Work with Error Log" on page 12-3.
6. Record configuration information as follows:
   - Number and type of IOAs attached to the failing Multiline Communications Controller.
   - Number, type, and speed of protocols running on an IOA.
   - Configuration objects of failing line or lines.
7. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
8. Take an IOP dump and copy the dump data to diskette or tape.
   - See "Input/Output Debug Utility" on page 12-50.
9. Send the data with an APAR or LICTR.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

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AJLY001 Procedures for the Twinaxial Work Station Controllers (Feature Numbers 2638, 6040, and 6140)

When a licensed internal code problem is found with Twinaxial Work Station Controllers (feature numbers 2638, 6040, and 6140) do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure that the latest level of code for the twinaxial work station controllers has been loaded. The loadable code group is AJLY001.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*.
4. Select all the recent error logs for the Twinaxial Work Station Controllers and copy them to a diskette or tape.
   - See "Work with Error Log" on page 12-3.
5. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
6. Send the data with an APAR or LICTR.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

AJLLN01 Procedures for the ASCII Work Station Controllers (Feature Numbers 2637, 6041, and 6141)

When a licensed internal code problem is found with ASCII Work Station Controllers (feature numbers 2637, 6041, and 6141) do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure that the latest level of code for the ASCII work station controllers has been loaded. The loadable code group is AJLLN01.
   - See the chapter on Working with Licensed Internal Code in the *Service Guide*.
4. Select all the recent error logs for the ASCII Work Station Controllers and copy them to a diskette or tape.
   - See "Work with Error Log" on page 12-3.
5. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
6. Send the data with an APAR or LICTR.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

AJSLC01 Procedures for the Multiple Function I/O Processor

When a licensed internal code problem is found with the Multiple Function I/O Processor do the following:

1. Record any observable symptoms of the failure.
   - See Chapter 3.
   - See "Completing an APAR" on page 6-1.
2. Consult the service support system for previous reports of the problem.
   - See "Problem Resolution" on page 2-3.
3. Make sure the latest level of the Multiple Function I/O Processor code has been loaded.
   - See "Work with Licensed Internal Code" in the *Service Guide*. The loadable code group is AJSLC01.
4. If the feature number is 2637, 2638, 2642, 2643, or 6150, then go to step 11.
5. If the feature number is not 2600, copy the dump from DASD to external media.
   - See "Display/Alter/Dump" on page 12-27. Use the Address Range menu with a beginning address of 00008700 0000 and a length of 200000.
6. Create the problem again with static trace running.
   - To run static trace, see "Input/Output Debug Utility" on page 12-50.
7. Copy the traced dump from DASD to external media.
   - See "Display/Alter/Dump" on page 12-27.
8. Take an IOP dump and copy the dump data to diskette or tape.
   - See "Input/Output Debug Utility" on page 12-50.
9. Select all recent storage device controller error logs and copy them to diskette, tape, or printer. That is, spool the data and copy the spool file to diskette, tape, or printer.
   - See "Work with Error Log" on page 12-3.
10. Send the data with an APAR or LICTR.
11. Take an IOP dump and copy the dump data to a diskette or tape.
    - See "Input/Output Debug Utility" on page 12-50.
12. Select all recent 6150 error logs and copy them to a diskette or tape.
    - See "Work with Error Log" on page 12-3.

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13. Record configuration information as follows:
    - Number and type of IOAs attached to the failing Communications Controller.
    - Number, type, and speed of protocols running on an IOA.
    - Configuration objects of failing line or lines.
14. Create the problem again with static trace running.
    - To run static trace, see "Input/Output Debug Utility" on page 12-50.
15. Take an IOP dump and copy the dump data to diskette or tape.
    - See "Input/Output Debug Utility" on page 12-50.
16. Send the data with an APAR or LICTR.

Note: You may be contacted to create the problem again using dynamic trace points set supplied to you at that time.

AJSG501 Service Processor Code (SPC) Procedures

Record the following information for SPC problems:

1. General state of the system. For example:
    - The system failed during a routine IPL. Only the system configuration had changed from the last successful IPL.
    - The system was running fine, then suddenly the system quit responding for no apparent reason.
2. If possible, the type of customer application which was running at the time of failure.
3. The state of the control panel run light (On/Off).
4. The state of the control panel attention light (On/Off).
5. The SRC displayed in words 11 through 18 on the panel display.
    - Each SRC has at least one word displayed as 11 XXXX XXXX. Additional SRC words may exist in panel functions 12 through 18. This is dynamically determined for each individual SRC.
    - Select functions 12, through 18 to record the SRC data for each word.
6. Record the last ten status SRCs from function 56.
7. The extended panel functions data in functions 54 through 58.
    - Refer to Chapter 14 for information on functions 25, 26, and 54 through 58.
    - Select function 25, then 26. This enables the extended panel functions.
    - Next, select functions 54 through 58 and record the data as follows:

Function	Data
54	5400 XXXX XXXX through 54FF XXXX XXXX
55	5500 XXXX XXXX through 55FF XXXX XXXX
56	5600 XXXX XXXX through 56FF XXXX XXXX
57	5700 XXXX XXXX through 5790 XXXX XXXX
58	5800 XXXX XXXX through 5850 XXXX XXXX

    For more information about these functions, see the "Low-Level Debug (LLD) Panel Functions" on page 14-9.
8. Send the data with an APAR or LICTR.

LCGs

Chapter 6. Creating and Submitting an APAR or LICTR

This chapter provides information about how to submit an authorized program analysis report (APAR) and a licensed internal code trouble report (LICTR). These reports are used to analyze, identify, and resolve problems with IBM code. In this chapter, the term APAR applies to both an APAR and a LICTR.

Preparing an APAR

Before creating and submitting any report, search the service support system to make sure the problem does not already exist. For more information about isolating a problem, see page 2-2. If the problem does not exist, and there is no known fix for solving the problem, enter the Create APAR (CRTAPAR) command to record the pertinent machine readable material on a load/dump volume. For more information about the CRTAPAR command, see the *CL Reference* manual.

To prepare an APAR data volume:

- Analyze the CRTAPAR command parameters to determine the load/dump volume ID, the report labeling information, and the optional data that you want included. The APAR load/dump volume must be in the *SAVRST format.
- Enter the CRTAPAR command with its required parameters to create and write a file to a tape, a diskette, or save-files. The report file can include items such as:
  - Dumps previously taken and written to a saved spooling printer file. (These can be dumps taken manually by the CL, or they can be dumps automatically taken and saved as a part of the automatic problem determination procedures.)
  - Other dynamic information is saved in spooling files such as trace data, job logs, portions of the system log, and other status information.
  - Information available in database files such as the problem log, the change log, and the history log.
  - Error log information using the error log identifier.
  - System or user programs and files suspected of being faulty, or files needed to produce the failure again.
  - Vital product data (VPD) for licensed programs, licensed internal code modules, a network, a controller, or logical unit descriptions.

Before submitting an APAR, check with your next level support to have the APAR screened and to have the symptoms of the problem entered into the service support system. For more information about what specific information to submit with an APAR, see Chapter 3 and Chapter 4.

See Chapter 5 for information on how IOP information (such as dumps, traces, and so on) is gathered and submitted with an APAR.

Converting Spooled Files to Physical Files: All spool files should be converted to a physical file using the Copy Spool File (CPYSPLF) command. It may be easier to diagnose a problem to have the spooled file online. If you need to convert your spool file to a physical file, see page 3-18.

To save the data from a spool file:

1. Create a physical file with a record length of 133.
2. Use the CPYSPLF command with CTLCHAR(*FCFC) to copy the spooled file data to the physical file.
3. Save the physical file to tape or disk.

Completing an APAR

To complete an APAR:

1. Select the **external symptom code** and **symptom keyword** from Table 6-1 on page 6-2 which best describes the external symptom. If more than one symptom applies, put the additional symptom codes or keywords at the end of the error description text.
2. Create the abstract's symptom string for AS/400 APARs using **keywords** that describe what is failing. Select the keyword or keywords from the tables for "Creating a Symptom String" on page 6-2.
3. Continue through the tables as directed. Add appropriate failing function keywords to the abstract until the table indicates that you have completed the symptom string. Separate each keyword in the abstract with a hypen (-). For example:

   ```
   ABSTRACT:  OSP-CALL-MSGCPF6801-F/QPTPARML-T/QCACHECK
   ```

   If a problem has more than one symptom, put the main symptom's keyword in the abstract and all the other keywords at the end of the error description.
4. Add any additional information to the abstract that helps define the problem. For some examples of abstracts, see Table 6-1 on page 6-2.
5. Insert the **module ID (or component)** of the suspected failing module from Table 4-1 on page 4-2 into the *Preassigned serial number* field located on the third create APAR display. The **component ID** is used to route the APAR to the appropriate person responsible for resolving the APAR.
6. Complete the error description on the last create APAR display.

   The error description should describe:

   - The problem as seen by the person experiencing the problem.
   - What the system was doing when the error occurred (for example, compiling a program, executing a command, viewing mail, and so on).

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- What actually happened (for example, an error message, dump, program check, and so on occurred).

The error description should be clear and concise. This information is used to understand how the problem occurred. For more tips, techniques, and general rules about handling APARs, see page 6-12.

Note: When an APAR is closed and the APAR results in a resolved problem, the resolved problem is made available by a PTF. For more information about PTFs, see "Problem Circumvention and Repair" on page 2-3.

Table 6-1. Symptom Codes and Keywords Used For Completing APARs

External Symptom Code	Symptom Keywords	An Example of an APAR Abstract
AB	SRCxxxxxxxx	IPL-**SRCB9003660** AFTER ABNORMAL POWER DOWN
	Replace xxxxxxxx with the first 8 characters of the SRC. For example, SRCB90037FF.	
DD	Use the symptom keyword that most accurately describes a problem that results from a documentation error. For example, use the symptom keyword MSGyyyxxxx or INCORROUT for a problem that results in a message or incorrect output because instructions in a manual were wrong.	List the symptoms of the problem that result from a documentation error.
IN	INCORROUT (incorrect output)	OSP-OPNQRYF-**INCORROUT**-PRT-D/T4224
LP	LOOP	PC400-OS2-PS2M-PCSFLR-CMNLAN-**LOOP**
MS	MSGyyyxxxx	OSP-CALL-**MSGCPF6801**-F/QCACHECK-T/QPTPARML
	Replace yyy with the message prefix (if there is one) and xxxx with the message number. For example, MSGCPF1234 or MSG5678.	
PR	PERFM (performance)	OFC-SNDDOC-**PERFM**
UR	UNPRED (unpredictable)	OSP-SAVOBJ-**UNPRED**
WS	WAIT	PC400-DOS-PS2P-PCSWSF-CMNTWNR-**WAIT**

Table 3-3 on page 3-3?

Creating a Symptom String

Besides using the following tables, you can create keywords using the ANZPRB command on an AS/400 with the same OS/400 release level as the PTF. Go through the ANZPRB displays for reporting a software problem. Enter information on the displays as if you encountered the problem. Enter one problem per each ANZPRB command. Do not report the problem yet. Instead, use the WRKPRB command to view the problem detail. Get the keywords from the *symptom string* field in the problems. For more information about using the ANZPRB command to create keywords for the symptom string, see the *Operator's Guide*.

To use the following tables:

1. Start with table Table 6-2 to begin creating your symptom string.
2. Follow the instructions of the tables or select all of the areas or functions possibly affected by the problem.
3. Add the keyword shown in the tables to the symptom string for each of the functions or areas you selected.
4. Go the next table indicated for each selection or instruction.
5. Continue to select items or follow the instructions until the symptom string is complete.

Table 6-2. Decide When The Problem Occurred

Problem Occurred	Keyword	Go To
During an IPL	IPL	Table 6-45 on page 6-11.
After the IPL completed		Table 6-3 on page 6-3.

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Table 6-3. Select the Problem Area

Area	Keyword	Go To
Operating System/400	OSP	Table 6-4 on page 6-3.
AS/400 Office/Vision	OFC	Table 6-6 on page 6-3.
AS/400 PC Support	PC400	Table 6-16 on page 6-5.
Utility programs or application development tools		Table 6-21 on page 6-6.
Communications		Table 6-32 on page 6-8.
Programming languages		Table 6-33 on page 6-8.
Migration	MIGR	Table 6-35 on page 6-9.
Intelligent printer data stream (IPDS)	IPDS	Table 6-45 on page 6-11.
Application programs		Table 6-42 on page 6-9.

Table 6-4. Identify the OS/400 Function

Instructions	Keyword	Go To
List all IBM menus, commands, and procedures that are likely to be associated with the problem.	Ten characters or less for each name	Table 6-5 on page 6-3.

Table 6-5. Select the Operating Environment

Environment	Keyword	Go To
System/36 environment	S36E	Table 6-45 on page 6-11.
Other		Table 6-45 on page 6-11.

Table 6-6. Select the Office Functions

Functions	Keyword	Go To
Calendars	CALNDR	Table 6-7 on page 6-3.
Mail		Table 6-8 on page 6-3.
Send		Table 6-9 on page 6-4.
Documents and Folders/Word Processing		Table 6-10 on page 6-4.
Directories and Distribution Lists		Table 6-13 on page 6-4.
Administration		Table 6-14 on page 6-4.
File into Document Library		Table 6-15 on page 6-4.
Other		Table 6-45 on page 6-11.

Table 6-7. Select the Calendar Type

Functions	Keyword	Go To
Individual Calendars	CALIND	Table 6-45 on page 6-11 for these functions.
Group Calendars	CALGRP	
Other		

Table 6-8. Select the Mail Function

Functions	Keyword	Go To
Details	MAILDT	Table 6-45 on page 6-11 for these functions.
Delete	MAILDLT	
View	MAILDSP	
Revise	MAILCHG	
Print	MAILPRT	
Forward/reply	MAILFR	
Outgoing mail	MAILOUT	
Action items	MAILACT	
Create hard copy local	MAILHCL	
Create hard copy remote	MAILHCR	
Select mail list	MAILSEL	
Print mail reports	MAILRPT	
Other		

Table 6-9. Select the Send Function

Functions	Keyword	Go To
Send messages	SNDMSG	Table 6-45 on page 6-11 for these functions.
Send note	SNDNOTE	
Send document	SNDDOC	
Other		

Table 6-10. Select the Document or Folder Function

Functions	Keyword	Go To
Search	OFCSRCH	Table 6-45 on page 6-11.
Work with documents in folders		Table 6-11 on page 6-4.
Work with folders	OFCFLDR	Table 6-45 on page 6-11.
Work with text profiles	OFCPRF	Table 6-45 on page 6-11.
Work with non-text document data	OFCGRPH	Table 6-45 on page 6-11.
Work with documents to be printed	OFCPRT	Table 6-45 on page 6-11.
Work with remote status		Table 6-45 on page 6-11.
Other		Table 6-45 on page 6-11.

Table 6-11. Select the Document Function

Functions	Keyword	Go To
Details	OFCDET	Table 6-45 on page 6-11.
Copy, rename, delete	OFCDOC	Table 6-45 on page 6-11.
Spell	OFCSPEL	Table 6-45 on page 6-11.
Paginate	OFCPGN	Table 6-45 on page 6-11.
Print	OFCPRT	Table 6-45 on page 6-11.
Create, revise, view		Table 6-12 on page 6-4.
Other		Table 6-45 on page 6-11.

Table 6-12. Select the Word Processor

Selections	Keyword	Go To
OfficeVision/400 Word Processor	WRD400	Table 6-45 on page 6-11 for these functions.
OfficeVision/400 Word Processor with PC Text Assist	WRDPC	
OfficeVision/400 Adapted Word Processor	WRDAWP	
Other		

Table 6-13. Select the Directories and Distribution Lists

Selections	Keyword	Go To
Personal directories	OFCPDIR	Table 6-45 on page 6-11 for these functions.
System directory	OFCSDIR	
Distribution lists	OFCDIST	
Nicknames	OFCNAME	
Other		

Table 6-14. Select the Administration Function

Functions	Keyword	Go To
Enrollment	ADMENR	Table 6-45 on page 6-11 for these functions.
Access codes	ADMACC	
Grant permission to use mail and filed documents	ADMGRT	
Revoke permission to use mail and filed documents	ADMRVK	
Delete owned objects	ADMDLT	
Work with office files	ADMFILE	
Work with library description file	ADMLIBD	
Other		

Table 6-15. Select the File Type

Type	Keyword	Go To
File local	DLSLCL	Table 6-45 on page 6-11 for these functions.
File remote	DLSRMT	

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Table 6-16. Select the PC Operating System

PC Operating System	Keyword	Go To
IBM Disk Operating System (DOS)	DOS	Table 6-17 on page 6-5 for these functions.
IBM Operating System/2 Extended Edition	OS2	
Other		

Table 6-17. Select the PC Type

PC	Keyword	Go To
IBM Personal Computer (PC1)	PC1	Table 6-18 on page 6-5 for these functions.
IBM Personal Computer XT (PCXT)	PCXT	
IBM Personal Computer AT (PCAT)	PCAT	
IBM Personal System/2 (PS/2) Model 30 or below	PS2P (See note.)	
IBM Personal System/2 (PS/2) above Model 30	PS2M (See note.)	
Other		

Note: If Release 1 through 2 PTF, put PS2 in the problem description field.

Table 6-18. Select the PC Support Function

Function	Keyword	Go To
Configuration file support	PCSCFG	Table 6-19 on page 6-5 for these functions.
Host system tasks	PCSHTSK	
Install command	PCSNSTL	
Message function	PCSMSG	
Organizer	PCSORG	
PC Support menu	PCSMNU	
PC Support update	PCSUPD	
Router	PCSRTR	
Shared folders	PCSFLR	
Text assist	PCSTXT	
Transfer function	PCSXFR	
Translation table	PCSXLATE	
Virtual print	PCSVPRT	
Work station function	PCSWSF	
Other		

Table 6-19. Select the PC Connection Type

Connection	Keyword	Go To
Twinaxial, direct attach	TDLC	Table 6-20 on page 6-5 for these functions.
Twinaxial through remote work station controller	RWS	
Token-Ring Network (TRLAN)	TRLAN	
Synchronous Data Link Control (SDLC)	SDLC	
Asynchronous communications (ASYNC)	ASYNC	
X.25 Packet-Switching Data Network	X25	
Other		

Table 6-20. Specify the PC Message Information

Instructions	Format	Go To
If there is no AS/400 message associated with the problem, list all PC message IDs likely to be associated with the problem.	MSGxxxx (xxxx=PC message ID)	If msg listed, end keyword generation. Otherwise, Table 6-45 on page 6-11

Note: If both a PC message and an AS/400 message could be associated with the problem, use the AS/400 message (go to Table 6-45 on page 6-11.)

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Table 6-21. Select the Utility Program or Tool

Area	Keyword	Go To
Advanced DBCS Printer Support Utility (APS)	APS	Table 6-45 on page 6-11.
Advanced Printer Function (APF)	APF	Table 6-45 on page 6-11.
AS/400 Business Graphics Utility (BGU)	BGU	Table 6-22 on page 6-6.
AS/400 Cryptographic Support	CRYPT	Table 6-45 on page 6-11.
AS/400 Performance Tools	RPFT	Table 6-45 on page 6-11.
AS/400 Query	QRY	Table 6-23 on page 6-6.
AS/400 Sort		Table 6-24 on page 6-6.
AS/400 Systems Management Utilities (SMU)	SMU	Table 6-45 on page 6-11.
Character Generator Utility (CGU)	CGU	Table 6-45 on page 6-11.
Data File Utility (DFU)		Table 6-25 on page 6-6.
Interactive Data Definition Utility (IDDU)	IDU	Table 6-27 on page 6-7.
Programming Development Manager (PDM)	PDM	Table 6-28 on page 6-7.
Report Layout Utility (RLU)		Table 6-29 on page 6-7.
Screen Design Aid (SDA)	SDA	Table 6-30 on page 6-7.
Source Entry Utility (SEU)	SEU	Table 6-31 on page 6-7.
System/38 compatible Query	QRY38	Table 6-23 on page 6-6.
System/38 compatible Text Management	TXT38	Table 6-45 on page 6-11.
Other		Table 6-45 on page 6-11.

Table 6-22. Select the AS/400 BGU Function

Function	Keyword	Go To
Create or change chart format	BGUCRT	Table 6-45 on page 6-11 for these functions.
Manage chart formats	BGUMNG	
Specify data	BGUDTA	
Display, print or plot chart	BGUDSP	
Create GDF	BGUCGD	
Specify GDF for chart output	BGUGDF	
Other		

Table 6-23. Select the Query Function

Function	Keyword	Go To
Create	QRYCRT	Table 6-45 on page 6-11 for these functions.
Change	QRYCHG	
Copy	QRYCPY	
Delete	QRYDLT	
Display	QRYDSP	
Print	QRYPRT	
Run	QRYRUN	
Other		

Table 6-24. Select the Sort Type

Sort Type	Keyword	Go To
Address output sort	SORTA	Table 6-45 on page 6-11 for these functions.
Regular sort	SORTR	
Summary sort	SORTRS	
Other	SORTOTH	

Table 6-25. Select the DFU Type

DFU Type	Keyword	Go To
System/36 Data File Utility	DFU36	Table 6-45 on page 6-11.
System/38 Data File Utility	DFU38	Table 6-26 on page 6-6.
AS/400 Data File Utility	DFU400	Table 6-26 on page 6-6.

Table 6-26. Select the DFU Function

DFU Function	Keyword	Go To
Run a DFU program	DFURUN	Table 6-45 on page 6-11 for these functions.
Create a DFU program	DFUCRT	
Change an existing DFU program	DFUCHG	
Delete an existing DFU program	DFUDLT	
Update data using temporary program	DFUUPD	

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Table 6-27. Select the IDDU Function

IDDU Function	Keyword	Go To
Work with data definitions	IDUDEF	Table 6-45 on page 6-11.
Work with data dictionaries	IDUDICT	Table 6-45 on page 6-11 for these functions.
Work with database files	IDUDB	
Work with libraries	IDULIB	
Other		

Table 6-28. Select the PDM Function

PDM Function	Keyword	Go To
Change	PDMCHG	Table 6-45 on page 6-11 for these functions.
Copy	PDMCPY	
Create	PDMCRT	
Delete	PDMDLT	
Display	PDMDSP	
Edit	PDMEDIT	
Move	PDMMOVE	
Print	PDMPRT	
Rename	PDMRNM	
Restore	PDMRST	
Save	PDMSAV	
Other		

Table 6-29. Select the RLU Function

Function	Keyword	Go To
Invocation	RLUINVO	Table 6-45 on page 6-11 for these functions.
Line commands	RLULCMD	
FLD line editing	RLUFEDT	
Marked block editing	RLUMBLK	
Field specification	RLUFSPE	
Print sample report	RLUPRSR	
DDS keywords	RLUDDSK	
Add database fields	RLUDBFL	
Exiting	RLUEXIT	
Other	RLU	

Table 6-30. Select the SDA Function

SDA Function	Keyword	Go To
Design screens	SDASCN	Table 6-45 on page 6-11 for these functions.
Design menus	SDAMENU	
Test display files	SDATEST	
Other		

Table 6-31. Select the SEU Function

SEU Function	Keyword	Go To
Edit member	SEUEDT	Table 6-45 on page 6-11 for these functions.
Browse member	SEUBRW	
Print member	SEUPRT	
Delete member	SEUDLT	
Other		

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Table 6-32. Select the Communications Function

Function	Keyword	Go To
Advanced peer-to-peer networking (APPN)	APPN	Table 6-45 on page 6-11 for these functions.
Advanced program-to-program communications (APPC)	APPC	
Alerts	ALRT	
Asynchronous communications (ASYNC)	ASYNC	
AS/400 Point-of-Sale Communications Utility	POSCOM	
Binary synchronous communications (BSC)	BSC	
Distributed Data Management (DDM)	DDM	
Distributed host command facility (DHCF)	DHCF	
Distributed systems node executive (DSNX)	DSNX	
Electronic customer support (ECS)	ECS	
Ethernet (ELAN)	ELAN	
File transfer support (FTS)	FTS	
Finance communications support	RETAIL	
Finance support (migrated from System/38)	FINANCE	
Interactive terminal facility (ITF)	ITF	
Intrasystem communications	INTRA	
Object distribution	OBJD	
Pass-through	PASSTHRU	
Remote job entry (RJE)	RJE	
Remote spooling communications subsystem (RSCS)	RSCS	
Remote work station (RWS)	RWS	
Retail communications	RETAIL	
SNA distribution services (SNADS)	SNADS	
SNA upline facility (SNUF)	SNUF	
Synchronous Data Link Control (SDLC)	SDLC	
Token-Ring Network (TRLAN)	TRLAN	
Transmission central protocol/internet protocol (TCP/IP)	TCPIP	
X.21 public data network	X21	
X.25 packet-switching data network	X25	
3270 device emulation	3270EM	
Other		

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Table 6-33. Select a Language

Language	Keyword	Go To
AS/400 BASIC	BAS	Table 6-34 on page 6-8.
AS/400 Pascal	PAS	Table 6-34 on page 6-8.
AS/400 PL/I	PL1	Table 6-34 on page 6-8.
CL (Control Language)	CL	Table 6-45 on page 6-11.
COBOL/400 (base support)	CBL400	Table 6-34 on page 6-8.
COBOL/400 (System/36-compatible COBOL)	CBL36	Table 6-34 on page 6-8.
COBOL/400 (System/38-compatible COBOL)	CBL38	Table 6-34 on page 6-8.
C/400	C400	Table 6-34 on page 6-8.
FORTRAN/400	FTN	Table 6-34 on page 6-8.
OCL (System/36 compatible Operation Control Language)	OCL	Table 6-45 on page 6-11.
Procedures Language 400/REXX	REXX400	Table 6-45 on page 6-11.
RM/COBOL-85	CBLRM	Table 6-34 on page 6-8.
RPG/400 (base support)	RPG400	Table 6-34 on page 6-8.
RPG/400 (System/36-compatible RPG II)	RPG36	Table 6-34 on page 6-8.
RPG/400 (System/38-compatible RPG III)	RPG38	Table 6-34 on page 6-8.
SQL/400	SQL	Table 6-34 on page 6-8.
Other		Table 6-34 on page 6-8.

Table 6-34. Select the Compiler Environment

Environment	Keyword	Go To
Compilation	CMPL	Table 6-45 on page 6-11 for these functions.
Runtime		

Table 6-35. Select the Migration Source

Source System	Keyword	Go To
System/34	S34	Table 6-45 on page 6-11.
System/36		Table 6-36 on page 6-9.
System/38		Table 6-39 on page 6-9.

Table 6-36. Select the Migration Aid

Function	Keyword	Go To
Restoring items saved by Migration Aid	S36MRST	Table 6-41 on page 6-9.
Running migration status reports	S36RPT	Table 6-45 on page 6-11.
Running compiles	S36CMPL	Table 6-37 on page 6-9.
Restoring items saved outside of Migration Aid	S36RST	Table 6-41 on page 6-9.
Resolving user IDs and office names	S36RSL	
Other		Table 6-45 on page 6-11.

Table 6-37. Select the Compiler

Compiler	Keyword	Go To
RPG II	RPG36	Table 6-45 on page 6-11 for these functions.
Automatic report	RPG36	
BASIC	BAS	
COBOL	CBL36	
SFGR	SFGR	
Other		

Table 6-38. Select the Resolve Function

Function	Keyword	Go To
User profiles and user IDs	USRPRF	Table 6-45 on page 6-11 for these functions.
Access codes	ADMACC	
Calendar groups	CALGRP	
Individual calendars	CALIND	
Distribution lists	OFCDIST	
Personal directories	OFCPDIR	
Other		

Table 6-39. Select the Migration Aid Function

Function	Keyword	Go To
Restoring items saved by Migration Aid	S38MRST	Table 6-41 on page 6-9.
Running migration status reports	S38RPT	Table 6-45 on page 6-11.
Restoring items saved outside of Migration Aid	S38RST	Table 6-41 on page 6-9.
Resolving user profiles and office names	S38RSL	Table 6-40 on page 6-9.
Other		Table 6-45 on page 6-11.

Table 6-40. Select the Resolve Function

Function	Keyword	Go To
User profiles and user IDs	USRPRF	Table 6-45 on page 6-11 for these functions.
Access codes	ADMACC	
Calendar groups	CALGRP	
Individual calendars	CALIND	
Distribution lists	OFCDIST	
System/38 personal directories	OFCPDIR	
Other		

Table 6-41. Select the Restoring Media

Media Method	Keyword	Go To
Tape	TAPE	Table 6-45 on page 6-11 for these functions.
Diskette	DSKET	
Migration Data Link (MDL)	MDL	
Other		

Table 6-42. Select the IBM Application Program

Application	Go To
AS/400 MAPICS DB appliction	Table 6-43 on page 6-10.
AS/400 MAPICS II application	Table 6-44 on page 6-10.

Table 6-43. Select the Problem Area of the MAPICS DB Application

Area	Keyword	Go To
Cross application support	CASDB	Table 6-45 on page 6-11 for these functions.
Accounts payable	APDB	
Financial analysis	FADB	
General ledger	GLDB	
Payroll	PRDB	
Accounts receivable	ARDB	
Order entry and invoicing	OEIDB	
Purchasing	PURDB	
Sales analysis	SADB	
Capacity requirements planning	CRPDB	
Forecasting	FCSTDB	
Inventory management	IMDB	
Master production schedule planning	MPSPDB	
Material requirements planning	MRPDB	
Product Data Management	PDMDB	
Production control and costing	PCCDB	
Production monitoring and control	PMCDB	
Repetitive production management	REPDB	
Other		

Table 6-44. Select the Problem Area of the MAPICS II Application

Area	Keyword	Go To
Cross application support	CAS	Table 6-45 on page 6-11 for these functions.
Accounts payable	AP	
Financial analysis	FA	
General ledger	GL	
Payroll	PAYROLL	
Accounts receivable	AR	
Order entry and invoicing	OEI	
Purchasing	PUR	
Sales analysis	SA	
Capacity requirements planning	CRP	
Forecasting	FCST	
Inventory management	IM	
Inventory management for process	IMFP	
Location/Lot management	LLM	
Master production schedule planning	MPSP	
Material requirements planning	MRP	
Product Data Management	PDM	
Production control and costing	PCC	
Other		

Table 6-45. Specify Message Information

Instructions	Format	Go To
List message IDs likely to be associated with the problem.	MSGxxxxxxx (Replace xxxxxxx with the message ID.)	If a message is listed, next instruction. If the problem is a PC problem, Table 6-47 on page 6-11. Otherwise, Table 6-46 on page 6-11.
List codes that may be inserted in the messages for information.	RCxxxxxxxx (Replace xxxxxxxx with the code that appears in the message.) If Release 1 through 2 PTF, put xxxxxxxx in the problem description.	Next instruction.
List the FROM program likely to issue the messages listed.	F/Qxxxxxxxxx or F/#xxxxxxxxx (Replace xxxxxxxxx with the entire program name that appears in the message.) If Release 1 through 2 PTF, put Qxxxxxxxxx or #xxxxxxxxx in the problem description.	Next instruction.
List the TO program likely to issue the messages listed.	T/Qxxxxxxxxx or T/#xxxxxxxxx (Replace xxxxxxxxx with the entire program name that appears in the message.)	The symptom string is complete if all keywords have been identified.

Note: If both a message and an SRC could be associated with the problem, the message is used and the SRC ignored. The problem description is used only if neither a message nor an SRC is associated with the problem.

Table 6-46. Identify the System Reference Code (SRC)

Instructions	Format	Go To
List SRCs likely to be associated with the problem.	Use the form SRCnnnnnnn if the first letter of SRC would be A, B, C, or D. Replace n with the word in word 11. Use the form SRCeeeetttt if the first letter of the SRC is not A, B, C, or D. Replace e with the first 4 characters of word 11 and replace t with the last 4 characters of word 12.	If the SRC is listed, the symptom string is complete if all keywords have been identified. If the problem is a migration problem, the symptom string is complete if all keywords have been identified. Otherwise, Table 6-47 on page 6-11.

Table 6-47. Select the Problem Description

Type of Problem	Keyword	Go To
Looping	LOOP	The symptom string is complete if all keywords have been identified.
Waiting	WAIT	The symptom string is complete if all keywords are identified.
Performance	PERFM	The symptom string is complete if all keywords are identified.
Incorrect output	INCORROUT	If the problem is a PC problem, the symptom string is complete if all keywords have been identified. Otherwise, Table 6-48 on page 6-12.
None of the above	UNPRED	The symptom string is complete if all keywords have been identified.

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Table 6-48. Select the Device Class That Is Creating the Incorrect Output

Device Class Affected	Keyword	Go To
Local display stations	CRT	Table 6-49 on page 6-12 for these classes.
Local printers	PRT	
Remote display stations or printers	RWS	
Tape unit	TAPE	
Diskette unit	DSKET	
Disk unit	DISK	

Table 6-49. Indicate the Device Type

Instructions	Format	Go To
Indicate device types that are likely to be affected by this problem. (For displays and printers the list may be too long, so list the types most likely to be reported.)	Create separate entries for each device type in the format of D/Txxxx (for example, D/T5251).	The symptom string is complete if all keywords are identified.

Tips, Techniques, and General Rules for Handling an APAR

These tips, techniques, and general rules are for:

- Creating an APAR
- Defining a problem
- Submitting an APAR

Creating an APAR

The following tips, techniques, and general rules are for creating an APAR:

- Create an APAR after:
  - Completing problem determination (PD)
  - Identifying the source of the problem or problem source identification (PSI)
  - Searching the service support system for known symptoms of the problem
  - Gathering all the needed information necessary to solve the problem
  - Completing a thorough investigation

  Normally, an APAR is created by dispatching a problem management record (PMR) and typing APAR on the command line of the PMR display. The PMR contains all the logged information about the problem.

  An APAR uses the component field of the PMR to determine if a LICTR or APAR is being created. Before you enter the APAR command, verify that the component field of the PMR reflects the result of problem determination (PD) or problem source identification (PSI).

  For more information about determining and isolating a problem, see page 2-2.

- Assign an appropriate severity level to every APAR.

  The initial severity field of an APAR is the priority (not severity) field of the PMR. If necessary, type over the APAR's initial severity field with an appropriate severity level. See "APAR or LICTR Severity Codes" on page 6-16 for the appropriate severity code to assign.

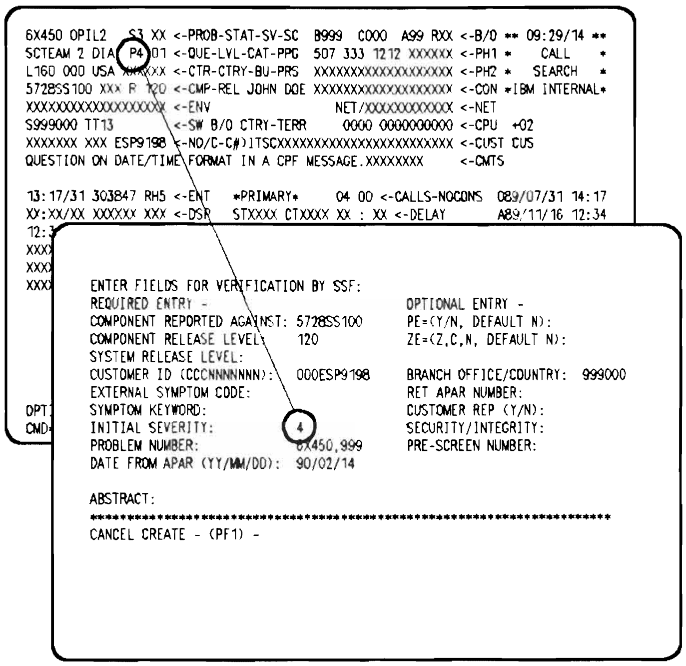

Figure 6-1. Comparing an APAR to a PMR

A severity level that is too high:

- Requires special attention

  For example, a severity 1 APAR requires a service representative at the customer site and the person solving the problem to work on the problem for 24 hours a day until the problem is solved or circumvented. If the problem needs more information, patching, or tried on the failing system, a service representative must be available to do these tasks immediately. It is not a severity one if these and any other tasks cannot be performed immediately.

- May result in a returned (RET) APAR if additional information is needed.

  Gathering additional information to solve a problem may cause you to exceed the number of days allowed for solving the problem.

A severity level that is too low:

- Might not result in satisfactory response time to the customer's problem
- Might not result in a PTF immediately

  Severity 1 and 2 APARs normally result in a PTF immediately after the APAR is closed as a programming error (PER). Severity 3 and 4 APARs may require you to negotiate a PTF's availability. All AS/400 APARs closed as programming errors must have a PTF. MRI PTFs are treated differently because they require translation.

  For more information about PTFs, see page 2-3.

For more information about APAR severity levels and closing codes, see the "APAR or LICTR Closing Codes" on page 6-16.

Defining a Problem

The following tips, techniques, and general rules are for defining a problem:

- Take your time and be as precise as you can be when creating an APAR.
- Investigate the cause of the problem thoroughly.

  If the customer's problem cannot be recreated in a test environment, investigate the difference between the customer's problem and the test environment before creating an APAR.
- Describe one problem per APAR.

  If you have many different problems on one system, each problem needs to be reported separately even if the problems appear in the same program. If you are seeing different symptoms of the same problem then submit one APAR against the source of the problem and list all symptoms.

  For more information about symptoms, see page 2-2.
- Describe the problem using the IBM limited vocabulary whenever possible.

  English is not the main language in most countries. The limited vocabulary helps you to communicate adequately with those reading your APAR.
- Describe the problem so that the problem is easy to understand.

  Be as precise about the problem as you can. It is recommended that you first write a draft version of the problem on paper. Let someone who is not familiar with the problem review your draft to see if the problem is easily understood. Otherwise, let someone else who is familiar with the problem review the draft and make suggestions to improve the description of the problem.
- Describe the failing system.

  Do you have a work station problem? What model is the AS/400? What D/T is the work station? What is the work station? What model is it? Is it attached by Token-Ring, SDLC, or Twinax?
- For others and ECS to find your APAR, use Table 6-1 on page 6-2 to create the APAR abstract and the following conventions to create the APAR's error description:

Device types Device types are identified by the D/T prefix, followed immediately by the IBM product number for the device:

Wrong	**Correct**
3196	D/T3196
5219	D/T5219

Environments
These environments are possible on an AS/400: System/36 execution environment, System/38 mode, or native AS/400. Whenever an environment is not indicated, it is assumed that the problem occurs on a native AS/400; otherwise, the environment or mode should be indicated by the prefix S36 or S38 followed by the letter E:

Wrong	**Correct**
S/36EE	S36E
S38EE	S38E

For more information about what information can be used to diagnose a problem or submit with an APAR, see "EE—System/38 Environment:" on page 4-18 and "EX—System/36 Environment" on page 4-19.

FROM and TO programs
The FROM and TO programs are used with the F/ and T/ prefixes. These prefixes conform to the ECS standards. Also, the prefix distinguishes these programs from the programs that actually have been fixed and appear in the APAR.

Wrong	**Correct**
FROM QMHUNG	F/QMHUNG
TO#AICALLX	T/#AICALLX

Hardware You can find hardware conventions in the hardware support facility (HSF) in the service support system under tip H034515. For information about component IDs, see Table 6-50 on page 6-17.

Hexadecimal values
Hexadecimal values should be identified by an X/ as the prefix. Do not put the hexadecimal value between apostrophes as the apostrophe is a logical NOT in search arguments:

APAR/LICTR

Wrong	Correct
HEX '12AB'	X/12AB
X'34CB'	X/34CB

Licensed internal code
Use HLIC and VLIC keywords in your reports.

Wrong	Correct
HMC	HLIC
VMC	VLIC

For more information about servicing licensed internal code by loadable code groups (LCGs), see Chapter 5.

Messages Messages are identified by the MSG prefix, followed by a 3-character product prefix of AS/400, followed by a 4-digit message number:

Wrong	Correct
CPF0815	MSGCPF0815
SEU0400	MSGSEU0400

Some messages lack the 3-character product prefix (for example, PC messages, work station messages, and so on). These messages follow immediately the MSG prefix:

Wrong	Correct
PCMSG5219	MSG5219
KBD0099	MSG0099

For more information about messages, see page 3-5.

Return, response, and sense codes
2- and 4-byte return, response, and sense codes should all be given with a prefix of RC followed by the actual data.

Wrong	Correct
RC 8890	RC8890
SNS 1003 0101	RC10030101

SRCs SRCs are shown on the control panel. They may consist of more than one word. A word is the 4 bytes of data you see at each function from 11 to 18. A SRC is identified in the service support system by the prefix SRC, followed immediately by 4 byte of data appropriate for this SRC. Depending on the first halfword of function 11 different data needs to be reported. Generally speaking, if the first halfbyte of function 11 is a numeric value other than 0, you are dealing with a hardware problem. For this type of problem the vital information is contained in the first halfword of function 11 (which is either the device type or the IOP derotation) and the second halfword of function 12 (which contains actually the SRC):

Wrong	Correct
11 6110 XXXX 12 0000 3109	SRC 6110 3109

For all other SRCs the relevant data is stored in the 4-byte word of function 11. The second halfbyte indicates if the problem has been detected in the licensed internal code or the operating system. As a general rule, if the second halfbyte is a 1 or a 6 create a LICTR, and if it is a 9 create an APAR. For the APAR and LICTR, report the SRC with the SRC prefix immediately followed by the 4-byte word of function 11:

Wrong	Correct
11 B600 1215	SRCB6001215
SRC B900 2C30	SRCB9002C30

For problems that are reported by the operating system (second halfbyte of the word in function 11 is a 9) report the contents of the word in function 12 as it could contain the phase, function, subfunction, exception IDs, error codes, pointers, and other important information about a problem that occurred during an IPL. This information appears in the same way as the information of word 11. It is not necessary to indicate which function the data was obtained from. However, you should put them in the right order:

Wrong	Correct
11 B900 37FF	SRCB90037FF
12 2018 0020	SRC20180020

For more information about SRCs, see page 18-4 and Appendix D.

VLOG entries
The vertical licensed internal code log (VLOG) contains information that is useful for solving a problem. The basic information here is given in form of a major and a minor code. For function and machine checks, the minor code is also referred to as the VLIC exception code. To report a VLOG entry in an APAR use the prefix VL followed immediately by the 2-byte major code and 2-byte minor code:

Wrong	Correct
VLOG 0200 13C0	VL020012C0
MAJOR 0600 MINOR 138D	VL0600138D

For more information about VLOG entries, see Chapter 31.

For more information about reporting a problem, see page 2-6.

- Refer to Table 6-1 on page 6-2 for more information about creating the symptom string.

  The APAR abstract contains the symptom string. The symptom string contains the keywords. Choosing the correct keywords and creating the correct symptom string is important for ECS to find your APAR.

- Insert the failing module ID or component into the preassigned serial number field as instructed in step 5 on page 6-1.

- Explain why the dumps, traces, and other information you are sending are useful for solving the problem.

Submitting an APAR

The following tips, techniques, and general rules are for submitting an APAR:

- Include the results of your investigation with the APAR.

  If you are unsure of your results, do not include them in the APAR text in the service support system, but rather, include your results in a note and submit the note with your APAR.

- Include step-by-step instructions to create the problem again.

  Accurately write and test your instructions. Let someone who is not familiar with the problem review your written instructions to see if the problem can be recreated.

- Include any and all the information that is needed to recreate and solve a problem with the APAR.

  Include all necessary files, subfiles, includes (data areas), copy members, and so on. Resolving an APAR can be delayed without this information. If you can, test that the information you send in is sufficient to recreate the problem again. See Chapter 3 and Chapter 4 to help you determine what information to submit with your APAR.

- Convert spoolfiles to physical files.

  This helps ensure that the receiver of your spoolfile can restore to a system in a useful format. For more information about converting spoolfiles, see "Converting a Spool File to a Physical File" on page 3-18.

- Send in your own marked up version of the dump or trace.

- If you are sending a VLIC trace, indicate what kind of trace has been selected.

  For more information VLIC traces, see Chapter 30.

- Load dumps, traces, and any other pertinent information about the problem to tape.

  If you do not have a tape use a cartridge. Dump the information to tape using 1600 or 6250 bpi.

  Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

- Do not include the whole QS36F. Send only the needed files.

- Make sure that all diagnostic information you are providing pertains to the same problem occurrence.

  For example, do not provide an IOP dump from yesterday's occurrence of a communication error and the source/sink (VLIC) trace from today. It is impossible to match different diagnostic information from separate occurrences.

- Write-protect the magnetic media (not available on IBM 8-inch diskettes) before you send them.

- Label the material you send in.

  Identify every piece with the APAR number it belongs to. In addition a label on the magnetic media should contain information about its contents:

  - What has been saved (Programs, libraries, files, EREP, ...)
  - How has it been saved (SAVLIB, SAVOBJ, SAVE, MSSD, CPYSPLF, CPYF, CRTAPAR, SAVES36, ...)
  - What tape density has been used (1600, 3200, 6250 BPI)

- Avoid referring to the problem management services (PMS), HONE, or any other similar facility. PMRs disappear from the service support system 28 days after they are closed. If the PMR disappears, the APAR would contain an incorrect reference.

- A PMR may be necessary if you are sending an APAR electronically or if the customer is sending the information himself. The information included with a PMR must only be about the specific information being sent and not about the problem itself. All the information about the problem must go into the APAR text. If you need to send a PMR, send it to your next level of support. If you send your APAR material by mail or courier, you should include all material in the package you send. This eliminates the need to send a PMR.

- Provide all diagnostic information indicated in Chapter 3 and Chapter 4.

  Contact your next level of support to verify if a special item that is hard to get is still necessary.

- Determine if an electronic APAR is enough?

  In some cases, an electronic APAR, sometimes referred to as NODOC, may be sufficient to resolve a reported problem. The following are some key questions that should assist you to determine if an electronic APAR is necessary:

  - Can the problem be created on a different system?
  - Are there only IBM software or programs involved?

- Is there only IBM hardware involved?

If your answer to any of these questions is no, then you need to include more information with your APAR. If you determine that you do not need to send more information, you must send a PMR to your next level of support. The PMR should state that you created an APAR in the service support system and that you are not going to send any more information. If you fail to do this, your APAR will not get opened.

- Verify that the information is being sent in a useful format before sending an APAR.
- Send the APAR and all related information by external or IBM internal mail.

  Address your APAR to:

  IBM Corporation
  AS/400 APAR Control
  Bldg. 015-2 / Dept. 45Y
  Highway 52 and 37th Street NW
  Rochester, MN 55901
  USA

- Add the associated APAR number of the service support system to the outside of the package or envelope.

Considerations for World Trade Countries

- Translate display images to English

  All hard copy display images that contain non-English information should be translated into English. Document if the position of the information is relevant rather than the information itself.

- Translate any important comments in source listings.

  This makes diagnosing the problem much easier and faster.

- Avoid translating messages that are identified in IBM publication.
- Consider sending severity 1 and 2 APARs by Integrated Bulk Transmission System (IBTS).

  See APARs II03730 and II03443 in the service support system for the process of submitting APAR documentation on tapes and diskettes. Ten megabytes or less of data arrive the next day. The amount of time it takes to send 10 megabytes or more of data depends on the amount of data to be transmitted, on the penetration and availability of the network.

APAR or LICTR Closing Codes

Indicating a Valid APAR or LICTR

PER	Error in a license program component.
PRS	Permanent restriction.
DOC	Documentation error.
UR1	Not able to reproduce (or known to be corrected) on a future release that will be available from IBM Software Distribution (ISD).
UR3	Unable to reproduce (or known to be corrected) on the currently supported release. Reported against a release supported at the time the APAR was written.

Indicating an Invalid APAR or LICTR

USE	User error.
MCH	Machine error.
DUA	Duplicate of a resolved unacceptable APAR or LICTR or a duplicate of an APAR or LICTR which was closed more than 10 days ago.
DUB	Duplicate of a resolved acceptable APAR received within 10 days of the original APAR closing.
UR2	Same as a UR1 except that the APAR was reported against a release that was not supported at the time the APAR was written.
UR4	Same as a UR3 except that the APAR was reported against a release that was not supported at the time the APAR was written.
SUG	Suggestion.
CAN	APAR has been cancelled.

Indicating an Unresolved APAR or LICTR (Invalid)

RET	Problem cannot be resolved with documentation provided.
DUU	Duplicate of an unresolved APAR.
UR5	Not able to reproduce on the same release as reported. This closing code is not used if UR1, 2, 3, or 4 is correct.

APAR or LICTR Severity Codes

1 The customer is not able to use the program, which has a critical impact on his operations. This condition needs an immediate solution.

2 The customer is able to use the program, but his operations are severely restricted by the problem.

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3 The customer is able to use the program with some restrictions on the functions that he can use. These restrictions, however, do not have a critical impact on his operations.

4 The problem causes little or no impact to the customer's operation, or the customer has found a way to circumvent the problem.

AS/400 VPD, Component ID, and FESN Cross Reference Table

Reference to Table 6-50 may be necessary when completing an APAR.

Table 6-50 (Page 1 of 2). OS/400 VPD, Component ID, and Field Engineering Service Number (FESN) Cross References

Prefix's APAR	PTF	Component ID	AS/400 VPD	FESN	Change Team	Description
BP	CP	5799CZGRT	5799CZG	0923353	RH2810	Service support system product application program (PAP)
BP	CP	5799CZG00	5799CZG	0922445	RH2810	Service support system product application program (PAP)
MA	MF	9400DG000	AJDG001	5000008	RH9403	Horizontal licensed internal code
MA	MF	9400DG3CM	AJDG3CM	5000010	RH9401	Licensed internal code for communications
MA	MF	9400DG300	AJDG301	5000007	RH9401	Vertical licensed internal code
MA	MF	9400EAA00	AJEAA01	5000021	RH9419	9336 Disk Cluster
MA	MF	9400EA000	AJEA001	5000006	RH9407	Licensed internal code for the 9332 Device Function Controller
MA	MF	9400ED000	AJED001	5000005	RH9406	Licensed internal code for the magnetic storage device controller
MA	MF	9400EHB00	AJEHB01	5000020	RH9418	IOP for System/370 tape
MA	MF	9400EHM00	AJEHM01	5000019	RH9417	IOP for the 2440 Tape Unit with compression
MA	MF	9400EH900	AJEH901	5000013	RH9411	Licensed internal code for the 9346 Tape Unit and 2440/9348 Magnetic Tape Subsystem Controllers
MA	MF	9400EK000	AJEK001	5000004	RH9408	Licensed internal code for the 9335 Disk Unit
MA	MF	9400EW100	AJEW101	5000018	RH9416	9336 Disk Cluster IOP
MA	MF	9400GJ000	AJGJ001	5000002	RH9404	Licensed internal code for the 9406 multiline communications controller
MA	MF	9400GJF00	AJGJF01	5000017	RH9415	9404 and 9406 common communications controller
MA	MF	9400GJZ00	AJGJZ01	5000009	RA5394	Licensed internal code for the 5294/5394 Remote Work Station Controller
MA	MF	9400LLN00	AJLLN01	5000014	RH9412	Licensed internal code for the ASCII Work Station Controller
MA	MF	9400LY000	AJLY001	5000001	RH9405	Licensed internal code for the twinaxial work station controller
MA	MF	9400SG500	AJSG501	5000011	RH9414	Service processor licensed internal code for 9406
MA	MF	9400SLC00	AJSLC01	5000012	RH9413	9404 Multifunction IOP and Communications controller
SA	LN	5799DAG00	5799DAG	0922634	RH2812	Programmer Tool PRPQ AS/400
SA	LS	5799DCK00	5799DCK	0922842	RH2814	Knowledge Tool PRPQ Inference
SA	LL	5799DCT00	5799DCT	0922841	RH2814	Knowledge Tool PRPQ Translate
SA	SF	5799DGQ00	5799DGQ	0923318	RH2818	AS/400 timing and status
SA	SF	5799DHP00	5799DHP	0923439	TR2813	Super compare utility
SA	SF	5799DNP00	5799DNP	0960677	TR2814	Freestanding C/400
SA	SF	5799XAY00	5799XAY	0960383	TR2812	C/400 run-time (Release 1.2 only)
SA	SF	5798RXP00	5799RXP	0903255	RH2814	Telephony PO
SA	SF	5730FN100	5730FN1	0960215	JP2803	AS/400 Advanced Function DBCS
SA	SF	5730FT100	5730FT1	0923323	RH2816	FORTRAN by RM
SA	SF	5730MC100	5730MC1	0923322	RH2828	COBOL by RM
SA	SF	5730SM100	5730SM1	0960866	RH2819	System management utility
SA	SF	5730TL100	5730TL1	0960851	RH2814	TACF licensed program product
MA	MF	572899900	5728999			Licensed internal code
SA	LR	5728AP100	5728AP1	0922504	JP2802	Advanced Print Support (World Trade only)
SA	L5	5728BA100	5728BA1	2281531	TR2801	BASIC
SA	L4	5728CB100	5728CB1	2281561	TR2802	COBOL (1985 and 1974)
SA	SF	5728CF100	5728CF1	0923157	RH2817	ICF Retail (point of sale)
SA	L6	5728CM100	5728CM1	0923174	TR2803	Communications Utilities
| SA	LD	5728CR100	5728CR1	2281565	RH2801	Cryptographic support
SA	SF	5728CX100	5728CX1	2281568	TR2812	C language
SA	L3	5728DB100	5728DB1	2281589	TR2804	System/38 compatibility database tools
SA	LC	5728DCT00	5728DCT	0922274	RH2811	Dictionary
SA	LB	5728DS100	5728DS1	2281591	TR2811	Business Graphics Utilities
SA	SF	5728FNT00	5728FNT	0923175	BL2801	AS/400 APF fonts
SA	LF	5728PC100	5728PC1	2281631	RH2802	PC Support
SA	LA	5728PL100	5728PL1	2281632	TR2806	PL/1

APAR/LICTR

Table 6-50 (Page 2 of 2). OS/400 VPD, Component ID, and Field Engineering Service Number (FESN) Cross References

Prefix's APAR	PTF	Component ID	AS/400 VPD	FESN	Change Team	Description
SA	LT	5728PS100	5728PS1	0922341	TR2807	PASCAL
SA	LZ	5728PT100	5728PT1	2281635	RH2803	Performance tools
SA	LU	5728PW100	5728PW1	2281636	TR2808	Application Development Tools
SA	L2	5728QU100	5728QU1	2281650	RH2804	Query
SA	L1	5728RG100	5728RG1	2281711	TR2809	RPG II and III
SA	SF	5728SS1CM	5728SS1	0922436	RH2809	OS/400 communications
SA	SF	5728SS1ZZ	5728SS1	0960733	RH2800	OS/400 SMU ID
SA	SF	5728SS100	5728SS1	0922437	RH2800	OS/400
SA	SF	5728SS101	5728SS1	0922441	TR2800	OS/400 language run-time support
SA	SF	5728SS102	5728SS1	0922335	HU2800	OS/400 GDDM support
SA	SF	5728SS103	5728SS1	0922442	JP2800	OS/400 DBCS support
SA	SF	5728SS104	5728SS1	0922488	SI2800	OS/400 online documentation
SA	SF	5728SS105	5728SS1	0922802	CA2800	OS/400 cross system product (AE component)
SA	SF	5728SS106	5728SS1	0923170	BL0300	OS/400 page printer support
SA	SF	5728SS107	5728SS1		EN2800	OS/400 REXX
SA	LX	5728ST100	5728ST1	2281722	RH2805	SQL
SA	SF	5728TC100	5728TC1	0923173	RH2815	AS/400 TCP/IP utility
SA	LY	5728WP100	5728WP1	2281781	RH2806	Office
S3	U6	5727MG1MG	5727MG1	2271665	TR2810	System/36 to AS/400 migration aid
S3	LM	5714MG1MG	5714MG1	2140045	TR2810	System/38 to AS/400 migration aid
S3	LK	5714MG1MG	5714MG1	2140045	TR2810	AS/400 migration aid

Part 2. Resource and Configuration Management

Resource Overview

Chapter 7. Resource and Configuration Management Overview

On the AS/400 system, OS/400 provides for:

- Resource management
- Device configuration management, see page 7-4

Refer to the figures in Chapter 1. These figures show how resource and configuration management relates to problem management and ECS.

Resource Management

Resource management collects information about and maintains a database for the system's hardware and software resources. The system resource manager (SRM) interfaces with the resource manager database (RMDB) to let you display and change the resource information in the RMDB. The information in the RMDB is available across the machine interface and is used by problem analysis and other OS/400 components.

The RMDB contains:

- The systems hardware and software vital product data (VPD)
- Topology information
- PTF information

The hardware VPD is collected during an initial program load (IPL) or when resources are added after an IPL (device powers on). The VPD is stored in a set of resource configuration records (RCRs). The RCRs are compared with the resource manager database (RMDB) during each IPL. For newly installed devices, RCRs, are used to update the RMDB. For more information about RCRs, see page 10-1.

The topology information is kept in a topology file and is part of the RMDB. The information in the topology file comes with the system. The topology file contains information about the location of rack units in a rack and how cards and devices are cabled together. Whenever any units are added to the rack or the system is upgraded, the topology file must be updated using the WRKHDWPRD command.

You can also use the System Upgrade Program (SUP) to help you do hardware upgrades. This program generates customized instructions for a system upgrade. SUP automatically updates the topology data in the RMDB. SUP should be used when the RMDB is damaged and the data is lost. For more information about this program, see the *System Installation and Upgrade Guide — 9406*.

The software installation manager provides for collection and recording of software VPD and topology information when code products or components are added or modified. The software VPD and topology information is used to correctly install and maintain all licensed program products and licensed code groups (LCG). Product topology and dependency checking ensures software fixes are correctly ordered and applied.

Ways to View VPD and Topology Information

Figure 7-2 on page 7-3 shows an example of a rack configuration list (RCL) on the 9406 System Unit. The rack configuration list is known as the system configuration list on the 9404 System Unit.

- Use the Work with Hardware Products (WRKHDWPRD) command to view, update, copy, replace, and print hardware topology information and VPD.

  The rack configuration list is a displayed or printed view of the system hardware resources (excluding workstation controller attached devices and remotely attached devices). The RCL is produced by selecting an option from the Work with Hardware Products menu. See the *Service Guide* or the *System Operations: Operator's Guide* for more information about working with the rack configuration list.
- Use the Work with Hardware Resources (WRKHDWRSC) command to view the VPD, current hardware status, and the configuration objects associated with the hardware.
- Use the GO LICPGM command to view installed licensed program products.
- Use the outfile support of DSPSFWRSC and then use DSPPFM on the resulting physical file. You can view the level of each replaceable unit of code within the internal licensed code groups using the *Work with licensed internal code* option under DST.

  For more information about loadable code groups, see Chapter 5. For more information about working with licensed internal code, see the *Service Guide*.
- To determine the products installed on the system, enter: DSPPFM QARZHELM.
- To determine the program products and the components of the licensed internal code installed on the system, enter: DSPPFM QARZLCG.

Changing the System ID: The system type is indicated in the system ID. The following procedure can be used if the system type and nubmer is missing or incorrect. To change the system ID:

1. Enter the WRKHDWPRD command.
2. Select the *Work with rack configuration* option.

   The system ID appears at the top of the display. The format of the ID is: system type, system number (AAS assigned number), and date and time of the last change.

3. Press the F21 (Change system type/number) key to change the system type and number.
4. Type in 9400 or 9406 for the system type.
5. Type in the advanced administration system (AAS) number (not the central processing unit's serial number) at the prompt. This number is used to track the system for future upgrades.

The date and time are updated automactically.

Resource and Device Configuration Management

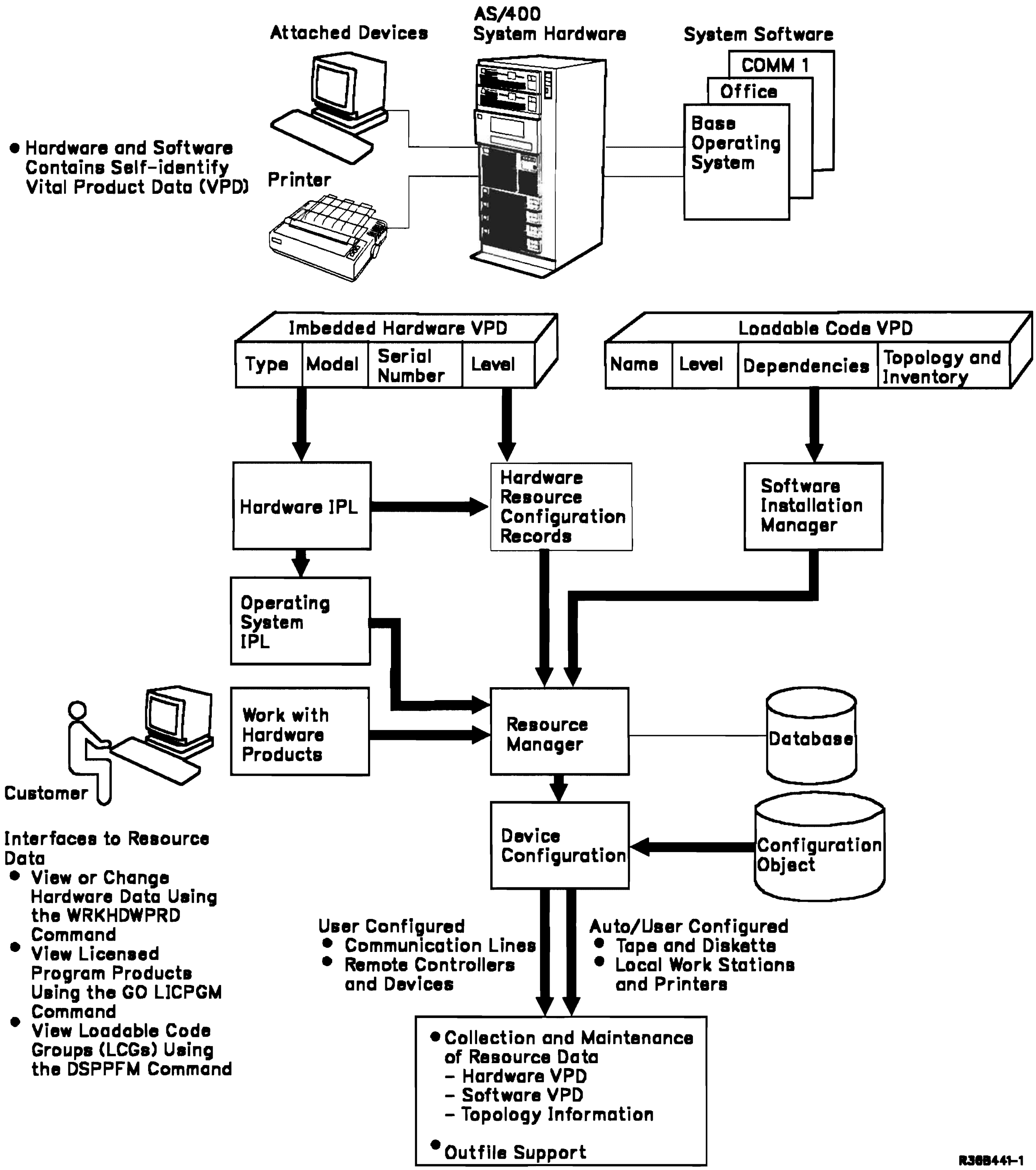


Figure 7-1. Resource Management Overview

5728SS1 R03 M00 891006	Rack Configuration List	12/03/89 14:14:14	Page 1

System ID . . . . : 9406-0000377-19890515-092306

Description	Type-Model or Feature	Resource Name	Serial/ Part Number	Location: Rack ID	Location: EIA Location	Location: Device Slot	Location: Card Slot
1.6M Rack	9309-002		10-12345	A			
8-inch Diskette Unit	9331-001	DKT01	53-0000000	A	30		
5.25 Diskette Unit	9331-002	DKT02	53-0000000	A	27		
Reel Tape Unit	9347-001	TAP01	00-0000000	A	21		
Main Card Enclosure	9406-B50		10-10010	A	13		
16MB Main Storage	3060	MS01	00-0000000	A	13		1
16MB Main Storage	3060	MS02	00-0000000	A	13		2
16MB Main Storage	3060	MS03	00-0000000	A	13		3
Processor Card	2502	MP01	10-8796008	A	13		4
Service Processor	2505	SP01	10-8800002	A	13		5
Mag Stge Device Ctl	6110	SI01	10-8860154	A	13		6
Mag Stge Device Ctl	6110	SI02	10-8860155	A	13		7
Twinaxial WSC	6040	CTL01	10-8843624	A	13		8
Comm Processor	6130	CC01	10-8824094	A	13		9
Two-Line Adapter	6031	LIN01	10-7545112	A	13		10
Port 1		LIN011					
Port 2		LIN012					
Two-Line Adapter	6031	LIN02	10-7536199	A	13		11
Port 1		LIN021					
Port 2		LIN022					
Two-Line Adapter	6031	LIN03	10-7598386	A	13		12
Port 1		LIN031					
Port 2		LIN032					
Two-Line Adapter	6031	LIN04	10-7751298	A	13		13
Port 1		LIN041					
Port 2		LIN042					
I/O Card Unit	5021		10-23456	A	2		
Twinaxial WSC	6040	CTL02	10-7751154	A	2		1
Comm Processor	6130	CC02	10-7751056	A	2		2
Token-Ring Adapter	6034	LIN05	10-7574015	A	2		3
Port 1		LIN051					
1.6M Rack			10-45678	B			
Disk Stge Device Ctl	9335-A01	DC03	57-73919	B	30		
Disk Stge Device Ctl	9335-A01	DC04	57-73899	B	27		
850MB Disk Unit	9335-B01	DD001	57-50353	B	21		
850MB Disk Unit	9335-B01	DD005	57-50389	B	15		
850MB Disk Unit	9335-B01	DD003	57-44925	B	9		
850MB Disk Unit	9335-B01	DD002	57-44952	B	3		
1.6M Rack			10-09876	C			
Disk Unit Enclosure	9336-020	DC05	10-9869881	C	8		
870MB Disk Unit	1203	DD009	10-9879877	C	8	0	
870MB Disk Unit	1203	DD010	10-8768766	C	8	1	
Disk Unit Enclosure	9336-010	DC06	10-8767801	C	3		
480MB Disk Unit	1201	DD011	10-8674375	C	3	0	
480MB Disk Unit	1201	DD012	10-8761079	C	3	1	
480MB Disk Unit	1201	DD013	10-8759817	C	3	2	
480MB Disk Unit	1201	DD014	10-8750299	C	3	3	

Figure 7-2. An Example of a Rack Configuration List

The list is 132 columns wide. The device slot column shows the number of the device slot on the disk unit. This example shows a 9336 Model 10 and Model 20 with a 1201 and a 1203 attached.

Resource Overview

How the Resource Manager Builds and Maintains the RMDB

1. During IPL, the VLIC builds the RCRs using the VPD collected from the system resources. For more information about an IPL, see Chapter 18.
2. Next, the resource manager compares the RCR with the history information contained in the RMDB.
3. The resource manager then:
   a. Processes each RCR and puts each record in one of the following lists:

New*	A new resource reporting for the first time during the current IPL
Unchanged	An existing resource with no changes in location or identity
Moved*	An existing resource that was found in a new location
Replaced*	A resource of the same type at the same location has a new serial number
Inoperative*	A resource that is reporting an inoperative condition
Unknown*	A resource is not reporting during the current IPL

   b. Processes the lists

      If new resources are found and the auto-configuration system value QAUTOCFG equals 1, then the resource manager calls device configuration management to build new resource configuration objects. For information about device configuration management, see page 7-4.
   c. Updates the RMDB using information in the RCRs
   d. Sends a message to the operator message queue (QSYSOPR) for each new, moved, replaced, inoperative, or unknown resource

      Figure 7-3 shows messages are posted to the QSYSOPR message queue for all resources in the lists marked with an asterisk (*) except for those resources that are displays and printers attached to the work station controller that have a status of unknown, moved, or replaced. Use the DSPMSG command to view the messages.

      Use these messages and a print out of the RCL to analyze any problems that may occur after an upgrade.

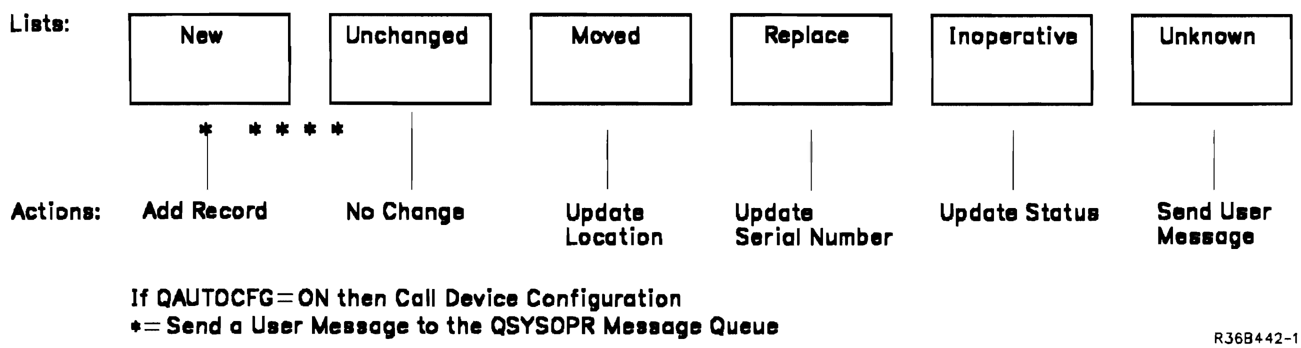


Figure 7-3. Lists Contained in the Resource Configuration Record (RCR)

Recovering from an Error during the Building of the RMDB

If the message:

`CPI0B41 - INTERNAL FAILURE IN THE SYSTEM`

appears, an unexpected error occurs in the resource manager. The catalogue of correct resource names may not be complete. The RMDB may need to be cleared. When this happens, place the cursor on the message, press Help key, and follow the instructions in the second level help text.

Device Configuration Management

Device configuration management lets you create, change, or delete configuration objects automatically or manually (under your control). The **configuration objects** are used by programs to access and use hardware resources, such as printers, displays, communication lines, tapes, and diskettes. Creation, of configuration objects for resources directly attached to the system, is controlled by an auto-configuration system value, QAUTOCFG. If QAUTOCFG is set to yes, configuration objects are automatically created for all locally attached devices except ASCII devices. If QAUTOCFG is set to no, the user creates configuration objects using menus or commands. Configuration object templates are provided with OS/400 to minimize the amount of information you need to collect for solving a problem.

Controlling Auto-Configuration

Auto-configuration is controlled by a system value QAUTOCFG.

If QAUTOCFG Equals	**Then Do**
1 (on)	Auto-configuration
0 (off)	No auto-configuration

The value's default is on when the system is shipped. The value can be changed to off by anyone who chooses to manually create and manage configuration objects.

The value QAUTOCFG can be displayed or changed by using the DSPSYSVAL and CHGSYSVAL commands, respectively.

Auto-configuration uses the following resources:

- Work station controllers and attached twinaxial devices
- Work station controllers (attaching ASCII devices)
- Tape devices
- Diskette devices
- Tape controllers and devices

The value of QAUTOCFG is checked when new records are added to RMDB during an IPL or when a resource alter occurs. Resource alter occurs when a device powers on after an IPL is complete.

The naming conventions used by auto-configuration are controlled by the system value QDEVNAMING. The values are:

*NORMAL
*S36
*DEVADR

For more information about QDEVNAMING, see the *Device Configuration Guide*.

Auto-configuration of APPC controllers on Token-Ring and Ethernet lines is not controlled by the QAUTOCFG system value. This is controlled by the AUTOCRTCTL parameter in the Token-Ring or Ethernet line. For more information about the parameter, see the *APPN User's Guide*.

Rules for Adding New Configuration Objects

- If there are any new records and QAUTOCFG equals 1, then device configuration management is invoked to create the new configuration objects.
- If there are no new records and QAUTOCFG equals 1 then device configuration management is invoked to check for the existence of a configuration object.

  If no configuration object is found then build one.

  If new type of object was found at same address as the old object then delete the old object and create the new one.

The RMDB must not be cleared without first setting QAUTOCFG to 0. If QAUTOCFG equals 1, then a second set of resource objects is built for all resources reporting in because they all appear to be new. Device configuration management always creates configuration objects for new resources.

Save or Restore of RMDB

Figure 7-4 shows how a save or restore of RMDB and copy or replace of topology is performed. The following steps summarize the saving or restoring of the RMDB and copying or replacing of the topology portion of the RMDB:

1. The Save System (SAVSYS) command saves the RMDB in the QSYS library.
2. The *Install operating system* option on the DST main menu loads the RMDB if the database is damaged.
3. The COPY parameter on the WRKHDWPRD command or the *Copy rack configuration* option builds a file QASURACK in the library QUSRSYS from the topology part of the RMDB.
4. The REPLACE parameter on the WRKHDWPRD command or the *Replace rack configuration* option loads the file back into the topology part of the RMDB.
5. The resource topology record is replaced when it matches a VPD record.

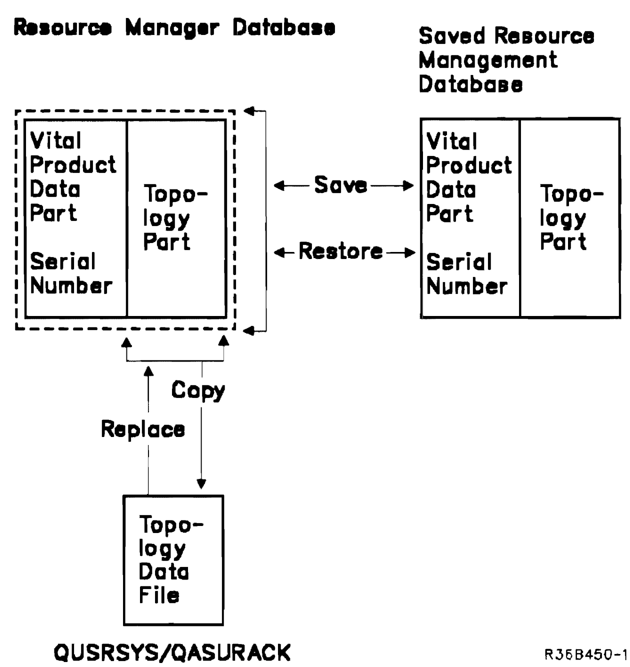


Figure 7-4. Saving or Restoring the Resource Management Database (RMDB)

Naming a Device Configuration Object

The device configuration object name is established during IPL by device configuration management. The default names established are: PRT01, PRT02, PRT03, and so on for printers, DKT01 and DKT02 for diskettes, and TAP01, TAP02, TAP03 and so on for tapes. These default names are influenced by the QDEVNAMING system value. These names can be changed by the customer; however, to change the name the object must be deleted and created again with a new name.

The names of configuration object are seen in error and system operator messages. For example:

```
Device TAP01 vary on failed.
Cannot allocate device XXX01.
```

The word device appears before the actual name as shown in the above messages.

If you do not know what the configuration object name is use the name displayed in the error message or do one of the following to determine the name:

- Enter the WRKDEVD command. Use *PRT, *DKT, or *TAP to limit what is displayed. For example:

  ```
  WRKDEVD *TAP
  ```

- Enter the WRKCFGSTS *DEV command. For example:

  ```
  WRKCFGSTS *DEV *TAP
  ```

  Select the *Work with description* option from the display that appears.

  Note: The device name of the configuration object is tied to the resource name. The device name and resource name can appear to be the same name if the customer has not defined the system's device names.

Naming Resources

A unique name is assigned to each physical resource by the resource manager when its description is added to the resource manager database. The following naming conventions are used by the resource manager for those resources with configuration objects:

Name	Meaning
LINnn	Communication IOAs
CTLnn	Work station controllers
DKTnn	Diskette units
TAPCTLnn	Tape controllers
TAPnn	Tape devices

Resource names and the configuration objects associated with the resource names are displayed using the WRKHDWRSC command. This command is the primary means for viewing resource names.

Resource names are listed on the rack configuration list (RCL). The rack configuration list is the primary way to view resource names. You can view the RCL using the WRKHDWPRD command. This list should be printed and available before and after every upgrade activity.

Resource names are used to associate logical configuration objects (such as line, controller, and device description) objects to real physical resources. The names are used in:

- Line descriptions to point to a physical port
- Work station controllers (WSC) descriptions to point to physical controller IOP
- Tape controller description to point to a tape controller A box
- Tape device description to point to a tape device
- Diskette device description to point to a diskette device
- Cartridge tape device description to point to a cartridge tape device

If an IOP reports a blank serial because of a bad module, resource management will use the VPD from the resource file stored earlier when the module was working. If an IOP reports blank serial from a slot previously not occupied, it is assigned a new resource name unless it is the only IOP of this type on the system.

An IOP reporting blank serial number will be totally transparent until that IOP is moved to a new slot and there are other IOPs of the same type on the system.

An IOP reporting blanks as the type must be replaced.

Clearing and Building the RMDB

The RMDB can be automatically cleared by the operating system or it can be cleared by a service person using a manual procedure. The database should never be cleared without proper supervision.

The resource manager clears and rebuilds the database during an IPL if the database is found to be damaged.

The resource manager builds a new database if a system install is in progress and the serial number in the database being installed does not match that of the processor unit. It is assumed that the installed database is from another system, and therefore, the database does not match the hardware of the system being loaded. When this happens, the following message

```
CPI0B50 - SYSTEM RESOURCE MANAGER DATABASE BEING INITIALIZED
```

is sent to the operator message queue.

If the customer loads old configuration objects also, then two sets exist (this is really a customer responsibility). If QAUTOCFG equals 0 then no configuration objects are built (except for the install device, first workstation controller, and for device at address 0 (primary console)).

Note: For the first work station controller and the device at address 0, the configuration descriptions created are special *shadow* configuration descriptions that are used to complete the install and IPL. For more information about the use of a console during IPL, see Chapter 19.

If a system restore is in progress, then the restore logic contacts the resource manager and if the RMDB is not damaged then the RMDB on the install tape is not restored. If the RMDB is damaged the RMDB on the tape is loaded. At a later time during the current IPL, the resource manager runs and checks the serial number of the 9406 rack unit in the restored database against the serial number of the 9406 rack unit reported in the RCR. If they do not match, the database is cleared and rebuilt during a system install described above.

Consequences of Clear and Rebuild

Card swapping (as a maintenance technique), violating card upgrade rules, and certain card failure conditions can cause the resource name of a resource to change when the RMDB is cleared and rebuilt.

Resource names can change if any hardware is moved or added to the system in a way that changes the relative sequence of the cards along the bus. If this happens, some resources are assigned different resource names during the rebuild of the RMDB. When this happens, the configuration objects refer to incorrect resources.

Figure 7-5 shows an example of an incorrect configuration.

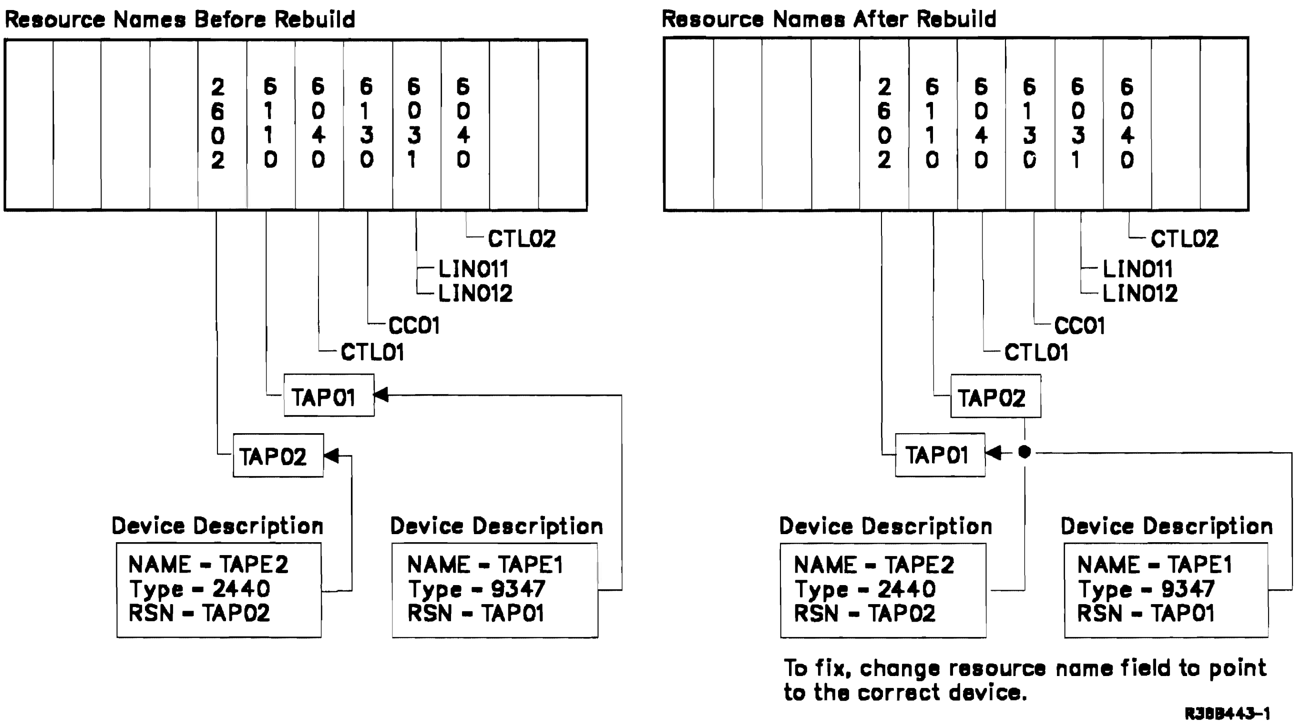


Figure 7-5. An Example of an Incorrect Configuration

When the configuration object resource name is incorrect:

- If QAUTOCFG equals 1, a duplicate set of device and controller description objects are created.
- The console may not be available or may come up on a device not located near the system
- The ECS line may not be useable
- Customers applications may fail because vary on lines, controllers, or devices fail.

Recovering from an Incorrect Configuration

To recover from a resource name change:

- Change the resource name of the configuration object so that it points to the correct physical resource.
- Delete any duplicate configuration objects created by auto-configuration.
- For problems with the RCL, incorrectly reported serial numbers and other VPD, page 10-1.

Note: Keeping the RMDB current and printing the RCL before and after all upgrade activity ensures that the right information is available in the event the RMDB is or must be cleared.

Preventing Resource Name Changes

To prevent resource names from changing:

- Keep the first work station controller card first on the bus.

  The console is the device with address 0 on the first work station controller on the bus. If it is not kept as the first card on the bus, the console moves to another device that is address 0 on the new first work station controller. This device may be in another building or some other place outside the machine room. This gives very confusing symptoms on bring up after an upgrade or service action. It also breaks the pointers to the configuration object resource name.

- Seat all cards carefully. When a card is not seated properly it can appear to be missing from the system. Also, poorly seated cards cause resources to appear missing and when reseated later, they appear as new resource and are given new resource names. Figure 7-6 shows some examples of cards not seated properly.

- Warn customers whenever the RMDB needs clearing and configuration management is needed. Clearing and rebuilding RMDB should be supervised by your next level of support.

  It is important to warn the customers when the RMDB needs clearing because some resource names may change when the RMDB is rebuilt. It is important to accurately determine which resource names have changed and which configuration objects need fixing.

- Verify you have a current RCL and a copy of the topology file before each upgrade. The RCL can be used for problem analysis if a problems occurs during the upgrade.

- Use the *System Upgrade Guide — 9406 (Vol 1)* to insure proper card placement or movement sequences. Do not swap cards as a maintenance technique. Only exchange a card with one from stock.

  Use the RCL to verify all cards are properly seated. Missing resources are easy to identify. For example, if there is a card in slot 8 and there is no information for slot 8 on the RCL.

- Print the RCL and copy the topology file after successfully completing an upgrade. This insures you have the topology file. The topology file can be used to replace the one lost when the system clears the RMDB.

- Do not clear the RMDB to place resource names in order. The resource manager maintains a permanent relationship of the names and serial numbers of each card and device on the system. Clearing the database could destroy this relationship.

- Place the memory upgrade cards right to left (empty slots to the left). Place 16 megabyte cards to the left of the 4 or 8 megabyte cards. Install the 4 and 8 megabyte cards in any order. Existing 16 megabyte cards must be moved if adding 4 or 8 megabyte cards.

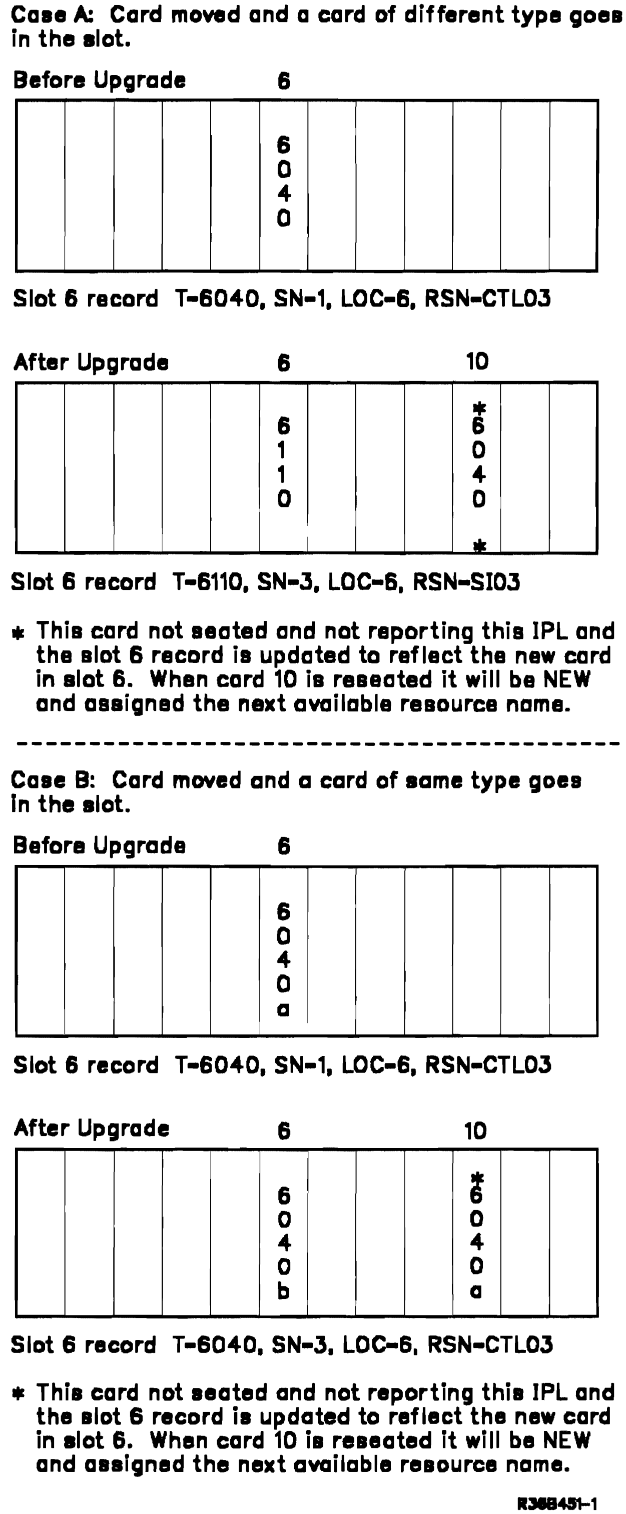


Figure 7-6. Examples of Incorrectly Moving and Placing Cards

Chapter 8. Managing and Configuring Storage

This chapter describes:

- Auxiliary storage pools (ASPs)
- Journaling
- Mirroring
- Checksums

Auxiliary Storage Pools

ASPs help avoid thrashing and provides help getting data in and out of the system.

ASPs are used to separate DASD units in to areas called **pools**. Figure 8-1 shows how DASD is separated by ASPS. The system, when first delivered, has one pool. This pool is called the **system pool**. Any DASD that is part of the system pool are accessible to and owned by the system. This means the system controls where and what data is written to DASD.

When DASD is selected for removal from the system ASP and for use in separate ASP it then becomes part of a **user ASP**. There can be as many as 15 user ASPs. These user ASPs are numbered 2 through 16. These user ASPs may be used to store many types of objects. For a list of those objects you cannot store, see the *Backup and Recovery Guide*.

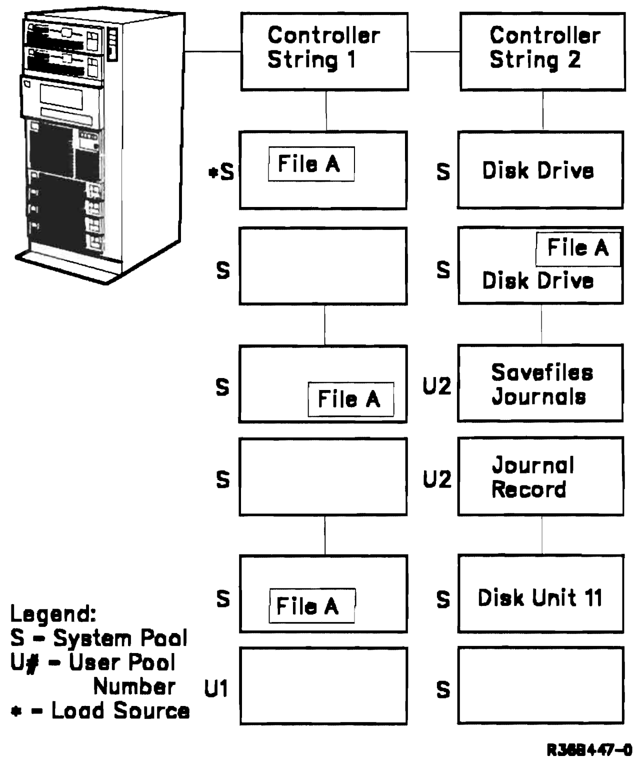


Figure 8-1. An Example of Auxilary Storage Pools (ASPs) and Journaling

Journaling

Journaling is an audit trail of all the activity that affects a physical file, logical file and access paths. Activities such as updates, deletions, additions, opens and closes are recorded. The information collected by journaling may be used to update a saved file to the current state of the journaled file.

The objects needed to accomplish journaling are journals, journal receivers and the objects to be journaled.

The journal is directly attached to the object to be journaled and contains the names of the journaled objects and a pointer to the journal receiver.

The journal receiver is the object that contains the data to assist in the recovery of the journaled object.

Journaling is most effective when used in conjunction with ASPs and savefiles. Figure 8-1 shows an example of journaling. For more information about journaling, see the *Backup and Recovery Guide*.

Mirroring

Mirroring can be used to protect disk data from DASD failures. Mirroring is selected by ASP. All disk units in a mirrored ASP are duplicated on a set of mirrored units.

Mirroring increases the system's availability. Each ASP, including the system ASP, can be configured for mirroring. All objects created in a mirrored ASP are protected from loss when a disk fails.

A disk unit that fails in a mirrored ASP does not cause the system to stop. The system continues to run with the mirror of the disk that failed. The failed disk may be replaced and returned to service while the system continues to run. This is called concurrent maintenance. For example, you can possibly repair or replace a failed disk unit, controller, or IOP while the system continues to run. If concurrent maintenance is not possible, the system continues to operate, and maintenance can be deferred.

Mirroring needs twice the number of disk devices in all ASPs that are protected. Devices are paired by the system to maximize protection. Ideally, all disk pairs would be under separate buses so that a bus failure does not cause a system to stop.

For more information about planning and using mirrored protection, see the *Backup and Recovery Guide*.

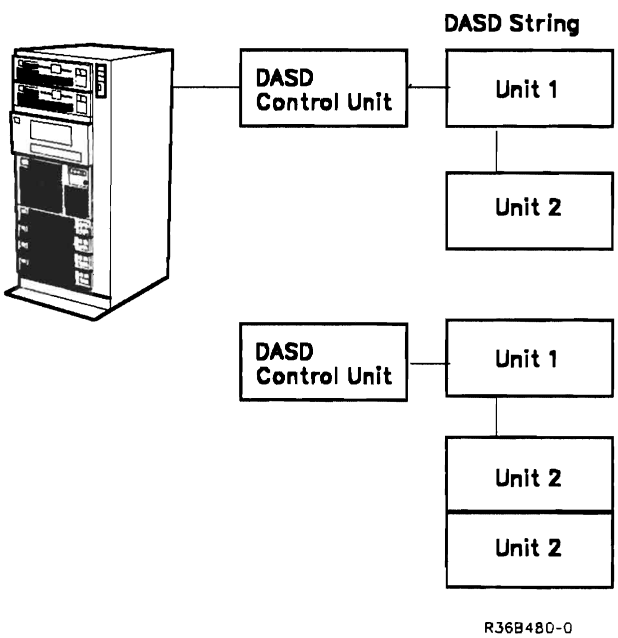


Figure 8-2. An Example of a Mirrored System

Checksums

Checksum is an option that can be used to recover from a single DASD failure without having to load DASD again. Checksum also protects against damaged objects caused by imperfections in the disk surface.

Checksums help protect data. Checksumming saves the activity that is performed on the data. After a system becomes inoperative, the data stored on the system can be recovered from the previous normal power off of the system. The checksum data can be applied to the recovered or saved data.

The checksum set can consist of two to eight units. The identification of the checksum set is made by the system. You are not allowed to identify them. Each set consists of units of similar device types and models. Figure 8-3 shows an example of a checksum set.

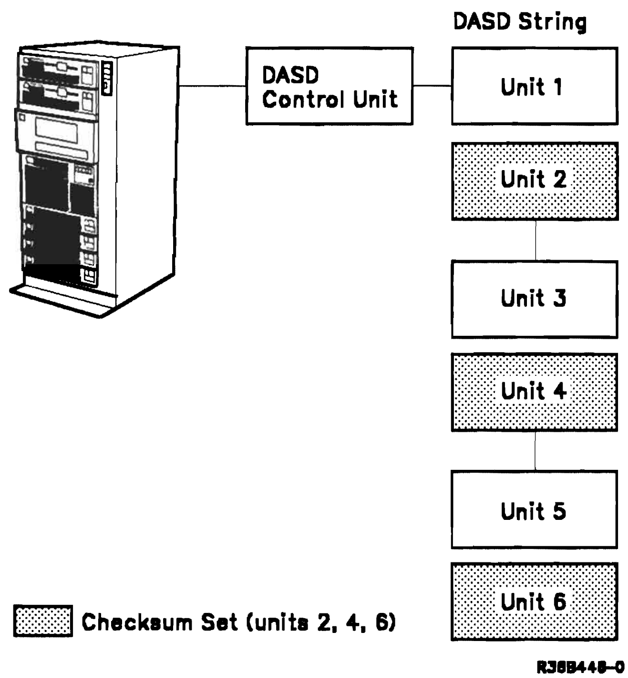


Figure 8-3. An Example of a Checksum Set

Checksum Area

The entire area of a disk unit is not protected by checksum. The area not protected by checksum is called the **unprotected area**. The unprotected area is used by the system for temporary storage. The system's performance would slow down if the unprotected temporary storage area was checksummed. Figure 8-4 on page 8-3 shows an example of a checksum area.

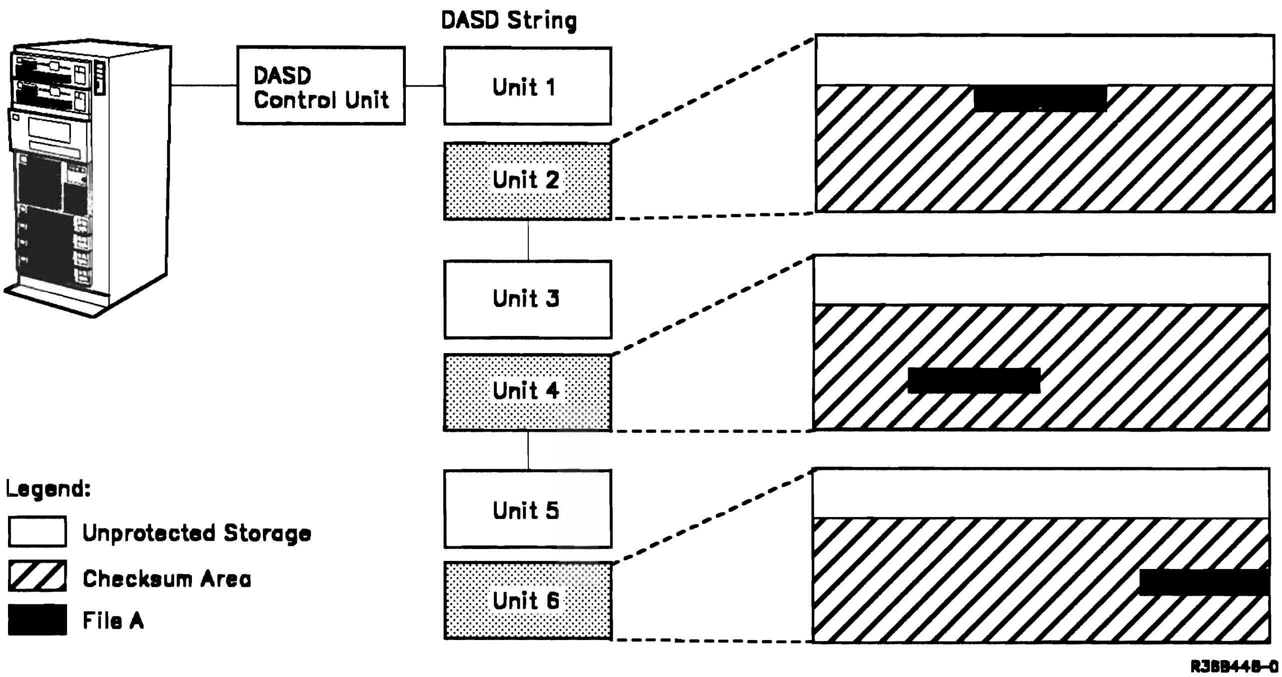


Figure 8-4. An Example of a Checksum Area

Checksum Stripes

Striping divides available DASD storage into 16 megabyte stripes. Each member of the checksum set has a corresponding arrangement across all the DASDs in the set. This allows for any disk unit in a set to be reconstructed. Reconstruction uses the data stored in any of the corresponding disk units contained in that set. Figure 8-5 shows an example of checksum stripes.

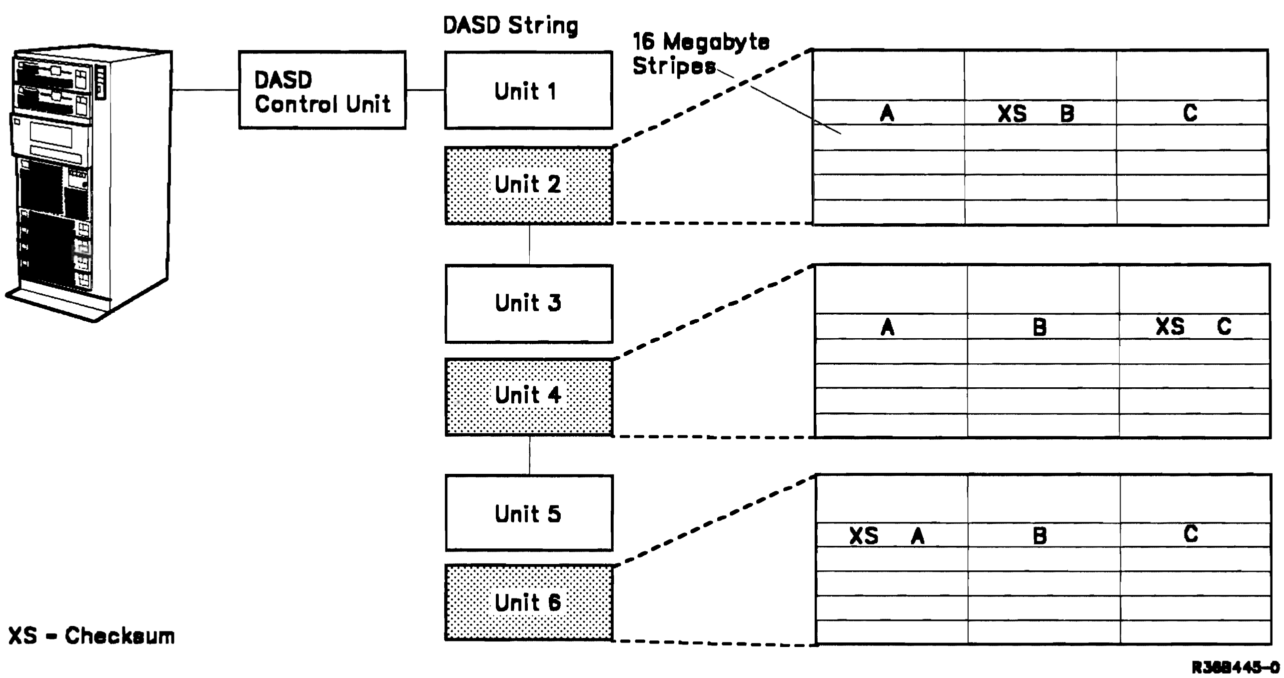


Figure 8-5. An Example of Checksum Stripes

Recovering from a User ASP Failure

If disk unit recovery is not 100% successful when a drive in the user ASP fails, one of the following procedures should be done to recover from the failure:

- If only the journal receiver was in the user ASP:
  1. Enter CHGJRN with JRNRCV(*GEN) to attach a new receiver
  2. Save the journaled files to establish a new starting point in case you need to enter the Apply Journal Change (APYJRNCHG) command again.
- If both the journal and journal receiver were in the user ASP:
  1. Create the journal and receiver again.
  2. End journaling using ENDJRNPF and ENDJRNAP.
  3. Start journaling using JRNPF and JRNAP.
  4. Save the journaled files.

Chapter 9. System Upgrading

Upgrade Install Sequence

The following is the sequence for an upgrade install:

- Installation is order sequence sensitive.
- Insure prerequisite software or code is installed.
- Insure all hardware and prerequisite PTFs are installed before any hardware activity is started.
- Insure that system has been saved.
- Install hardware using documentation.
- Verify installation at each point.
- Update rack configuration list.
- Return all parts to the proper owner.
- Customer restores system.
- Remind customer that another configuration may be needed again.

Because each upgrade order is based on the configuration of the system at the time the upgrade is placed, the changes should be installed in the sequence in which they were ordered. The following is an example of how this can cause problems: A feature is ordered and shipped for a B40, then a model conversion to a B50 is ordered and shipped. Both orders are scheduled to be installed on the same day. In this case, the installation instructions for the feature that was ordered use the B40 rules. Therefore, the feature should be installed before the machine is converted to a B50.

It is important that the software or code prerequisite levels are checked before any upgrades or changes are installed. For information on how to check the software and code levels, see "How to Determine the Level of Loadable Code" on page 5-2. The prerequisites, if any, are listed in the installation instructions for the change. It is the customer's responsibility to install the software and it is the service representative's responsibility to make sure that the software is installed before any change is started. All prerequisite PTFs should be installed before any hardware activity is started to operate correctly.

One very useful tool to use during every upgrade is the rack configuration list. Make sure that the system recognizes the new hardware shown on the rack configuration list.

The system may need to be reconfigured before any new feature or device can be used. This is particularly true when disk units are installed. More information about system configuration can be found in the *Device Configuration Guide* and the *Backup and Recovery Guide*.

Using the System Upgrade Documentation

Throughout the documentation, devices are machine types and machine equipment specifications (MESs) are 9406 feature or model upgrades. The upgrade documentation includes:

- The *System Upgrade Guide — 9406 (Vol 1)*

  This guide includes:

  – A master index

    To maintain rule integrity it is important that changes are installed in the proper sequence. Proper sequencing is accomplished by answering appropriately the yes and no questions questions contained in the index of the *System Upgrade Guide — 9406 (Vol 1)*. All upgrades should start with the index.

  – Procedures for installing a rack

  – Procedures for installing a device

  – Procedures for verifying all upgrades

    The verification procedures are very important when completing a change. For more information about proper verification, see Figure 9-1 on page 9-2.

- The *System Upgrade Guide — 9406 (Vol 2)*

  This guide includes:

  – Procedures for removing devices and racks

  – Information about relocating the system

  – Information about installing and testing the ECS line

All MES instructions are developed so that the feature can be installed without having to know exactly where the other cards are plugged in the card cage(s). The MES instructions resolve all placement priorities. The logic for resolving card placement priorities is built into the MES instructions. Also, the MES instructions are model and sequence sensitive. The instructions for the 9406 model must match the machine.

Types of Instructions

These are the types of instructions shipped with the feature:

Instruction	Purpose
Primary	Used to install the features that were ordered.
Companion	Used to install the features that were removed or displaced during an install of the ordered feature.

These types of instructions work together to insure that all upgrade, install, and configuration rules for the model are met.

An MES always includes primary and may include companion instructions. The companion instructions are included for every feature that could possibly be removed while installing the primary feature; therefore, it is possible that the companion instructions may be duplicated if multiple features (MES's) are being installed at the same time.

Flow of the Upgrade Documentation and Instructions

Figure 9-1 shows the overall flow of the upgrade documentation and instructions.

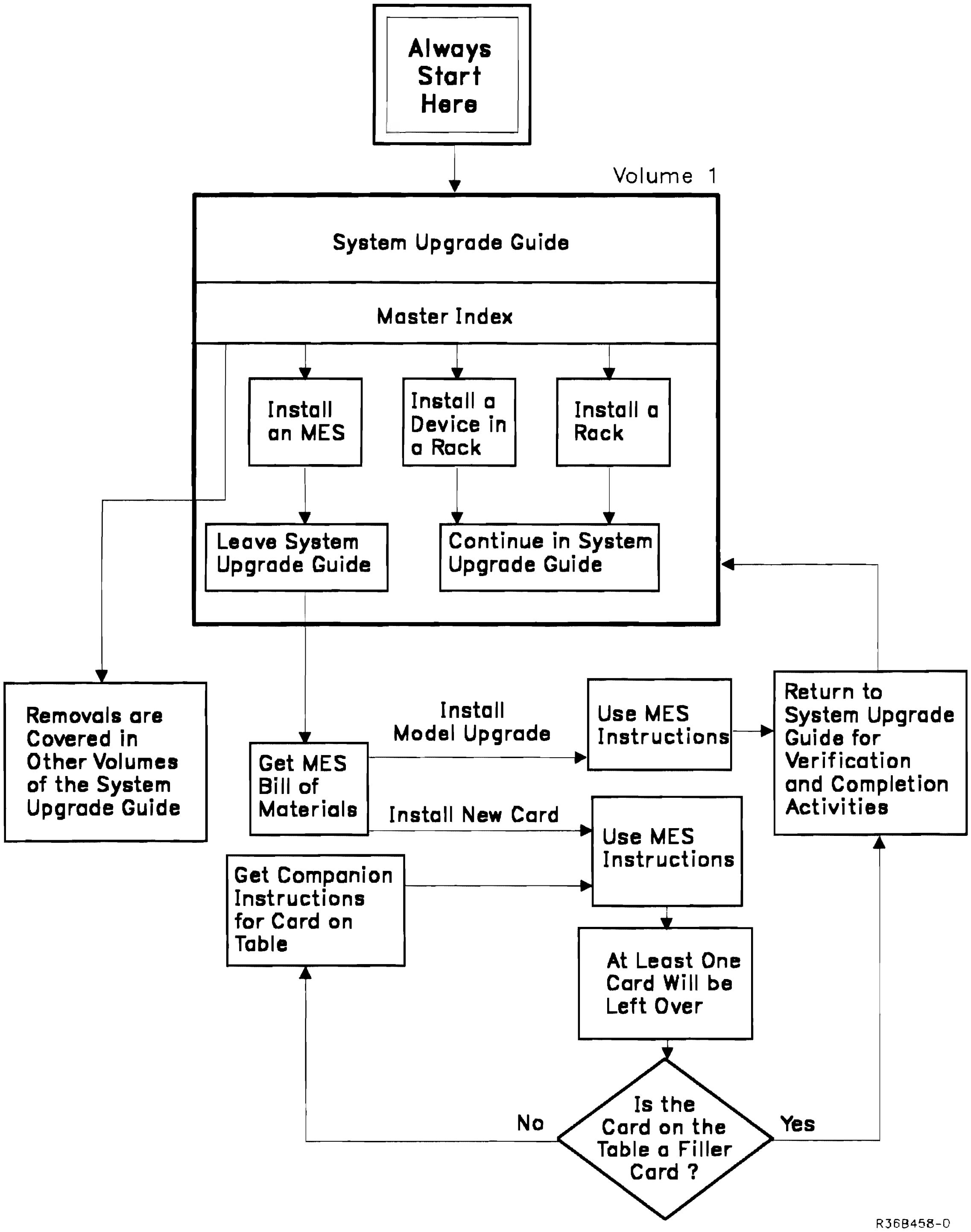


Figure 9-1. Overall Flow of the Upgrade Documentation

Notice:

- An upgrade always starts with the master index so that the upgrade performs in the right sequence.
- How the MES instruction loops. For example, the primary instructions are used to install the feature. Then, if a functional card was removed to install the primary feature, the companion instructions are used to install the removed card. Continue following the loop until an air flow card is removed.
- The verification procedures are very important. The procedures:
  - Insure that the change is correct and running properly. The rack configuration list is an important tool used in these verification procedures.
  - Lead you back to the correct location in the documentation if any more changes need to be made.
  - Assist you with parts disposition and other upgrade completion activity

RCR

Chapter 10. Resource Configuration Record (RCR)

The resource configuration record (RCR) is used to reflect the current configuration of locally attached resources on the system. The RCR includes vital product data (VPD) for I/O processors (IOPs), I/O adapters (IOAs), storage controllers, local devices and communication ports. Each resource attached to the system corresponds to an entry in the RCR. Each RCR entry holds product and status information about the resources used on the system.

The RCR can be used to help solve rack or system configuration problems and incorrect reporting of serial number to ECS. The RCR can also be used to determine if a resource has been installed and configured correctly before performing an IPL of the whole system. This can save time analyzing a problem.

Printing the RCR

The RCR can be accessed from SST and DST. Do the following to view and print the resource information:

1. If you are using DST, go to step 2. If you are using SST, set up a printer for printing.
   a. Check if the printer is varied on by doing the following:
      1) View the list of printers available on the system using the WRKCFGSTS *DEV PRT* command.

         Note: By default, the system starts the printer names with PRT. This procedure uses PRT01 as the printer name. The customer could have changed the printer names. To determine how the printers are named by the customer, see page 7-6.

      2) Vary on the printer by entering a 1 next the printer you want varied on, if not varied on or active already.
   b. Check if the printer is listed on the output queue by doing the following:
      1) Enter the WRKOUTQ command to work with output queues. If the printer name (usually PRT01) appears in the *writer* column, write down the name of the queue the printer is assigned. If no printer is listed, enter the CRTOUTQ command and press F4 (Prompt) to enter an output queue name of your choice. Then enter the STRPRTWTR PRT01 command and press F4 (Prompt) to enter the output queue name that you chose.
2. Select the *Start a service tool* option from SST or DST.
3. Select the *Display/alter/dump* option from the Start a Service Tool menu.

   For more information about display/alter/dump, see page 12-27.
4. Select the *Display/alter/dump output device* from the Display/alter/dump menu and dump to a printer.
5. Select the *Vertical licensed internal code (VLIC) data* option from the Select Data menu.
6. Select the *Resource configuration record (RCR)* option from the VLIC Data menu.
7. Select the *Dump in hexadecimal (logical blocks)* option from the Select Format display.

   For more information about the Select Format display, see page 12-31.

On the next display that appears, enter a dump title for your print file. If you use SST to print the RCR, a spool file is created and placed in the current output queue. If you use DST, a menu appears prompting you to allocate a printer to DST, if one is not allocated already. When a printer is allocated, the RCR is printed.

Levels of Information in the RCR

The RCR consists of three levels of information. They are:

Level	Description
1	This is the highest level. This level contains information about storage, communication, or workstation IOPs. Additional IOP information is also provided in the RCR header entries.
2	This level contains IOA, controller, or local workstation device information. The entries in this level are associated with the previous level 1 entry.
3	This level contains storage device or communication port information. The entries in this level are associated with the previous level 2 entry.

The different levels help you to determine, for example, which IOAs (in level 2 entries) are attached to which IOP (in level 1 entry). Table 10-1 shows how the levels in the RCR relate to hardware.

Table 10-1. Comparing Hardware to RCR Levels

Level	Storage	Commu-nications	Work-station (2 levels only)	Multi-purpose (Communications and Storage)	
1	IOP	IOP	IOP	IOP for 9404 only.	
2	Controller	IOA	Device	Controller	IOA
3	Device	Port		Device	Port

RCR Examples

Figure 10-1 on page 10-3 and Figure 10-2 on page 10-4 are examples of RCR information for two different configurations. All fields in the report are in hexadecimal notation. All field abbreviations that are common across levels 1 through 3 have the same definitions. The following fields and their abbreviations are described to help you understand the report.

RCR Header Entry

Field Description

1 LOAD is the base load ID. This ID is needed by an IOP during an IPL.

2 TYP is the IOP feature number or IOP type. The feature number identifies the product.

3 IOPDS is the IOP direct select address. This address consists of 4 digits. The bus number is the first two digits, the card number is the third digit and the board number is the fourth digit.

4 STS is the IOP status. The status consists of 2 digits. The first digit can be:

Digit	Description
A or B	Operational IOP
E or F	The IOP is operational and contains the loadsource DASD.

All other values indicates the IOP was not operating during IPL. The second digit can be:

Digit	Description
8	The IOP has DASD attached.
0	The IOP has no DASD attached.

Level 1—Input/Output Processors (IOPs) Entry

Field	Description
5	UA is the unit address of the IOP. The unit address is the local address used to identify the physical resource.
6	BLID is the base load ID. This ID is needed by an IOP during an IPL.
7	SERNO is the serial number. The serial number is a sequential number that is unique for each part of a given type.
8	TYPE is the feature number or type. The number or type functionally identifies the product.
9	STATT is the status. The status is determined from digit 1. The status can be:

Digit 1	Description
0	During an IPL, the IOP became inoperable. Other resources can become inoperable at any time.
8	The resource is operational.
9	The resource is operational and was the device that provided IPL data.

10	IOPNA is the number of level 2 entries (IOAs, storage controllers, or local workstations) attached to the IOP.
11	PRTNO is the part number.
12	IOPTY is the IOP subtype classification This field can have the following values:

Value	Description
S	This is the storage IOP subtype
C	Communications IOP subtype
W	Workstation IOP subtype
M	Multifunction IOP subtype. This allows for a storage and communications function to be on one card.

13	MODEL is the model number. The model number identifies the feature level of a product within a given type number.

Level 2—Input/Output Adapters (IOAs) and Storage Controllers Entry

Field Description

14 UA is the unit address of the IOA or storage controller attached to the IOP. The unit address is the local address used to identify the physical resource.

15 LV2DS is the IOA direct select address. This address is not applicable for storage controllers. This address consists of 4 digits. The bus number is the first two digits, the card number is the third digit and the board number is the fourth digit.

On cards that use book packaging, this direct select address is the same as the IOP direct select address.

16 LV2NA is the number of level 3 entries (communication ports or storage devices) associated with the level 2 entry (IOA or storage controller).

17 IOATY is the IOA or storage controller subtype classification. This field has the following values:

Digit	Description
S	This is a storage controller subtype.
I	This is a communications IOA subtype.

Level 2 for Local Work Stations and Level 3 for Storage Devices, or Communication Ports Entry

Field Description

18 UA is the unit address of the storage devices, local work stations, or communication ports configured or attached to the IOA. The unit address is the local address used to identify the physical resource.

```
    DISPLAY/ALTER/DUMP                            RCR PRINTOUT                        04/03/89  08:47:07   PAGE     5

RESOURCE CONFIGURATION RECORD
BUS  0000     IOP  0001

RCR HEADER ENTRY

1 LOAD    A0300000     3 IOPDS  0020            LOGBA  02             CID     00000104     4 STS    A0
2 TYP     6140

SEGMENT ADDRESS EXTENDER 0009
   A0010007 0210                     A0300000 00200200    000104A0 F6F1F4F0  00009002 06002000 *          ............6140........*

RCR LEVEL 1 IOP ENTRY

5 UA      FFFF             RESID  000E0000     8 TYPE   6140           RCTT   0             13 MODEL  001
6 BLID    A0300000       7 SERNO  08875067     9 STATT  8000        11 PRTNO  0000072X6374
  CDPTR   A0013500 0000    OBJCD  QCTL        10 IOPNA  0004        12 IOPTY  W

SEGMENT ADDRESS EXTENDER 0009
   90020600 2000    00000000 40D9C3D9  40D3C5E5 C5D340F1    40404040 FFFF0000  000E0000 F6F1F4F0 *.... RCR LEVEL 1     ........6140*
   90020600 2020    F0F0F0F1 A0300000  00000000 08875067    80000000 F0F0F0F0  F0F7F2E7 F6F3F7F4 *0001................0000072X6374*
   90020600 2040    0000F1F0 40000000  00000000 00000000    00000000 00000000  00000000 00000000 *..10 ............................*
   90020600 2060    00000000 A0013500  0000D8C3 E3D34040    40404040 00040500  90020500 080001E6 *..........QCTL      ...........W*
   90020600 2080    80000000 00000000  000E0000 F6F1F4F0    F0F0F0F1 A0300000  00000000 08875067 *............61400001............*
   90020600 20A0    00000012 F0F0F0F0  F0F7F2E7 F6F3F7F4    00000010 00000000  00000000 00000000 *....0000072X6374................*
   90020600 20C0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         16 LINES      90020600 20E0     TO      90020600 22C0     SAME AS ABOVE

RCR LEVEL 2 LOCAL WORKSTATION OR LEVEL 3 STORAGE DEVICE ENTRY

18 UA     0000             RESID  000060C6       TYPE   3180           RCTT   0                MODEL  002
  BLID    00000000         SERNO  00000000       STATT  8000           PRTNO
  OBPTR   A0013400 0000    OBJLD  QCONSOLE       IOPTY  W

SEGMENT ADDRESS EXTENDER 0009
   90020600 5800    00000000 40D9C3D9  40D3C5E5 C5D340F2    40404040 00000000  000060C6 F3F1F8F0 *.... RCR LEVEL 2     .......F3180*
   90020600 5820    F0F0F0F2 00000000  00000000 00000000    80000000 00000000  00000000 00000000 *0002............................*
   90020600 5840    0000F0F0 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *..00............................*
   90020600 5860    00000000 A0013400  0000D8C3 D6D5E2D6    D3C54040 E601C000  00000000 00000000 *..........QCONSOLE  W...........*
   90020600 5880    00000000 60C6F3F1  F8F0F0F0 F0F20000    00000000 00000000  00000000 00080000 *.....F31800002..................*
   90020600 58A0    000002FF 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
   90020600 58C0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         15 LINES      90020600 58E0     TO      90020600 5AA0     SAME AS ABOVE
   90020600 5AC0    00000000 00000000  00000000 00000000    00000000 00000000  0000              *.........................      *
                                                                                                                      R36B456-0
```

Note: Notice this record has 3 levels.

Figure 10-1. An Example of a RCR for a Twinaxial Work Station Controller

```
    DISPLAY/ALTER/DUMP                          RCR PRINTOUT                         04/03/89  08:47:07   PAGE     1

RESOURCE CONFIGURATION RECORD
BUS  0000     IOP  0000


RCR HEADER ENTRY

 1 LOAD   81748702     3 IOPDS  0010             LOGBA  01               CID    00000100        4 STS     EB
 2 TYP    2507

SEGMENT ADDRESS EXTENDER 0009
    A0010007 0200     81748702 00100100  000100EB F2F5F0F7    00009002 08000400                    *...........Y2507........      *

RCR LEVEL 1 IOP ENTRY

 5 UA     FFFF            RESID  00001280      8 TYPE    2507            RCTT    0              13 MODEL  001
 6 BLID   81740702      7 SERNO  08889001      9 STATT   8000         11 PRTNO   0000072X6373
   CDPTR  00000000 0000   OBJCD               10 IOPNA   0005         12 IOPTY   M

SEGMENT ADDRESS EXTENDER 0009
    90020600 0400     00000000 40D9C3D9  40D3C5E5 C5D340F1    40404040 FFFF0000  00001280 F2F5F0F7  *.... RCR LEVEL 1    ........2507*
    90020600 0420     F0F0F0F1 81740702  00000000 08889001    80000000 F0F0F0F0  F0F7F2E7 F6F3F7F3  *0001................0000072X6373*
    90020600 0440     0000F1F0 40000000  00000000 00000000    00000000 00000000  00000000 00000000  *..10 ...........................*
    90020600 0460     00000000 00000000  00000000 00000000    00000000 00050600  90020200 008001D4  *..............................M*
    90020600 0480     00000000 00000000  00001280 F2F5F0F7    F0F0F0F1 81740702  00000000 08889001  *............25070001............*
    90020600 04A0     0000007A F0F0F0F0  F0F7F2E7 F6F3F7F3    00000010 1200F2F1  C6F2F6F5 F5F2F1C6  *....0000072X6373......21F265521F*
    90020600 04C0     F2F6F5F3 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *2653...........................*
    90020600 04E0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *...............................*
                             15 LINES     90020600 0500     TO     90020600 06C0     SAME AS ABOVE


RCR LEVEL 2 IOA ENTRY

14 UA     01FF            RESID  00001288        TYPE    6100            RCTT    0                 MODEL  015
   BLID   00000000        SERNO  00010783        STATT   8800            PRTNO
15 LV2DS  0000         16 LV2NA  0001         17 IOATY   S

SEGMENT ADDRESS EXTENDER 0009
    90020600 0C00     00000000 40D9C3D9  40D3C5E5 C5D340F2    40404040 01FF0000  00001288 F6F1F0F0  *.... RCR LEVEL 2    ........6100*
    90020600 0C20     F0F0F1F5 00000000  00000000 00010783    88000000 00000000  00000000 00000000  *0015............................*
    90020600 0C40     0000F0F0 40000000  00000000 00000000    00000000 00000000  00000000 00000000  *..00 ...........................*
    90020600 0C60     00000000 00000001  02009002 020000C0    01E20000 00000000  00000000 00000000  *.................S..............*
    90020600 0C80     00001288 F6F1F0F0  F0F0F1F5 00000000    00000000 00010783  00000002 00000000  *....61000015...................*
    90020600 0CA0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *...............................*
                             16 LINES     90020600 0CC0     TO     90020600 0EA0     SAME AS ABOVE
    90020600 0EC0     00000000 00000000  00000000 00000000    00000000 00000000                     *........................      *

RCR LEVEL 2 LOCAL WORKSTATION OR LEVEL 3 STORAGE DEVICE ENTRY

18 UA     0100            RESID  00001290        TYPE    6100            RCTT    0                 MODEL  015
   BLID   00000000        SERNO  00010783        STATT   9800            PRTNO
   OBPTR  00000000 0000   OBJLD                  IOPTY   S

SEGMENT ADDRESS EXTENDER 0009
    90020600 3400     00000000 40D9C3D9  40D3C5E5 C5D340F3    40404040 01000000  00001290 F6F1F0F0  *.... RCR LEVEL 3    ........6100*
    90020600 3420     F0F0F1F5 00000000  00000000 00010783    98000000 00000000  00000000 00000000  *0015............................*
    90020600 3440     0000F0F0 40000000  00000000 00000000    00000000 00000000  00000000 00000000  *..00 ...........................*
    90020600 3460     00000000 00000000  00000000 00000000    00000000 E2014000  00000000 00000000  *.....................S. .........*
    90020600 3480     00000000 1290F6F1  F0F0F0F0 F1F50000    00000000 00000001  07830000 00020000  *......61000015..................*
    90020600 34A0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *...............................*
                             16 LINES     90020600 34C0     TO     90020600 36A0     SAME AS ABOVE
    90020600 36C0     00000000 00000000  00000000 00000000    00000000 00000000  0000               *..........................    *
                                                                                                                      R36B455-0
```

Note: Notice this record has only 2 levels.

Figure 10-2. An Example of a RCR for a Multifunction I/O Processor

RCR

Part 3. AS/400 Service Tools

Problem Handling

Chapter 11. Problem Handling Service Tools

Figure 11-1 shows an overview of some service tools that are available from the control panel when the system is not operating.

System Not Operating

The following must be operating on bus 0 to use DST:

- A disk containing licensed internal code (the load source disk).
- A display on port 0, address 0 or port 1, address 0 of the first work station controller or on port 0, address 0 of the second work station controller.
- A printer attached to the work station controller as needed by some service functions.

Control Panel — Place the keylock in Manual position. Select type A IPL, then start IPL (function 3). Press the Enter key.

IPL menu — Select the Work with dedicated service tools option.

Password prompt — Use the default password 22222222 or ask customer for reassigned password.

DST

- Perform an IPL
- Install operating system

  Note: For problems during install, select the option on the DST display that causes, the Install menu to appear.

- Work with licensed internal code
- Work with disk units
  - Work with disk configuration
  - Analyze disk device problem
  - Work with disk unit recovery
  - Work with disk unit information
- Work with DST environment
  - Work with active service tools
  - Select printer, tape, or diskette
  - Cancel operations and deallocate device
  - Change DST passwords
- Select DST console mode
- Start a service tool
  - Display/alter/dump
  - Vertical licensed internal code log
  - Trace vertical licensed internal code
  - Display hardware configuration
  - I/O debug utility
  - Print stand-alone dump (main storage dump)
  - Work with error log
  - Power off the system
- Perform automatic operation system install
- Work with save storage and restore storage

R36B471-1

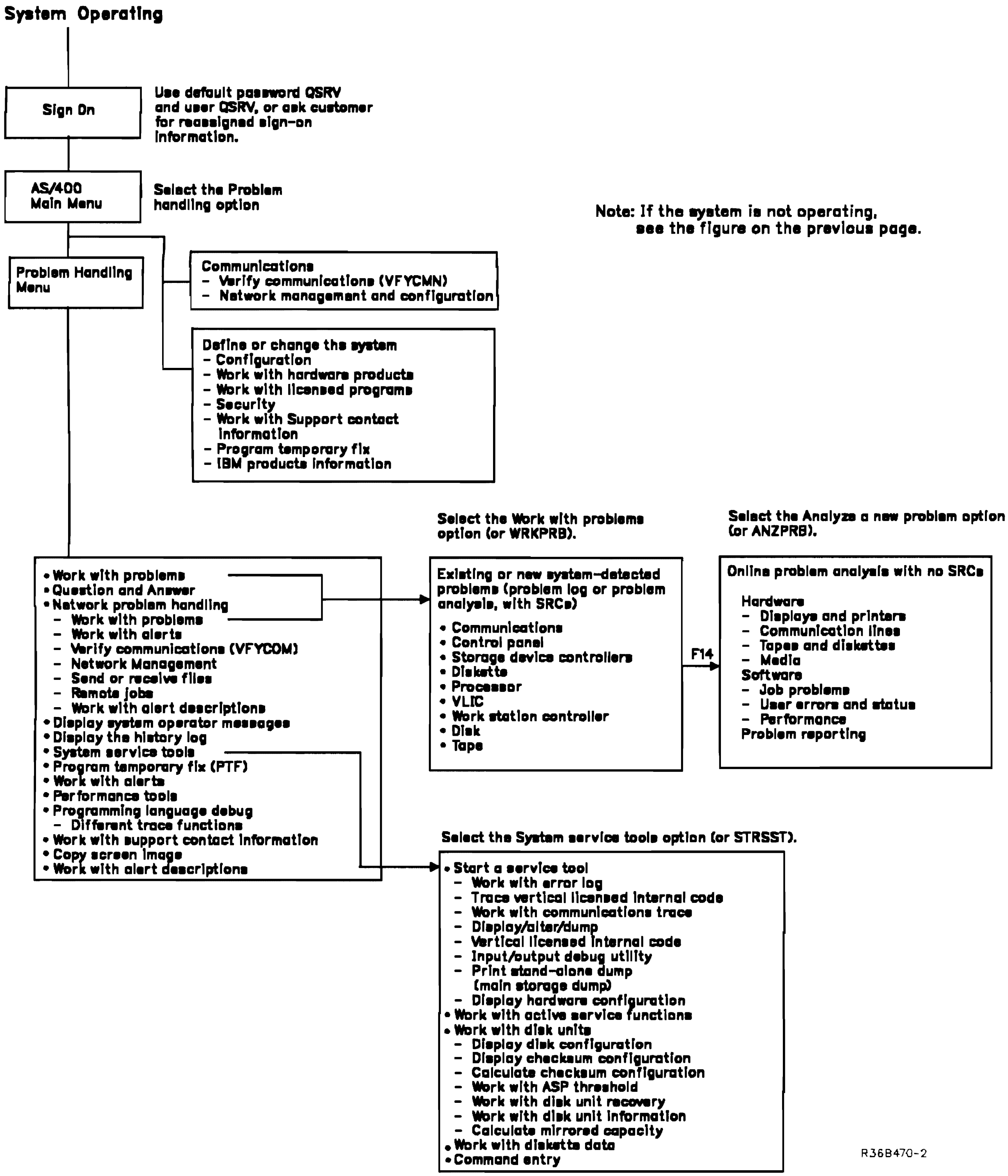
Note: If the system is operating, see the figure on the next page.

See Figure 13-1 on page 13-4 for more information about the DST menu flow.

Figure 11-1. An Overview of the Service Tools Available When the System is Not Operating

Figure 11-2 on page 11-2 shows an overview of some service tools that are available from the System Main menu when the system is operating. The options on the System Main Menu are described in this chapter are:

- Communications, see "Communications Verification" on page 11-3
- Define or change the system, see "Rack or System Configuration" on page 11-6
- Problem handling, see "Online Problem Analysis and Resolution" on page 11-7.



See Figure 11-3 on page 11-8 for more information about problem handling menu flow. See Figure 12-1 on page 12-2 for more information about the SST menu flow.

Figure 11-2. An Overview of the Service Tools Available When the System is Operating

Communications Verification

To verify communications on the AS/400 system:

- Select the *Verify communication link* option from the Communications menu. Select the *Communications* option from the System Main Menu.
- Enter the VFYCMN command on any command line.

Or,

- Select the *Verify communications* option from the Network Problem Handling menu.

The Verify Communications (VFYCMN) command may be used to:

- Verify and diagnose problems
- Concurrently report status of modems and communications lines
- Monitor modem interface signals
- Concurrently measure line signal parameters

This tool can help search for hardware problems that are not handled by the analyze problem (ANZPRB) command.

The communications verification command or option can be used to verify that the communications equipment (for example, communications adapter card) and the communications remote link work properly. The procedure can be used to test communications components starting with the communications input or output adapter right up to the remote modem.

Verify communications can be used to test the communications components, before using a line for the first time or in case of problems with a previously working line and configuration.

Verify and Diagnose Problems

You can:

- Verify the operation of the communications hardware and cables after installation.
- Diagnose communications hardware and cable problems when problem analysis cannot be run.
- Send test data to the remote equipment to verify end to end connnectivity.

Verify communications requests the name of a particular line for which tests should be run. When each test is run, only a pass or fail indication is given. The concurrent LPDA-2 tests return detailed information about the communications equipment and line. Additional problem isolation information can be obtained by running more than one test. For example, the cable test may fail, but to be sure that the cable is bad, the adapter card test must also be run. If it passes, the cable is bad; otherwise, the adapter card is bad.

The following tests are available:

Test — **Description**

Link — This test verifies that a complete communications operation is possible between devices. It is valid for SDLC, BSC, and X.25 protocols, but not the asynchronous protocol. It can be run on a token-ring and Ethernet networks. For SDLC or X.25, the system has to be primary (or negotiable).

This test lets you send data to a remote device using the SDLC, X.25, or BSC protocols. This test is particularly useful when testing multipoint lines. This test verifies that a specific terminal is working correctly without disrupting normal operation to the other terminals. To run this test, the line must be varied on and a connection must be established to the remote equipment because this test is done by the functional communications software. For the BSC protocol, a service representative may be needed to start the diagnostic programs at the remote equipment if the remote equipment is not an AS/400 system.

If this test fails and the other terminals on the line are working correctly. The remote device being tested, the working to that device, or the remote modem is not working correctly and should be repaired. If this test fails and all devices on this line are not working correctly, the modems, the cables, the terminals, and the local communications adapter card may be failing. To isolate the problem, run the communications I/O adapter test, the cable test, the local, and the remote modem tests.

Local Modem — This test verifies that the local modem is working correctly. This test compares data sent to the local modem with the data the modem sends back. The test checks the adapter card, modem cable and local modem.

To run this test, the local modem must support LPDA-1 or LPDA-2 diagnostics, V54 loop 3 diagnostics, or the IBM wrap capability. The MODEM parameter in the line description is used to determine which diagnostic program to use. The MODEM parameter options are: normal (not used for diagnostic support), V54, IBMwrap, IBMLPDA1, or IBMLPDA2.

Before the tests begin, the MODEM parameter in the line description is checked to see if the modems support the diagnostic programs using standard tests such as LPDA. Therefore, it is important to set this parameter correctly in the line description.

The communications line must be varied off because a diagnostic program is loaded into the communications adapter. When this test is running, the local modems run the link problem determination aid (LPDA-1 or LPDA-2) and CCITT V54 procedures. The diagnostic program replaces the programs that are used during normal operation.

If this test fails, the problem may either be in the cable or the local modem or the adapter card. To isolate the problem, the cable test and the communications adapter card test may need to be run. If this test passes, the communications adapter card, the modem cable, and the modem are working correctly.

Note: The modems that do not support LPDA-1 or LPDA-2 diagnostics may not be completely tested and may still be bad when the test is finished.

Remote Modem This test verifies that the remote modem is working correctly. This test sends data to the remote modem and compares the data sent with the data returned by the remote mode. The test checks local hardware, remote modem and the link between them.

To run this test, the remote modem must support LPDA-1 or LPDA-2 diagnostics and be attached to a nonswitched line. The MODEM parameter in the line description is used to determine which diagnostic program to use. The MODEM parameter options are: normal (not used for diagnostic support), V54, IBMLPDA1, or IBMLPDA2.

Before the tests begin, the MODEM parameter in the line description is checked to see if the modems support the diagnostic programs using standard tests such as LPDA. Therefore, it is important to set this parameter correctly in the line description.

The communications line must be varied off because a diagnostic program is loaded into the communications adapter. When this test is running, the remote modems run the link problem determination aid (LPDA-1 and LPDA-2) and CCITT V54 procedures. The diagnostic program replaces the programs that are used during normal operation.

If this test fails, the problem may either be the remote modem or the phone line; otherwise, the phone line and the remote modem are opearting correctly.

Cable This test verifies that the local modem cable is working correctly. This test needs a wrap plug to be connected to the communications cable. It compares the data sent to the wrap plug with the data received. The adapter card and the external cable is checked.

When this test runs, the line must be varied off because a diagnostic program is loaded into the communications adapter. The diagnostic program replaces the programs that are used during normal operation.

If this test fails, the problem may either be in the cable or the communications adapter card. To isolate the problem, run the communications adapter card test. If this test passes, the communications adapter card, the modem cable are working correctly.

Communications I/O Adapter
This test verifies that the communications input/output (I/O) adapter card is working correctly. This test needs a wrap plug on the I/O adapter card. When this test is running, the line must be varied off because a diagnostic program is loaded into the communications adapter. The diagnostic program replaces the programs that are used during normal operation.

If this test fails, the communications I/O adapter card is not working correctly and should be replaced. Sometimes, the associated processor card may not be working correctly. The processor card should be replaced if a new adapter card does not correct the problem. Some adapter cards have a built-in processor and do not have an associated processor card. Use the WRKHDWPRD command to determine if the the adapter card has an associated processor card. If this test passes, the communications I/O adapter is working correctly.

Communications interface trace
The purpose of this test is to monitor the modem interface signals and to detect use of the modem interface that is wrong or not compatible. This test displays five of the modem interface signals in a graphic format, showing the time relationship of the signals to each other.

This test monitors the following five modem interface signals:

Signal	Description
CD	Carrier detect The modem uses this signal to show the DTE that the modem is receiving an acceptable carrier signal. Because of hardware limits on short frame sampling, the CD signal may not be accurate. In this condition, an asterisk (*) takes the place of the sample data. The status is still correct.
CTS	Ready for sending The modem activates this signal in response to the Request To Send signal when it is ready to transmit data. When the CTS signal is active, the DTE can send data on the transmitted data line. CTS delay is the time between the RTS signal active condition and the CTS signal active condition. On most nonswitched telephone line modems, there are three CTS delay options, ranging from 0 to 250 milliseconds (ms). Switched telephone line modems, operating in half-duplex mode, are normally set for 150 to 250 ms of CTS delay.
DSR	Data set ready For nonswitched telephone lines, the active DSR signal shows that the modem is powered-on and ready to transmit and receive data. For switched telephone lines, the active DSR signal shows that the modem is connected to the telephone line and is ready to transmit data.
DTR	Data terminal ready Data terminal equipment (DTE) uses this signal to show the modem that the DTE is ready to transmit and receive data.
RTS	Request to send DTE uses this signal to activate or deactivate the modem's modulator lines. If the DSR signal is active, the RTS signal causes the modem to activate the carrier signal.

Concurrent LPDA-2 Tests

This option runs the Verify Link supporting LPDA-2 (VFYLNKLPDA) command. The concurrent LPDA-2 tests let you retrieve information from the data circuit-terminating equipment (DCEs). DCEs may be analog (modems) or digital (data service unit or channel service units, DSU/CSUs). Information can be obtained from four tests:

- DCEs and line status
- DCEs and line test
- Analyze line
- Send/receive test

LPDA-2 tests can be run on a line while applications are actively using that line. The tests do not disrupt communications but will temporarily slow the data transfer.

The following restrictions apply to these tests:

- The DCEs must support LPDA-2.
- Tests may be run only on nonswitched synchronous data link control (SDLC) lines.
- For multiport DCEs, the DCEs and Line Status command will be nondisruptive. The other LPDA-2 tests may be disruptive.
- Tests cannot be run on an active secondary line. A line is secondary if its data link role is either secondary or is negotiable and has negotiated to secondary. A line is active if a controller description under that line is varied on.

The **DCEs and line status** and the **DCEs and line test** options are two modes of the same LPDA-2 request. DCEs and Line Status reports parameters which are monitored by the local and remote DCEs during normal communications. The DCEs and line test reports these parameters in addition to running internal tests and reporting the results. This test is sent over the communications line to the remote DCE at a slower transmit speed, if poor line conditions are causing problems at normal speed.

The DCEs and Line Status/Test commands return the following information:

- Configuration summary

  This includes DCE type and model, address, operating mode, transmit speed, network function, LPDA-2 code level, switched network backup (SNBU) status, data terminal equipment (DTE) interface connection, and installed features.

- DCEs and line parameters

  This includes receive level, number of received line signal detector (RLSD) losses, line quality, number of line errors, ages of remote DCE power-off and failure, ages of local DCE reinitialization and error conditions, DCE idle condition, base DCE in error, and features in error.

- Remote DCE interface status

  This reports the current status and previous activity of the signals on the DTE interface lines attached to the remote DCE. The DCE monitors the following signals: request to send, clear to send, transmit data, receive data, received line signal detector, data signalling rate selector, data terminal ready, DTE power loss detected, and test control.

The **Analyze line test** can be run only on analog DCEs (modems). The test causes the modems to exchange test patterns on the line. The modems measure parameters of the analog signals. The modems report frequency shift, 2nd and 3rd harmonic distortion ratios, signal to noise ratio, phase jitter, receive level, transmit level, and round trip delay time. Also reported are modem type and model, address, number of line errors and RLSD losses, and transmit speed. The modem returns acceptable limits for some of the parameters.

The **Send/receive test** causes the DCEs to exchange several blocks of test patterns and track the errors that occur during transmission. It reports DCE type and model, address, transmit speed, signal lost condition, worst line quality, number of line errors, and the number of blocks sent, received, and in error.

Rack or System Configuration

The rack configuration list (RCL) is a good source to find the plug location of a card when the address or the resource name is known.

To define or change the system or rack configuration, select the *Define or change option* from the System Main Menu. The Define menu is displayed. The Define menu has an option for the WRKHDWPRD command. This option displays a menu where you can select the work with rack configuration list on the 9406 System Unit or the system configuration list on the 9404 System Unit.

After changes are made to the rack configuration, the service representative must first change the rack configuration data by selecting the *Work with rack configuration* option from the Work with Hardware Products menu. The rack configuration list should be printed and checked for accuracy. Then, the data should be saved to a file and to a save tape or diskette.

For more information about managing a rack or system configuration, see Chapter 7. For more information about solving configuration problems, see Chapter 10 on page 10-1. To display or change system values, see "System Values" on page 19-5. Also, see the applicable *Service Guide*, and the *Operator's Guide*.

Saving the Rack Configuration Data

To save rack configuration data:

1. Select the *Copy rack configuration* option from the Work with Hardware Products menu. The QASURACK and QUSRSYS file and library names appear on the next display.
2. Override the QUSRSYS and QASURACK file names but do not override these names with the QSYS or QGPL library names. For consistency, use the default names whenever possible.
3. Press the Enter key when the file and library names are what you want. A message appears stating that the rack configuration has been copied.
4. Enter the SAVLIB or SAVOBJ commands to save the data to an alternate media.

Restoring the Rack Configuration Data

If the system resource management database (RMDB) is damaged, the program which maintains the machine reported information restores part of the data contained in the database. The following procedure must be used to restore the rack configuration data.

1. Enter the RSTOBJ command to restore the previously saved file from the alternate media. This is only needed if the file no longer exists on disk.
2. Select the *Replace rack configuration* option from the Work with Hardware Products menu. The QASURACK and QUSRSYS file and library names appear on the next display.
3. Override the QUSRSYS and QASURACK file names with the names you used when the file was copied.
4. Press the Enter key when the file and library names are what you want. A message appears stating that the rack configuration has been replaced.

This process may be completed only if no devices have been added, and if no cards have been added or moved since the time the file was copied. This process still works if feature cards have been replaced with cards of the same type in the same card slot, or if devices have been replaced with devices of the same type and model.

Online Problem Analysis and Resolution

Figure 1-3 on page 1-4 and Figure 1-4 on page 1-5 show an overview of online problem analysis and its relationship to problem management. Problem analysis and resolution is used to prepare problems to be reported either through voice or Electronic Customer Support (ECS). Figure 1-8 on page 1-8 shows an overview of ECS.

Online problem analysis manages system detected and user detected errors. Online problem analysis includes, when possible, problem resolution. Problem analysis provides tools for isolating, repairing, and reporting problems and it can run concurrently with other user programs. This means that problem analysis allows part of the system to be reserved from customer use for analyzing and solving problems while leaving the other part of the system available for customer use.

Online problem analysis consists of the following:

- The Work with Problems (WRKPRB) command to work with existing problems and the Analyze a Problem (ANZPRB) command to analyze a user-detected problem.
- Displays that direct the user through problem determination procedures. Options are available to:
  - Work with existing problems

    This option and the WRKPRB command are used to view the problem log. Problems can be dispalyed, analyzed, or reported to a service provider.
  - Analyze a new problem

    Analyze a new problem may be invoked when the user detects a problem that has not been detected by the system. The Analyze a New Problem displays are designed to solve problems, isolate problems to a failing component, or generate a symptom string for reporting to your next level of support. A symptom string is generated for a program error that is later used by the service support system to determine if the program problem already has any PTF available.

  Note: The ANZPRB command is the same as pressing the F14 (Analyze Problem) key on the Select Problem display.
- A problem log that contains system problem messages and the status of each problem. For more information about the problem log, see page 15-10.
- Reports used to report problems to the service support system. For more information about the service support system, see page 11-12.

ANZPRB Command: The Analyze Problem command is used to generate a user detected problem. For example, ANZPRB can be used to to analyze or report:

- Slow system or poor response time problems
- Incorrect output problems
- Communications problems that have no SRC
- Job or programming problems
- Equipment or hardware problems
- Problems that make it necessary to do an IPL of the system again
- Problems on a device or system not attached to the local system.

The analyzing problem menus and options and the ANZPRB command take you through a series of questions and checklists to determine or isolate the user-detected problem. During analysis, additional testing may be suggested using the Verify Communications (VFYCMN) command.

At the end of problem analysis, an alert can be sent and/or a service request can be prepared. When a service request is made for a user-detected problem, the service support system is searched for existing PTF's for the symptoms that were gathered for the problem. If a fix for the problem is found in the service support system, the PTF is given to the customer. If no problem is found, the problem is given to the next level of support for additional problem analysis and resolution.

You can do problem analysis remotely from another AS/400 system using the Systems Management Utilities licensed program product. See the *Systems Management Utilities User's Guide* for more information.

Menu Flow

Figure 11-3 and Figure 11-4 on page 11-9 show the overall structure of problem handling use for online problem analysis and resolution.

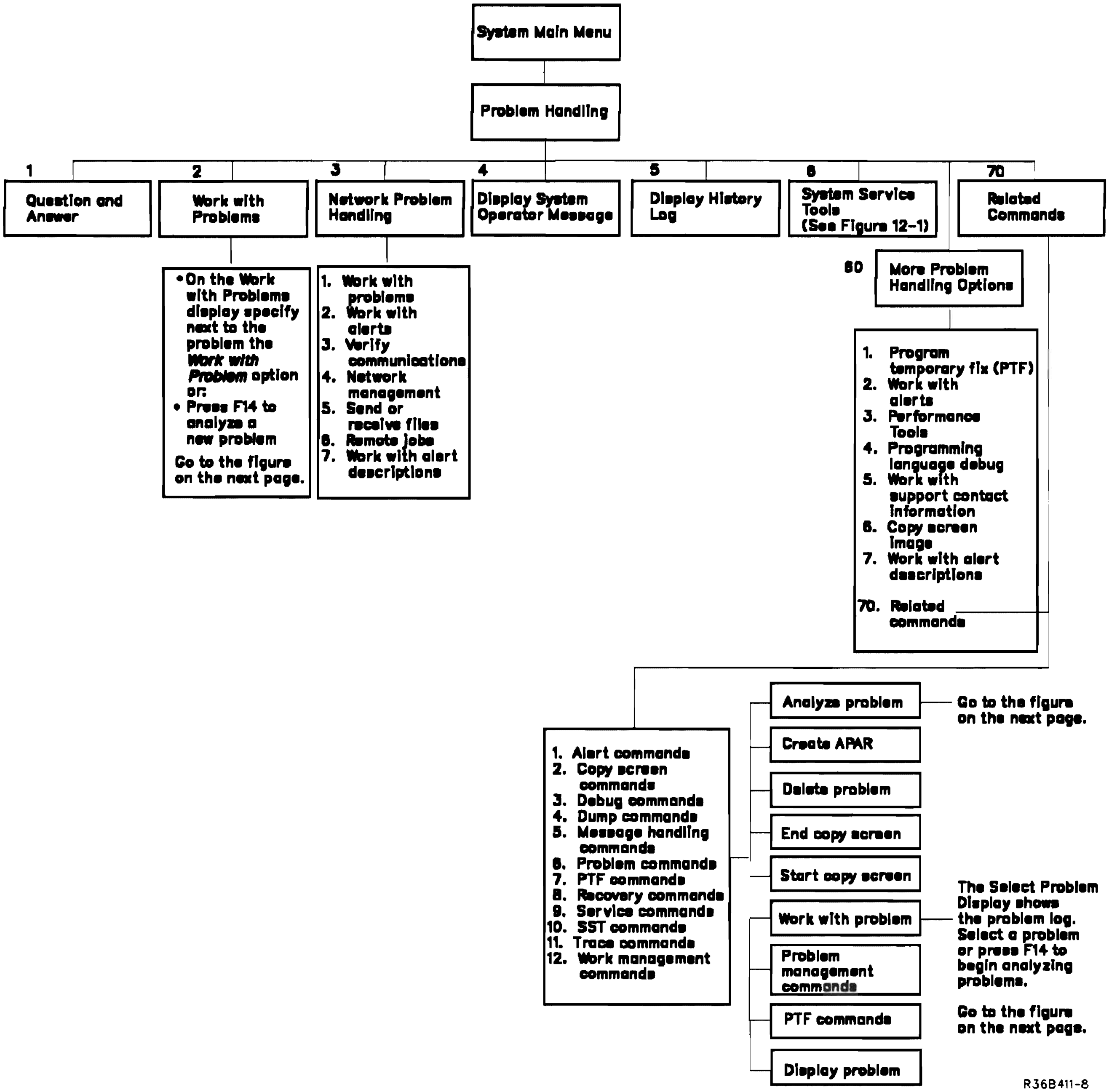


Figure 11-3. Problem Handling Menu Flow

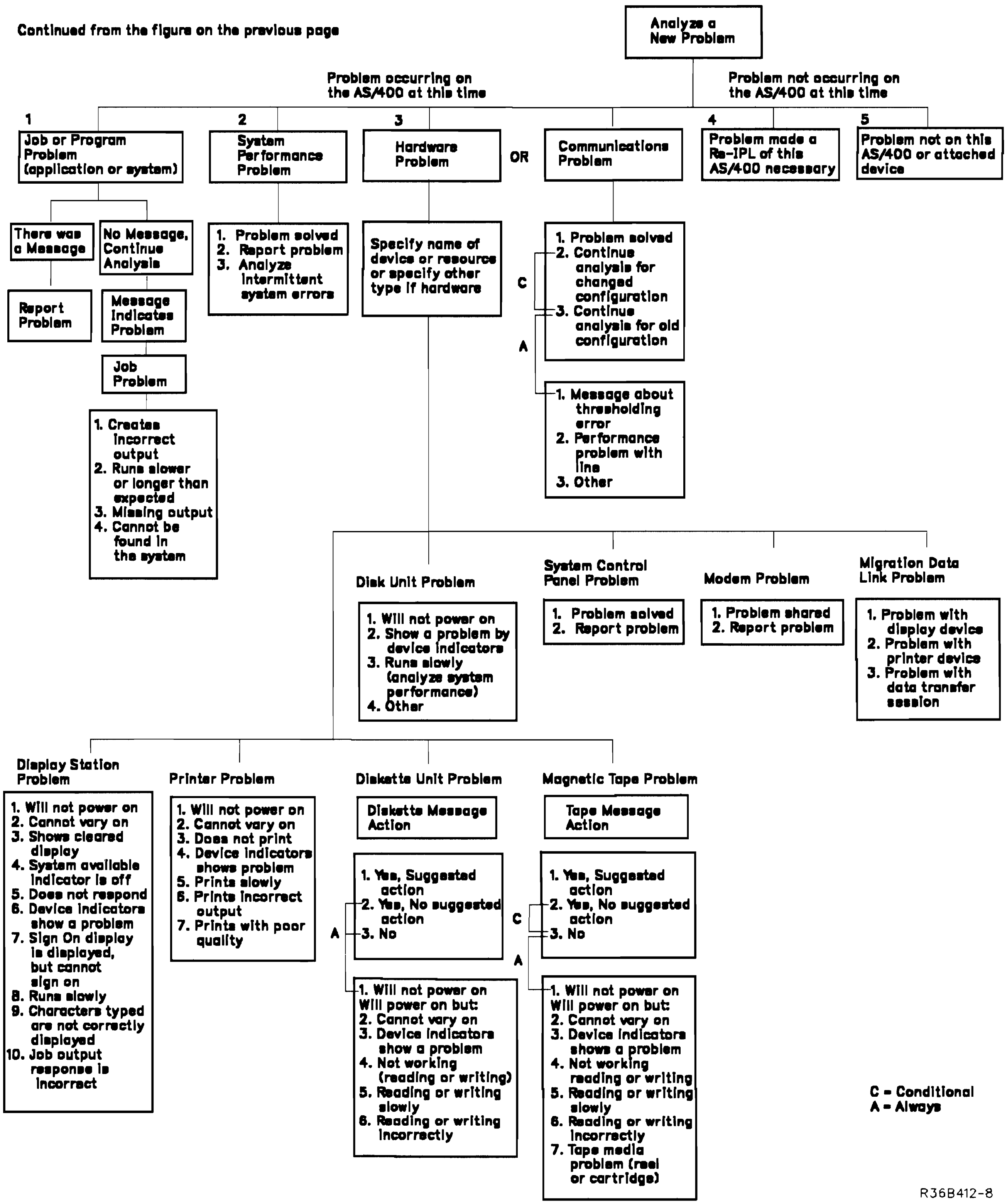


Figure 11-4. Analyze a Problem Menu Flow

Problem Handling

Problem Handling Options

1. Question-and-answer (Q & A)

   For more information about this option, see "Question-and-Answer Function" on page 11-15.

2. Work with problems

   For more information about this option, see "How to Work with Problems."

3. Network problem handling

   For more information about this option, see: "Network Problem Handling" on page 11-16.

4. Display system operator messages

   For more information about this option, see "Messages" on page 3-5 and the *Operator's Guide*.

5. Display history log

   For more information about this option, see "History Log" on page 15-8.

6. System service tools (SST)

   For more information about this option, see Chapter 12.

60. More problem options

    For more information about the Copy screen image option on the second Problem Handling display, see "Copy Screen Image" on page 11-19.

70. Related commands

    This option gives you an alternative way to work with or analyze a problem. Selecting this option causes the Problem Management Commands menu to appear. To work with or analyze a problem, select the *Problem commands* option. The Problem Commands menu appears. From the Problem Commands menu select the *Work with a problem* or *Analyze a problem* option. Other options are available to create APARs and to use PTF commands.

For more information about problem handling, see the *Operator's Guide*.

How to Work with Problems

Figure 11-5 on page 11-11 shows an overview of how to work with problems when you are signed on to the system.

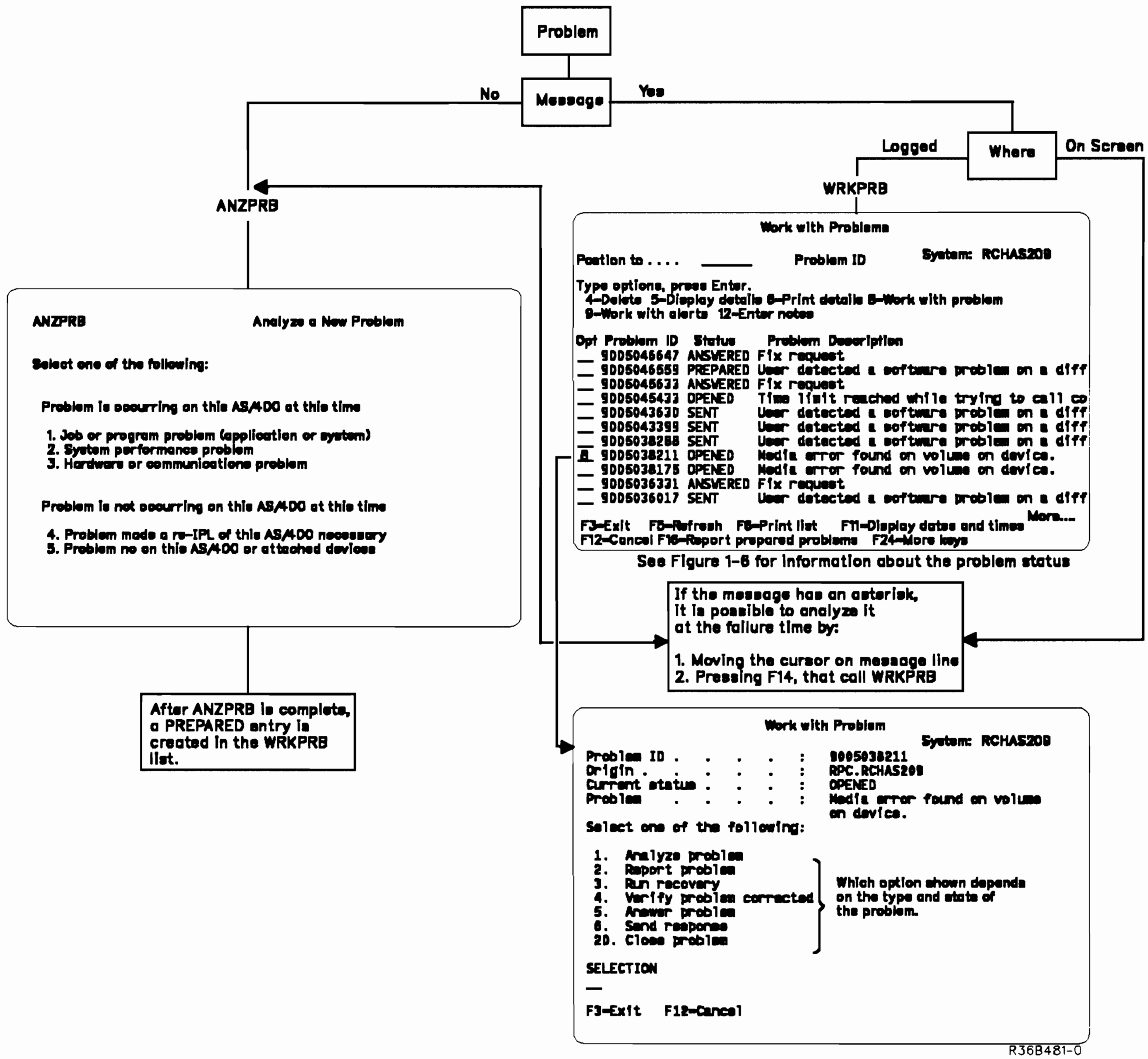


Figure 11-5. An Overview of How to Work with Problems When Signed On to the System

To solve new or existing system or user detected problems, do the following:

For New Problems: Online problem analysis can be started:

- From viewing a system detected error message that has an asterisk (*) in front of it and its associated second-level text shown on the System Operator's Message Queue display using the F14 (Problem Analysis) key.
- By entering the Analyze Problem (ANZPRB) command on any display with a command line.
- By entering GO PROBLEM on any display with a command line.
- By selecting the *Related commands* option on the second Problem Handling menu. Then select the *Problem commands* option on the Problem Management Commands menu. Finally, select the *Analyze problem* option on the Problem Commands menu.
- By selecting the *Work with problem* option on the first Problem Handling menu. The Select Problem display (sometimes referred to as the problem log display) appears. From the Select Problem display, press F14 (Problem Analysis).

  For more information about the problem log, see page 15-10.

For Existing Problems: Online problem analysis can be started by:

- Entering the Work with Problem (WRKPRB) command on any display with a command line.
- Entering GO PROBLEM on any display with a command line.
- Selecting the *Problem handling* option from the System Main Menu. Then select the *Work with problems* option from the Problem Handling menu. The Work with Problems display appears.

  For more information about the problem log, see page 15-10.
- Selecting the *Related commands* option on the second Problem Handling menu. Then select the *Problem commands* option on the Problem Management Commands menu. Finally, select the *Work with problems* option on the Problem Commands menu.

Almost every display used for running problem analysis using the WRKPRB or ANZPRB commands, has Help available. Many problem analysis displays have more than one Help display.

Before doing any problem analysis, the message queue must be in *BREAK mode. After pressing the F14 key, problem analysis starts the necessary problem isolation procedure to find the problem. A list of possible causes is displayed. You are then requested to place a service call to report the problem.

You can report a problem by selecting options from the problem analysis displays or the Work with Problems display. If entered by the Send Program Temporary Fix Order (SNDPTFORD) command, the user can request a specific fix or PTF, data about current problems, or a preventive fix or PTF package. For more information about PTFs, see "Problem Circumvention and Repair" on page 2-3.

The user can delay handling or responding to the problem until later. At the later time, the error message or messages on the message queue or the problem log entry can be displayed.

The description of the problem in the problem log entry is the same one (without message replacement text) that is sent to the QSYSOPR MSGQ. The error log ID in the problem log can be displayed to confirm a match.

While analyzing a new problem, the altered or prepared a service requests can be sent to the service support system. Otherwise, a service request can be prepared for a specific hardware or software problem and defer sending it to the service support system at a later time. Information on preparing a service request can be found in the *Operator's Guide*.

Service Support System: When problem analysis is completed, the customer is given the option of reporting the problem. For many problems, analysis results are presented as a field replaceable part (FRU). Other analysis procedures make a symptom string to be reported with the problem. Figure 1-5 on page 1-6 shows an overview of how a system problem is reported to the service support system.

A problem that has been isolated through the online problem analysis functions can be reported by selecting the *Report* option from the Work with Problem menu. This option causes the system to automatically start a communications session with the IBM service support system. You can either request service or report machine and program problems to the IBM service support system, and you can order corrective and preventative fixes. No direct interaction between the user and the IBM support system is needed.

Note: Problems can also be reported to service providers other than IBM.

The IBM service support system is an information retrieval system designed to make critical service information readily available to personnel in branch offices and field support locations throughout the world. The data bank of the service support system contains information about hardware and software problems relating to IBM products. Information is added to this data bank continuously so that it reflects the current status of problems.

The IBM service support system provides a sophisticated search facility which allows retrieval of problems that is based on a search argument consisting of one or more words. These words are not restricted to specific fields but can reside anywhere in the problem record. Also, the service support system provides facilities for entry of new problems, for answering and closing of existing problems, and for sending messages to remote locations throughout the world.

Problems are recorded and tracked in the service support system as APARs, LICTRs, hardware incidents, and tips. See Chapter 6 for information about submitting an APAR.

Providing Support from a Remote Location: You can analyze and assist with problems on an AS/400 from a stand-alone remote work station attached to the system. You can also do this from a remote work station that is attached to the system using pass-through. You can do this using the Start Remote Support (STRRMTSPT) and End Remote Support (ENDRMTSPT) commands. These commands can only be entered by the person requesting support.

Use the STRRMTSPT command to create and vary on all the configurations needed for remote support. All configuration objects created by this command are destroyed and new objects are created the next time you enter the STRRMTSPT command.

To allow remote support from a remote location, do the following:

1. Enter the STRRMTSPT command from any location except from the remote work station that is going to access the system. The Start Remote Support display appears.
2. Enter on the Start Remote Support display the:
   - Device class

     The device class can be:

     *VRT This class indicates that the remote person connects using pass-through. If you specify this class, you must specify the:

     - Remote location name of the remote work station

       This value must match the local location name in the APPC device description on the support system. QREMOTE is the default local location name at the remote support system.
     - Local location name of the local work station

       This value must match the remote location name specified in the APPC device description on the support system. QLOCAL is the default remote location name at the remote support system.

     *RMT This class indicates that that the remote person connects using a stand-alone remote work station. Do not specify a remote or a local location name.

     The remote hardware used for *RMT could be:

     - A 5294 Model 1 Controller with a display and a printer attached
     - A PC running with remote 5250 emulation (emulates a 5294 Model 1 Controller with a display and a terminal)

     The remote hardware used for *VRT could be:

     - An AS/400 that uses display station pass-through
   - Device type of the remote work station
   - Model number of the remote work station
   - Station address

     This address defaults to FE. Two controllers cannot be created on a system with the same station address or exchange ID. This parameter can be changed to produce a unique station address or exchange ID combination. The remote support controller must also change if the station address default is not taken.
3. Provide the remote location with phone number used to dial the system.
4. Provide the remote location with a valid user ID and password when the Sign On display appears at the remote work station.

   Note: Copy screen image can be used to view the system's displays from a remote location. A user ID or password is not needed if copy screen image is used.
5. Ensure that the remote work station is signed off before this command attempts to vary off that work station.
6. Enter the ENDRMTSPT command to clean up an ended remote session. Enter this command from any work station except from a remote work station. This command deletes the configuration objects created by the STRRMTSPT command after finishing the vary off sequence. Enter the ENDRMTSPT command to restore all ECS functions that were made inactive by the STRRMTSPT command. ECS remains inactive until you enter the ENDRMTSPT command.

The following objects are created by the STRRMTSPT command:

Object	Description
QTIRMTLIN	Line description (SDLC switched)
QTIRMTCTL	Controller description
QTIRMTDSP	Display description
QTIRMTPRT	Printer description
QTIPASLIN	Line description (SDLC switched)
QTIPASCTL	Controller description
QTIPASDEV	Device description
QTIVRTCTL	Virtual controller description
QTIVRTDSP	Virtual display description

QTIPASLIN, QTIPASCTL, QTIPASDEV, QTIVRTCTL, and QTIVRTDSP are only created when you specify the device class as *VRT. *VRT indicates you are using pass-through.

The following commands are used to create the configuration objects for a remote work station (*RMT):

```
CRTLINSDLC   LIND(QTIRMTLIN) RSRCNAME(LIN011)
             ONLINE(*NO) ROLE(*PRI) CNN(*SWTPP)
             EXCHID(05600000) MAXCTL(1)
             SWTCNN(*ANS) DUPLEX(*HALF)

CRTCTLRWS    CTLD(QTIRMTCTL) TYPE(5294) MODEL(1)
             LINKTYPE(*SDLC) ONLINE(*NO)
             SWITCHED(*YES) SWTLINLST(QTIRMTLIN)
             EXCHID(056000__)
             INLCNN(*ANS) STNADR(__)

CRTDEVPRT    DEVD(QTIRMTPRT) DEVCLS(*RMT) TYPE(5356)
             MODEL(3) LOCADR(01) ONLINE(*NO)
             CTL(QTIRMTCTL) MAXLENRU(*CALC)

CRTDEVDSP    DEVD(QTIRMTDSP) DEVCLS(*RMT) TYPE(_____)
             MODEL(_____) LOCADR(00) ONLINE(*NO)
             CTL(QTIRMTCTL) MAXLENRU(*CALC)
```

The following commands are used to create the configuration objects for remote work station attached using pass-through (*VRT):

Problem Handling

CRTLINSDLC	LIND(QTIPASLIN) RSRCNAME(LIN011) ONLINE(*NO) ROLE(*SEC) CNN(*SWTPP) EXCHID(05600000) SWTCNN(*ANS) STNADR(__) DUPLEX(*HALF) MAXCTL(1)
CRTCTLAPPC	CTLD(QTIPASCTL) LINKTYPE(*SDLC) ONLINE(*NO) SWITCHED(*YES) APPN(*NO) SWTLINLST(QTIPASLIN) RMTNETID(*NONE) EXCHID(05600000) INLCNN(*ANS) ROLE(*PRI) STNADR(___)
CRTDEVAPPC	DEVD(QTIPASDEV) RMTLOCNAME(_____) ONLINE(*NO) LCLLOCNAME(_____) RMTNETID(*NONE) CTL(QTIPASCTL) MODE(LU62) APPN(*NO)
CRTCTLVWS	CTLD(QTIVRTCTL) ONLINE(*NO)
CRTDEVDSP	DEVD(QTIVRTDSP) DEVCLS(*VRT) TYPE(_____) MODEL(_____) ONLINE(*NO) CTL(QTIVRTCTL) KBDTYPE(*SYSVAL)

Use the appropriate display command to view the configuration. Check to see if the remote configuration matches the local configuration. Specify the correct name of the device. The previously listed configuration objects are the names of the devices.

For more information about these and other commands, see the *CL Reference*.

Index Search

When you are having difficulty running the system, index search allows you to search on online glossary of terms and functions. Index search has step-by-step instructions for key system procedures.

How to Use: Index search can be started by pressing a function key on a help display, from an option on the problem handling menu, or by entering the STRINDSCH command.

Index search allows you to tell the system to search for specific information. Once you are in index search, type the phrase or words to search for and then press Enter. When you press Enter, the system searches for topics related to the words you supplied and displays a list of topics found. If you press Enter without typing anything, the system displays a list of all available topics.

Besides index search, Figure 11-6 on page 11-15 shows how to get online help. Extended help is available only when you are not using SST, DST, PAR, or other service functions. See the "About This Manual" on page v for more information about online help.

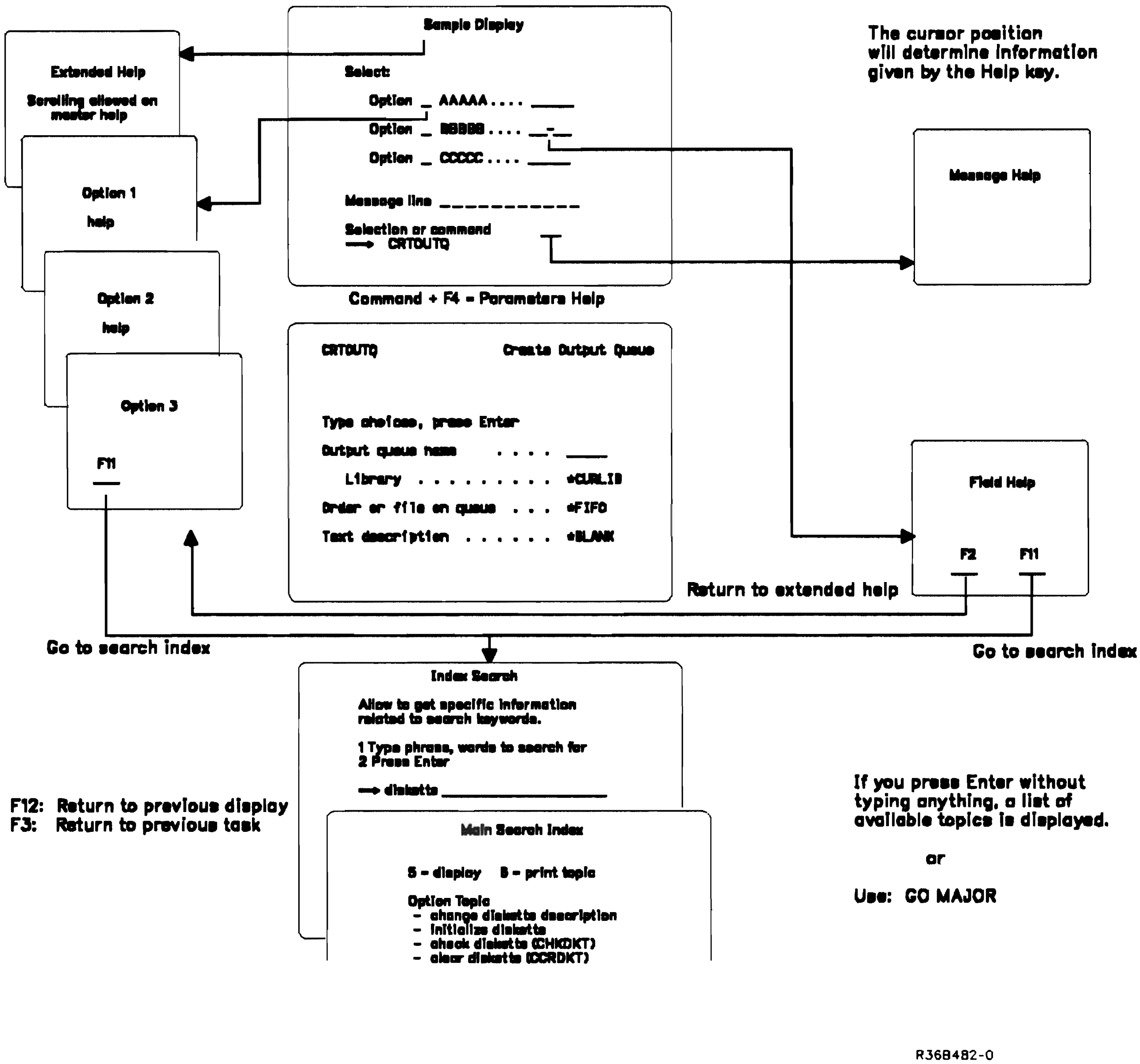


Figure 11-6. An Overview of How to Get Online Help

Question-and-Answer Function

The question-and-answer (Q & A) function provides answers to questions that you may have. The supplied Q & A database contains frequently asked questions and answers about the AS/400 system and supported software products.

Q & A gives you access to information stored as questions and answers on either a local or remote system. Questions and answers may be supplied by anyone. After searching for an answer, questions may be submitted by the general user to a Q & A coordinator who can answer the question and if desired, add the question, with its answer, to the Q & A database. The Q & A coordinator can also submit questions to a remote Q & A database of another AS/400 system.

How to Use: To use the Q & A, press F13 (User support) on any system menu to show the User Support menu. Then select the option to use the question-and-answer function. Also, Q & A can be started by options from system menus, directly by using the Start Question-and-Answer (STRQST) command, or by using one of the more task directed commands. The user is prompted by a series of menus and displays to complete one or more of the following Q & A database tasks:

- Search/ask
- Work with questions that you asked
- Load the database on the system
- Work with a Q & A database

The Q & A coordinator can complete one or more of the following tasks:

1. Search/ask
2. Work with questions that you asked
3. Answer/publish
4. Load database on the system
5. Create Q & A database for distribution
6. Delete locally added questions
7. Work with a Q & A database
8. Work with candidate questions
9. Edit

The sequence of searches should be as follows:

1. Search the local database (including the customer's own database)
2. If the answer is not found, submit a question to the central site.
3. The central site may be connected to an organization that provides the installation with application software and/or takes orders for equipment and software. The central site can escalate the query to this support organization if they offer access to their Q & A database.
4. If the support organization cannot find an answer, the question can be escalated to your next level of support.

Since Q & A uses APPC, it can share an existing APPC connection between a remote site and the central site. The person who entered the original question, sees only the status of the question up to one level. If the problem is escalated beyond one system, pass-through must be used to view the status.

System security is used, so the security officer can control, by task and database, authorization to use a given Q & A database. For more information about Q & A, see the *System Operations: Question-and-Answer Database Coordinator's Guide*, SC21-8086 as described in the *Information Directory*.

Network Problem Handling

Options: The Network Problem Handling menu has the following options:

- Work with alerts
- Communications verification, see page 11-3
- Work with alert descriptions, see page 11-18

For more information about alerts, see the *Operator's Guide*, and the *Communications and Systems Management User's Guide* as described in the *Information Directory*.

Work with Alerts: You can use this option to view alert messages from other systems. An alert is an SNA architected message that is sent from one system in a communications network to a central network management sight called the problem determination focal point. Figure 1-3 on page 1-4 shows how alerts relate to problem management.

The alert facility is part of the operating system. The alert facility can be used to manage the network. The focal point is a network node that is the destination of the alerts. The AS/400 system can be the central focal point for problem management. The central focal point can also receive alerts. Together, the alert facility and the network management tools control the communication network from a central point.

You can work with alerts entering the WRKALR command or by selecting the *Work with alerts* option from the Network Problem Handling menu.

The option or command displays all logged alerts. You can filter the number of alerts displayed by period (date and time), by alert type (local, received, or held), and by resource name or type. For more information about the WRKALR command, see the *CL Reference* and the *Communications and Systems Management User's Guide*.

After entering the command or selecting the *Work with alerts* option, the following display appears:

```
                          Work with Alerts                    RCH38377
                                                      03/26/90  09:51:39
Type options, press Enter.
  4=Delete   5=Display recommended actions   8=Display alert detail

     Resource
Opt  Name       Type  Date   Time   Alert Description: Probable Cause
     RCHAS209   CP    03/26  08:46  Undetermined error: Undetermined
     RCHAS209   CP    03/26  08:46  Undetermined error: Undetermined
 5   RCH38377*  DSP   03/26  08:02  Workstation subsystem failure: Workstation
     RCH38377*  DSP   03/26  08:02  Device error: Display
     RCH38110*  RNG   03/26  07:51  Token-ring temporary error: Local token-ring
     RCH38110*  RNG   03/26  07:51  Token-ring temporary error: Local token-ring
     RCH38377*  LU    03/26  07:25  Unable to communicate with device: Device
     RCH38377*  LU    03/26  07:25  Unable to communicate with device: Device
     RCH38377   CP    03/26  08:06  Software program error: Software program
     RCH38377*  LU    03/25  16:47  Device error: Display/printer
     RCH38377*  LU    03/25  16:47  Device error: Display
     RCH38377*  LU    03/25  16:47  Device error: Display/printer
     RCH38110*  RNG   03/26  07:51  Token-ring temporary error: Local token-ring
                                                                   More...
F3=Exit   F10=Show new alerts   F11=Display problem IDs      F12=Cancel
F13=Change attributes           F21=Start automatic refresh  F24=More keys
```

Figure 11-7. An Example of a Work with Alerts Display

Note: The resource name that appears in the Work with Alerts display is the lowest resource in the hierarchy unless the name is followed by an asterisk (*). If the resource name is followed by an asterisk, the resource name displayed is not associated with the resource type next to it. The resource name becomes the lowest resource and the resource name displayed is for a resource that is higher up in the hierarchy. For example, RCH38377* DSP indicates that there is a resource (a display) connected to the system RCH38377 that is failing.

Options: The following options can be entered next to the alert shown on the Work with Alerts display:

Option	Description
4	Deletes an alert.
5	Displays recommended actions for solving the problem. Selecting this option causes the Display Recommended Actions display to appear.
8	Displays detailed information about the alert. Selecting this option causes the Display Alert Detail display to appear.

Display Recommend Actions: Entering a 5 next to an alert on the Work with Alerts display, displays the recommended actions for the alert. The following is an example of the Display Recommended Actions display:

```
                       Display Recommended Actions                 RCH38377
                                                          03/26/90  09:51:39
----------Resource Hierarchy-----------
  Resource Name        Resource Type
    RCH38377              CP
    CTL02                 LC
    CTL02060              DSP


Failure causes  . . . . :   Display
                            Loadable workstation controller microcode
                            Workstation controller
Actions . . . . . . . . :   Perform AS/400 problem determination procedures
                            Perform problem determination procedure at the
                              reporting location for Log record number
                              9000527617
                            Contact service representative for AS/400
                            Report the following
                                                                    More...
Press Enter to continue.

F3=Exit   F12=Cancel   F17=Display detail
```

Figure 11-8. An Example of a Display Recommended Actions Display

The following fields on the Recommended Actions Display are described:

Cause In this field, one or more of the following causes are displayed: user cause, install causes, and failure causes. For alerts received from System/38 or System/36, the cause field always shows *cause undetermined* and the Alert Details Display is used to provide more information.

Actions This field provides information to run problem analysis using the ANZPRB command, display the history log using DSPLOG QHST command, look or respond to the system message on the orginating system using the DSPMSG QSYSOPR command, or run problem determination procedures on the system that created the alert.

Display Alert Detail: Entering an 8 next to an alert on the Work with Alerts display, displays the detailed information about the alert. The following is an example of the Display Alert Detail display:

```
                        Display Alert Detail                        RCH38377
                                                          03/26/90  09:51:39
----------Resource Hierarchy-----------
  Resource Name         Resource Type
    RCH38377              CP
    CTL02                 LC
    CTL02060              DSP


Logged date/time . . . . . . :   03/26/90  08:02:43
Problem date/time  . . . . . :   03/26/90  08:02:38
Alert type . . . . . . . . . :   Permanent
Alert description  . . . . . :   Workstation subsystem failure
Probable causes  . . . . . . :   Workstation subsystem
                                 Display
                                 Workstation controller microcode
                                 Workstation controller

                                                                     More...
Press Enter to continue.

F3=Exit   F11=Display detail menu   F12=Cancel   F18=Display actions
```

Figure 11-9. An Example of a Display Alert Detail Display

The following fields on the Display Alert Detail display are described:

Field **Description**

Resource hierarchy
: This field shows the resource heirarchy for the alert. The lowest entry shows the resource name and the type of the failing resource. For a full list of resource types, see the *Communications: Communications and Systems Management User's Guide*, SC21-9661. When the resource is not known, the control point (CP) name of the system that sent the alert is displayed as the lowest entry.

Date/time
: It is useful to compare the logged date and time against the problem date and time to check if the alert was held at the originating system. However, the difference in time logged and the time of the problem may be due to a difference in time zones.

  Note that System/36 and System/38 do not send the problem date and time information to an AS/400. To determine if an alert was held at the originating system, look at the *Held Alert* field in the Display Alert Detail display.

Alert type and description
: The alert type can be permanent, temporary, performance, impending problem, or unknown. The alert type and description assist the network operator to decide the next step for problem analysis.

Probable cause
: These are generated by the sending system and are in order of decreasing probability. Probable causes are also received from either a System/38 or System/36.

Alert detail
: Additional displays show the message ID, message text, hardware and software details used to provide more information about the problem. This information is obtained from either an AS/400, System/38, or System/36. Also, there is a field which displays whether the alert is locally generated or recieved.

Work with Alert Descriptions: You can use this option to define the contents of an SNA alert for a particular message ID. Alert descriptions are used to define the alerts that are created for an alertable message. To work with alert descriptions, select the *Work with alert descriptions* option from the Network Problem Handling menu. You can use this option along with other CL commands to create and send alerts for an alertable message.

Creating and Sending an Alert: Do the following to create and send your own alert:

1. Define the message to be alertable using the WRKMSGD command.
2. Define the content of the alert using the *Work with alert descriptions* option or the WRKALRD command.
3. Make the alert processing active by using the CHGNETA ALRSTS(*ON) command.
4. The system or an application sends an alertable message to the QSYSOPR message queue or QHST log. The alert is created and sent to the system's focal point.

   Note: Only messages that are sent to the QHST log are alertable. Messages sent to QSYSOPR message queue are a subset of those going to QHST. Therefore, if an application message needs to be alertable, the send program message (SNDPGMMSG) command in the program must send this message to the QSYSOPR or QHST message queues.

5. Use the *Work with Alerts* option at the focal point to view the alert. For more information about the this option, see page 11-16.

The WRKMSGD command displays a list of messages. From the list of messages displayed you can display the message description to determine if the message is alertable. If the ALROPT field is set to *NO, then you can enter the Change Message Descriptions (CHGMSGD) to make the message alertable. Together, this option and these commands are used to specify if a message causes an alert to be generated.

A subset of CPF messages are alertable and they come with their own alert descriptions. The alert option comes set to a particular default that you change. In addition, it is possible to make additional messages alertable.

The alert (ALROPT) parameter in a message description command can be set to:

Parameter Setting	Purpose
*IMMED	This generates an alert immediately.
*DEFER	This causes an alert to be generated after local problem analysis has completed. *DEFER should only be specified for messages that are eligible for problem analysis. The log problem (LOGPRB) parameter in the message description determines this.
*UNATTEND	An alert is generated only when the system is unattended; for example, when the alert status (ALRSTS) network attributes have been set to *UNATTEND. These are messages that would normally be handled by a local operator; for example, paper jammed in printer, diskette required, and so on.
*NO	No alert is created for this message.

In addition, to provide information on the resource that has the problem, the resource name variable has to be specified in the message description. For example, message CPI8E6F says:

```
Line &23 failed.  Recovery stopped.
```

&23 is the variable that contains the name of the line. If this is the information that the local system would like to include in the alert, the message description can be changed as follows:

```
CHGMSGD MSGID(CPI8E6F) MSGF(QSYS/QCPFMSG)
  ALROPT(*IMMED 23)
```

The line name is transmitted as the resource name, within the resource hierarchy, having the problem.

The combination of the ALROPT in the message description as well as the ALRSTS in the network attribute determine whether an alert is sent:

Network Attribute	ALROPT Parameter in the Message Description
ALRSTS(*ON)	*IMMED sends an alert, *DEFER sends an alert after local problem analyis is run, and *NO does not send an alert.
ALRSTS(*UNATTEND)	*IMMED, *DEFER, and *UNATTEND send alerts. *NO does not send an alert.
ALRSTS(*OFF)	*IMMED, *DEFER, *UNATTEND, and *NO do not send any alerts.

For more information about working with alert descriptions, see the *Communications and Systems Management User's Guide*.

Copy Screen Image

Copy screen image option is an ECS function that allows you to diagnose problems.

Copy screen image lets a user at one display view screen images being processed by a second user at another display. Through commands or menus, screen images may be copied from one display to:

- Any compatible display defined to the system
- A database file

Copying screen images to a database file enables you to process this data at a later time and serves as an audit trail for what occurs during the operation.

Copy screen image is a problem analysis tool. For example, a customer can use it to debug their own applications. Also, a service representative can directly participate in problem analysis on a customer's system.

The source device is the active work station that is being copied. The output or target device is the passive work station that contains the copied image of the source device. The requester work station initiates the command. The requester work station could be the source, target, or any other work station. Figure 11-10 on page 11-20 shows an overview of the copy screen image function.

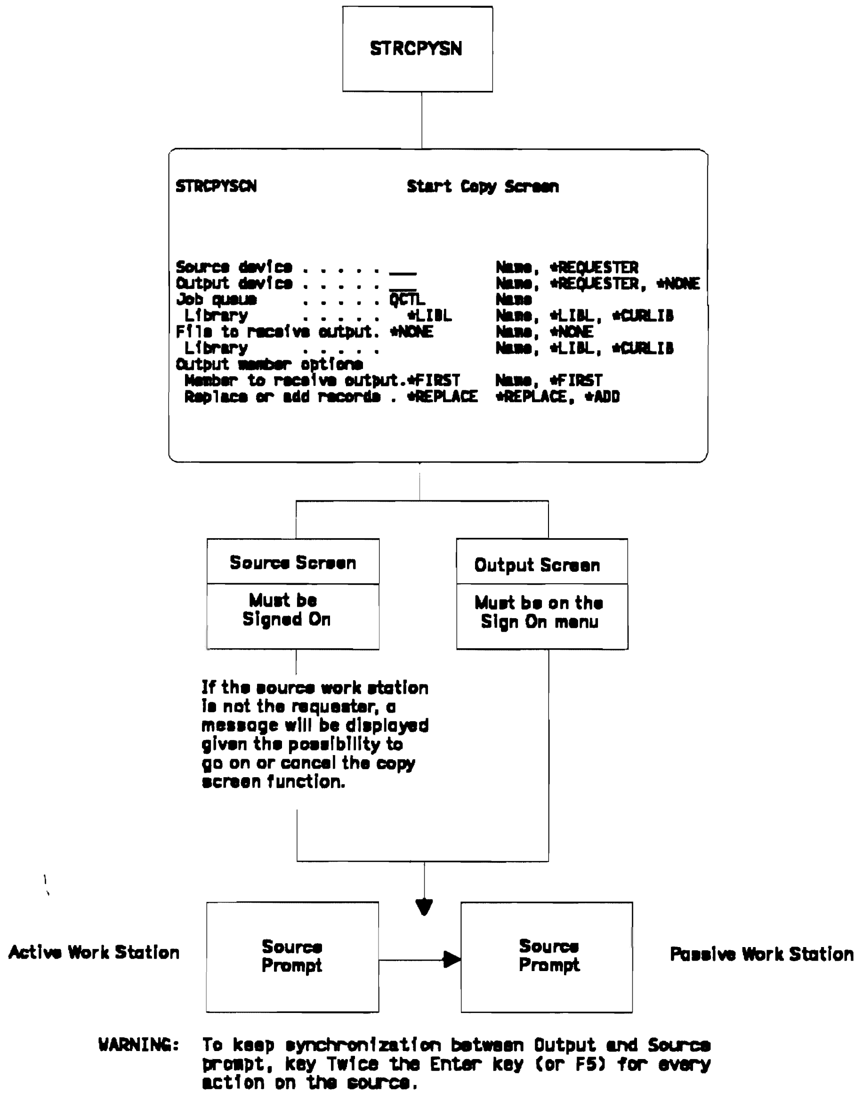


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Figure 11-10. An Overview of the Copy Screen Image Function

When copying is started, the requestor can specify, by device name, which displays are to be the source device and target device. A function key at the source display is used to copy the screen image at the source display to the target display and/or the database.

At any time, the function can be ended from any display on the system including the source and the target. Copying can be ended from the source device or by a person not involved in the operation by using the applicable End Copy Screen (ENDCPYSCN) command or menu interfaces. Also, copying can be ended from the target display by pressing the System Request key, entering the ENDCPYSCN command, and pressing Enter.

How to Use: To initiate copy screen image, select the *Copy screen image* option from the More Problem Handling menu or enter the Start Copy Screen (SRTCPYSCN) command on any command line. To copy screen images, see the *Operator's Guide*.

If copy screen image is being run to a remote work station, the remote line, controller, and device must be configured. For more information about remote configuration, see the *Device Configuration Guide* as described in the *Information Directory*.

The STRCPYSCN command can only be used by displays with a sign on to the same system. The requester (of the STRCPYSCN command) specifies the name of the source device that should be copied. The output device can be the requestor's device or another device that is not signed on. Note that these devices can include pass-through displays.

When a request is made to start copy screen image, a break message is sent to the source display. Screens are copied after the break message is replied to.

When copying from one display to another, the keyboard on the target display is disabled, except for the System Request key. Only the End Copy Screen (ENDCPYSCN) command is allowed on the command line after pressing the System Request key on the target display.

Notes:

1. Screens on a wide mode display that are displaying the wide format cannot be copied to a regular display.
2. Screens are not copied until a function key on the source display is pressed. View the source screen before it is copied. End the copy function if the source screen should not be viewed at the target.
3. Graphic displays do not copy.
4. The target display cannot be signed on when the Start Copy Screen (STRCPYSCN) command is entered, unless the target display is also the initiators display. This means that the observer at the target display does not need to have a password to the system.
5. The service representative's display can be the source display and the customer's display the target display.

SST

Chapter 12. System Service Tools (SST)

SST operates in a full paging environment with OS/400. SST is the OS/400 version of DST except for some options of DST. For example, DST options that allow you to service the DASD subsystem do not run under SST. SST has a full operating system support; therefore, full error recovery is possible.

The system service tools (SSTs) run one or more vertical licensed internal code (VLIC) or hardware service tools under the control of OS/400. SST lets you use service tools concurrently with the customer's application programs; however, not all the SST can be invoked to run concurrently.

Refer to Table 2-1 on page 2-3 and Table 3-3 on page 3-3 for some of the problems that can be solved using some of the service tools described in this chapter.

Note: Some dedicated service tools are the same as the system service tools. For example, the *Print stand-alone dump* tool is the same in DST and SST. Chapter 13 refers you to this chapter for those tools that are alike. If you are in DST and you encounter an error when dumping information to tape or diskette while using a tool described in this chapter, go to "Intervention Display I/O Manager Return Codes" on page 13-18.

How to Use

To use SST:

- Select the *Problem handling* option from the System Main Menu and then select the *Work with service tools* option from the Problem Handling menu.

or:

- Enter the Start System Service Tools (STRSST) command on the System Main Menu command line.

Notes:

1. The System Request key can be used with any of the options under SST.
2. You must have service authority to use SST.

Entering Commands

Press F10 to enter control language commands from SST.

Ending SST

Press F3 and F12 to end system service tools. All active service tools end. If you need to keep any service tool active while running a program outside SST, press F12 on the End SST display and use SST to do one of the following:

- Select the *Command entry* option from the SST main menu.
- Press the System Request key.

SST Menu Flow

Figure 12-1 shows the overall menu flow for SST.

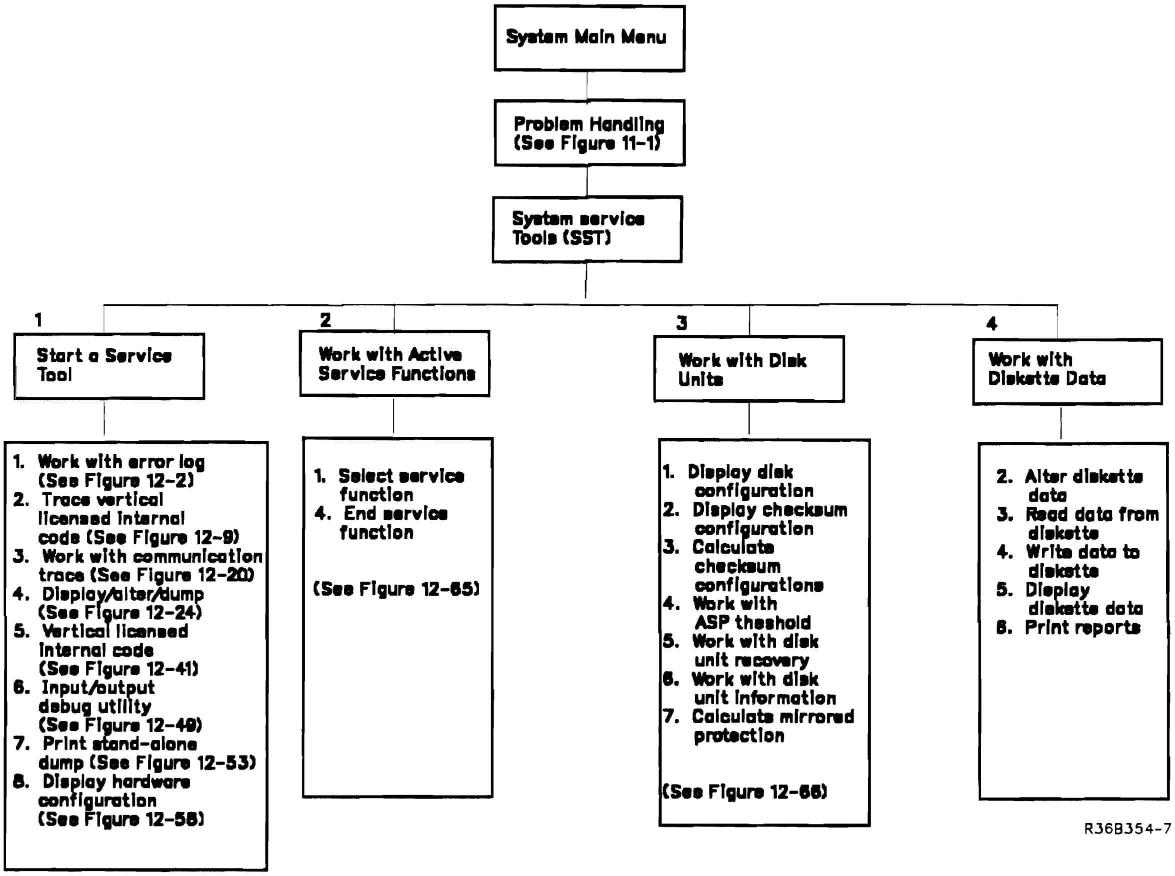

Figure 12-1. SST Menu Flow

Options

The SST main menu has the following options:

1. Start a service tool

   This option shows a menu of service tools that you can start from the System Service Tools main menu. For more information about this option, see page 12-3.

2. Work with active service tools

   This option lists active service tools and their status. Service tools can be started and left active while you start another service tool. Use this option to re-enter a service tool that is active or to end an active service tool. The status of a service tool shows if the service tool is active or ending. For more information about this option, see page 12-66.

3. Work with disk units

   This option shows a menu of tools that can be run for disk devices. You can work with disk configuration, display checksum configuration, calculate disk configuration (with or without checksums), or work with the storage threshold, and calculate mirrored capacity.

   All tools can be used in the dedicated or limited paging environment of DST; however, not all tools are available in concurrent or full paging environment of SST and DST. For more information about disk configuration, auxiliary storage pools, checksums protection, and mirrored protection, see Chapter 7 and Chapter 8. For more information about this option, see page 12-67.

4. Work with diskette data

   This option lets you read data from a diskette containing cyclical redundancy check (CRC) errors. CRC errors occur when unreadable data is encountered on a diskette during a read operation. Normally, when an CRC error is encountered you are not able to read read the diskette past the point of the failing sector. Using this option, diskettes containing sectors with CRC errors can be read. For more information about this option, see page 12-69.

Start a Service Tool

Access this menu by selecting the *Start a service tool* option from the System Service Tools menu.

Options

The Start a Service Tool menu has the following options:

1. Work with error log

   This option displays or prints errors that have occurred in disk and tape units, communications, processors, and work stations. This option also lets you work with tape and diskette statistics. For more information about this option, see page 12-3.

2. Trace vertical licensed internal code

   This option shows a menu that lets you start or stop a trace of vertical licensed internal code. You can also display, dump allocate, or clear the trace tables where the vertical licensed internal code trace is recorded. Use this option, carefully, if you suspected VLIC software problem. For more information about this option, see page 12-10.

3. Work with communications trace

   This option lets you start or stop a trace of data on a communications line. Any traced data can then be printed. Use this option to isolate problems on communications lines that cannot be resolved using the *Communications problems* option from the Problem Handling menu. This option is only available in SST because the communications lines operate only under SST. This option allows multiple sessions to be running concurrently; therefore, you can check out more than one communications line at a time. For more information about this option, see page 12-20.

4. Display/alter/dump

   This option lets you display or change virtual storage data. You can dump the storage data to a tape, a diskette, or to a printer. You can also print data that was previously dumped to a tape or diskette. Use this option carefully. You work with the customer's data when you use this option. For more information about this option, see page 12-27.

5. Vertical licensed internal code log

   This option lets you display vertical licensed internal code log information for potential VLIC problems. You can dump the vertical licensed internal code log information to a tape, a diskette, or to a printer.

   Most VLIC components try to recognize when they may have a problem and take steps to log all the necessary data. They may actually be able to continue processing. The components may log an entry in the VLIC log as a precaution.

   These entries are always available whether the system is in limited or full paging environment; however, the entries can only be placed in the log in full paging environment. For more information about this option, see page 12-46.

6. Input/output debug utility

   This option shows a menu that lets you display, trace, or set a break point in the input/output processor (IOP) licensed internal code. IOPs control the storage devices, work stations, and communications data links on your system. For more information about this option, see page 12-50.

7. Print stand-alone dump

   The system normally creates a main storage dump when in the process of going down. This option lets you display the main storage dump, or copy the dump to a tape, a diskette, or to a printer. For more information about this option, see page 12-55.

8. Display hardware configuration

   This option displays the configuration and status of the hardware attached to the system. The list of hardware is obtained from the resource configuration record (RCR), which is built by the system during an IPL. For more information about resource configuration records (RCRs) see page 10-1. For more information about this option, see page 12-61.

Work with Error Log

Note: The preferable method of correcting errors is to use the error log with the WRKPRB (Work with Problem) command.

Select this option on the Start a Service Tool display, which is selected on the System Service Tools (SST) display.

If the system is operational, use this *Work with error log* option under SST; if the system is not operational, use the *Work with error log* option under dedicated service tools (DST). For a description of error log, see "Error Log" on page 15-1.

Menu Flow: Figure 12-2 on page 12-4 shows the options on the Work with Error Log display.

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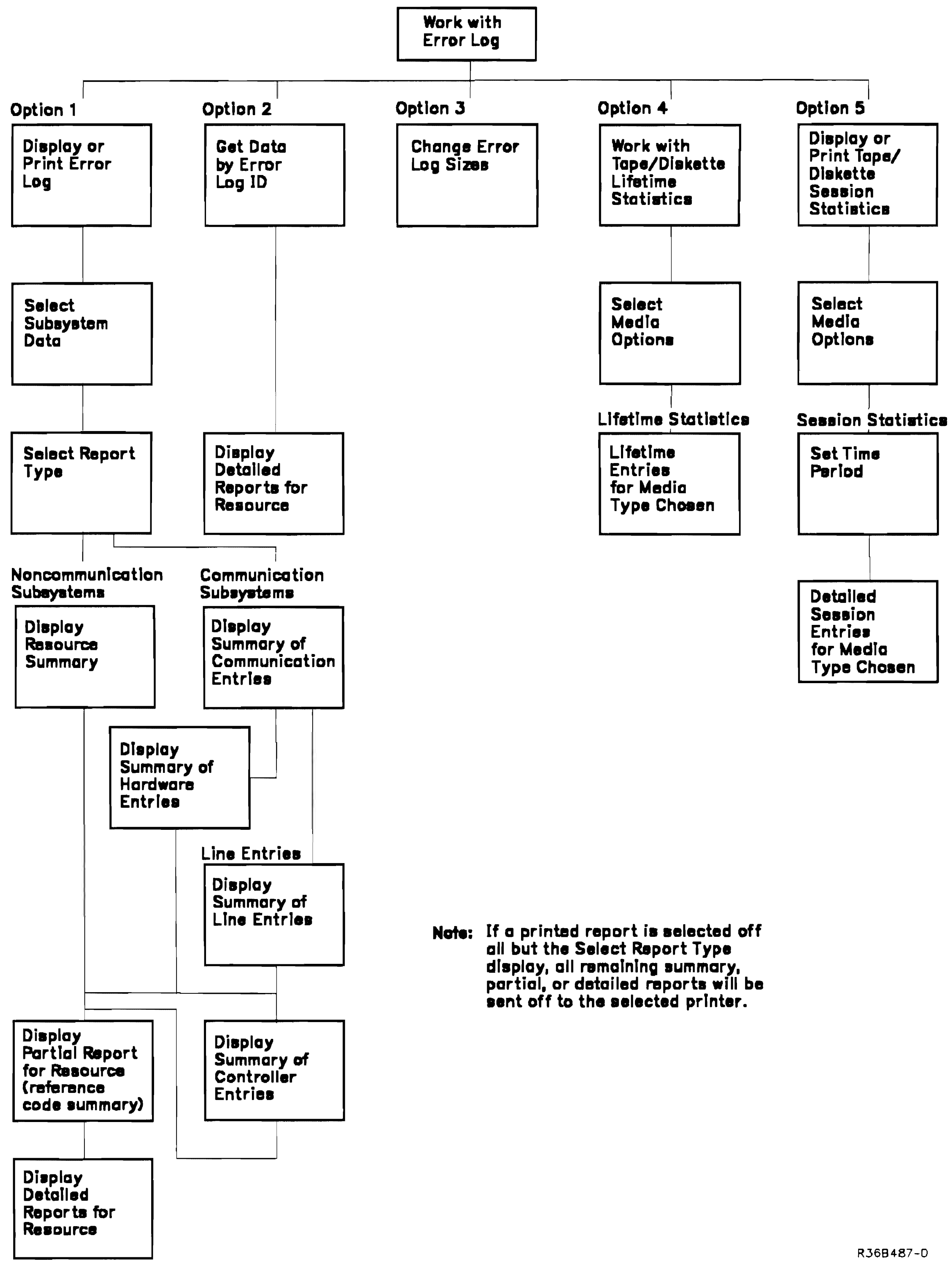

Note: If a printed report is selected off all but the Select Report Type display, all remaining summary, partial, or detailed reports will be sent off to the selected printer.

Figure 12-2. Work with Error Log Menu Flow

SST

Options: The Work with Error Log display has the following options:

1. Display or print error log

   This option lets you display or print the error data logged for the processor, magnetic media, local work stations, communications or subsystems.

2. Get data by error log ID

   This option lets you display or print error data from the error log by the error log identifier. The **error log identifier** is a unique identifier that ties together all data related to a single error condition.

3. Change error log sizes

   This option lets you verify or change the amount of storage on a disk device used for error log data.

4. Work with tape/diskette lifetime statistics

   This option lets you display, print, or delete the statistical data logged for the lifetime use of a reel tape, cartridge tape, or a diskette. **Lifetime** is the total length of time one of these media will allow information to be read from or written to it.

5. Display or print tape/diskette session statistics

   This option lets you display or print the statistical data logged for a session of reel tape, cartridge tape, or a diskette. **Session** is the length of time one of these media is in position to be read from or written to (read/write heads loaded).

The *Work with error log* option lets you:

- Display or print errors that the system has detected.
- Work with tape and diskette statistics.
- Analyze error log data by specific subsystem. Subsystem choices are processors, magnetic sources, local work stations and communications (SDLC, BSC, X.25, local area network, Ethernet V2 or IEEE 802.3 and remote work station).

  Note: ASCII and asynchronous work stations are logged by the IOP type they are connected to.
- Analyze all error log data associated with the same error log ID. You must have an error log ID to use this tool.
- Obtain error summary information.
- Obtain information about a grouping of errors.
- Obtain information about specific errors.
- Change error log area sizes.
- Obtain information about volume statistics for removable magnetic media.
- Examine session or lifetime counters for a specific volume or removable media type.
- Delete volume statistics lifetime counters.
- Select time and date, error log ID, device type, logical address, communications line, and subsystem.
- Send output to a printer (if a printer is available) or a work station.

Notes:

1. Unformatted data is available using display/alter/dump. You can obtain this data if problems occur while using the *Work with error log* option. A VLIC machine index can be dumped (address 0000 2B00 0000) with the option to format index entries.
2. Asterisks (*) are shown when characters cannot be displayed or printed because they are not defined EBCDIC codes.
3. If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

How to Interpret Work with Error Log Reports: Figure 12-3 shows an example of a summary of error log entries for the magnetic media log.

```
                  Display Summary of Magnetic Media Entries

 From . . :   08/26/90  10:00:00      To  . :   08/27/90  10:00:00

 Type option, press Enter.
   5=Display report  6=Print report

           1                                 Serial       2             3
 Opt    Resource       Type     Model     Number      Address       Count
  _     DEVICE         0000      000      10-17794    0010-0000       4
  _     DEVICE         9332      400      10-22661    0010-0400       1
  _     DEVICE         9347      001      00-00000    0010-0700       8
  _     CNTL           9347      001      00-00000    0010-07FF       5
  _     DKT01          9331      001      53-00000    0010-0300       2
  _     TAPE           9347      001      00-00000    0010-0700       4
  _     TAP01          9347      001      00-00000    0010-0700       1



 F3=Exit                F5=Refresh          F10=Display previous log
 F11=Display next log   F12=Cancel
```

Figure 12-3. Example of Summary of Magnetic Media Entries Display

- The *Resource* field **1** contains a description of where the error occurred.

  If the error log records do not contain resource names, the Work with Error Log function generates an address and resource name using the I/O processor direct select address and the device unit address.

  The address that is generated looks similar to this:

  `BBcb-xxyy`

  where:

  BBcb = I/O processor direct select address (DSA)

  The Work with Error Log function uses the DSA to identify an I/O processor, where:

  BB = Bus number
  c = Card number
  b = Board number

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xxyy = Unit address (UA)

There is a unit address (UA) for each resource attached to an I/O processor. The UA is the local address used by an I/O processor to get access to a specific physical resource, where:

xx = Port or I/O adapter
yy = Station, port, or device

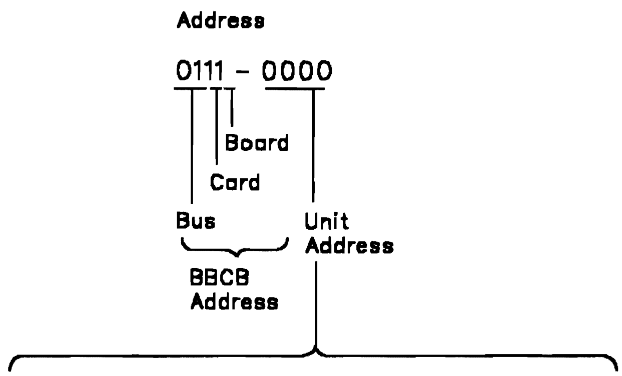
The resource names that are generated are:

Subsystem	**Possible Names Used**
Processor	IOP or SYSTEM
Magnetic media (tape, disk, or diskette)	IOP, CNTL or DEVICE
Local workstation	IOP, PORT or DEVICE
Communications	IOP, IOA or PORT

For example, if an error is logged with a unit address of 01FF in the magnetic media subsystem and no object name was specified in the log entry, the Work with Error Log function puts the common name *CNTL* in the *Resource* field.

Notes:

1. If a character in any of the following fields cannot be displayed, an asterisk (*) is displayed instead of that character:
   - *Resource* field
   - *Type* field
   - *Model* field
   - *Serial Number* field
2. The *Address* field **2** contains the BBcb address and the unit address (see Figure 12-4). The BBcb address relates to the hardware bus, card, and board address. The system or Rack Configuration List should be used to determine which slot number the BBcb address relates to. Look for the service information area on the configuration list. For a description of the *Address* field **2**, see Figure 12-4.



	Byte 1	Byte 2
Storage Devices DASD Tape	Controller Address (Switch Setting)	Device Address (Facility or Unit)
Work Station Controller 6040	Port Number on Twinaxial Work Station Controller	Address Setting on Work Station
Communications 6130 6031	IOA Position Relative to Multiline Communications Controller	Port Number (for the port on the IOA)

R36B488-0

Figure 12-4. Address Description

Note: A BBcb address is equal to a direct select address.

- The *Count* field **3** contains the number of times the error occurred.

SST

The summary report display has two options:

- Display report
- Print report

Select the *Display report* option by keying a 5 in the *Opt* (option) field for a specific resource. This displays a partial report for that resource.

Figure 12-5 shows an example of a partial report for a 9332 device.

```
                        Display Partial Report for Resource

From  . . :   08/26/90  10:00:00      To  . :   08/27/90  10:00:00
                           4               Serial
Resource        Type     Model       Number      Address         Total Count
DEVICE          9332      400        10-22661    0010-0400             1

Type option, press Enter.
  5=Display report  6=Print report

                                                 5
Option        Reference Code                 Error Type              Count
  _               101E                       Temporary                  1





                                                                       Bottom
F3=Exit       F5=Refresh            F12=Cancel
```

Figure 12-5. Example of Partial Report

For more information on reference codes (such as FRUs that relate to the failure), see the *Unit Reference Code Guide* for the machine type and model listed in the *Type* and *Model* fields **4**.

In the *Error Type* field **5**, the event that has occurred is described. Some of the events are errors; some of the events are not actual errors. The events that might be listed in the *Error Type* field are:

Permanent An error for which no successful retries occurred.

Temporary An error for which a successful retry occurred.

Threshold An error occurred when the number of temporary errors exceeded a given threshold for that type of temporary error.

Qualified An error occurred which is described (qualified) further in the *Description* field on the Display Detail Report for Resource display under the Work with Error Log function. For additional information and action, see the reference code guides.

Statistic Indicates that this error type contains statistical information (number of bytes read or written, for example).

Recoverable An error occurred for which intervention was required for recovery (printer out of forms, for example).

Informational Indicates that a non-error event of importance occurred.

Machine Check An error occurred that resulted in making the system not operable. These errors are logged during the next IPL if the system was not powered off. They are logged with the data that was displayed in control panel Functions 11 through 18.

Remote Indicates buffered errors from remote devices or controllers.

Select the *Display report* option by keying a 5 in the *Opt* (option) field for a specific reference code. This displays a detail report for that reference code.

Figure 12-6 shows an example of a detail report for reference code 111E. Important information regarding a specific reference code is shown.

```
                     Display Detail Report for Resource

From  . . :   08/26/90  10:00:00      To  . :   08/27/90  10:00:00

Resource         Type      Model   Serial Number         Address
DEVICE           9332       400    10-30193              0070-0601

Error log ID . . . . . . :  00070160   Sequence . . . . . . :      6300 6
Date . . . . . . . . . . :  08/26/90   Time . . . . . . . . :  13:30:00
Reference code . . . . . :  111E       Error Code . . . . . :  00000000 7
Table ID . . . . . . . . :  93320400 8 IPL Source . . . . . :  B
Error type . . . . . . . :  Temporary
Description  . . . . . . :
Read error, data should be in another disk area

Machine exception data
  Format . . . . . . . . :    4        Block  . . . . . . . :    000527E7
  Cylinder . . . . . . . :  0000       Head . . . . . . . . :          00
  Sector . . . . . . . . :   00        Message ID . . . . . :          48
  Bytes 0-15 . . . . . . :   0000000000000048  0000000000000000
  Bytes 16-29  . . . . . :   0000000527E70000  000000000000

Press Enter to continue.
                                    9
F3=Exit                             F6=Display hexadecimal report
F10=Display previous detail report  F12=Cancel
```

Figure 12-6. Example of Detail Report

The sequence number **6** is increased by 2 each time an entry is put into the error log.

The error code **7** is a 4-byte hexadecimal value returned from the I/O adapter hardware. The code is used mainly for protocol or licensed internal code problems.

The table ID **8** identifies a group of reference codes. See the following chart for a list of the table IDs.

SST

Table ID	Description	Publication
2440xxxx	Magnetic Tape Subsystem	*Unit Reference Code Guide*
2507F060	Common Operating Program	*Unit Reference Code Guide*
2500xxxx	System Processor	*Unit Reference Code Guide*
2601xxxx	Tape Unit Controller	*Unit Reference Code Guide*
2602xxxx	Tape Unit Controller	*Unit Reference Code Guide*
2604xxxx	Tape I/O Processor	*Unit Reference Code Guide*
2608xxxx	Tape Unit Controller	*Unit Reference Code Guide*
2635xxxx	Ethernet Network Adapter	*Unit Reference Code Guide*
3422xxxx	Magnetic Tape Subsystem	*Unit Reference Code Guide*
3430xxxx	Magnetic Tape Subsystem	*Unit Reference Code Guide*
3480xxxx	Magnetic Tape Subsystem	*Unit Reference Code Guide*
3490xxxx	Magnetic Tape Subsystem	*Unit Reference Code Guide*
6030F010	SDLC	*Unit Reference Code Guide*
6030F020	BSC	*Unit Reference Code Guide*
6030F030	ASYNC	*Unit Reference Code Guide*
6030F040	X.25 Packet	*Unit Reference Code Guide*
6030F050	Token-Ring	*Unit Reference Code Guide*
6030F060	Communications Common Licensed Internal Code	*Unit Reference Code Guide*
6030F080	X.25	*Unit Reference Code Guide*
6030F140	BSC System	*Unit Reference Code Guide*
60310001	ASYNC/BSC/HDLC Adapter	*Unit Reference Code Guide*
60340001	Token-Ring Network Adapter	*Unit Reference Code Guide*
6040xxxx	Twinaxial Workstation Controller	*Unit Reference Code Guide*
6041xxxx	ASCII Workstation Controller	*Unit Reference Code Guide*
6110xxxx	Magnetic Storage Device Controller	*Unit Reference Code Guide*
6111xxxx	Magnetic Storage Device Controller	*Unit Reference Code Guide*
61300001	Multiline Communications Controller	*Unit Reference Code Guide*
61340001	Token-Ring Network Adapter	*Unit Reference Code Guide*
EE09xxxx	Service Processor	*Unit Reference Code Guide*
EE0Fxxxx	OS/400	*Unit Reference Code Guide*
EE1Dxxxx	Vertical Licensed Internal Code	*Unit Reference Code Guide*
EE60xxxx	Control panel	*Unit Reference Code Guide*
9331xxxx	Diskette	*9331 Diskette Unit Service Information: Service Guide and Reference Code Guide*
9332xxxx	Disk	*9332 Disk Unit Reference Code Guide*
9335xxxx	Disk	*9335 Direct-Access Storage Subsystem Guide to Unit Reference Codes*
9336xxxx	Disk	*9336 Direct-Access Storage Subsystem Service Information*
9346xxxx	Tape unit	*9346 Tape Unit Service Guide and Reference Code Guide*
9347xxxx	Tape unit	*9347 Tape Unit Service Guide*
9348xxxx	Tape unit	*9348 Tape Unit Service Information*

Display hexadecimal report **9** is an optional field for this report. Additional information may be available in the hex dump portion. Press F6 (Display hexadecimal report) to access hexadecimal dump information (see Figure 12-6 on page 12-7). Figure 12-7 shows a breakdown of the information logged in the hex dump.

Note: If a character in the *EBCDIC* field cannot be displayed, a period (.) is displayed instead of that character.

To find information in the hex dump, read down the **Description** column in Table 12-1 or Table 12-2 on page 12-9 until you find the item you want (for example, reference code). Read across to the leftmost column to find the hex offset. For reference code, this is 004A. Notice that the reference code is two bytes long.

Go to Figure 12-7 and read down the leftmost column until you find the entry 000040. Read across to the right to the data under A. Hex offset 004A starts here. Since the reference code is two bytes long, hex offsets 004A and 004B contain the reference code.

```
                    Display Hexadecimal Report for Resource

Resource        Type      Model      Serial Number   Address
DKT01           6131      000        00-0000000      0010-0000

Offset   0 1 2 3  4 5 6 7  8 9 A B  C D E F       EBCDIC
000000   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000010   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000020   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000030   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000040   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000050   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000060   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000070   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000080   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
000090   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
0000A0   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
0000B0   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$
0000C0   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx      $$$$$$$$$$$$$$$$


Press Enter to continue.                                        More...
F3=Exit    F12=Cancel
```

Figure 12-7. Example of a Hexadecimal Report for Resource

Table 12-1. Hexadecimal Dump Byte Assignments for Keyed Data

Hex Offset	Length in Bytes	Description
0000	4	Release level
0004	4	Length of component specific data
0008	8	Time stamp
0010	4	Sequence number
0014	1	Subsystem type
0015	4	I/O processor type
0019	2	I/O processor direct select address
001B	4	I/O adapter type
001F	2	I/O adapter direct select address
0021	10	Line name
002B	10	Controller description name
0035	10	Logical unit description name
003F	4	Device type
0043	3	Model number
0046	4	Serial number
004A	2	Reference code
004C	4	Error log identification
0050	8	Volume identification
0058	2	Unit address
005A	1	Error type
005B	13	Reserved

Table 12-2. Hexadecimal Dump Byte Assignments for Nonkeyed Data

Hex Offset	Length in Bytes	Description
0068	8	Reference code translate table (RCTT) name
0070	4	Component ID
0074	4	Manufacturing ID
0078	12	Part number
0084	1	Format of data
0085	1	Delayed reporting
0086	1	Signal event
0087	4	IOP return error code
008B	1	Communications protocol
008C	7	Reserved
0093	10	System resource path name 1
009D	10	System resource path name 2
00A7	10	System resource path name 3
00B1	15	Reserved

Table 12-3. Hexadecimal Dump Byte Assignments for Variable Component Specific Data

Hex Offset	Length in Bytes	Description
00C0-FFFFFFF		This field is different for each error log and is intended for engineering use only.

Get Data by Error Log ID: This option lets you:

- Analyze all error log data associated with the same error log ID.
- Select by error log ID.

Output can be sent to a work station or to a printer, if a printer is available.

Note: You must have an error log ID to use this function.

Change Error Log Sizes: This option lets you change error log area sizes.

Note: Increase the error log sizes when Work with Error Log prompts you.

Work with Tape/Diskette Lifetime Statistics: This option lets you:

- Work with the tape unit and the diskette unit lifetime statistics.
- Get information about volume statistics for tapes or diskettes.
- Review lifetime counters for a specific volume, tape, or diskette.
- Delete volume statistics lifetime counters.

The output of this option can be sent to a printer, if a printer is available, or to a work station.

Select the *Work with tape/diskette lifetime statistics* option to display a lifetime entry report.

Figure 12-8 shows an example of a lifetime entry report. This report shows information about various volume IDs for tape. You might want to exchange diskettes or tapes with high read or write errors.

```
                 Work With Tape/Diskette Lifetime Statistics

Removable media . . . . . . :   1/4 inch cartridge tape

Type options, press Enter.
  4=Delete entry   6=Print entry

        Volume     --------Errors--------     --------K Bytes-------
Option  ID                  Read       Write            Read    Written

  _     2001                   0           0              10         10
  _     QEF045                 0           0             500          0
  _     VOLM01                 0           0            1500          0
  _     VOLM99                 0           0             200          0




F3=Exit             F5=Refresh          F10=Delete all
F11=Print all       F12=Cancel
```

Figure 12-8. Example of a Lifetime Report

Note: If a character in the *Volume ID* field cannot be displayed, an asterisk (*) is displayed instead of that character.

Display or Print Tape/Diskette Session Statistics: This option lets you:

- Display or print session statistics for a tape unit or a diskette unit.
- Select a media type to display or print the statistics.
- Select a time range to display or print the statistics.
- Select a volume ID to display or print the statistics.

The output of this option can be sent to a printer, if a printer is available, or to a work station.

SST

Trace Vertical Licensed Internal Code

This option can be selected from either the Start a Service Tool menu of SST or selected from the Start a Service Tool menu of DST. This option is sometimes referred to as VLIC trace.

Use VLIC trace to collect and print data about the internal workings of the vertical licensed internal code. The traces you can invoke are:

- Module call, see page "Call Trace Menu" on page 12-14.
- VLIC component, see page "Component Traces Display" on page 12-14.
- IMP instructions, see page "IMP Instruction Trace Menu" on page 12-16.
- 938X instructions supervisory linkage (SVL), see page "MI Instruction Supervisory Linkage (SVL) Trace" on page 12-16.
- Multiprogramming level, see page "Multiprogram Level Trace" on page 12-16.
- Task switch, see page "Task Switch Trace" on page 12-17.

For more information about these traces, see Chapter 30.

Collecting Trace Data: To collect trace data:

1. Start VLIC trace
2. Run the job until a failure occurs
3. Stop VLIC trace
4. Dump the trace data to a tape, diskette, or printer

The trace data is collected in two tables internal to VLIC. One trace table is for the task switch trace; the other trace table (general) is for the rest of the traces. See Chapter 30 and Chapter 31 for an extensive description of the traces, the trace tables, and the trace entries.

Function Keys: F3 and F12 have the following functions:

Key	Function
F3	Causes an immediate return to the trace VLIC main menu
F12	Causes a return to the previous display

The Help key may provide help text pertinent to the current display.

Menu Flow: Figure 12-9 on page 12-11 shows the trace VLIC menu flow.

SST

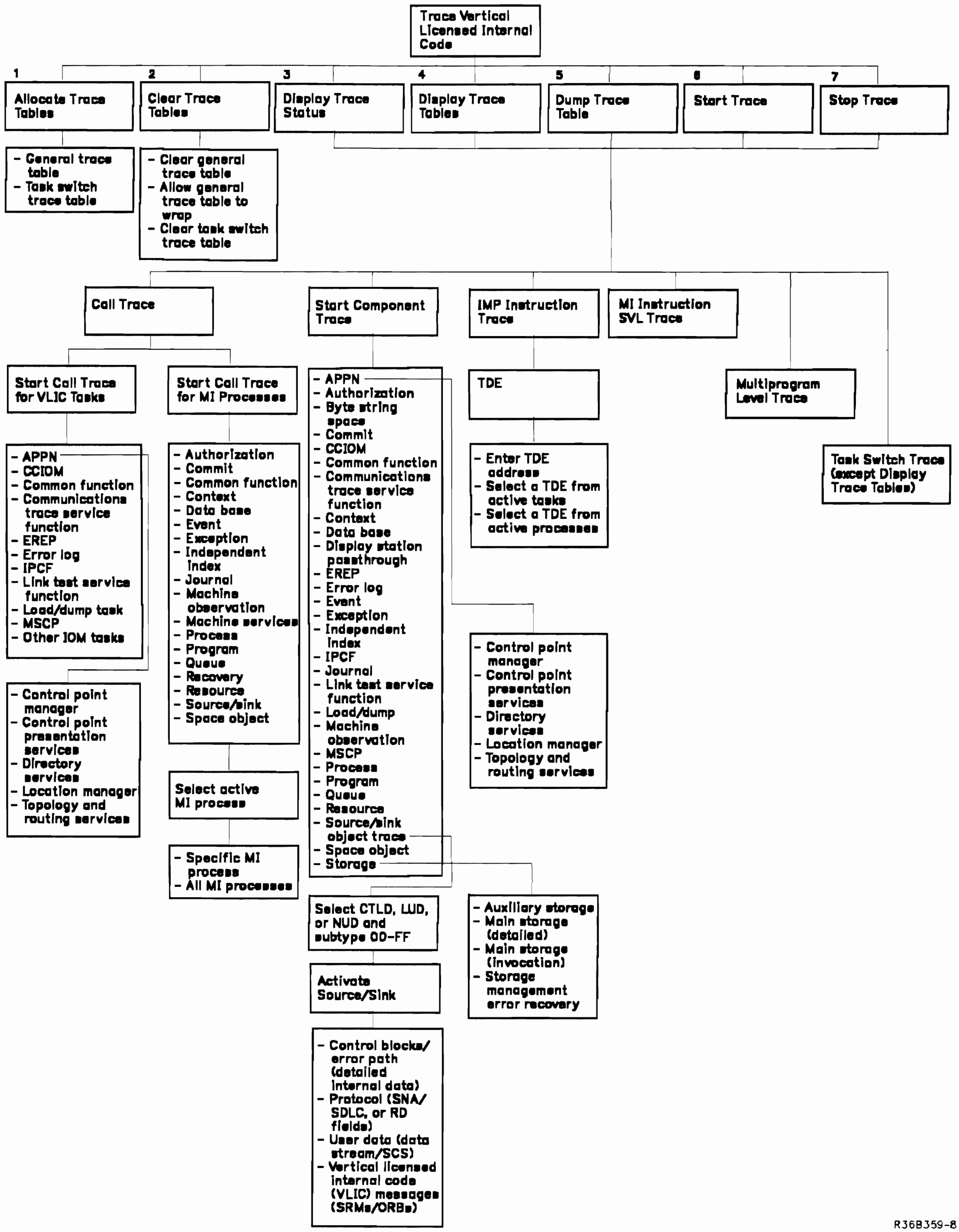


Figure 12-9. Trace Vertical Licensed Internal Code Menu Flow

Options: The options for tracing vertical licensed internal code are:

1. Allocate trace tables, see page 12-12
2. Clear trace tables, see page 12-12
3. Display trace status, see page 12-12
4. Display trace tables, see page 12-13
5. Dump trace tables, see page 12-13
6. Start traces, see page 12-14
7. Stop traces, see page 12-17

Note: Clear table or tables before starting trace.

Allocate Trace Table: This option is called from the Trace Vertical Licensed Internal Code menu. Use this option to allocate trace tables.

Options:

The Allocate Trace Table display has the following options:

1. Allocate general trace table

   This option traces all points other than switches between tasks.
2. Allocate task switch trace table

   This option traces switches between tasks.

Note: Allocating a trace table clears and sets the starting values for the selected table.

Allocate General Trace Table: The following display appears when the *Allocate general trace table* option is selected from the Allocate Trace Table menu.

```
                         Allocate General Trace Table

Type choices, press Enter.

  General table size:
    Current . . . . . . . :  ____
    New . . . . . . . . . .  ____   ____-____ (K bytes)
  Record buffer size:
    Current . . . . . . . :  _
    New . . . . . . . . . .  _      _-_ (K bytes)

  Maximum record size  . . :  1 (K bytes)




F3=Exit   F12=Cancel
```

Figure 12-10. An Example of an Allocate General Trace Table Display

Allocate Task Switch Trace Table: The following display appears when the *Allocate task switch trace* option is selected from the Allocate Trace Table menu.

```
                       Allocate Task Switch Trace Table

Type choices, press Enter.

  Resident table size:
    Current . . . . . . . :  ____
    New . . . . . . . . . .  ____   ____-____ (K bytes)

  Pageable table size:
    Current . . . . . . . :  ____
    New . . . . . . . . . .  ____   ____-____ (K bytes)




F3=Exit   F12=Cancel
```

Figure 12-11. An Example of an Allocate Task Switch Trace Table Display

Clear Trace Tables: This option is called from the Trace Vertical Licensed Internal Code menu. Use this option to clear trace tables before activating trace.

```
                              Clear Trace Table

Type choices, press Enter.

  General trace table:
    Clear . . . . . . . . .  _   1=Yes, 2=No
    Allow wrap . . . . . . .  _   1=Yes, 2=No

  Task switch trace table:
    Clear . . . . . . . . :  _   1=Yes, 2=No




F3=Exit   F12=Cancel
```

Figure 12-12. An Example of a Clear Trace Table Display

Select yes or no to allow the table to wrap around itself or stop when the table fills. Press F3 to return to the Trace Vertical Licensed Internal Code menu or press F12 to cancel the clear trace request.

Display Trace Status: This option is selected from the Trace Vertical Licensed Internal Code menu. Selecting this option on the Trace Vertical Licensed Internal Code menu displays the Active Trace Status display.

Input Fields: The Display Trace Status display has the following input fields:

_ Call traces, see page 12-14 **1**

_ Component traces, see page 12-14 **2**

_ Internal microprogram (IMP) instruction trace, see page 12-16 **3**

_ MI instruction supervisory linkage (SVL) trace, see page 12-16

_ Multiprogramming level (MPL) trace, see page 12-16

_ Task switch trace, see page 12-17

Enter a 5 next to any item listed to display the status of a trace.

More detailed status is available for input fields **1** through **3** of this menu if this menu shows the status On. The procedures and displays to display trace status are similar to those of start trace. Because of the similarity, the display trace status displays are not described here. Refer to the *Start trace* option on page 12-14.

Display Trace Tables: This option is selected from the Trace Vertical Licensed Internal Code menu. Selecting the *Display trace table* option on the Trace Vertical Licensed Internal Code menu displays the Display Trace Table display.

Input Fields: The Display Trace Tables display has the following input fields:

_ Call traces, see page 12-14

_ Component traces, see page 12-14

_ Internal microprogram (IMP) instruction trace, see page 12-16

_ MI instruction supervisory linkage (SVL) trace, see page 12-16

_ Multiprogramming level (MPL) trace, see page 12-16

Enter a 5 next to any item listed to display a trace.

The task switch trace type cannot be displayed. F9 displays all traces. Display is automatically invoked after selecting a trace to be processed. The procedures and displays to display trace tables are similar to those of start trace. Because of the similarity, the display trace table displays are not described here. Refer to the *Start trace* option on page 12-14.

After you have made your selections, you are prompted for:

- Trace entries within a specified time. Only the trace entries within a specified time range can be displayed.
- The initial position for the display of the trace records. The most recently recorded trace records are at the end of the trace table.

For examples of trace tables see "Display Trace Table Examples" on page 12-17.

Dump Trace Tables: This option is selected from the Trace Vertical Licensed Internal Code menu. Selecting the *Active trace status* option on the Trace Vertical Licensed Internal Code menu displays the Dump Trace Table display.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Input Fields: The Dump Trace Tables display has the following input fields:

_ Call traces, see page 12-14

_ Component traces, see page 12-14

_ Internal microprogram (IMP) instruction trace, see page 12-16

_ MI instruction supervisory linkage (SVL) trace, see page 12-16

_ Multiprogramming level (MPL) trace, see page 12-16

_ Task switch trace, see page 12-17

Enter a 6 next to any item listed to dump a trace.

F9 dumps all traces. A dump is automatically invoked after selecting a trace to dump. The dump requests specify the trace type, time period, and the diskette, tape, or printer I/O device. The procedures and displays to dump trace tables are similar to those of start trace. Because of the similarity, the dump trace table displays are not described here. Refer to the *Start trace* option on page 12-14.

The specification of the trace type to be selected for the dump is similar to the sequence for trace activation. For all call and general traces, an additional level of qualification within a trace type may be specified. Up to 23 levels of qualification within a trace type and a qualifier ranges are permitted. Qualifier ranges are valid for component traces only. They are not valid for call traces. For trace points and qualifiers, see Chapter 30.

Because the task switch trace record contains only a partial time stamp, these records are dumped after all call and general trace records without any time period qualification.

After selecting a trace, you are prompted for the following:

- A beginning and ending qualifier range within a specific trace. You can limit the selection to one qualifier number by making both values the same. Again, qualifier ranges are valid for component traces only. They are not valid for call traces.
- A range of time. Only those entries time stamped within the specified range are dumped.
- The output device for the trace table dump function.

Start Trace: This option is selected from the Trace Vertical Licensed Internal Code menu. Selecting the *Start trace* option on the Trace Vertical Licensed Internal Code menu displays the Start Trace display.

Input Fields: The Start Trace display has the following input fields:

- _ Call traces, see page 12-14 **4**
- _ Component traces, see page 12-14 **5**
- _ Internal microprogram (IMP) instruction trace see page 12-16 **6**
- _ MI instruction supervisory linkage (SVL) trace see page 12-16
- _ Multiprogramming level (MPL) trace see page 12-16
- _ Task switch trace, see page 12-17

Enter a 1 next to any item listed to start a trace.

Input fields **4** through **6** cause other menus to be displayed for further qualification; whereas, all input fields except **4** through **6** cause traces to be activated immediately.

Call Trace Menu: Selecting any option on the Trace Vertical Licensed Internal Code menu displays the options for the Call Trace Menu.

Options: The Call Trace Menu has the following options:

1. Start call traces for MI processes

   This option traces by a synchronous MI process. For a list of options, see "Start Call Traces for MI Processes Display."
2. Start call trace for VLIC tasks

   This option traces by an asynchronous VLIC task. For a list of options, see "Start Call Traces for VLIC Tasks Display."

Enter a 1 next to any item listed to start a trace.

Start Call Traces for MI Processes Display: The input fields are:

- _ Authorization management
- _ Commit management
- _ Common function
- _ Context management
- _ Database management
- _ Event management
- _ Exception management
- _ Independent index
- _ Journal management
- _ Machine observation
- _ Machine services
- _ Process management
- _ Program management
- _ Queue management
- _ Recovery
- _ Resource management
- _ Source/sink management
- _ Space object management

Select one or more VLIC components for call tracing. You must select the *Start* option by entering a 1 next to any of the trace items listed to proceed to the Start Call Traces for MI Processes menu. The Start Call Traces for MI Processes menu options are:

1. Specific MI process

   Select this option to activate a call trace for one or more specific MI processes.
2. All MI processes

   Select this option to activate the call trace for all system processes. It returns you to the Start Call Traces for MI Processes display.

Start Call Traces for VLIC Tasks Display: The input fields are:

- _ Advanced Peer-to-Peer Networking (APPN)
- _ Common class input/output manager
- _ Common function
- _ Communications trace service tool
- _ Environmental recording, editing, and printing (EREP)
- _ Error log
- _ Interprocess communications facility (IPCF)
- _ Link test service function
- _ Load/dump task
- _ Machine services control point (MSCP)
- _ Other input/output manager (IOM) tasks

Select one or more VLIC components for call tracing. You must select the *Start* option by entering a 1 next to any of the trace items listed to proceed to the Start Call Traces for VLIC Tasks menu. The Start Call Traces for VLIC Tasks menu, is used to select the specific TDEs. The Start Call Traces for VLIC Tasks menu options are as follows:

1. Specify TDE address

   You are prompted for a specific TDE address from 00000000 0000 through FFFFFFFF FFFF.
2. Select a TDE from active tasks

   A display of active tasks is presented for your selection.

Component Traces Display

Input Fields: The Component Traces display has the following input fields:

- _ Advanced Peer-to-Peer Networking (APPN)
  - Control point manager
  - Control point presentation services
  - Directory services
  - Location manager
  - Topology and routing services
- _ Authorization management
- _ Byte string space
- _ Commit management
- _ Common class input/output manager (CCIOM) **7**
- _ Common function

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- _ Communications trace service tool
- _ Context management
- _ Database management **8**
  - — Start trace for a specific database object (A display appears letting you enter an object address range from 00000000 0000 through FFFFFFFF FFFF.)
  - — Start trace for all database objects (This option returns you to the Component Traces menu.)
- _ Display station pass-through
- _ Environmental recording, editing, and printing (EREP)
- _ Error log **9**
- _ Event management
- _ Exception management
- _ Independent index
- _ Interprocess communications facility (IPCF)
- _ Journal management
- _ Link test service function
- _ Load/dump
- _ Machine observation
- _ Machine services control point (MSCP)
- _ Process management
- _ Program management
- _ Queue management
- _ Resource management
- _ Source/sink object trace

  Note: For additional selections, see "Start Source/Sink Object Traces Display."

- _ Space object management
- _ Storage management
  - — Auxiliary storage management
  - — Main storage management (detailed)
  - — Main storage management (invocation)

Enter a 1 next to any item to start a trace.

From this display all input fields except **7** through **9** cause the trace type to be activated immediately; whereas, input fields **7** through **9** cause other menus to be displayed for further qualification. The resulting menu options are listed with those input fields. For more information about each of these components, see Chapter 30.

Start Source/Sink Object Traces Display: If you selected the *Source/Sink object trace* option from the Start Component Trace display, you are prompted for the object type, subtype, and name. The following display shows an example of these prompts.

```
                        Specify Source/Sink Object

Type choices, press Enter.

  Type . . . . . . . . . . .  _    1=Control Unit Description (CTLD)
                                   2=Logical Unit Description (LUD)
                                   3=Network Unit Description (NUD)

  Subtype  . . . . . . . . .  _    00-FF

  Object . . . . . . . . . .  ____________________




F3=Exit   F6=Start DST objects trace   F12=Cancel
```

Figure 12-13. An Example of a Specify Source/Sink Object Display

Pressing F6 on the previous display starts a DST object trace. If F6 is not pressed and the Enter key is pressed, and if an object is found, the Start Sources/Sink Object Traces display appears. When F6 is pressed, the following display appears:

```
                      Select Source/Sink DST Objects

Type options, press Enter.
  1=Select

Opt  Description                  Type       Subtype
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
 _  _ ____________________       _____        _
                                                          More...
F3=Exit   F12=Cancel
```

Figure 12-14. An Example of a Select Source/Sink DST Objects Display

Press the Enter key. If the object is found, the following Start Source/Sink Object display appears.

SST

```
                     Start Source/Sink Object Traces

 Type options, press Enter.
   1=Start trace

 Opt   Description
  _  _ Control blocks/Error path (detailed internal data)
  _  _ Protocol (SNA/SDLC or RD fields)
  _  _ User data (data stream/SCS)
  _  _ Vertical Licensed Internal Code (VLIC) messages (SRMs/ORBs)

 F3=Exit   F12=Cancel
```

Figure 12-15. An Example of a Start Source/Sink Object Traces Display

Select one or more source/sink object traces.

Note: When any of the items on this display are started, the source/sink instruction trace (type SI) is automatically activated. For more information about the SI component, see Chapter 4 and Chapter 30.

IMP Instruction Trace Menu:

Warning: This type of trace can cause a machine deadlock. Use this service tool at your own risk.

A warning notice, like the one above, is displayed before the IMP instruction trace is activated. Press the Enter key to continue, or press F3 to return to the primary menu without activating an IMP instruction trace.

Note: IMPI tracing is not automatically activated again across IPLs. All traces are stopped on an IPL.

Options: The IMP Instruction Trace Menu has the following options:

1. Specify VLIC module name and offset

   You are prompted for the module name and offset range (00000000 0000 through FFFFFFFF FFFF) used to trace instructions. You are also prompted to specify the mode for branch instructions only or all instructions.

2. Specify address range

   You are prompted for the address range (00000000 0000 through FFFFFFFF FFFF) used to trace instructions. You are also prompted to specify the mode for branch instructions only or all instructions.

Note: If instruction mode is chosen, all instructions processed in the specified range are recorded. If branch mode is chosen, only branch instructions are recorded. For each branch instruction recorded, the branch target is also recorded whether it is in the range or not.

After you supply the information requested by the prompts, the Start IMP Instruction Trace menu is displayed.

Start IMP Instruction Trace Menu: The options are:

1. Task dispatching element (TDE) address

   A display is presented and you must supply a TDE address range from 00000000 0000 to FFFFFFFF FFFF.

2. Active VLIC tasks

   A display of active VLIC task TDEs is presented for your selection.

3. Active MI processes

   A display of active process TDEs is presented for your selection.

MI Instruction Supervisory Linkage (SVL) Trace: This trace let you:

- Allocate the trace tables, see page 12-12.
- Clear the trace tables, see page 12-12.
- Display a trace status, see page 12-12.
- Display the trace tables, see page 12-13.

  You are prompted to enter a specific qualifier, a range of qualifiers, or all the qualifiers.

- Dump a trace, see page 12-13.

  You are prompted to enter a specific qualifier, a range of qualifiers, or all the qualifiers.

- Start a trace, see page 12-14.
- Stop a trace, see page 12-17.

See Chapter 30 for a description of this trace.

Multiprogram Level Trace: This trace lets you:

- Allocate the trace tables, see page 12-12.
- Clear the trace tables, see page 12-12.
- Display a trace status, see page 12-12.
- Display the trace tables, see page 12-13.

  You are prompted to enter a specific qualifier, a range of qualifiers, or all the qualifiers.

- Dump a trace, see page 12-13.

  You are prompted to enter a specific qualifier, a range of qualifiers, or all the qualifiers.

- Start a trace, see page 12-14.
- Stop a trace, see page 12-17.

See Chapter 30 for a description of this trace.

Task Switch Trace: This trace lets you:

- Allocate the trace tables, see page 12-12.
- Clear the trace tables, see page 12-12.
- Display a trace status, see page 12-12.
- Dump a trace, see page 12-13.

  You are prompted to enter a specific qualifier, a range of qualifiers, or all the qualifiers.
- Start a trace, see page 12-14.
- Stop a trace, see page 12-17.

See Chapter 30 for a description of this trace.

Stop Trace: This option is selected from the Trace Vertical Licensed Internal Code menu. The procedures and displays to stop trace are similar to those of start trace. Because of the similarity, the stop trace displays are not described here. Refer to the *Start trace* option on page 12-14. Enter a 2 next to any of the trace items listed to stop a trace. Press the F9 key to stop all traces.

Display Trace Table Examples: Displays for the following trace table examples are shown:

- Call and general trace table
- MI SVL trace detail record
- General trace detailed record
- Call trace detailed record

The IMP Instruction Trace Menu has the following options:

Call and General Trace Table Display: Use this display to view the retrieved trace records, to scroll forward and backward, and to select a detailed display of a trace record.

```
                        Display Call and General Trace Table

 Type option, press Enter.
   5=Display

                                               Date      Time           TDE
 Opt   Identifier  Description                 DD/MM/YY  HH:MM.SS:MSEC  Number
  _    SV*00001    MI SVL                      05/12/88  12:01:59.990   00000012
  _    SI*00009    Source/Sink instructions    05/12/88  12:01:59.995   00000012
  _    MG*00101    Source/Sink messages        05/12/88  12:02:00.002   00000015
  _    CB*00101    Control blocks              05/12/88  12:02:00.022   00000015
  _    CALL-BALL   #LOMIOMA    to    #RITRSSI  05/12/88  12:02:00.028   00000015
  _    Return-BRL  #RITRSSI    to    #LOMIOMA            12:02:00.030   00000015
  _    LP*00101    Protocol                    05/12/88  12:02:00.034   00000015
  _    SI*00004    Source/Sink instructions    05/12/88  12:02:00.083   00000012
  _    AU*31224    Authorization management    05/12/88  12:02:00.123   00000012
  _    CO*11111    Commit management           05/12/88  12:02:00.147   00000012
  _    JO*54321    Journal management          05/12/88  12:02:00.212   00000015
  _    MN*12345    Context management          05/12/88  12:02:00.213   00000015
  _    II*02020    Independent index           05/12/88  12:02:00.255   00000012
  _    EV*33333    Event management            05/12/88  12:02:00.300   00000012
                                                                        More...
  F3=Exit   F12=Cancel
```

Figure 12-16. An Example of a Display Call and General Trace Table Display

The following are examples of displays that appear after selecting an item from the previous Call and General Trace Table display.

MI SVL Trace Detail Record Display: Use this display to view the detailed contents of an MI SVL trace.

```
                      Display MI SVL Trace Detailed Record

                                                 Date      Time          TDE
 Identifier     Description                      DD/MM/YY  HH:MM:SS.MSEC Number
 SV*00001       MI SVL                           05/12/88  12:01:59.990  00000012

 Instruction . . . . . . . :   REQIO
 Instruction number . . . . :   0040
 Base register 0
   (B0) . . . . . . . . . . :   00230000 0240
 Instruction Address
   Register (IAR) . . . . . :   0360
 Program . . . . . . . . . :   QCDFMIO







 Press Enter to continue.

 F3=Exit   F12=Cancel
```

Figure 12-17. An Example of a Display MI SVL Trace Detailed Record Display

General Trace Detailed Record Display: Use this display to view the detailed contents of all general traces except MI SVL.

```
                      Display General Trace Detailed Record

                                                 Date      Time          TDE
 Identifier     Description                      DD/MM/YY  HH:MM:SS.MSEC Number
 SI*00009       Source/Sink instructions         05/12/88  12:01:59.995  0000012

 Entry number  . . . . . . :      1
 Entry length  . . . . . . :     16
 + 0000     01234567 89ABCDEF  01234567 89ABCDEF    * ................ *

 Entry number  . . . . . . :      2
 Entry length  . . . . . . :     12
 + 0000     01234567 89ABCDEF  01234567             * ............     *

 Entry number  . . . . . . :      3
 Entry length  . . . . . . :     50
 + 0000     01234567 89ABCDEF  01234567 89ABCDEF    * ................ *
 + 0010     01234567 89ABCDEF  01234567 89ABCDEF    * ................ *
 + 0020     01234567 89ABCDEF  01234567 89ABCDEF    * ................ *

 Press Enter to continue.

 F3=Exit   F12=Cancel
```

Figure 12-18. An Example of a Display General Trace Detailed Record Display

SST

Call Trace Detailed Record Display: Use this display to view the detailed contents of call traces.

```
                    Display Call Trace Detailed Record

                                              Date      Time          TDE
Identifier    Description                     MM/DD/YY  HH:MM:SS.MSEC Number
Call-BALL     #LOMIOMA    to   #RITRSSI       05/12/88  12:02:00.020  00000015

From:
  Module . . . . . . . . . :    #LOMIOMA
  Offset . . . . . . . . . :    1A24
To:
  Module . . . . . . . . . :    #RITRSSI
  Offset . . . . . . . . . :    0000

Press Enter to continue.

F3=Exit   F12=Cancel
```

Figure 12-19. An Example of a Display Call Trace Detailed Record Display

An Example of a VLIC Trace: A VLIC trace helps debug hangs, error recovery, and printer problems that do not have a buffer print mode. For example, some printers that do not have a buffer print mode are the 3812 and 5219 printers. To get a VLIC trace do the following:

1. Select the *System service tools* option from the System Main Menu, or on the Command Entry display, enter the Start SST (STRSST) command.
2. Select the *Start a service tool* option from the System Service Tools menu.
3. Select the *Trace vertical licensed internal code* option from the Start a Service Tool menu.
4. Select the *Clear trace tables* option from the Trace Vertical Licensed Internal Code menu. Note that the *Allocate trace tables* option may need to be used to create a large enough trace table.
5. Select the *Yes* option to clear the general trace table from the Clear Trace Tables display.
6. Press F3 to return to the Trace Vertical Licensed Internal Code menu.
7. Select the *Start trace* option from the Trace Vertical Licensed Internal Code menu.
8. Select the *Start trace* option to start the component traces from the Start Traces display.
9. Select the *Start trace* option to start the source/sink object trace from the Start Component Traces display.
10. Enter type 2 and subtype 01 on the Specify Source/Sink Object display. For the object, enter the name of the printer.
11. Select the *Start trace* option to start all of the source/sink object traces on the Start Source/Sink Object Traces display.
12. Select the *Start trace* option to start the source/sink object trace from the Start Component Traces display.
13. Enter type 1 and subtype 01 on the Specify Source/Sink Object display. For the object, enter the name of the controller.
14. Select the *Start trace* option to start all of the source/sink object traces on the Start Source/Sink Object Traces display.
15. Press F3 to return to the Trace Vertical Licensed Internal Code menu.

    At this time, begin tracing activity by using the Start Print Writer (STRPRTWTR) command. Enter this command from a different work station. For more information about the STRPRTWTR command, see "Tracing Writer Jobs" on page 17-11.
16. Wait until the hang or error recovery occurs.
17. Select the *Stop traces* option from the Trace Vertical Licensed Internal Code menu.
18. Press F9 on the Stop Traces display to stop all traces.
19. Press F3 on the Stop Traces display to return to the Trace Vertical Licensed Internal Code menu.
20. Select the *Dump trace tables* option from the Trace Vertical Licensed Internal Code menu.
21. Press F9 on the Dump Trace Tables display to dump all traces.
22. Specify no time or select the No option on the Specify Time Qualification display.
23. Select the *Printer* option from the Select Dump Device display. It is not necessary to include the control trace records.
24. Wait until the message, `Dump completed successfully,` appears.
25. Press F3 to return to the Trace Vertical Licensed Internal Code menu.
26. Select the *End trace vertical licensed internal code* option from the Trace Vertical Licensed Internal Code menu.
27. Select the End SST from the System Service Tools menu.

An Example of Tracing Datastreams: The following procedure is an example of how you can use VLIC trace to trace datastreams between a work station controller and an AS/400.

1. Select the *Start a service tool* option from the SST main menu.
2. Select the *Trace vertical licensed internal code* option from the Start a Service Tool menu.
3. Select the *Clear trace tables* option from the Trace Vertical Licensed Internal Code menu.
4. Select the *Yes* option to clear all the general trace tables and the task switch trace tables. Also, select the *Yes* option on this display to let the general trace table to wrap.
5. Press F3 to return to the Trace Vertical Licensed Internal Code menu.
6. Select the *Start traces* option from the Trace Vertical Licensed Internal Code menu.

SST

7. Select the *Start trace* option to start the component traces from the Start Traces display.
8. Select the *Start trace* option to start the source/sink object trace from the Start Component Traces display.
9. Enter type 1 if you are tracing the entire controller or type 2 for the type if you are tracing a particular display or printer on the Start Source/Sink Object Traces display.
10. Enter subtype 01 for the subtype on the Start Source/Sink Object Traces display.
11. Enter only one object name to trace on the Start Source/Sink Object Traces display. For example, DSP01, ADSP02, PRT03, CTL05 and so on.
12. Press the Enter key.
13. Type a 1 in the *User/data (data stream/SCS)* field on the Start Source/Sink Object Traces display.
14. Press the Enter key. The trace is now started.
15. Press F12 a couple of times until you return to the Trace Vertical Licensed Internal Code menu.
16. Select the *Stop traces* option from the Trace Vertical Licensed Internal Code menu.
17. Press F9 from the Stop Traces display to stop all traces. The trace is now stopped.

To spool the trace:

18. Press F12 from the Stop Traces display to return to the Trace Vertical Licensed Internal Code menu.
19. Select the *Dump trace tables* option from the Trace Vertical Licensed Internal Code menu.
20. Press the F9 key on the Dump All Traces display to dump all trace tables.
21. Select the *Printer* option from the Select Dump Device display. It is not necessary to include the control trace records.
22. Wait until the message, `Dump completed successfully`, appears. The trace is now on the spooled output file ready to be printed.
23. Press F3 to return to the Trace Vertical Licensed Internal Code menu.
24. Select the *End trace vertical licensed internal code* option from the Trace Vertical Licensed Internal Code menu.
25. Select the End SST from the System Service Tools menu.

To print the spooled file:

26. Enter the WRKJOB command.
27. Select the *Work with spooled files* option.
28. Find the trace in the list. It should be named QPCSMPRT.
29. Select the option to change the file.
30. Change the output queue to equal the name of the printer you want to print to. For example, PRT01.
31. Press the Enter key.
32. Enter STRPRTWTR PRT01 on the command line.
33. Return to the System Main Menu.
34. Enter DSPMSG on the command line of the System Main Menu.
35. Press the F4 (Prompt) key.
36. Change the first field to *SYSOPR.
37. Enter an I if there is a message.
38. Press the Enter key. The trace should start printing.

Work with Communications Trace

This option lets you start or stop a trace of data on a communications line. Once you have run a trace of data, the data can be formatted for printing or viewing. You can view the print file only in the output queue.

Communications trace can be used to isolate errors that cannot be isolated using the system communications verification routines as described on page 11-3. Communication trace options run under SST. SST lets you use the communications line while communications trace is active.

Data may be traced and formatted for lines with the following communications type:

- Asynchronous
- BSC
- Synchronous data link control (SDLC)
- X.25
- Token-Ring network
- Ethernet Version 2 or IEEE 802.3

Note: Traces on a twinaxial data link control (TDLC) line are not given support.

The AS/400 communications trace can run from any display connected to the system. Anyone, with special authority (SPCAUT) of *SERVICE, can run the trace on an AS/400. Communications trace supports all line speeds. See the *Communications User's Guide* for the maximum aggregate line speeds on the ASC, BSC, SDLC, and X.25 protocols available on the 9404 System Unit and 9406 System Unit communications controllers.

Communications trace should be used when:

- The problem analysis procedures do not yield sufficient information about the problem.
- You suspect a protocol violation is the problem.
- You suspect a line noise to be the problem.
- The error messages indicate there is an SNA BIND problem.

Running communications trace requires detailed knowledge of the line protocols being used to correctly interpret the data generated. Whenever possible, start the communications trace before varying on the lines. This gives you the most accurate sample of your line coming up.

How to Use: To use the *Communications trace* option:

1. Start SST by selecting the SST option from the System Main Menu or by entering the STRSST command.
2. Select the *Start a service tool* option from the System Service Tools menu.
3. Select the *Work with communications trace* option from the Start a Service Tool menu. The following Work with Communication Traces display appears. If no traces are active in the system, an empty Work with Communications Traces display appears.

```
                      Work with Communications Traces

Type choice, press Enter.
  2=Stop trace   4=Delete trace   6=Format and print trace
  7=Display message

          Line
Choice    Name         Trace Description        Protocol   Trace Status

  _      LosAngeles   Test LosAngeles Line       SDLC      Active

  _      Mpls         Test Mpls Line             TRN       Stopped

  _      Tucson       Test Tucson Line           ASYNC     Waiting




F3=Exit    F5=Refresh      F6=Start trace   F10=Change size
F11=Display buffer size    F12=Cancel
```

From the Work with Communications Traces display, press F11 to get to this display.

```
                      Work with Communications Traces

Type choice, press Enter.
  2=Stop trace   4=Delete trace    6=Format and print trace
  7=Display message

Option    Line      Buffer Size (K)   Trace Direction    Stop/Wrap

  _       LosA           128               Sent             Stop

  _       Mpls           256               Both             Stop

  _       Tucson         4096              Received         Wrap




F3=Exit    F5=Refresh      F6=Start trace   F10=Change size
F11=Display trace status   F12=Cancel
```

Details of the trace, including status, are displayed. The trace status can be one of the following:

Condition	Description
Waiting	The trace is waiting for the line to be varied on (not collecting data).
Active	The trace data is being collected.
Stopping	The trace is stopping.
Stopped	The trace has stopped (not collecting data).
Error	An error occurred on the line while the trace was collecting data. The data might or might not be collected. The trace stopped.

Menu Flow: Figure 12-20 on page 12-21 shows the Work with Communications Trace menu flow.

SST

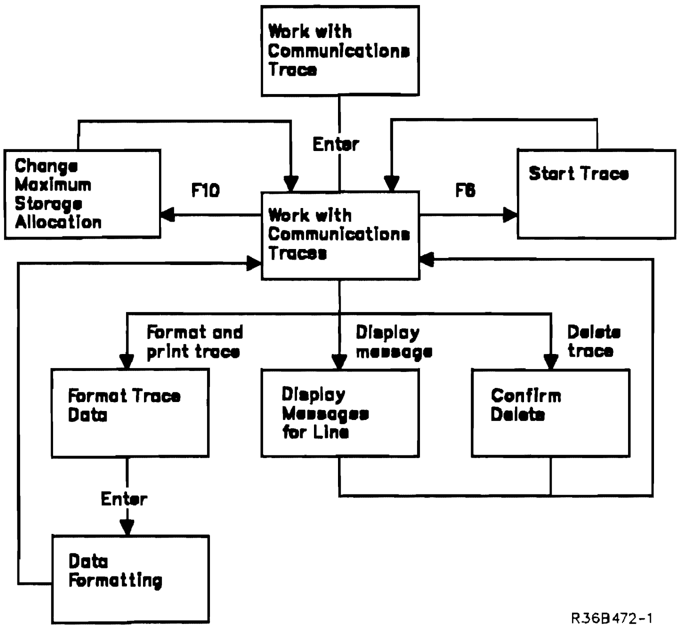

Figure 12-20. Work with Communications Trace Menu Flow

Options and Function Keys: The Work with Communications Trace menu has the following options and function keys:

- Start trace (F6), see page 12-21.

  This function key lets you start tracing the data on a communications line. The Start Trace display appears after you press this function key. For more information about the Start Trace display, see page 12-21.

- Stop trace (option 2)

  A trace must be stopped before the data can be formatted. To ensure the trace is stopped, use the Refresh function key to check the trace status. For more information about interrupting a trace, see page 12-22.

- Format and print trace (option 4)

  For more information on the *Format and print trace* option, see "Format and Print Trace" on page 12-22.

- Delete trace (option 6)

  Traces are not deleted when you leave a communications trace. Select this option to delete the trace data when you no longer need it. This releases space so that other traces can be started without increasing the maximum amount of storage provided for the communications trace.

- Display message (option 7)

  This option shows you a message indicating the status of the trace that has stopped because of an error.

- Change size (F10)

  This function key allows you to change the amount of storage used by all traces. You may want to increase the amount of storage if your system has many active traces or the traces will be active for a long time.

- Display buffer size or display trace status (F11)

  These function keys allow you to select which set of data is shown for the traces.

- Refresh (F5)

  This function key updates the data on the display.

Starting a Trace: The Work with Communications Traces display has a Start trace function key that lets you select options for tracing data. The following is an example of a Start Trace display:

```
                         Start Trace

Type choices, press Enter.

  Line . . . . . . . . . . . . . . . .   ________

  Trace description  . . . . . . . . .   ______________

  Buffer size  . . . . . . . . . . . .   _  1=128K, 2=256K, 3=2048K
                                            4=4096K, 5=6144K, 6=8192K

  Stop on buffer full  . . . . . . . .   _  Y=Yes, N=No

  Data direction   . . . . . . . . . .   _  1=Sent, 2=Received, 3=Both

  Number of bytes to trace
    Beginning bytes  . . . . . . . . .   _  VALUE, *CALC
    Ending bytes   . . . . . . . . . .   _  VALUE, *CALC



F3=Exit   F5=Refresh   F12=Cancel
```

Figure 12-21. An Example of a Start Trace Display

You must enter the name of a communications line in the *Line* prompt. If you do not know the name of the line:

1. Press F16 to return to the System Service Tools (SST) display.
2. Select the Command entry function key from the System Service Tools (SST) display.
3. Type in `WRKCFGSTS lin` (the Work with Configuration Status command with a line option) to get a list of all available lines on the system.
4. Select the *Work with active service tools* option under SST to return to communications trace. For an example of the Work with Active Service Tools display, see Figure 12-65 on page 12-66.

You can enter text that describes the trace to be started in the *Trace description* field. This field can help you identify the trace.

You can select a *Buffer size* to hold the communications data that the trace collected. The default buffer size is 1 = 128K bytes. The size of the buffer to use is based on the speed of the communications line and the amount of time expected to trace the data. For high speed lines or long periods of tracing, a larger buffer size is recommended.

You have the option to stop tracing to view only the starting data coming across a line or to permit tracing to continue by specifying Yes or No in the *Stop on buffer full* field. Specify Yes to stop the trace when the buffer is full. If you do not specify Yes and if the buffer is full, the buffer fills from the top again and any data stored before is written over.

You can select the direction of data to be traced by specifying one of the three selections in the *Data direction* field:

- Only data being sent from the system (option 1)
- Only data being received by the system (option 2)
- Both (option 3)

Note: For lines that are SDLC short hold mode, the trace does not include any controller names if *Sent* is specified for the data direction.

You can select how much data should be traced in a frame of data. 36 bytes is the minimum value allowed for both the beginning and the end value. The protocol header is included in the 36 byte minimum value. The value that is entered is the amount that is saved as part of the trace. The maximum value allowed is determined by the line you are tracing.

Notes:

1. The beginning or ending byte values are ignored by the BSC protocol.
2. The ending byte value is ignored by the SDLC and HDLC protocols.

When you correctly input all required options and press the Enter key, the Work with Communications Trace display appears.

Interrupting a Work with Communications Trace: You may exit the communications trace and SST to do other work while trace is active. To return to the communications trace:

1. Select the *Start a service tool* option from the SST Main Menu.
2. Select the *Work with communications trace* option from the Start a Service Tool menu.

The trace remains active until:

- The option to stop the trace is selected.
- The line being traced is varied off.
- The line being traced has an error.
- The trace buffer is full and the option to stop on buffer full is selected.

Format and Print Trace: This option lets you select various formatting options and prepare the trace data for printing. The options shown for each protocol vary. Figure 12-22 shows an example of a Format Trace Data display for a CSMA/CD protocol.

```
          Format Trace Data for ______________

 Line  . . . . . . . . . . . . :  _______

 Type choices, press Enter.

   Controller . . . . . . . . . .  ________   *ALL, Name

   Data representation  . . . . .  _          1=ASCII, 2=EBCDIC

   Format SNA data only . . . . .  _          Y=Yes, N=No

   Format RR, RNR command . . . .  _          Y=Yes, N=No

   Format TCP/IP data only  . . .  _          Y=Yes, N=No

   Format UI data only  . . . . .  _          Y=Yes, N=No

   Select CSMA/CD data  . . . . .  _          1=802.3, 2=ETHV2 3=Both


 F3=Exit   F5=Refresh   F12=Cancel
```

Figure 12-22. An Example of a Format Trace Data Display for a CSMA/CD Protocol

Notes:

1. Pressing the Enter key without making any changes to the defaults on the Format a Trace Data display gives you all the data associated with the trace; however, the information is not in any special format.
2. Select an option to format and print only the data that you want to see.
3. All options available for formatting are dependent on protocol of the the line being traced. Only valid choices appear for each protocol.
4. Not all combinations of options are valid for all protocols. If you select an invalid option, error messages appear. If an error message appears, you must change your selections. You can restore all options to their default values using the Refresh key.
5. See the online help for more information about these options and how to locate, print, save, and send the spooled trace data.

Select whether or not to:

- Format only the records for a specific controller by typing in *ALL or the name of the controller in the *Controller* field.

  Notes:

  1. When you type in a controller name in this field, the printout contains only the records that match that controller name.
  2. Records that have a blank controller name are the result of transmission modes that cannot be connected. These appear in the printout only when *ALL is selected.

- Format the data for printing in ASCII by typing a 1 or in EBCDIC by typing a 2.

  This option determines how the hexadecimal data is converted to characters. Most data transmitted by the system contains an indication of whether it should be considered ASCII or EBCDIC characters. This option is used only when the data does not contain such an indication. It does not change any data that clearly specifies how it is to be interpreted.

If you select ASCII for this option, the hexadecimal is converted to displayable characters following ASCII conversion rules. If you select EBCDIC for this option, the hexadecimal data is converted following EBCDIC conversion rules. For example, hexadecimal C1 would be A in EBCDIC but hexadecimal 41 would be A in ASCII characters.

- Format only records with SNA data by typing a Y (Yes) or an N (No) in the *Format SNA data only* field.

  This option is only valid for Local Area Networks, SDLC, and X.25. Selecting Yes for this item causes only SNA (Systems Network Architecture) data to be formatted and then spooled. Selecting No for this item causes the line protocol (SDLC, X.25, CSMA/CD, or TRLAN) data to be formatted and spooled, but the SNA data is spooled unformatted (hexadecimal).

- Format records with RR or RNR commands by typing a Y (Yes) or an N (No) in the *Format RR, RNR commands* field.

  This option is only valid for Local Area Networks, SDLC, and X.25. Selecting Yes for this item causes RR (Receiver Ready) and RNR (Receive Not Ready) commands to be formatted along with other data. Selecting No for this item causes RR and RNR commands not to be formatted with other data.

- Format only the records with TCP/IP data by typing a Y (Yes) or an N (No) in the *Format TCP/IP data only* field.

  This option is only valid for Local Area Networks and X.25. Selecting Yes for this item causes only frames that contain Terminal Control Protocol/Internet Protocol (TCP/IP) data to be formatted and then spooled. Selecting No for this item causes the line protocol (TRLAN, CSMA/CD, or X.25) data to be formatted and then spooled.

- Format only records with UI data by typing a Y (Yes) or an N (No) in the *Format UI data only* field.

  This option is only valid for Local Area Networks. Your selection for *Format SNA data only* must be No to select Yes for this option. Selecting Yes for this item causes only Unnumbered Information (UI) data to be formatted and then spooled. Selecting No for this item causes the line protocol (TRLAN or CSMA/CD) data to be formatted and then spooled.

- Select CSMA/CD data for IEEE 802.3 only, Ethernet Version 2, or both.

  This option is only valid for CSMA/CD Local Area Networks. Selecting 1 for this item causes only IEEE 802.3 data to be formatted and then spooled. Selecting 2 for this item causes the Ethernet V2 data to be formatted and then spooled. Selecting 3 for this item causes the both types of data to be formatted and then spooled.

When the format of the trace data is complete, the output is placed in a spool file named QPCSMPRT in the default output queue. The spooled trace data cannot be displayed or printed from communications trace or SST. To look at (browse), print, save, or transmit the spooled trace data, you must leave SST and use system functions. For directions on how to look at (browse), print, save, or transmit the spooled data, press the Help key.

The format of the trace data is:

- An introduction page containing, for example, line name, protocol, start and stop dates and times, trace options, and formatting options.
- A help page, to aid you in understanding the output, is printed on a page following the introduction page. Help text for a specific protocol is given because the trace data differs for each communications protocol.
- The formatted trace data output. See Figure 12-23 on page 12-24.

```
Record        Data   Record    Data    Record  Controller                Number  Number    Poll/
Number  S/R  Length  Status    Type    Timer   Name / Number  Command   Sent    Received  Final
------  ---  ------  --------  ------  ------  -------------  -------   ------  --------  -----
000001  S        10  00000000  EBCDIC   40A2   CTLNAME001/C0  XID                          On

                     Data . . . . :    0102030405060708090A

000002  R        10  00000000  EBCDIC   40A4   CTLNAME001/C0  XID                          On

                     Data . . . . :    0102030405060708090A

000003  S         0  00000000  EBCDIC   40A9   CTLNAME001/C0  SNRM                         On

000004  R         0  00000000  EBCDIC   40AD   CTLNAME001/C0  UA                           On

000005  S        15  00000000  EBCDIC   40AD   CTLNAME001/C0  I         0       0          Off

                     Data . . . . :    0102030405060708090A0B0C0D0E0F

 *** End of Computer Output ***
```

Figure 12-23. An Example of a Formatted Trace Data Output for SDLC

The width of the spooled file is 132 characters. The data is in hexadecimal representation and either ASCII or EBCDIC character representation. The different columns of the trace output common to all protocols are:

Record number This column shows the number of the trace record.

S/R This column shows if the record type is sent (S) or received (R).

Note: The letter C in this column indicates an X.21 short hold mode connection was cleared.

Data length This column shows the amount of data, in decimal, contained in the record.

Record status This column shows the protocol-dependent return code for the trace record. 00000000 is an unqualified success. Other return codes are listed in the functional specification for the protocol that is running or the port manager. For a list of return codes, see "Protocol Dependent Return Codes" on page 12-25.

Record timer This column shows the time since the last event.

Data type This column shows whether the data traced is printed in ASCII or EBCDIC character representation. If the character representation of the data is mostly periods, you may want to format the data again using the other option for data representation.

Controller name / number
This field indicates which controller originated the frame or record. In some conditions, this data is not available and the column remains blank.

Note: All traces end with *** End of Computer Output *** to mark the end of the spooled data.

Communications Trace Limitations: Only two communications traces can run concurrently on one communications controller. Only one trace can exist for the same line at the same time.

Although a communications trace can start before or after the line is varied on, a communications trace must be started *before* the line is varied on if it is important to see the starting information coming across the line.

Although two or more users can select the same trace to format and print, this may cause performance concerns. When multiple users attempt to use the same resources (trace data), slow responses may occur because one user must wait for the other user to finish before beginning to process the data.

When an AS/400 system is configured as an SDLC secondary station on a multipoint line, the communications controller traces all records or frames sent to the system to include those frames and records intended for other stations. When using the communications trace service tool to format the data for this configuration, the resulting report may show received records that were intended for other stations.

On a single point-to-point line, where only one secondary station is configured, SDLC traces all frames received before it gets the frames intended for other station addresses. It is not until the secondary SDLC receives the other station addresses that it knows which single-station address the communications equipment uses.

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Protocol Dependent Return Codes: The record status column in a formatted communications trace dump may show these return codes for:

- All protocols

Return Code	Meaning
00 00 00 00	Successful, no errors

- SDLC and X.25

Return Code	Meaning
12001121	Frame aborted (received 7 consecutive one bits) This indicates there is noise on the communications line or problems with the modem.
14001515	Frame check (FCS) error This indicates there is noise on the communications line or problems with the modem.
14001516	Frame not a multiple of 8 bits This indicates there is noise on the communications line or problems with the modem.
14001520	Frame too short (frame is less than 32 bits) This indicates there is noise on the communications line or problems with the modem.
12001521	Received frame truncated This means the FCS is good but the frame contains more data than the IOP's buffer; this is possibly a remote configuration or code error, or ESD problem.
12001530	Receive overrun This rarely occurs; it means there is a work load or ESD problem. An ESD problem is one in which electrical noise from outside the AS/400 is entering the system and interfering with the I/O adapter.
54002050	Transmitted frames path error For SDLC, this is not really a transmit. It just documents that a permanent error has halted all further line and trace activity. Any entries following this one would mean that the line went down and was started again. The real error is in the IOP's error log. For X.25, this indicates that an error was detected while preparing the frame and the frame was not sent.

- ASYNC statuses

Return Code	Meaning
12 00 1A 02	Trace stopped due to stop trace request
12 00 1A 06	Trace buffer send on full or wrap
12 00 1A 0A	Trace stopped due to stop trace request with data lost
12 00 1A 0E	Trace buffer send on full and wrap with trace data lost
12 00 1A 07	Trace record contains partial record
16 00 1A 02	Break received while transmitting a record
16 00 1A 07	Break detected
16 00 1A 10	Received record equals maximum receive buffer size
16 00 1A 20	End of record character received
16 00 1A 30	Break received while reading record
46 00 1A 00	Inter-character timeout
46 00 1A 01	Inter-character timeout with parity error
46 00 1A 02	Inter-character timeout with framing error
46 00 1A 03	Inter-character timeout with parity and framing error
46 00 1A 04	Inter-character timeout with data discarded
46 00 1A 05	Inter-character timeout with data discarded and parity error
46 00 1A 06	Inter-character timeout with data discarded and framing error
46 00 1A 07	Inter-character timeout with data discarded, parity and framing error
46 00 1A 11	Receive buffer full and parity error
46 00 1A 12	Receive buffer full and framing error
46 00 1A 13	Receive buffer full with framing error and parity error
46 00 1A 14	Receive buffer full with data discarded
46 00 1A 15	Receive buffer full with data discarded and parity error
46 00 1A 16	Receive buffer full with data discarded and framing error
46 00 1A 17	Receive buffer full with data discarded, framing error and parity error
46 00 1A 21	Parity error in received record and the record is terminated by EOR character
46 00 1A 22	Framing error in received record and the record is terminated by EOR character
46 00 1A 23	Framing error and parity error in received record and the record is terminated by EOR character

46 00 1A 24	Data discarded in received record and the record is terminated by EOR character
46 00 1A 25	Data discarded and parity error in received record and the record is terminated by EOR character
46 00 1A 26	Data discarded and framing error in received record and the record is terminated by EOR character
46 00 1A 27	Data discarded, framing and parity errors in received record and the record is terminated by EOR character
46 00 1A 31	Parity error in received record and the record is terminated by break signal
46 00 1A 32	Framing error in received record and the record is terminated by break signal
46 00 1A 33	Parity error and framing error in received record and the record is terminated by break signal
46 00 1A 34	Data discarded in the received record and the record is terminated by break signal
46 00 1A 35	Data discarded and parity error is received record and the record is terminated by break signal
46 00 1A 36	Data discarded and framing error is received record and the record is terminated by break signal
46 00 1A 37	Data discarded, parity and framing errors in received record and the record is terminated by break signal

- BSC statuses

Return Code	Meaning
12 00 1A 02	Trace stopped due to stop trace request
12 00 1A 07	Trace record contains partial record
12 00 1A 0A	Trace stopped due to stop trace request with trace data lost
44 00 15 15	BCC error on received data
46 00 1B 02	Sync Continue Timeout
12 00 15 30	Receive Overrun
12 00 2B 01	Data Received as response to poll
46 00 2B 05	Unexpected response to TTD
46 00 2B 06	Unexpected response to WACK
46 00 1B 01	Sync data timeout
46 00 2B 0C	Transmit terminated by unexpected COD character
46 00 2B 0D	Transmit terminated, no COD character defined
42 00 1A 09	DLE sequence error in transparent data
42 00 1A 00	Lost data due to receive buffer full

- Port Monitor

Return Code	Meaning
12 00 11 23	CTS dropped warning
12 00 11 26	CTS active
12 00 11 27	DCE Not ready
12 00 11 28	DCE controlled not ready warning
12 00 11 29	DCE operational
12 00 11 40	DSR drop warning on leased line
12 00 11 41	DSR returned active on leased line
12 00 1A 70	OK to transmit
44 00 11 1C	CTS dropped
54 00 14 90	DSR dropped
32 00 10 06	Primitive command out of sequence
12 00 11 21	Previous Port Monitor request cancelled by user
44 00 16 18	CTS on before RTS
44 00 16 20	CTS signal failed to come up in required time

Display/Alter/Dump

Invoke the *Display/alter/dump* option from the Start a Service Tool menu. The *Start a service tool* option is selected from the System Service Tools menu. (A limited number of display/alter/dump options is also available under the control of DST.) Use display/alter/dump to retrieve selected data from storage, and write the data to an output device. The output device can be:

- The console display (display/alter functions)

  When you select the console display as the output device, you can alter the contents of storage, or you can scroll backward and forward through storage.

- A printer (dump-to-printer function), a tape (dump-to-tape function), or a diskette (dump-to-diskette function)

  When the output device is either a printer, a tape, or a diskette, the actual dump task runs asynchronously with the display/alter/dump control functions. That is, while a dump is completing on the printer, tape, or diskette, you can operate the display/alter function (output device is the display), or you can make other dump requests for the printer, tape, or diskette. The dump requests are saved in a first-in-first-out queue and are processed one at a time.

  Note: If the display/alter/dump service function stops, the dump request currently being processed ends also, whether it has completed or not. Dump requests that are not processed are lost.

You can use the *Display/alter/dump* option to print a diskette or tape that contains output from display/alter/dump or from other VLIC service tools or functions; you can also display the status of the display/alter/dump task.

You control the display/alter/dump function by choosing menu options and by responding to prompts.

Function Keys: F3 and F12 have the following functions:

Key	Function
F3	Causes an immediate return to the Display/Alter/Dump menu
F12	Causes a return to the previous display

The Help key provides help text pertinent to the current display.

Menu Flow: Most of the displays shown by the *Display/alter/dump* option are designed according to data type. Therefore, the set of displays associated with the display device is nearly identical to the screens associated with the printer, tape, and diskette devices. The displays are shown, by function, only once. There are four sets of displays, one for each device. Figure 12-24 on page 12-28 shows the display/alter/dump display levels and menu flow.

The differences between the display sets are usually near the final output steps. For example, you have to specify a dump title for the printer and diskette but not for the display. Also, diskette or tape require a volume and file name.

The options associated with the display device for scrolling and altering storage are unlike the options for the other three devices; however, only a few of the displays are different.

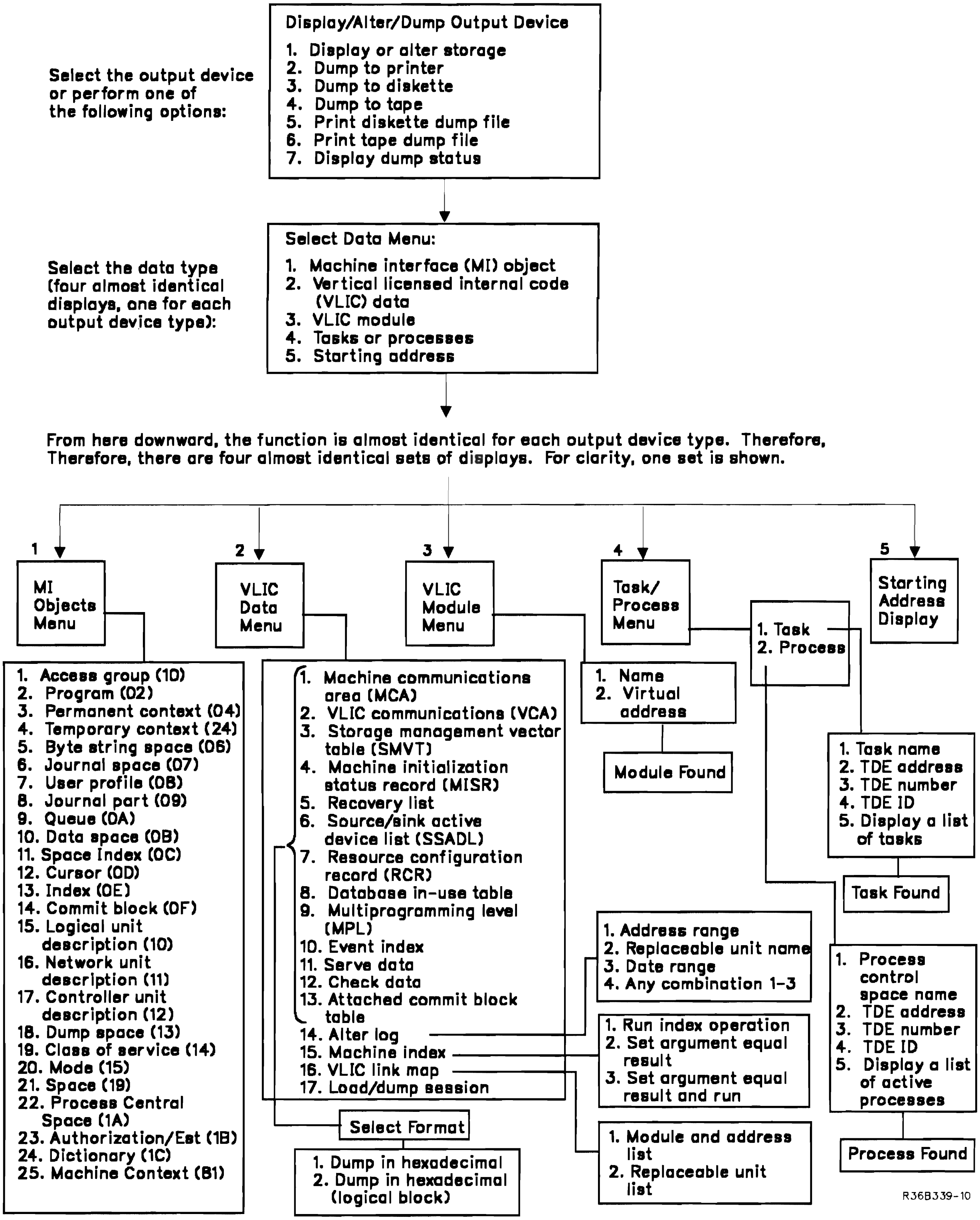

Figure 12-24. Display/Alter/Dump Screen Levels and Menu Flow

Options: Select the output device or perform one of the following options:

1. Display/Alter storage

   This option lets you display or alter storage. Select the display as the output device. After you have selected this option, the Select Data Menu appears.
2. Dump to printer

   This option lets you select the printer as the output device. After selecting a printer, select an option from the Select Data Menu.
3. Dump to diskette

   This options lets you select the diskette as the output device. After selecting a diskette, select an option from the Select Data Menu.
4. Dump to tape

   This option lets you select the tape as the output device. After selecting a tape, select an option from the Select Data Menu.
5. Print diskette dump file

   - You are prompted for the dump file that you want display/alter/dump to print.
   - You can also print part of a dump by specifying the beginning and ending page numbers (from the printed dump) on line 5.

     Note: Display/alter/dump can print only files that are created by the display/alter/dump, VLIC trace, or VLIC log service tools.
6. Print tape dump file

   This option is similar to the Print diskette dump file option.
7. Display dump status

   This option lets you display the title of the dump currently being processed or the number of dump requests waiting to be processed

   Note: If the dump task ends abnormally, this display shows this status and displays information for the abnormal end.

Select Data Menu

Options: Select the data type (four nearly identical screens, one for each output device type):

1. Machine interface (MI) object, see page 12-30
2. Vertical licensed internal code (VLIC) data, see page 12-30
3. VLIC module, see page 12-31
4. Tasks/processes, see page 12-31
5. Starting address, see page 12-31

Use this menu to select the type of data to be presented to the output device.

Notes:

1. The Dump to Printer, Dump to Diskette, and Dump to Tape menus are identical to this Display/Alter menu except for the information variable.
2. If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

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Machine Interface (MI) Object Menu

Options: The Machine Interface (MI) Object menu has the following options:

1. Access group (01)
2. Program (02)
3. Permanent context (04)
4. Temporary context (04)
5. Byte string space (06)
6. Journal space (07)
7. User profile (08)
8. Journal port (09)
9. Queue (0A)
10. Data space (0B)
11. Space index (0C)
12. Cursor (0D)
13. Index (0E)
14. Commit block (0F)
15. Logical unit description (10)
16. Network unit description (11)
17. Controller unit description (12)
18. Dump space (13)
19. Class of service (14)
20. Mode (15)
21. Space (19)
22. Process control space (1A)
23. Authorization list (1B)
24. Dictionary (1C)
25. Machine context (81)

Use this menu to select the type of system instruction object to be dumped or displayed. Note that the number in parentheses in each entry is the object type identifier. For more information about object types and subtypes, see Chapter 25.

After you select one of the object types, displays are presented that allow you to specify how display/alter/dump is to find the object. The options (by object) are:

1. Name and context name
2. Name (for objects in the machine context)
3. Address

Vertical Licensed Internal Code (VLIC) Data Menu

Options: The Vertical Licensed Internal Code (VLIC) Data menu has the following options:

1. Machine communications area (MCA)
2. VLIC communications area (VCA)
3. Storage management vector table (SMVT)
4. Machine initialization status record (MISR)
5. Recovery list
6. Source/sink active device list (SSADL)
7. Resource configuration record (RCR)

   For more information about RCRs, see page 10-1.
8. Database in-use table
9. Multiprogramming level (MPL)
10. Event index
11. Seize data
12. Lock data
13. Attached commit block table
14. Alter log
15. Machine index
16. VLIC link map
17. Load/dump session

Options 1 through 13 result in the data being written to the selected device. After you have selected your device, the Select Format display appears. For more information about entering an address and selecting a format, see page 12-31.

Option 14 results in menus that allow you to select alter log entries. You can qualify your selection by selecting one of the following options:

1. Address range
2. Replaceable unit name
3. Date range
4. Any combination of 1 through 3 above

Note: The default data in the input positions when this display appears are:

- Zeros for the address range
- Blanks for FRU name and date range

Only the data that you enter is used as criteria for the search; the default data is not used.

The following display is an example of an alter log entry found.

```
                         Display Alter Log Entry

Date/Time
  of alter . . . . . . . . :   11/20/87  MM/DD/YY    (12:10:15  HH:MM:SS)

Replaceable
unit name  . . . . . . . . :   #RIDADAT

Address altered  . . . . . :   0000 00000401 C200

Data:
  Old . . . . . . :   11111111 11111111 11111111 11111111    ................
  New . . . . . . :   22222222 22222222 22222222 22222222    ................
  Current . . . . :   33333333 33333333 33333333 33333333    ................




Press Enter to continue.

F3=Exit   F12=Cancel
```

Figure 12-25. An Example of a Display Alter Log Entry Display

In this example, the data at the altered storage address has been destroyed and no longer exists. (If the data did exist, it would be displayed.)

If the altered data is not part of a replaceable unit, line 5 is blank.

Option 15 prompts for the address of the machine index or causes the Run Index Operation display to appear. For more information about the Run Index Operation display, see page 12-35.

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Option 16 results in a menu with the following options that you can use to select a particular type of link map:

1. Module and address list
2. Replaceable unit list

Note: This option is not available if the output device is the display.

VLIC Module Menu: This menu provides options that let you specify how display/alter/dump is to find the desired module by:

- Name
- Virtual address

A prompt is then issued for either the name or the address of the module.

When the module is found, the following Module Found display appears that contains the following information:

- Module
  - Name
  - Virtual address
  - Length
- Entry
  - Name
  - Virtual address
- Replaceable unit
  - Name
  - Virtual address
  - Length
  - EC level
  - Part number
  - Replaceable unit header address

The Module Found display prompts you to press the Enter key to write the module to the selected output device (an entry is made in the dump request queue).

Tasks/Processes Menu

Options: The Tasks/Processes menu has the following options:

1. Task
2. Process

A **task** is a structure used to track work in VLIC. Its base component is a task dispatching element (TDE) which is the basic work control structure used by HLIC and the hardware for task switching.

A **process** is a structure used as the basic work element above the MI. A TDE is its lowest structure.

The difference between tasks and processes is the amount of structure built around the TDE. For more information about tasks or processes, see Chapter 27 on page 27-1.

Task Option: Selecting this option on the Tasks/Processes menu displays the Find Active Task menu from which you specify how display/alter/dump is to find the task by:

1. Task name
2. TDE address
3. TDE number
4. TDE ID
5. Displaying a list of tasks

When the search is completed, the Task Found display, which contains the following task attributes, is shown:

- Task name
- TDE address
- TDE number
- TDE ID

The Task Found display prompts you to press the Enter key to write the task to the selected output device (an entry is made in the dump request queue). If the output device is a display, then the Display Storage display appears.

Process Option: Selecting the process option on the Tasks/Processes menu displays the Find Process menu from which you must specify how display/alter/dump is to find the process by:

1. Process control space name
2. TDE address
3. TDE number
4. TDE ID
5. Display of a menu of active processes

When the search is completed, the Process Found display, which contains the following process attributes, is shown:

- Process control space name
- Process subtype
- Process TDE address
- Process TDE number
- Process TDE ID

The Process Found display prompts you to press the Enter key to write the process to the selected output device (an entry is made in the dump request queue).

Starting Address Display: This option uses slightly different displays depending on the output device.

- If the system does not have a preassigned address for the printer, tape, or diskette you selected, you are prompted for a beginning address in storage and the length of data that you want dumped. Also, for a printer, you are prompted for a dump title, and for the diskette and tape, you are prompted for a volume file name.

  The following Select Format display appears when the address ranges are entered for the printer, tape, and diskette:

```
                              Select Format

 Output device . . . . . . :   Printer

 Select one of the following:

      1. Dump in hexadecimal
      2. Dump in hexadecimal (logical blocks)
      (3. Maybe filled in at run time)
      (4. Maybe filled in at run time)









 Selection
      _

F3=Exit   F12=Cancel
```

Figure 12-26. An Example of a Select Format Display

The options on the Selection Format menu refer to the map levels of the dump. For more information about mapping levels, see 12-37.

- If the system has a preassigned address for the printer, tape, or diskette you selected, the Starting Address Display does not appear; however, the previous Select Format display does appear.
- For the console display, you are prompted for a beginning address of the data to be displayed. The following display shows an example of the data presented:

```
                                Display Storage

Control . . . . . . .   _____                nnnnn, Pnnnn, Lcccc, .cccc
Address . . . . . . .   00000046 1600

1600       25000000 00000000  00780080 0C028000   _  * ................ *
1610       00464A80 F6800000  08000000 01008000   _  * ....6........... *
1620       00064FE0 7FFFFFD1  7CC00000 800F000B   _  * ..|....J@....... *
1630       85C60000 0B1C8400  A0011500 03360000   _  * .F.............. *
1640       08000000 A0011500  00C00000 00000000   _  * ................ *
1650       00000000 00009002  0604CC00 00000000   _  * ................ *
1660       00000000 08000000  00000000 00000000   _  * ................ *
1670       00000000 A0010008  0200A001 00084DA0   _  * ..............(. *
1680       00000B1C 8AA20000  000086CA 00000B1C   _  * ................ *
1690       84008000 091A0000  00000000 00000000   _  * ................ *
16A0       00000000 00000000  A0011500 05380000   _  * ................ *
16B0       00000000 00000000  00000000 00000000   _  * ................ *
16C0       010E0000 00000000  00000000 00000000   _  * ................ *
16D0       0200F680 80000000  00000000 00000001   _  * ..6..............*
16E0       00000000 00000000  00000031 80000046   _  * ................ *
16F0       0400A001 15000010  00000000 0000F680   _  * ..............6. *
F3=Exit        F4=Alter labels       F5=Refresh          F6=Display stack
F9=Pop stack   F10=Push stack        F11=Alter storage   F12=Cancel
```

Figure 12-27. An Example of a Display Storage Display

This display shows data in both hexadecimal and character format. You can also alter the contents of storage by altering either the hexadecimal or character portions of the data display. The data display portion of the display is lines 6 through 21 and positions 12 through 73. The hexadecimal area is positions 12 through 47. The character area is positions 55 through 73.

Tag bits are extra bits built into the memory cards for security. Tags can only be turned on in MI pointers. There is one tag bit for each word (4 bytes) of main storage. The bits may only be set by a few special HLIC instructions. The bits are cleared any time someone stores data into a word and does not use the special HLIC instructions. This allows authority and address information to be stored permanently for a process in a pointer. Users may modify the pointer with a small set of instructions or else the tag bits are turned off and the storage is no longer considered a pointer.

If the tag bits are on, designating one of the 4-word lines as a system instruction pointer, a P is displayed in position 52. If the tag bits are off and if you insert a P in position 52 (when in alter mode) and press the Enter key, the tag bits are turned on.

The primary uses of this display are to scroll through storage and to alter storage.

Control Line Commands: The following control line commands keys apply:

Command	Description
nnnnn	Add or subtract nnnnn (a hexadecimal value) to the current address and display again. nnnnn is the scroll amount (forward or backward) used to generate a new address. Use the Roll keys to scroll forward and backward.
Pnnnn	Add nnnn to the current address. Then use the 6-byte value at that location as the new display address and display again. nnnn is the scroll amount used to generate a new address.
Lcccc	Place the equated label cccc into the equate table. Use the current display address for the address portion of the table entry. A message is displayed indicating the success or failure (table full) of this operation.
.cccc	Use the address equated to cccc in the equate table as the new display address and display again. If cccc cannot be found in the table, a message is displayed.

Address Line Entries: IF you insert a hexadecimal value over the current display address and press either the Enter key or F10, the data at the new address is displayed.

Hexadecimal Data Area Entries: The commands and their descriptions are:

Command	Description
P	When you place a P on any character of the display field and press the Enter key or F10, the address used for the display begins on a byte boundary. If the P was not placed on a character at a byte boundary, the address starting on the previous byte boundary is used as the new display address. Data at that address is displayed. The only invalid positions for a P are the last 10 characters on the display. Any addresses starting at those positions are beyond the range of the display and cannot be shown from this display.
S	If you place an S on the first byte of a hexadecimal data line and press either the Enter key or F10, the value in bytes 10 through 13 of that line is concatenated with 2 bytes of zeros and used as the new display address.

Function Keys: The Display Storage display has the following function keys:

Key	Function
F4	Shows the equate summary display. Use that display to enter and remove equates from the table.
F6	Shows the stack menu display. Use that display to select one of the stacked addresses for display again.
F9	Causes the most recent entry in the stack to be removed and used as the new display address, if the address stack is not empty.
F10	Causes the current display address to be saved in the address stack (last-in-first-out).
F11	Used to toggle between display and alter mode. Change the mode of the display to alter mode so that alterations to the contents of storage can be made, or change the mode of the display to display mode so that alterations to the contents of storage cannot inadvertently be made.
F12	Causes a return to the previous display (the display immediately before the data display).

Rules for Using the Input Fields, Commands, and Function Keys

- If you press either F12 or F3, changes that you have made to input fields are ignored.
- The address saved by F10 or equated by LCCCC is always the address of the data currently displayed, never the address to be displayed next.
- If the current display is for a bad address (storage does not exist) and you press F10, it is treated the same as the Enter key and no stack operation is performed.
- You can perform control line operations using F4, the Lcccc command, and F11. You can perform the stack operation using F10 in conjunction with other display operations, such as alteration of data or specification of a new display address.
- The control line operations (the Roll keys, the nnnnn, Pnnnn, .cccc commands, and F6) are overridden by other display operations such as alteration of data or specification of a new display address.
- The following display operations are conflicting:
  - Changing the address line displayed (line 4), and specifying an operation in the displayed data.
  - Specifying a data alteration while in display mode.
  - Specifying both a new display address (S or P) and data alteration in the displayed data.
  - Specifying a data alteration in the hexadecimal display area and also in the character display area for the same byte in storage.

Note: When this display is first presented, it is in display mode and storage cannot be altered. The title of the display reflects the mode. Use F11 to change to the mode. If the display was in display mode, pressing F11 changes the display to alter mode. The display stays in alter mode until you use F11 again. Pressing F11 returns the display to display mode. When the display is in alter mode and you press the Enter key, all valid changes made to the data portion of the display are made to storage. To ensure that storage is not changed inadvertently, you should return the display to display mode after an alter operation is performed.

Scrolling: You can scroll backward and forward through storage by using the Roll keys. Each time the Roll keys are pressed, the next 100 hex characters of data is presented in ascending or descending address sequence depending on the Roll key pressed.

Each time a new display of data is presented, the address is shown on the line just below the control area. If you want to go directly to some other area of storage, enter the desired address in the address area and press the Enter key. You can then scroll forward, backward, or alter storage at the new address.

This display also allows you to easily progress forward and backward through long address chains without having to write down each address.

Scrolling Address Chains: If you need to follow a sequence of addresses in storage, the following allows you to keep track of where you have been and lets you return easily:

- If you press F10, the present address is saved in a last-in-first-out (LIFO) stack of addresses.
- If you insert a P at the beginning of a 6-byte address displayed on the display and press the Enter key, the data at that address is displayed. The data is not altered by this operation.

If you insert a P and then press F10 instead of the Enter key, the present address is saved in the LIFO address stack, and the data at the new address is displayed. You can save up to 42 addresses in the stack.

- To return through the stack of addresses, use F9. When you are using this display and have addresses in the stack, each time you press F9, the last address that was put in the stack is removed, and the data at that address is displayed again.

  When the stack is empty and you press F9, a message appears showing the stack as empty.

Note: For system pointers, use an S instead of a P. (The system pointer must be on a 4-word boundary, and the S must be placed on the first character of the hexadecimal display line.)

Displaying the Address Stack: To display the address chain stack, press F6. The Select Stack Entry menu is then displayed showing the addresses in the stack.

```
                         Select Stack Entry

 Select one of the following:

      1. 00000406 E600         15. 00000000 0000         29. 00000000 0000
      2. 800032D9 F4EE         16. 00000000 0000         30. 00000000 0000
      3. 00000000 0000         17. 00000000 0000         31. 00000000 0000
      4. 00000000 0000         18. 00000000 0000         32. 00000000 0000
      5. 00000000 0000         19. 00000000 0000         33. 00000000 0000
      6. 00000000 0000         20. 00000000 0000         34. 00000000 0000
      7. 00000000 0000         21. 00000000 0000         35. 00000000 0000
      8. 00000000 0000         22. 00000000 0000         36. 00000000 0000
      9. 00000000 0000         23. 00000000 0000         37. 00000000 0000
     10. 00000000 0000         24. 00000000 0000         38. 00000000 0000
     11. 00000000 0000         25. 00000000 0000         39. 00000000 0000
     12. 00000000 0000         26. 00000000 0000         40. 00000000 0000
     13. 00000000 0000         27. 00000000 0000         41. 00000000 0000
     14. 00000000 0000         28. 00000000 0000         42. 00000000 0000

 Selection
      _

F3=Exit   F12=Cancel
```

Figure 12-28. An Example of a Select Stack Entry Display

This display shows the current list of addresses stacked using F10. You can select any entry as the new display address by entering the associated number in the option field and pressing the Enter key.

An address selected for display from this screen is ignored if another operation was requested in the address or data display portion of the data display screen that invoked this screen.

You can use the stack menu to go directly to any address in the stack without going backward through the stack using F9.

Equating Addresses: You can equate the current display address (line 4) to a four-character label and save both the label and address for later reference. To do this, insert Lcccc (where cccc is the label) in the control line and press the Enter key. The label and address are saved in a 42-entry table.

If you enter cccc in the control line, the corresponding address in the equate table is used as the new display address.

If you enter nnnnn on the control line and roll up to increment or roll down to decrement, the current display address is incremented or decremented by nnnnn, and the new address is used as the new display address.

If you enter Pnnnn on the control line, the 6-byte pointer at offset nnnn from the current display address is used as the new display address.

To display the table containing the equated labels, insert an E and press F4. The Alter Equated Labels display appears.

```
                            Alter Equated Labels

 Type information, press Enter.

 Label   ---Address---        Label   ---Address---        Label   ---Address---
 BAKR    00000046 E600        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000
 ____    00000000 0000        ____    00000000 0000        ____    00000000 0000

 F3=Exit   F12=Cancel
```

Figure 12-29. An Example of an Alter Equated Labels Display

This display shows the current list of equated labels. You can add, alter or delete entries on this display.

- To add an entry, position the cursor to a blank label entry, enter the desired 4-character label and 6-byte address, and press the Enter key.
- To alter an entry, enter the desired change to an entry that does not have a label of blanks and press the Enter key.
- To delete an entry, blank out the label for the entry and press the Enter key.

Altering Storage: You can alter any area of storage when in alter mode. To place the display in alter mode, press F11. Storage cannot be altered when the display is in display mode. F11 is used to toggle between display and alter mode. The title on the panel states if the display is in alter or display mode.

To alter the contents of storage, merely type in the new data in place of the old and press the Enter key.

Each time storage is altered, an entry is recorded in the alter log. The alter log entry consists of the old data (the complete line of data as it was displayed), the new data (the complete line), and the time and date of the entry. If it is a VLIC replaceable unit that is altered, the replaceable unit name is also displayed.

EBCDIC data in storage is displayed on the right side of the display as alphabetic characters. You can change the EBCDIC data by keying new alphameric data into the right side of the display and then pressing the Enter key. The alphameric data is automatically translated to hex in storage (the same alter log procedures apply).

When you are altering data and make an error or if you inadvertently alter data, the following considerations apply:

- Blanks (the space bar) cause no change when entered in the hexadecimal data area. This is useful if you make a keying error and do not remember what data was there previously. Merely space over the entire change and press the Enter key. No change takes place.
- If you alter storage and want to restore it to what it was originally, you can use display/alter/dump to display the resulting entry in the alter log. The old data, the new data, and the data as it exists (if it does exist) is displayed.
- Rather than blank out the conflicting data, F5 is used to refresh or restore the data if a conflict occurs.

Warning: When display/alter/dump is used under SST to display/alter storage, changes made to the VLIC nucleus code resident at 8000 0006 XXXX (main storage) are temporary and are effective only for the remainder of the current IPL. To make permanent changes to the nucleus code for subsequent IPLs, the user must make the changes at 0000 0600 XXXX, which is the virtual address where the VLIC nucleus is built and saved. Notice that to convert the address in main storage to a virtual address, a six was subtracted from the eighth position the main storage address.

The Run Index Operation Display:

```
                           Run Index Operation

Type choices and/or change the argument area, press Enter.
  Option . . . . . . . . . .   ___      1=Run index operation
                                        2=Set argument equal result
                                        3=Set argument equal result and run
  Function . . . . . . . . .   FINDLT
  Trunk  . . . . . . . . . .   00000000 0000
  Result length . . . . :  00  Result area length  . . .   00
    0000    00000000 00000000  00000000 00000000    * ................ *
    0010    00000000 00000000  00000000 00000000    * ................ *
    0020    00000000 00000000  00000000 00000000    * ................ *
    0030    00000000 00000000  00000000 00000000    * ................ *

  Argument length  . . .   00  Suffix length . . . . . .   00
    0000    00000000 00000006  00000000 00000000    * ................ *
    0010    00000000 00000000  00000000 00000000    * ................ *
    0020    00000000 00000000  00000000 00000000    * ................ *
    0030    00000000 00000000  00000000 00000000    * ................ *

F3=Exit      F4=Function codes   F5=Index control block         F6=Trunk page
F9=Argument  F10=Result          F11=Display/Alter result area  F12=Cancel
```

Figure 12-30. An Example of a Run Index Operation Display

This display is used to display or alter index entries. The options and their meaning are:

1. Run index operation
2. Set argument equal result
3. Set argument equal result and run

The data is displayed both in hexadecimal and character formats. The valid function codes can be found by using the Help key. The *Trunk* prompt is used as an input address for the index that you wish to find. The trunk address for an index refers to the base page of the index. Trunk is similar to the root or trunk of, for example, a family tree. After you find the index, you can use the function codes to find other desired entries. Changes to data are only allowed in the *Argument* prompt. Argument is the key value that is to be used when performing operations on the index. The length fields are used to determine how much of the index entries is to be used for the index operations.

Alterations that are made to the data corresponding to the result area on the data display, when using F11, are not placed back in the index. This is a protection against accidental destruction of an index.

Function Keys: The following function keys are available on the Run Index Operation display:

Key **Function**

F4 Function codes

This function key shows the following available function codes that can be used in index operations:

Function Code	Description
FINDLO	Find low of equals
FINDHI	Find high of equals
FINDPR	Find prior

FINDNX	Find next
FINDGP	Find generic prior
FINDGN	Find generic next
FINDLT	Find lowest entry
FINDHT	Find highest entry
FINDLP	Find lowest else prior
FINDLN	Find lowest else next
FINDHP	Find highest else prior
FINDHN	Find highest else next
FINDSP	Find save prior
FINDSN	Find saved next
INSERT	Insert entry
INSCON	Insert entry conditional
INSOVL	Insert overlay only
REMVLO	Remove low of equals
REMVHI	Remove high of equals

F5 Index control block

This function key displays the index control block display. The data on this display cannot be altered. An example of this display is as follows:

```
                         Index Control Block

 FUNCT: 00    LARGO: 00  LSUFA: 00  LRESA: 00  LRESR: 00  REFCT: 00

 FLAGS: 0000  ERROR: 0   EOIX:  0   MSMCH: 0   FULL:  0
              CATAS: 0   INSCD: 0   SPEC:  0

 PAGES: 000000000000000000000000

 AARGA: 00000000 0000     ARESA: 00000000 0000  TRUNK: 00000000 0000

 STATS: 00000000

 WORKAREA: 000000000000000000000000000000000000000000000000




Press Enter to continue.

F3=Exit   F12=Cancel
```

Figure 12-31. An Example of an Index Control Block Display

F6 Trunk page

This function key is used to display the Trunk Page display. The data on this display cannot be altered. An example of this display is as follows:

```
                    Trunk/Base Page


 0000   00000000 00000000  00000000 00000000   * ................ *
 0010   00000000 00000000  00000000 00000000   * ................ *
 0020   00000000 00000000  00000000 00000000   * ................ *
 0030   00000000 00000000  00000000 00000000   * ................ *
 0040   00000000 00000000  00000000 00000000   * ................ *
 0050   00000000 00000000  00000000 00000000   * ................ *
 0060   00000000 00000000  00000000 00000000   * ................ *
 0070   00000000 00000000  00000000 00000000   * ................ *






Press Enter to continue.

F3=Exit   F12=Cancel
```

Figure 12-32. An Example of a Trunk/Base Page Display

F9 Argument

This function key displays the Alter Argument display. This display is used to display or alter the lower 64 bytes of an index entry. Changes to data can only be made to lines 0040 through 0070 on this display; changes to the other lines must be made on the Run Index Operations display. The length fields of the argument can also be changed. An example of this display is as follows:

```
                           Alter Argument

Type desired changes, press Enter.
Press F12=Cancel to return with saved changes.

 Argument length . . .  00   Suffix length . . . . . .  00
    0000    00000000 00000000  00000000 00000000   * ................ *
    0010    00000000 00000000  00000000 00000000   * ................ *
    0020    00000000 00000000  00000000 00000000   * ................ *
    0030    00000000 00000000  00000000 00000000   * ................ *
    0040    00000000 00000000  00000000 00000000   * ................ *
    0050    00000000 00000000  00000000 00000000   * ................ *
    0060    00000000 00000000  00000000 00000000   * ................ *
    0070    00000000 00000000  00000000 00000000   * ................ *







F3=Exit   F12=Cancel
```

Figure 12-33. An Example of an Alter Argument Display

F10 Result

This function key displays the Alter Result display. This display shows an additional 64 bytes of a result from the Run Index Operation display. Only the result area length can be changed. An example of this display is as follows:

```
                                 Alter Result

 Type changes to result area length, press Enter.
 Press F12=Cancel to return with saved changes.

   Result length  . . . :   00   Result area length  . . .   00
      0000    00000000 00000000  00000000 00000000   * ................ *
      0010    00000000 00000000  00000000 00000000   * ................ *
      0020    00000000 00000000  00000000 00000000   * ................ *
      0030    00000000 00000000  00000000 00000000   * ................ *
      0040    00000000 00000000  00000000 00000000   * ................ *
      0050    00000000 00000000  00000000 00000000   * ................ *
      0060    00000000 00000000  00000000 00000000   * ................ *
      0070    00000000 00000000  00000000 00000000   * ................ *









 F3=Exit   F12=Cancel
```

Figure 12-34. An Example of an Alter Result Display

Mapping Levels: The amount of data, the type of data, and the amount of formatting depends on the maintenance analysis procedure (MAP) level in use at the time of the dump. Different MAP levels are provided because some problems are easier to solve with little or no dump formatting. For example, if an object is completely overlaid with other data, it is more useful to see the general pattern of the overlaying data, and an unformatted hexadecimal dump shows the pattern the best.

There are four MAP levels:

Level	Description
1	Has the least formatting and causes each segment group associated with the object to be dumped as an address range in hexadecimal format.
2	Causes the object to be broken into logical pieces. Each piece is dumped separately and may or may not be formatted.
3	Includes the logical breakdown as described in MAP level 2, and also, other physical operations are performed on the data to make the dump more useful. For example, when this level is in use, each of the entries in a machine index is dumped, and the generated code is disassembled.
4	Usually, this causes the same output as MAP level 3 except that some data is presented in abbreviated form. For example, only the first and last entry in an index is printed.

Depending on how complicated the object, not all dumps have all four map levels. For example, a space object does not have all four map levels.

To select the map level or format you want the dump, see the Select Format display on page 12-31.

Specifying Levels: You can use the display/alter/dump service tool to specify any allowable MAP level for the object you want to dump. The other service tools, including VLIC components that dump to the VLIC log, implicitly specify the MAP level to be used.

Examples of Map Levels 1 through 4: Figure 12-35 on page 12-38 through Figure 12-38 on page 12-40 show examples of MAP levels 1 through 4 for a dump of the machine context object.

SST

```
   DISPLAY/ALTER/DUMP                              MAP LEVEL 1                                      19/03/79  12:46:02   PAGE      1

MACHINE CONTEXT   ADDRESS: 000A   00000D00 0000

BASE SEGMENT
   00000D00 0000     01800008 000A0000  0D000000 0000FF00    00000000 00000000  00000000 00000000 *................................*
   00000D00 0020     80008100 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
   00000D00 0040     00000000 00000000  00001000 FFFF0000    00000000 00000000  00000000 00000000 *................................*
   00000D00 0060     00000000 00000000  00000000 0D0000A0    00000000 00000000  00000000 00000000 *................................*
   00000D00 0080     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
   00000D00 00A0     00000D00 02000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
   00000D00 00C0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                          9 LINES      00000D00 00E0     TO     00000D00 01E0     SAME AS ABOVE
   00000D00 0200     73F10125 CC0802B1  03D20001 03D20001    00000000 00000000  00000002 00000000 *.1.......K.......................*
   00000D00 0220     00000000 080104D8  E2E8E200 0A000119    00000007 D8E2C5C3  D6C6D900 0A00011A *.......QSYS..........QSECOFR.....*
   00000D00 0240     00000004 0104D8E2  E8E2000A 00011B00    000007C3 D7C6D7D9  D6C3000A 00011D00 *......QSYS..........CPFPROC......*
   00000D00 0260     000008D8 E2F2E4E2  D9D7C600 0A00013A    00000010 0108D8E2  F2D4C1D9 C9D5000A *...QS2USRPF............QS2MARIN..*
   00000D00 0280     00014E00 000008D8  E2F2C3D5 E3E7E300    0A00015D 000000C3  D6D5E2D3 000A0001 *.......QS2CNTXT.........CONSL....*
   00000D00 02A0     B0000000 D7D9D5E3  F1000A00 01BB0000    00000000 00000000  00000000 00000000 *....PRNT1........................*
   00000D00 02C0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                          7 LINES      00000D00 02E0     TO     00000D00 03A0     SAME AS ABOVE
   00000D00 03C0     00000000 00000000  00000000 00000000    00001879 18A41897  4E1B0A73 460F2086 *................................*
   00000D00 03E0     024374F9 1BEB4605  20620224 18451E52    0243241F 6F0F1826  1E330224 24090200 *...9.................?...........*
   00000D00 0400     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         63 LINES      00000D00 0420     TO     00000D00 0BE0     SAME AS ABOVE
   00000D00 0C00     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         31 LINES      00000D00 0C20     TO     00000D00 0FE0     SAME AS ABOVE
```

Figure 12-35. MAP Level 1 of 4 for the Machine Context Object

```
   DISPLAY/ALTER/DUMP                              MAP LEVEL 2                                      19/03/79  12:46:02   PAGE      2

SEGMENT HEADER    (YYSGHDR)

    TYPE  01    FLAGS  80    EXT  000A    OBJ   00000D00  0000      SPLOC       0000FF00 0000


EPA HEADER   (YYEPAHDR)

    ATT1   80              TYPE   81              STYP 00                NAME
    SPATT  00              SPIN   00              SPSZ 0                 OSIZ   00001000       AUTH    FFFF
    VER    0000            TIME   23/08/28  12:20:54                     UP@    00000000 0000  AG@     00000000 0000
    CT@    00000000 0000   OHDR   00000D00 00A0     RCVY   00000000      PERF   00000000


   00000D00 0000     01800008 000A0000  0D000000 0000FF00    00000000 00000000  00000000 00000000 *................................*
   00000D00 0020     80008100 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
   00000D00 0040     00000000 00000000  00001000 FFFF0000    00000000 00000000  00000000 00000000 *................................*
   00000D00 0060     00000000 00000000  00000000 0D0000A0    00000000 00000000  00000000 00000000 *................................*
   00000D00 0080     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*


INDEX PAGES
   00000D00 0200     73F10125 CC0802B1  03D20001 03D20001    00000000 00000000  00000002 00000000 *.1.......K.......................*
   00000D00 0220     00000000 080104D8  E2E8E200 0A000119    00000007 D8E2C5C3  D6C6D900 0A00011A *.......QSYS..........QSECOFR.....*
   00000D00 0240     00000004 0104D8E2  E8E2000A 00011B00    000007C3 D7C6D7D9  D6C3000A 00011D00 *......QSYS..........CPFPROC......*
   00000D00 0260     000008D8 E2F2E4E2  D9D7C600 0A00013A    00000010 0108D8E2  F2D4C1D9 C9D5000A *...QS2USRPF............QS2MARIN..*
   00000D00 0280     00014E00 000008D8  E2F2C3D5 E3E7E300    0A00015D 000000C3  D6D5E2D3 000A0001 *.......QS2CNTXT.........CONSL....*
   00000D00 02A0     B0000000 D7D9D5E3  F1000A00 01BB0000    00000000 00000000  00000000 00000000 *....PRNT1........................*
   00000D00 02C0     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                          7 LINES      00000D00 02E0     TO     00000D00 03A0     SAME AS ABOVE
   00000D00 03C0     00000000 00000000  00000000 00000000    00001879 18A41897  4E1B0A73 460F2086 *................................*
   00000D00 03E0     024374F9 1BEB4605  20620224 18451E52    0243241F 6F0F1826  1E330224 24090200 *...9.................?...........*
   00000D00 0400     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         79 LINES      00000D00 0420     TO     00000D00 0DE0     SAME AS ABOVE
   00000D00 0C00     00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                         15 LINES      00000D00 0E20     TO     00000D00 0FE0     SAME AS ABOVE
```

Figure 12-36. MAP Level 2 of 4 for the Machine Context Object

SST

```
   DISPLAY/ALTER/DUMP                                MAP LEVEL 3                                 19/03/79  12:46:02   PAGE      3

MACHINE CONTEXT   ADDRESS: 000A   00000D00 0000

SEGMENT HEADER    (YYSGHDR)

    TYPE  01     FLAGS  80     SIZE  0008    OBJ    00000D00  0000      SPLOC      0000FF00 0000


EPA HEADER   (YYEPAHDR)

    ATT1    80              TYPE   81                STYP 00                   NAME
    SPATT   00              SPIN   00                SPSZ 0                    OSIZ    00001000       AUTH     FFFF
    VER     0000            TIME   23/08/28  12:20:54                          UP@     00000000 0000  AG@      00000000 0000
    CT@     00000000 0000   OHDR   00000D00 00A0     RCVY    00000000          PERF    00000000

   00000D00 0000     01800008 000A0000  0D000000 0000FF00   00000000 00000000  00000000 00000000 *................................*
   00000D00 0020     80008100 00000000  00000000 00000000   00000000 00000000  00000000 00000000 *................................*
   00000D00 0040     00000000 00000000  00001000 FFFF0000   00000000 00000000  00000000 00000000 *................................*
   00000D00 0060     00000000 00000000  00000000 0D0000A0   00000000 00000000  00000000 00000000 *................................*
   00000D00 0080     00000000 00000000  00000000 00000000   00000000 00000000  00000000 00000000 *................................*


INDEX TRUNK PAGE

   00000D00 0200     73F10125 CC0802B1  03D20001 03D20001   00000000 00000000  00000002 00000000 *.1.......K.......................*
   00000D00 0220     00000000 080104D8  E2E8E200 0A000119   00000007 D8E2C5C3  D6C6D900 0A00011A *.......QSYS..........QSECOFR.....*
   00000D00 0240     00000004 0104D8E2  E8E2000A 00011B00   000007C3 D7C6D7D9  D6C3000A 00011D00 *......QSYS..........CPFPROC......*
   00000D00 0260     000008D8 E2F2E4E2  D9D7C600 0A00013A   00000010 0108D8E2  F2D4C1D9 C9D5000A *...QS2USRPF............QS2MARIN..*
   00000D00 0280     00014E00 000008D8  E2F2C3D5 E3E7E300   0A00015D 000000C3  D6D5E2D3 000A0001 *.......QS2CNTXT.........CONSL....*
   00000D00 02A0     B0000000 D7D9D5E3  F1000A00 01BB0000   00000000 00000000  00000000 00000000 *....PRNT1........................*
   00000D00 02C0     00000000 00000000  00000000 00000000   00000000 00000000  00000000 00000000 *................................*
                           7 LINES      00000D00 02E0     TO     00000D00 03A0     SAME AS ABOVE
   00000D00 03C0     00000000 00000000  00000000 00000000   00001879 18A41897  4E1B0A73 460F2086 *................................*
   00000D00 03E0     024374F9 1BEB4605  20620224 18451E52   0243241F 6F0F1826  1E330224 24090200 *...9.................?...........*


                              SUB    NAME
ENTRY#  TYPE                  TYPE   LEN    OBJ ADDRESS           NAME

  1      04 CONTEXT            01     4     000A  0011B00 0000    QSYS
  2      04 CONTEXT            01     7     000A  0011D00 0000    CPFPROC
  3      04 CONTEXT            01     8     000A  0015D00 0000    QS2CNTXT
  4      08 USER PROFILE       01     4     000A  0011900 0000    QSYS
  5      08 USER PROFILE       01     7     000A  0011A00 0000    QSECOFR
  6      08 USER PROFILE       01     8     000A  0013A00 0000    QS2USRPF
  7      10 LUD                01     8     000A  001B000 0000    QS2CONSL
  8      10 LUD                01     8     000A  0014E00 0000    QS2MARIN
  9      10 LUD                01     8     000A  001BB00 0000    QS2PRNT1
```

Figure 12-37. MAP Level 3 of 4 for the Machine Context Object

SST

```
  DISPLAY/ALTER/DUMP                                 MAP LEVEL 4                                    19/03/79  12:46:02   PAGE      4

MACHINE CONTEXT   ADDRESS: 000A   00000D00 0000

SEGMENT HEADER    (YYSGHDR)

    TYPE  01    FLAGS  80    SIZE  0008   OBJ   00000D00  0000      SPLOC      0000FF00 0000


EPA HEADER   (YYEPAHDR)

    ATT1   80               TYPE   81                STYP 00                      NAME
    SPATT  00               SPIN   00                SPSZ 0                       OSIZ   00001000        AUTH     FFFF
    VER    0000             TIME   23/08/28  12:20:54                             UP@    00000000 0000   AG@      00000000 0000
    CT@    00000000 0000    OHDR   00000D00 00A0     RCVY    00000000             PERF   00000000

  00000D00 0000      01800008 000A0000  0D000000 0000FF00    00000000 00000000  00000000 00000000 *................................*
  00000D00 0020      80008100 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
  00000D00 0040      00000000 00000000  00001000 FFFF0000    00000000 00000000  00000000 00000000 *................................*
  00000D00 0060      00000000 00000000  00000000 0D0000A0    00000000 00000000  00000000 00000000 *................................*
  00000D00 0080      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*


INDEX TRUNK PAGE

  00000D00 0200      73F10125 CC0802B1  03D20001 03D20001    00000000 00000000  00000002 00000000 *.1.......K.......................*
  00000D00 0220      00000000 080104D8  E2E8E200 0A000119    00000007 D8E2C5C3  D6C6D900 0A00011A *.......QSYS..........QSECOFR.....*
  00000D00 0240      00000004 0104D8E2  E8E2000A 00011B00    000007C3 D7C6D7D9  D6C3000A 00011D00 *......QSYS..........CPFPROC......*
  00000D00 0260      000008D8 E2F2E4E2  D9D7C600 0A00013A    00000010 0108D8E2  F2D4C1D9 C9D5000A *...QS2USRPF............QS2MARIN..*
  00000D00 0280      00014E00 000008D8  E2F2C3D5 E3E7E300    0A00015D 000000C3  D6D5E2D3 000A0001 *.......QS2CNTXT.........CONSL....*
  00000D00 02A0      B0000000 D7D9D5E3  F1000A00 01BB0000    00000000 00000000  00000000 00000000 *....PRNT1........................*
  00000D00 02C0      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000 *................................*
                          7 LINES       00000D00 02E0      TO      00000D00 03A0     SAME AS ABOVE
  00000D00 03C0      00000000 00000000  00000000 00000000    00001879 18A41897  4E1B0A73 460F2086 *................................*
  00000D00 03E0      024374F9 1BEB4605  20620224 18451E52    0243241F 6F0F1826  1E330224 24090200 *...9.................?...........*


                                      SUB     NAME
ENTRY#  TYPE                          TYPE    LEN     OBJ ADDRESS           NAME

 1       04 CONTEXT                    01      4       000A  0011B00 0000    QSYS
 0       10 LUD                        01      8       000A  001BB00 0000    QS2PRNT1
****** END OF DUMP ******
EOF$EOF$
```

Figure 12-38. MAP Level 4 for 4 for the Machine Context Object

Depending on the object, map levels 1 through 4 in the dump appear formatted and unformatted. The data in the EPA and object specification headers may appear unformatted and formatted. You must specify for the remaining data of the dump whether you want formatted or unformatted from the Select Format display shown on page 12-31.

Formatted Control Blocks: Control blocks (those internal to VLIC and those in MI objects) are formatted in a consistent manner. The data elements are broken into fields with each field containing the field name in addition to the data. The field names are 1 to 5 character names that are derived by removing the common prefix text from the element name in the include structure that describes the field. For example, the type field in the segment group header is formatted as SGHTYPE. Here, the include name is YYSGHDR and the field name in the include is TYPE.

The data for each of the fields is converted from binary in one of the following:

- Hexadecimal digits
- EBCDIC characters
- Decimal numbers
- 6-byte virtual address
- 8-byte virtual address
- 16-byte MI pointer
- Time-of-day value converted into date and time

Figure 12-39 on page 12-42 shows at **1** an example of the LUD object specific header for each type of data conversion except the time-of-day conversion. The time-of-day conversion appears in the EPA header **1** (YYEPAHDR). The fields and conversion type are:

Control Block	Field Name	Conversion Type
	2	
1 YYEPAHDR	Time	Time-of-day
3 ZZSILUOB	**4** 3PT	16-byte MI pointer
.	**5** IP#	Hexadecimal
	6 DSP	6-byte virtual address
	7 UTP	EBCDIC
	8 DSL	Decimal

```
     DISPLAY/ALTER/DUMP                                                                 03/27/89  12:52:32   PAGE     1
 LOGICAL UNIT DESCRIPTION     SUBTYPE:  01      NAME:  DKT01                    ADDRESS:  0002  0030A900 0000
 SEGMENT HEADER    (YYSGHDR)
    TYPE  01   FLAGS  80   SIZE  0005    EXT  0002    OBJ  0030A900 0000    SPLOC  0030A900 06B0
 EPA HEADER    (YYEPAHDR) 1
    ATT1   80               JOPT    00                TYPE   10                STYP   01
    NAME   DKT01
    SPATT  80               SPIN    00                SPSZ   B48               OSIZ   00000005       PBAU   3F00
    VER    0101           2 TIME    08/10/88  23:12:59                         UP*    0002 00021D00 0000
    AG*    0000 00000000 0000                         CT*    0000 00000D00 0000                       OHDR   0002 0030A900 0000
    RCVY   00020000         PERF    00000000          MDTS   12/31/88  08:29:26                       JP*    0000 00000000 0000
    COB*   0000 00000000 0000                         JID    00000000000000000000                     OWAU   FF00
    IPL#   00000071         AL1     0000000000000000
   0030A900 0000    01800005 00020000  00020030 A9000000    00000000 00000000  00020030 A90006B0  *................................*
   0030A900 0020    80001001 C4D2E3F0  F1404040 40404040    40404040 40404040  40404040 40404040  *....DKT01                       *
   0030A900 0040    40408000 00000350  00000005 3F000101    6B9064E2 EFC000A7  00020002 1D000000  *  ..................S............*
   0030A900 0060    00000000 00000000  00000000 0D000000    00020030 A9000000  00020000 00000000  *................................*
   0030A900 0080    6C436A1B 000000E5  00000000 00000000    00000000 00000000  00000000 00000000  *.......V........................*
   0030A900 00A0    0000FF00 00000071  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
   0030A900 00C0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
   0030A900 00E0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
 ASSOCIATED SPACE
   0030A900 06B0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
   0030A900 06D0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
   0030A900 06F0    00050000 00000000  00000000 00000000    00000000 00000000  00000000 D8E2E8E2  *............................QSYS*
   0030A900 0710    D6D7D940 40405CD3  C9C2D340 40404040  P 80000000 00000000  0071A012 BF000380  *OPR   *LIBL      ................*
   0030A900 0730    0000D0EF 00010000  00000000 00000000    00000000 00000000  0000C4D2 E3F0F140  *..........................DKT01 *
   0030A900 0750    40404040 00000000  00000000 00000000    000A0200 00000000  00000000 0000D8C4  *    ..........................QD*
   0030A900 0770    D2D3E4C4 C9D54040  C4D2E3F0 F1404040    4040D8E2 E8E2D6D7  D9404040 5CD3C9C2  *KLUDIN  DKT01     QSYSOPR   *LIB*
   0030A900 0790    D3404040 40400100  00040000 00000000    00000000 00000000  00000000 00000500  *L     ..........................*
   0030A900 07B0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
                          2 LINES     0030A900 07D0     TO     0030A900 07F0     SAME AS ABOVE
   0030A900 0810    00000000 00000000  00000000 00F6F1F3    F2010000 00000000  00000000 00000000  *.............6132...............*
   0030A900 0830    00000000 0000C4D2  E3F0F140 40404040    00000000 00000000  00000000 00000000  *......DKT01      ................*
   0030A900 0850    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
                          2 LINES     0030A900 0870     TO     0030A900 0890     SAME AS ABOVE
   0030A900 08B0    00000000 00000000  00000000 40404040    40405000 00000000  00000000 0000F6F1  *............      ............61*
   0030A900 08D0    F3F2F0F0 F0F00000  00000000 00000000    00000000 00000000  00000000 00000000  *320000..........................*
   0030A900 08F0    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
                          7 LINES     0030A900 0910     TO     0030A900 09D0     SAME AS ABOVE
   0030A900 09F0    00000000 00000000  00000000 00000000                                          *................                *
 OBJECT SPECIFIC HEADER    (ZZSILUOB) 3
    ATS    01             7 UTP     6132              MNO    0000
    1PT    00 0000000000 0000 0000 00000000 0000      2PT    00 0000000000 0000 0000 00000000 0000
 4  3PT    00 0000000000 0000 0000 00000000 0000
 5  IP#    00000071         PSC     0                 PSA    00000000 0000 8 DSL    B96            MSL    384
 6  DSP    0030A900 0330    IOM     90020500 10C0     RMQ    00000000 0000   TDE    00000000 0000  ADL    90020500 2800
    PHA    00000000000000000010F2F5F0F7010800F2F5F1F70000000000000000
     DISPLAY/ALTER/DUMP                                                                 03/27/89  12:52:32   PAGE     2
 LOGICAL UNIT DESCRIPTION     SUBTYPE:  01      NAME:  DKT01                    ADDRESS:  0002  0030A900 0000
    SPI    0000             SOB     0000              SRU    0000              ALU    00             SLU    000000
    ALR    0000000000000000
    LDD    01               LDM     02                LDP    0000
    STO    00               ST1     10                ST2    00
    DIN    #DK00IOM         X22     0000              X33    00000000 0000
   0030A900 0100    F0F1F6F1 F3F2F0F0  F0F00000 00000000    00000000 00000000  00000000 00000000  *0161320000......................*
   0030A900 0120    00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *................................*
   0030A900 0140    00000071 00000000  00000000 03B001B0    0030A900 03309002  050010C0 00000000  *................................*
                                                                                                                      R36B417-3
```

Figure 12-39. An Example of a Formatted Control Block

Unformatted Hexadecimal Data: An unformatted hexadecimal dump is data that has not been broken into fields. The data is printed 32 bytes per **10** line and EBCDIC conversion **11** is done at the end of each line. The address **9** at the beginning of each line is either the virtual address of the data or the offset of the data from the beginning of a logical block. Sometimes, both the virtual address **14** and an offset **15** are shown. The virtual address is omitted for data that has no particular virtual address such as an entry in the machine index. If an offset is provided, it is the offset most commonly referred to. For example, the offset provided for ICBs is the offset from the value contained in register 3 **13**.

Hardware tag bits **12** that represent MI pointers are shown by the letter P preceding the 4-word (16-byte) pointer entry. If the P is present, the tag bits are on; if the P is absent, the tag bits are off.

Figure 12-40 shows an example of a dump that contains MI pointers.

```
    DISPLAY/ALTER/DUMP                                  PROCESS MAP LEVEL 3                    03/27/89  12:53:48  PAGE    17
MI PROCESS  PROCESS NAME - QBASE     QSYS      012206
PROCESS CONTROL SPACE         SUBTYPE:  EF       NAME:  QBASE      QSYS       012206         ADDRESS:  0071  A001CA00 0000
PROCESS CONTROL BLOCK / IWA
PCB   (YYPCB)
   IWAWK  A001CA000200006AAE00320300000000            PASAF  C0002200 0160    PASAI  000022AC          STATS  0000
   FICB   C0001D00 0970    PIWAL  C0001D00 5E00      TDE    A001CA00 0200    PTIME  0000000000000000
   PRACT  0000             EIACT  000F               ECACT  002F
   ESSRQ  4000000000000000027000000000000000000000000000000000000
   NOSRQ  4000000000000000027000000000000000000000000000000000000                                ASCUR  000B1A00
   PAR    C0000A00 0010    CHI    00000000 0000      SIB    00000000 0000    USRPM  00000000 0000  EIWA•  C0001D00 04C0
   •EVDT  00000000 0000    WESRM  00000000 0000      EXDES  C0001D00 0470    CRCHN  00000000 0000  TRCE•  00000000 0000
   INCUP  C0001D00 1478    INTOR  0071A001AA000000                           INVAT  0100           FCOB•  00000000 0000
   PCATR  E7E00000         ECMSK  0000               #EMON  000F             PRITY  46             SPID   02
   MAXAS  77359400         TS     00000000F4400000                           DFTO   00000004C4000000
   MAXPT  0FFFFFFF00000000                           PMPLC  01               MODCI  FC00FFFFC0000000
   UP     00 0000000000 0013 0002 00020200 0800      PCO    80 0000000000 3FF0 0071 C0001E00 0020
   NRL    80 0000000000 0000 0071 C0001E00 0520      PIPGM  00 1800000000 0000 0068 006D9900 0238
   PTPGM  00 1C00000000 0000 0068 006D9D00 0238      FPROG  00 1800000000 0000 0068 006CD700 023F
   EHPGM  00 1000000000 BB98 0068 00357200 0238      PASA   80 0000000000 0000 0071 C0002200 0100
   PSSA   80 0000000000 0000 0071 C0002100 0100      ACCGR  00 0000000000 0000 0071 A001CB00 011F
   STATE  A040             PISTA  0000               PIITS  000000           PIETS  000000         PFTS   000000
   PAUPL  00 0000000000 0000 0000 00000000 0000                                                           11
  C0001D00 0000      0680002F 00710000  0071A001 CA000000 10 A001CA00 0200006A  AE003203 00000000  *..............................*
  C0001D00 0020      C0002200 01800000  22AC0000 00000000    C0001D00 0970C000  1D005E00 A001CA00  *..............................*
  C0001D00 0040      02000000 00000000  00000000 000F002F    00000000 00000000  00000000 00000000  *..............................*
9 C0001D00 0060      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *..............................*
  C0001D00 0080      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *..............................*
  C0001D00 00A0      00000000 00000000  00000000 00000000    00000000 00000000  00000000 0000C000  *..............................*
  C0001D00 00C0      1D000470 00000000  00000000 00000000    C0001D00 14780071  A001AA00 00000100  *..............................*
  C0001D00 00E0      00000000 00000000  E7E00000 0000000F    46027735 94000000  0000F440 00000000  *........X.................4 ....*
  C0001D00 0100      0004C400 00000FFF  FFFF0000 000001FC    00FFFFC0 00000000  00000000 00000000  *..D.............................*
  C0001D00 0120    P 00000000 00000013  00020002 02000800  P 80000000 00003FF0  0071C000 1E000020  *.......................0.........*
  C0001D00 0140    P 80000000 00000000  0071C000 1E000520  P 00180000 00000000  0068006D 99000238  *..............................*
  C0001D00 0160    P 001C0000 00000000  0068006D 9D000238  P 00180000 00000000  0068006C D700023F  *..........................P...*
  C0001D00 0180    P 00100000 0000BB98  00680035 72000238  P 80000000 00000000  0071C000 22000100  *..............................*
  C0001D00 01A0    P 80000000 00000000  0071C000 21000100  P 00000000 00000000  0071A001 CB00011F  *..........................H...*
  C0001D00 01C0      A0400000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *. ............................*
  C0001D00 01E0      00000000 00000000  00000000 00000000 12 00000000 00000000  00000000 00000000  *..............................*
                           6 LINES     C0001D00 0200     TO     C0001D00 02A0     SAME AS ABOVE
  C0001D00 02C0      00000000 00000000  00000000 00000000    006D3700 C0002100  01800000 00000000  *..............................*
  C0001D00 02E0      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *..............................*
                           3 LINES     C0001D00 0300     TO     C0001D00 0340     SAME AS ABOVE
  C0001D00 0360      00000000 00000000  00000000 00000000    00359C00 C0002100  01600000 00000000  *..............................*
  C0001D00 0380      00000000 00000000  00000000 00000000    00000000 00000000  00000000 00000000  *..............................*
                           3 LINES     C0001D00 03A0     TO     C0001D00 03E0     SAME AS ABOVE
  C0001D00 0400      40000000 00000000  00270000 00000000    00000000 00000000  00000000 00000000  * .............................*
  C0001D00 0420      40000000 00000000  00270000 00000000    00000000 00000000  00000000 00000000  * .............................*
  C0001D00 0440      000B1A00 C0000A00  00100000 00000000    00000000 00000000  00000000 C0001D00  *..............................*
  C0001D00 0460      04C00000 00000000  00000000 0000                                               *.............                *
```

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Figure 12-40 (Part 1 of 2). An Example of an Unformatted Hexadecimal Dump

SST

```
        DISPLAY/ALTER/DUMP                                 PROCESS MAP LEVEL 3                         03/27/89  12:53:48   PAGE    28
    MI PROCESS  PROCESS NAME - QBASE      QSYS       012206
    PROCESS CONTROL SPACE         SUBTYPE:  EF       NAME:  QBASE      QSYS        012206          ADDRESS:  0071  A001CA00 0000
    PROCESS CONTROL BLOCK / IWA
    C0001D00 0B30 +01C0 P 001B0000 00000000  0068006C D700023F   01000000 00000000   00000000 00000000 *............P...................*
    C0001D00 0B50 +01E0   00000000 00000000  00000000 00000000   00000000 00000000   00000000 00000000 *................................*
    C0001D00 0B70 +0200   00000000 00000000  00000000 00000000   00000000 00000000   00000000 00000000 *................................*
    ICB   (YYAIICED)   MI PROGRAM NAME - QWTMCMNL
         FWD    0F50              LIMIT  5E00                BKWD   0970              INVAT  0100
         FICB   000000            BICB   000000              GRC    0000              GPTR   00000000 0000     GSIZE  0000
         REG 1  C0001D00 0F20     REG 2  C0002200 01A0 13 REG 3  C0001D00 0B90     REG 4  C0034200 0170     REG 5  006CCC00 0000
         REG 6  007F2B00 0B58     REG 7  006CCC00 0000       REG 8  A001CA00 0200     REG 9  C0002200 04E0     REG A  8000000C 8FB2
         REG B  A0104500 0130     REG C  C0002200 0002       REG D  80000031 7580     REG E  80000031 7258     REG F  80000007 7200
         FPR 0  0000000000000000                             FPR 1  A001C80000000000                       FPR 2  9000000100000000
         FPR 3  0EE01E0009700000                             FPR 4  0000000000000000                       FPR 5  0000000000000000
         FPR 6  C0001D000D74C000                             FPR 7  1D000DE6C0001D00
         PCB    C0001D00 0010     IAR    1720                BREG0  006CCC00 0000     PARM   00000400 0298     ACB    006CCC00 0590
         PSSA   00000000 0000     PASA   C0002200 0160       AUP*   00000000          AUPSW  0000              EXHCB  00000000 0000
         FLAGS  00000000000000000000000000000000             IEATR  000000000000      PASAN  C0002200 09A0     PGMAU  023F
         IVMK   00000215          INVN   0001                BITS   8005
    C0001D00 0B90 +0000   0F505E00 09700100  00000000 00000000   00000000 00000000   C0001D00 0F20C000 *................................*
    C0001D00 0BB0 +0020   220001A0 C0001D00  0B90C003 42000170   006CCC00 0000007F   2B000858 006CCC00 *................................*
    C0001D00 0BD0 +0040   0000A001 CA000200  C0002200 04E08000   000C8FB2 A0104500   0130C000 22000002 *................................*
    C0001D00 0BF0 +0060   80000031 75808000  00317258 80000007   7200C000 1D000010   1720006C C0000000 *................................*
    C0001D00 0C10 +0080 15 00000400 0298006C  CC000590 00000000   0000C000 22000160   00000000 00000000 *................................*
14  C0001D00 0C30 +00A0   00000000 00000000  00000000 00000000   00000000 00000000   00000000 00000000 *................................*
    C0001D00 0C50 +00C0   00000000 0000C000  220009A0 023F0000   02150001 60050000   00000000 00000000 *................................*
    C0001D00 0C70 +00E0   00000000 00000000  00000000 00000000   A001C800 00000000   90000001 00000000 *..................H.............*
    C0001D00 0C90 +0100   0EE01E00 09700000  00000000 00000000   00000000 00000000   C0001D00 0D74C000 *................................*
    C0001D00 0CB0 +0120   1D000DE6 C0001D00  0C90A001 CA000000   C0001D00 00909004   04000300 C0001D00 *...W............................*
    C0001D00 0CD0 +0140   0010A001 CA000200  C0001D00 000FA001   CA000000 00000000   00000000 00000250 *................................*
    C0001D00 0CF0 +0160   00000000 000CC000  C0002200 0882C000   22000550 C0002200   07D0C000 22000450 *................................*
    C0001D00 0D10 +0180   0000F6FF FFFF0000  F6FFFFFF 0027C700   01000027 C700EA00   007F2600 01900000 *..6.....6.....G.....G...........*
    C0001D00 0D30 +01A0   F6FFFFFF 007F2A00  01000000 F6FFFFFF   0000F6FF FFFFA010   45000100 00313900 *6...........6.....6.............*
    C0001D00 0D50 +01C0   01000000 F6FFFFFF  0027C700 6A000606   C0002200 05F0C000   22000580 C0002200 *....6.....G..........0..........*
    C0001D00 0D70 +01E0   0980C000 22000590  C0002200 05A0C000   220005B0 01010000   00000000 2828C000 *................................*
    C0001D00 0D90 +0200   220001A0 C0002200  01B0C000 220001C0   C0002200 01D0C000   220001E0 C0002200 *................................*
    C0001D00 0DB0 +0220   01F0C000 22000200  C0002200 0210C000   22000220 C0002200   0230C000 22000240 *.0.............................. *
    C0001D00 0DD0 +0240   C0002200 0250C000  22000260 C0002200   0270C000 22000280   C0002200 0290C000 *................................*
    C0001D00 0DF0 +0260   220002A0 C0002200  02B0C000 220002C0   C0002200 02D0C000   22000390 C0002200 *................................*
    C0001D00 0E10 +0280   03A0C000 220003B0  C0002200 0380C000   22000350 C0002200   0360C000 22000370 *................................*
    C0001D00 0E30 +02A0   C0002200 03C0C000  220003D0 C0002200   03E0C000 220003F0   C0002200 0400C000 *......................0.........*
    C0001D00 0E50 +02C0   22000410 C0002200  02E0C000 220002F0   C0002200 0300C000   22000310 C0002200 *...............0................*
    C0001D00 0E70 +02E0   0320C000 22000330  C0002200 03400101   00000000 00000101   00000000 00000101 *............ ...................*
    C0001D00 0E90 +0300   00000000 00000101  00000000 00002030   00000000 00000000   00002030 00000000 *................................*
    C0001D00 0EB0 +0320   00200000 00002030  00000000 00360000   00002030 00000000   004C0000 000020B0 *................................*
    C0001D00 0ED0 +0340   00000000 00600000  00002030 00000000   00740000 000020B0   00000000 008A0000 *................................*
    C0001D00 0EF0 +0360   00002030 00000000  009E0000 00002030   00000000 00B20000   00000000 00000000 *................................*
    C0001D00 0F10 +0380   00000000 00000000  00000000 00000000   C0002200 094EC000   220007D0 007F2400 *................................*
    C0001D00 0F30 +03A0   02E0A010 450005A0  00000000 00000000   12503E00 0B900000   00000000 00000000 *................................*
                                                                                                                           R36B419-3
```

Figure 12-40 (Part 2 of 2). An Example of an Unformatted Hexadecimal Dump

Examples of Using Display/Alter/Dump: You can use the *Display/alter/dump* option to:

- Display the side an IPL is done on, see page 13-6
- Display a data space
- Locate and dump QWCSCPF, see page 21-1
- Dump a process or task
- Get to the shadow log

  To get to the shadow error log use display/alter/dump and display address hex 00008300000. Offset hex 0073 is the first entry.
- Find an output queue that was deleted
- Compare main storage to a subsystem description or to find out how many storage cards reported in to storage management during the last IPL
- Print the RCR, see page 10-1
- Find the IPL configuration table (ICT), see page 14-14

Displaying a Data Space: To display a data space:

1. Select the *Start a service tool* from the SST main menu.
2. Select the *Display/Alter/Dump* option from the Start a Service Tool menu.
3. Select the *Display/alter* option from the Display/Alter/Dump Output Device menu.
4. Select the *MI object* option from the Select Data menu.
5. Select the *Cursor* option from the MI Object menu.

SST

6. Select the *Name* option for the cursor object.
7. Enter the file and member name. Pad the names with blanks so that each of the names are 10 bytes.
8. Enter subtype 50, context for the name of library, and subtype 01.
9. At the cursor, enter P1A in the control field.
10. Press the Enter key. This takes you to the associated space.
11. Enter 02A0 in the control and roll up for the address of the data space.

    At approximately offset hex 02A0 there is a 16-byte system pointer to the data space. If byte 15 is a 0B, it is the data space. At approximately offset hex 02C0 is the pointer to the index. Byte 15 is the OC for the pointer to the index.
12. Enter the address or use pointer to go to the data space or index.

Locating a Process/Task Dump: To do a process/task dump:

1. Select the *Start a Service Tool* option from the SST main menu.
2. Select the *Display/alter/dump* option from the Start a Service Tool menu.
3. Select the *Dump to Printer* option from the Display/Alter/Dump Output Device menu.
4. Select the *Tasks or Processes* option from the Select Data menu.
5. Select the *Task* option from the Tasks/Process menu.
6. Select the *Display a list of tasks* option from the Task menu.
7. Find the process/task on the Task Found display and enter the number
8. Select the *Dump in hexadecimal (logical blocks)* option from the Select Format menu. For more information about the this dump, see "Mapping Levels" on page 12-37.
9. Enter the dump title and take the defaults for the rest of this process.

Finding an Output Queue: QSECOFR cannot sign on to the system because the profile was changed and the output queue was deleted. To find the output queue:

1. Signon as QSRV.
2. Select the *Start a service tool* option from the SST main menu.
3. Select the *Display/alter/dump* option from the Start a Service Tool menu.
4. Select the *Display/alter storage* option from the Display/Alter/Dump Output Device menu.
5. Select the *MI object* option from the Select Data menu.
6. Select the *User profile* option from the MI Object menu.
7. Find by name, QSECOFR.
8. When displaying, put P1A in the control field.
9. Press the Enter key.
10. The output queue appears at offset hex 007C.
11. Change the name shown to the name of the output queue.

Comparing Main Storage to a Subsystem Description: If the amount of main storage displayed on WRKHDWPRD is more than the amount you get when you add the pool sizes shown on the WRKSYSSTS display, it is likely that it is a hardware problem. To compare main storage to a subsystem description or to find out how many main storage cards reported in to storage management at the last IPL, do the following:

1. Select the *Start a service tool* option from DST or SST main menu.
2. Select the *Display/alter/dump* option from the Start a Service Tool menu.
3. Select the *VLIC data* option to display the machine communications area (MCA).
4. Write down the address that begins at displacement hex 00B2.
5. Display this address. You are now looking at the main storage data.

   The data between displacements hex 00 and hex 3F can be divided into eight sections of 8 bytes each. Each section represents a possible main storage card. During each IPL, storage management checks the amount of main storage available. It puts data into this table for each main storage card it finds. If an entry starts with an 8, this means that either no card has been found or the card has failed.

   For each good card, the last 2 bytes of the entry indicate the last 64K SID that is addressed by this card. You do not have to understand what this means. All you need to do is count the number of entries that do not start with an 8, and you will know how many good cards reported in on the last IPL.

   If the number of cards reporting in is less than the number of cards listed in WRKHDWPRD, hardware service should be called to find the problem. For example, the following was found in the main storage VPD starting at hex 00: 00880000 0000003F 00880040 0000007F 80000000 00000000 80000000 00000000. In this example, 2 good main storage cards reported in. (If you want to figure the total amount of main storage reporting in, multiply hex 40 (64 K) by the number found in the last 2 bytes of the last entry, then convert back to decimal. The answer you get will be in the size of K bytes.)

SST

Work with Vertical Licensed Internal Code (VLIC) Log

This option can be selected from either the Start a Service Tool menu of SST or selected from the Start a Service Tool menu of DST. This option works only to the full paging environment of DST and SST. Use this option to gather information about VLIC software failures. This option allows you to do the following:

- Dump selected VLIC log entries to a diskette, tape, or printer
- Change the following characteristics of the VLIC log:
  - The size of the note log area and the size of the dump log area
  - The size limit for dump entries
- Clear the VLIC log

The *Work with vertical licensed internal code* option is the same under DST or SST. In SST and DST, there are three dump tasks (one for the printer, one for tape, and one for the diskette) that run asynchronously from the control functions for this tool. The requests are saved in a first-in-first-out queue and there is no practical limit to the number of requests that you can have waiting to be processed. Chapter 31 lists valid major and minor codes and a brief description of the data contained in the log entry.

Menu Flow: Figure 12-41 on this page shows how the *Work with VLIC log* options relate to one another.

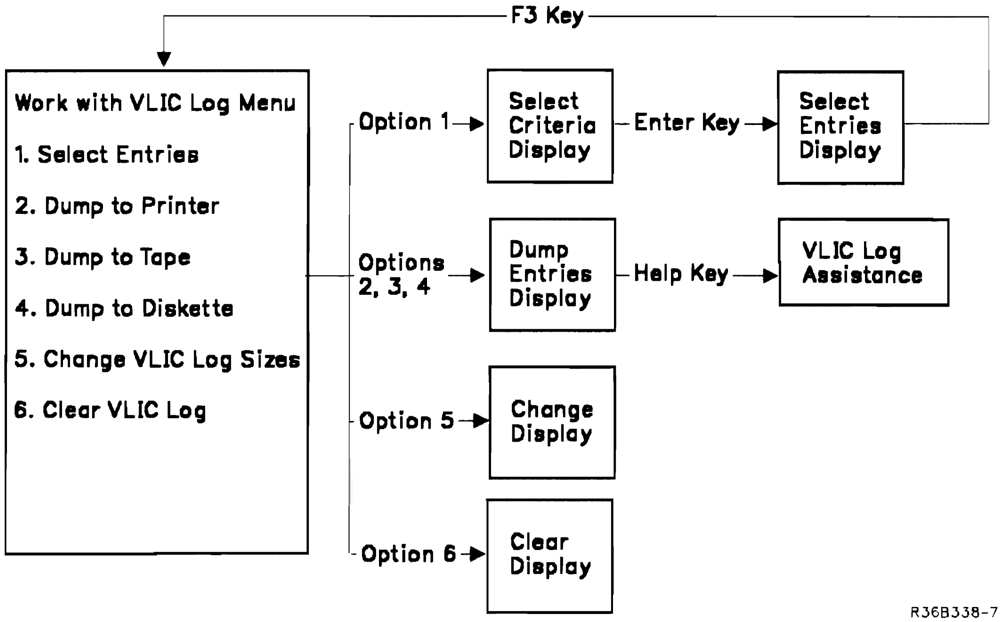

Figure 12-41. VLIC Log Display Flow

Options:

The Work with VLIC Log menu has the following options:

1. Select entries for the vertical licensed internal code (VLIC) log

   After you use this option and its succeeding displays to determine the entries to be dumped, you can return to this Work with VLIC Log menu and choose the options to dump entries to a printer, a diskette, or a tape to initiate the dump. To view the entries available for dump selection, choose this option to go to the VLIC Log Selection Criteria display. From the VLIC Log Selection Criteria display, go to the Select Entries From VLIC Log display. For more information about this option, see page 12-47.
2. Dump entries to printer from the VLIC log

   Enter the value in the Dump Entries to Printer From VLIC Log display for output to go to the printer. For more information about this option, see page 12-47.
3. Dump entries to tape from the VLIC log

   Enter the value in the Dump Entries to Printer From VLIC Log display for output to go to the printer. For more information about this option, see page 12-47.
4. Dump entries to diskette from the VLIC log

   Enter the value in the Dump Entries to Printer From VLIC Log display for output to go to a diskette. For more information about this option, see page 12-47.
5. Change the VLIC log sizes

   Choose this option to change the following characteristics of VLIC log:
   - The size of the note log area
   - The size of dump log area
   - The size limit for dump entries

   For more information about this option, see page 12-49.
6. Clear the VLIC log

SST

Choose this option to clear the VLIC log. This option displays the Clear prompt. For more information about this option, see page 12-49.

Ending VLIC Log: Press F3 or F12 on the Work with VLIC Log Menu to end the dump request currently being processed. A warning message is issued to make sure you want to end VLIC log or to continue the dump that is in process. The end function must be pressed again to end work with VLIC log.

Select Entries from the Vertical Licensed Internal Code (VLIC) Log: This option is selected from the Work with VLIC Log menu. The *Work with VLIC log* option is selected from the System Service Tools menu or from the *Work with service tools* option under DST. Selecting this entries option causes the following display to appear:

```
                         VLIC Log Selection Criteria

Type choices, press Enter.

  Starting note ID . . . . . . . .  ______    000000-FFFFFF

  Entry type:
    Major code . . . . . . . . . .  __        0000-FFFF
    Minor code . . . . . . . . . .  __        0000-FFFF









F3=Exit   F12=Cancel
```

Figure 12-42. An Example of a VLIC Log Selection Criteria Display

Use the VLIC Log Selection Criteria display to establish the criteria that determines the first note entry shown on the Select Entries from the VLIC Log display. To do this enter the note ID, a six digit hexadecimal number, on the VLIC Log Selection Criteria display where you want scrolling to begin and press the Enter key. The Select Entries from VLIC Log display appears. Scroll either forward or backward through the entries to view the entries on the Select Entries from the VLIC Log display.

Scrolling begins with the most recent entry in the log, and the option on the Scroll display is set to scroll backward through the entries.

You can limit the entries presented on the Select Entries from the VLIC Log display by specifying a major entry type (optional) and a minor entry type (optional if a major type is specified). Use the Help key to have the VLIC log assistance display shown; this display contains a list of the major entry types.

Select Entries from VLIC Log: Press the enter key on the VLIC Log Selection Criteria display to see the following display.

```
                        Select Entries from VLIC Log

Type choices, press Enter to dump entry to selected device.
  1=Printer   2=Tape   3=Diskette

     Note  Major                    Major  Minor                     Dump
Opt  ID    Description              Code   Code   Date     Time     K bytes
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____
 _   ____  _______________________  ____   ____   _______  _______  ____

F3=Exit   F12=Cancel
```

Figure 12-43. An Example of a Select Entries from VLIC Log Display

This display is sometimes referred to as the multiple note entry scroll prompt. Use this display to scroll through all of the note entries that meet the criteria that you established on the previous VLIC Log Selection Criteria display. Only the entries meeting that criteria are displayed.

Use the Roll keys to scroll forward and backward. The following scrolling considerations apply:

- Forward scrolling causes the entry at the bottom of the current display to appear as the top entry on the next display.
- Backward scrolling causes the entry at the top of the current display to appear at the bottom entry on the next display.
- An attempt to scroll beyond the limits of the note ID range causes the same entries to display again.

Press F3 to return to the Work with VLIC Log menu to initiate a dump of single or multiple entries. To dump multiple entries, choose one of the options to dump entries to a printer, tape, or diskette from the Work with VLIC Log menu. To dump single entries choose the *Select entries for VLIC log* option from the Work with VLIC Log menu.

Dump Entries to Printer, Tape, or Diskette from VLIC Log: This option is selected from the Work with VLIC Log menu. The *Work with VLIC log* option is selected from the System Service Tools menu or from the *Work with service tools* option under DST. Selecting this dump entries option causes the following display to appear:

```
                 Dump Entries to Printer from VLIC Log

Type choices, press Enter.

  Note ID:
    Starting . . . . . . . . . . .  ______   000000-FFFFFF
    Ending . . . . . . . . . . . .  ______   000000-FFFFFF

  Entry type:
    Major code . . . . . . . . . .  ___      000000-FFFFFF
    Minor code . . . . . . . . . .  ___      000000-FFFFFF

Select one of the following:

     1. Dump entry header
     2. Dump entry header and note entry
     3. Dump entry header and entire entry

Selection
     _

F3=Exit   F12=Cancel
```

Figure 12-44. An Example of a Dump Entries to Printer from VLIC Log Display

This display is the same for the *Dump entries to tape* and *Dump entries to diskette* options.

Use this display to establish the criteria that determines which note entries are to be dumped. To dump entries, return to the Work with VLIC Log menu from the Select Entries from VLIC Log display and choose one of the options to dump entries to a printer, tape, or diskette. The dump entries display is then presented. Use this display or option to specify which entries to dump and to initiate the dump request.

To use the dump entries display, do the following:

- Determine the level of detail you want dumped and enter the corresponding option (1, 2, or 3) in the control field on line 4.
  1. Dump entry header provides major and minor codes.
  2. Dump entry header and note entry provides the note data and header information.
  3. Dump entry header and entire entry provides all of the VLIC log entry information. This option is needed most often.
- The note ID is sometimes referred to as the VLOG ID. Enter the Starting and Ending note IDs, and the Major Code and the Minor Code fields. See Chapter 31 for a list of all major and minor codes.
- Press the Enter key to initiate the dump request.

For a printer request, pressing the Enter key causes the status of the dump request to be displayed on the message line:

```
Print dump request ID XXXX submitted.
```

For a diskette or tape request, pressing the Enter key causes the Select Diskette File or Select Tape File displays to appear. The results of the dump request are displayed on the message line of this display when you return from the Select Diskette File or Select Tape File displays.

The default starting note ID and entry type values are the same as the option selected from the Work with VLIC Log menu. The default ending note ID is set equal to the starting note ID.

If the ending note ID is less than the starting note ID, the dump selection is in descending instead of ascending sequence.

You cannot specify a minor entry type unless a major entry type is also specified. If left blank, the major and minor codes are not included in the selection criteria. The Help key causes a list of major code entries to be shown.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Select Diskette File: Pressing the Enter key on the Dump Entries to Diskette from VLIC Log display causes the following display to appear.

```
                 Select Diskette File

Type choices, press Enter.

  Volume ID . . . . . . . . . . .  ____

  File  . . . . . . . . . . . . .  ______








F3=Exit   F12=Cancel
```

Figure 12-45. An Example of a Select Diskette File Display

Use this display to describe the diskette or diskettes when the diskette drive is the output device.

After you press the Enter key, the Select Entries from VLIC Log display appears again showing the results of the dump request.

Note: You can print the contents of this diskette by using the display/alter/dump service tool.

Select Tape File: Pressing the Enter key on the Dump Entries to Tape from VLIC Log display causes the following display to appear.

```
                         Select Tape File

Type choices, press Enter.

  Volume ID . . . . . . . . . . . .  _____

  File  . . . . . . . . . . . . . .  ______

  Sequence number . . . . . . . . .  ___       0000-9999

  Check for active files  . . . . .  _         1=Yes, 2=No










F3=Exit   F12=Cancel
```

Figure 12-46. An Example of a Select Tape File Display

Use this display to describe the tape or tapes when the tape drive is the output device.

After you press the Enter key, the Select Entries from VLIC Log display appears again showing the results of the dump request.

Note: You can print the contents of this tape by using the display/alter/dump service tool.

Change VLIC Log Sizes: This option is selected from the Work with VLIC Log menu. The *Work with VLIC log* option is selected from the System Service Tools menu or from the *Work with service tools* option under DST. Selecting this change log sizes option causes the following display to appear:

```
                       Change VLIC Log Sizes

Type choices, press Enter.

 Note log:
   Last rebuild IPL number . . . :   _____
   Log size (K bytes):
     Old . . . . . . . . . . . . :   ___
     New . . . . . . . . . . . . .   ___       ___-___

  Dump log
   Last rebuild IPL number . . . :   _____
   Log size (K bytes):
     Old . . . . . . . . . . . . :   ___
     New . . . . . . . . . . . . .   ___       ___-___
   Maximum K bytes per entry:
     Old . . . . . . . . . . . . :   ___
     New . . . . . . . . . . . . .   ___       ___-___




F3=Exit   F12=Cancel
```

Figure 12-47. An Example of a Change VLIC Log Sizes Display

Use this prompt to display and/or change the basic status of the VLIC log. You can change the size of the note log area and the dump log area, and you can limit the size of individual dump entries.

If you change the values on this prompt and press the Enter key, the same display is shown again with the updated values.

Note: The smallest value that you can specify for the maximum K-bytes per entry field is 1 (1024 bytes). The largest value that you can specify for the maximum K-bytes per entry field is 4 (4096 bytes) less than that specified for the size of the dump log.

Clear VLIC Log: This option is selected from the Work with VLIC Log menu. The *Work with VLIC log* option is selected from the System Service Tools menu or from the *Work with service tools* option under DST. Selecting this clear log option causes the following display to appear:

```
                           Clear VLIC Log

Press F6=Clear VLIC log to clear the VLIC log.
Press F3=Exit or F12=Cancel to return without clearing the VLIC log.













F3=Exit   F6=Clear VLIC log   F12=Cancel
```

Figure 12-48. An Example of a Clear VLIC Log Display

This prompt is used as a safeguard to keep from inadvertently clearing the VLIC log. If you press F6, the VLIC log is cleared and the Work with VLIC Log menu appears. F3 or F12 causes the Work with VLIC Log menu to appear without clearing the VLIC log.

Input/Output Debug Utility

The *Input/output (I/O) debug utility* option assists in solving software problems in the licensed internal code of an I/O processor thus the nickname IOP debug or IOP dump. This option is available for SST and DST.

Note: The service representative should use this option only with guidance from the product developer and/or second level support.

Functions: The following functions are provided under DST and SST:

- Static trace, see page 12-50
- Dynamic trace, see page 12-50
- Breakpoint, see page 12-50
- Read I/O processor data, see page 12-50
- Dump I/O processor data, see page 12-50

Static Trace: This function collects, displays, prints, and saves data from static trace points. Trace points are located in the executable code of an I/O processor. (In an IOP, executable code is the software or the instruction stream and not the data storage area.) The trace points consist of a compare address and one or more data addresses. When the instruction at the compare address is completed, the contents of the memory at the corresponding data addresses is collected. Static trace points are defined by IBM and cannot be changed.

How to use: Even though the static trace points are defined by IBM, the static trace is included in a trace session by selecting the appropriate option from the Select Trace Functions display. No additional data is required. After a static trace is defined, it appears as a single trace point on the Work with Trace Points display where it can be turned on for the next trace session, turned off for the next session, or deleted from the set of defined trace points.

SST

Defining a static trace does not start a trace session. A trace session is started from the Work with Trace Sessions display. This display presents the trace sessions for the selected device, including the status (for example, running, stopped, or new).

A session is started by selecting the *Start* option for the Work with Trace Session display which has a default status of new. The Start a Trace Session display appears which allows entry of buffer options, a trace session description, and (for some devices) trace control information. The trace session includes those trace points which are currently on. After a trace session has started, it appears on the Work with Trace Sessions display with a status of running. From this display, a trace session can be stopped, and trace data can be displayed, printed, saved to a diskette or tape, or deleted.

Dynamic Trace: This function defines trace points in the executable code of an I/O processor. The data from these trace points can be collected, displayed, printed, and saved. Dynamic trace points are temporary user-defined trace points that are removed at the end of a trace session.

How to use: Dynamic trace points are defined on the Define a Trace Point display by specifying a trace address (the compare address), the type of address (real or offset into a program), an optional description, and a list of up to eight data addresses and lengths. After a dynamic trace point is defined, it appears on the Work with Trace Points display where it may be turned on, turned off, or deleted. A trace session is started from the Start a Trace Session display, as described under static trace on page 12-50.

Breakpoint: This function sets a breakpoint in the executable code of an I/O processor. The process instruction stops at the breakpoint address. Other functions under this utility can be performed while the process is stopped.

How to use: Breakpoints are defined on the Define Breakpoint display by specifying an offset address and an optional description. The address is used as an offset into a program known internally to the I/O processor. After a breakpoint is defined, it appears on the Work with Breakpoints display where it can be turned on, turned off, or deleted. Once a breakpoint is reached, the stopped process is resumed when any option is taken on the reached breakpoint. These options take immediate effect in the I/O processor.

Read I/O Processor Data: This collects, displays, prints, and saves data from the memory and registers of an I/O processor. This operation takes place through a software interface that exists only for operational processors.

How to use: Processor data can be read by specifying on the Read I/O Processor Data display the address from which to read, the type of address (real or offset into a program), the number of bytes to read, and the type of read (memory or registers). The data can be displayed, printed, or saved to a diskette or tape.

Dump I/O Processor Data: This collects, displays, prints, and saves data from the memory, hardware registers, and error log of an I/O processor. This operation takes place at the hardware bus level and may be used to gather data from inoperable processors.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

How to use: Processor data can be dumped by specifying on the Dump I/O Processor Data display the data type (dump, error log, storage, or registers), data offset, data length, and whether to issue a unit reset to the processor. Certain processors need a unit reset to perform the dump command. The data can be displayed, printed, or saved to a diskette or tape.

Warning: Issuing a unit reset to a processor that is running causes the processor to become inoperable. This may result in a system failure. An IPL is required to recover from the system failure.

All attached devices fail when the work station controller is dumped; therefore, if there is only one work station controller on the system, it cannot be dumped.

Menu Flow: Select the *Work with I/O debug utility* option from either the Start a Service Tool menu of SST or the Start a Service Tool menu of DST. Figure 12-49 shows the menu flow of the I/O Debug Utility.

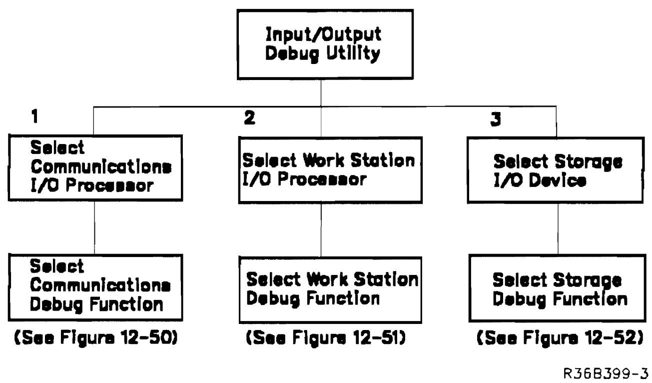

Figure 12-49. I/O Debug Utility Main Menu Flow

Options: The main menu of the I/O Debug Utility allows selection of the type of I/O device to work with. The options are:

1. Select communications I/O processor

   This option displays the communications processors and their active (varied-on) lines. One processor may be selected either by a processor or one of its lines. Selecting a line selects the controlling processor. For more information about this option, see page 12-51.

2. Select work station I/O processor

   This option displays the work station processors. One processor may be selected. For more information about this option, see page 12-52.

3. Select storage I/O device

   This option displays the storage I/O processors and their controlled devices. The 9332, 9335, 9336, and 6100 disk devices and those devices which have a system object name (for example, DKT01 and TAP01) are shown. One processor may be selected either by a processor or one of its devices. Selecting a device (except for the 9335 which selects itself) selects the controlling processor. For more information about this option, page see 12-53.

The communications, work station, or storage devices attached to the system are presented on a selection display. One device may be selected. Other displays show data associated with this device. Only one device can be selected at a time, but breakpoints and trace sessions can be active in other devices. The data associated with these functions is shown when the corresponding device is selected.

The selected device determines which debug functions are available. Although there are implementation differences among the various I/O devices, several of the functions are common. The general operation of these functions is described under "Functions" on page 12-50.

Ending the I/O Debug Utility: Ending this utility removes all active functions of the I/O devices and returns you to DST or SST.

Select Communications I/O Processor: This option supports the 2507, 6130, 6150, and 6160 communications processors.

Menu Flow: Figure 12-50 shows the menu flow for the Select Communications I/O Processor menu.

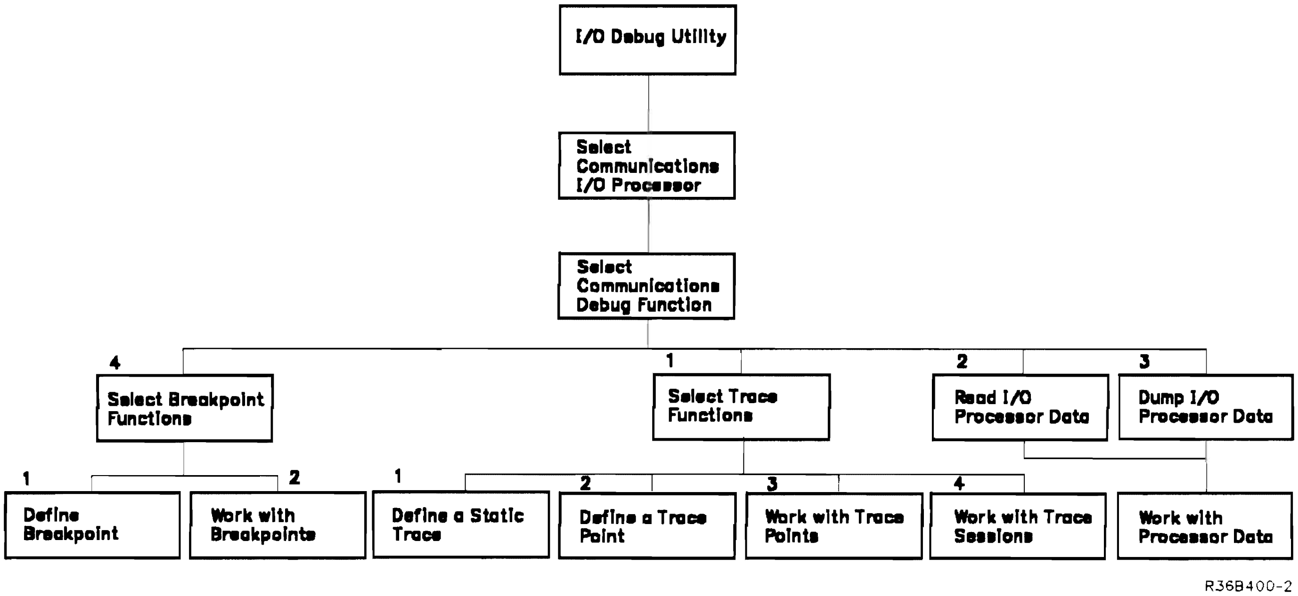

Figure 12-50. Select Communications I/O Processor Menu Flow

Options: The Select Communications I/O Processor menu has the following options:

1. Select trace functions

   For more information about this option, see page 12-53.
2. Read I/O processor data

   For more information about this option, see page 12-54.
3. Dump I/O processor data

   For more information about this option, see page 12-54.
4. Select breakpoint functions

   For more information about this option, see page 12-54.

Select Work Station I/O Processor: This option supports the 6040 and 6140 work station processors.

Menu Flow: Figure 12-51 shows the menu flow for the Select Work Station I/O Processor menu.

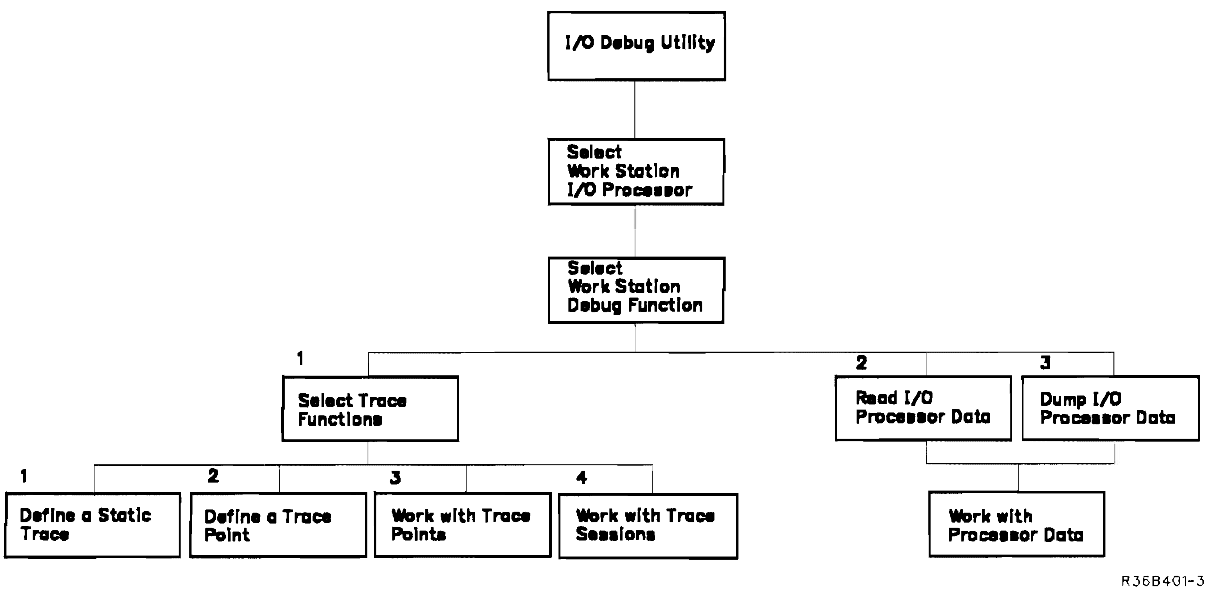

Figure 12-51. Select Work Station I/O Processor Menu Flow

SST

Options: The Select Work Station I/O Processor menu has the following options:

1. Select trace functions

   For more information about this option, see page 12-53.
2. Read I/O processor data

   For more information about this option, see page 12-54.
3. Dump I/O processor data

   For more information about this option, see page 12-54.

Select Storage I/O Device: This option supports the 2507, 2600, 2601, 2602, 2604, 6110, and 9335 storage devices as shown by the following options.

Menu Flow: Figure 12-52 shows the menu flow for the Select Storage I/O Device menu.

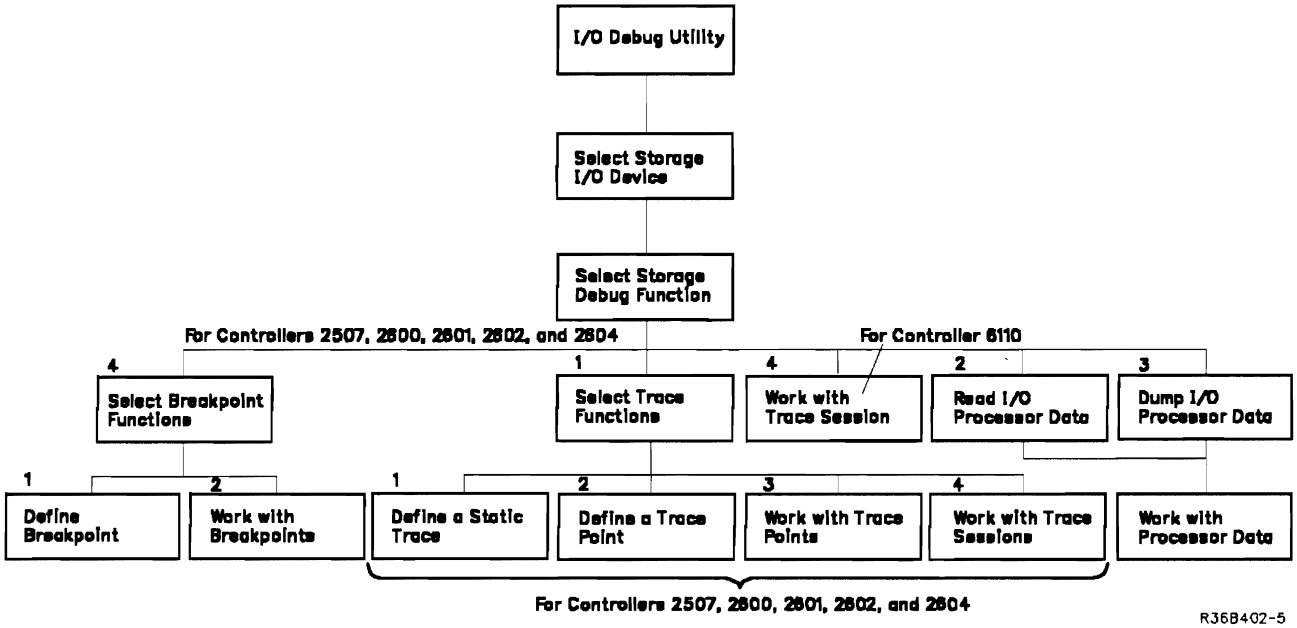

Figure 12-52. Select Storage I/O Device Menu Flow

Options: The Select Storage I/O Device menu has the following options:

1. Select trace functions (used for all storage devices)

   For more information about this option, see "Select Trace Functions."
2. Read I/O processor data (used for all storage devices except 9335)

   For more information about this option, see page 12-54.
3. Dump I/O processor data (used for all storage devices except 9335)

   For more information about this option, see page 12-54.
4. Select breakpoint functions (used for only the Multiple Function I/O Processor (feature number 2507), 9346 and 2440 Controllers (feature numbers 2600, 2601, 2602, and 2604)).

   For more information about this option, see page 12-54.

Select Trace Functions

Options: The Select Trace Functions display has the following options:

1. Define a static trace

   This option is used for all devices except for the the Magnetic Storage Device Controller (feature number 6110). This option defines a static trace for use in subsequent trace sessions. For communications devices, at least one line must be selected. At least one storage resource must be selected for the Multiple Function I/O Processor (feature number 2507), 9346 and 2440 Controllers (feature numbers 2600, 2601, 2602, and 2604).
2. Define a trace point

   This option is used for all devices except for the Storage Device Controller (feature number 6110) and the 9335 Device Function Controller. This option defines a dynamic trace point. For communications devices, a single line must be selected. A single resource must be selected for the Multiple Function I/O Processor (feature number 2507), 9346 and 2440 Controllers (feature numbers 2600, 2601, 2602, and 2604).

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3. Work with trace points

   This option is used for all devices except for the Storage Device Controller (feature number 6110) and the 9335 Device Function Controller. This option displays currently defined trace points for the selected I/O device on the Work with Trace Points display.
4. Work with trace sessions

   This option is used for all devices. This option displays the trace sessions for the selected I/O device on the Work with Trace Sessions display.

Work with Trace Points: The options are:

1. Turn on

   This option enables a trace point (static or dynamic). This point is included in the next trace session.
2. Turn off

   This option disables a trace point (static or dynamic). This point is not included in the next trace session.
3. Delete

   This option removes the definition of a trace point (static or dynamic). This point is not available for trace sessions unless it is defined again.

Work with Trace Sessions: The options are:

1. Start

   This option starts a trace session using the trace points which are currently on.
2. Stop

   This option stops a trace session.
3. No action
4. Delete

   This option deletes the data collected for a trace session and removes the session from this screen.
5. Display

   This option displays the trace data on the screen in hexadecimal dump format.
6. Print

   This option prints the trace data to a printer in hexadecimal dump format. The available printers are those which are used by the environment (DST or SST) under which the I/O Debug Utility is used.
7. Save to diskette

   This option saves the trace data to diskette in hexadecimal dump format.
8. Save to tape

   This option saves the trace data to tape in hexadecimal dump format.

Select Breakpoint Functions

Options: The Select Breakpoint Funtions display has the following options:

1. Define a breakpoint

   This option defines a breakpoint at the offset address specified. For communications devices, a single line must be selected. A single resource must be selected for the Multiple Function I/O Processor (feature number 2507), 9346 and 2440 Controllers (feature numbers 2600, 2601, 2602, and 2604).
2. Work with breakpoints

   This option displays the currently defined breakpoints for the selected device with the following Work with breakpoint options.

Work with Breakpoints: The options are:

1. Turn on

   This option enables a breakpoint in the selected I/O device. Processes stopped at this breakpoint are resumed.
2. Turn off

   This options disables a breakpoint in the selected I/O device. Processes stopped at this breakpoint are resumed.
3. Delete

   This option disables a breakpoint in the selected I/O device and removes its definition from this screen. Processes stopped at this breakpoint are resumed.

Read or Dump I/O Processor Data

Options: The Read or Dump I/O Processor Data displays have the following options:

1. Display data

   This option displays the collected data on the screen in hexadecimal dump format.
2. Print data

   This options prints the collected data on the screen in hexadecimal dump format. The available printers are those which are used by the environment (DST or SST) under which the I/O Debug Utility is used.
3. Alter data

   This option displays the collected data on the display in hexadecimal dump format and allows changes to be made to the data.
4. Save data to diskette

   This option saves the collected data to a diskette in hexadecimal dump format.
5. Save data to tape

   This option saves the collected data to tape in hexadecimal dump format.
6. Write data into I/O processor

This option writes the data (previously read from an I/O processor) back into the I/O processor.

An Example of How to Dump a Communications IOP: To dump a communications IOP, do the following:

1. Make sure the IOP that is to be dumped is not being used, if you are going to reset the IOP.
2. Enter the STRSST command to start SST.
3. Select the *Start a service tool* option from the SST main menu.
4. Select the *I/O debug utility* option from the Start a Service Tool menu.
5. Select the *Select communications I/O processor* option from the I/O Debug Utility menu.
6. Enter a 1, to select an IOP, next to the IOP you want to create a dump for.
7. Select the *Dump I/O processor data* option, enter the type, offset, and length of the data, whether or not to issue a unit reset, and press the Enter key.
8. After the IOP dump is created, the options to display, print, or save the dump data to tape or diskette are displayed.

Print Stand-Alone Dump

The service processor can only dump main storage to disk. The print stand-alone dump tool is used to copy a main storage dump on disk to diskette or tape and print stand-alone dump can print or display dumps from all three sources: disk, tape, and diskette. Before copying the main storage dump, the service support system should be consulted to see if a dump is needed or if a fix already exists for the problem. For more information about taking a main storage dump, see page 16-1

Warning: The printed print stand-alone dump is several thousand pages. Print the dump only when it is absolutely necessary.

Data to Print or Display: The items that can be printed or displayed using print stand-alone dump are:

- Central processing unit (CPU) data which includes:
  - CPU registers
  - Permanent storage
  - Real storage table
  - Segment ID/IMPI local storage (SID/ILS)
  - Floating-point registers
  - PD cache
  - Effective address status
  - External status
  - Instruction status
  - MCR vital status
  - MCR real status
  - Functional partition status
- Machine communications area (MCA)
- Machine check log buffer (MCLB)

  For more information about this buffer, see page 34-1.
- Task summary
- Task dispatching elements (TDE) chained to the TDE anchor pointer (MCA4RTDE) in the MCA

  For more information about TDEs, see Chapter 27.
- Call/return elements (CRE) chained to each TDE

  For more information about the TDE and CRE formats, see Figure 32-2 on page 32-4.
- All main storage pages in main storage at the time of the dump including:
  - Primary directory (PD) entry status for each page
  - PIN count for each page
  - Subpool numbers for each page
  - Storage management status bits which pin the page
  - Page's segment ID (SID) extender
  - Storage management flags

A **PIN** is a count of the number of times a page is marked in use. A page in use is held in main storage. If a page's PIN count is nonzero, the page is required to remain in or is not to be removed from main storage, and the V=R page frames are not to be changed.

A **segment identifier (SID)** refers to the 3 or 4 high-order bytes of a 6-byte virtual storage address. The SID extender is used internally to extend the size that can be specified.

Content Errors: For print stand-alone dump to provide correct information, the machine communications area (MCA), primary directory (PD), and storage management vector table (SMVT) structures dumped by main storage dump must be valid data. If print stand-alone dump determines that the above structures contain invalid data, the following happens:

- TDE and CRE chains are not printed or displayed.
- Main storage pages are printed or displayed in real address order.
- Page header fields contain zeros.

Requirements for Using Tape or Diskette: The following are needed when using tape or diskette:

- The tape must be initialized using the Initialize Tape (INZTAP) command. The file name is DMS.
- When using the tape, you are prompted for the volume ID of the tape and the 4-character sequence number of the file. For example, you may use 0001 as the first file on the tape.

If the main storage dump is copied to a diskette, the following considerations apply:

- The diskette must be initialized using the Initialize Diskette (INZDKT) command.
- The volume name and file name of each diskette must be DMS.

SST

- If there are multiple diskettes, each diskette must be read back in the same order as when the dump was taken.

Menu Flow: This option is available in SST and DST. Select the *Print stand-alone dump* option from the Start a Service menus. The *Start a service tool* option is selected from the System Service Tools menu and from the the Dedicated Service Tools menu.

A SST and a DST print stand-alone dump are the same, except if DST is in the limited paging environment (that portion of the IPL before storage management recovery). In this case, you can always copy a dump from DASD to tape. However, you need to do storage management recovery to print, display, or dump if the input is from tape or if the main storage is greater than 16 megabytes.

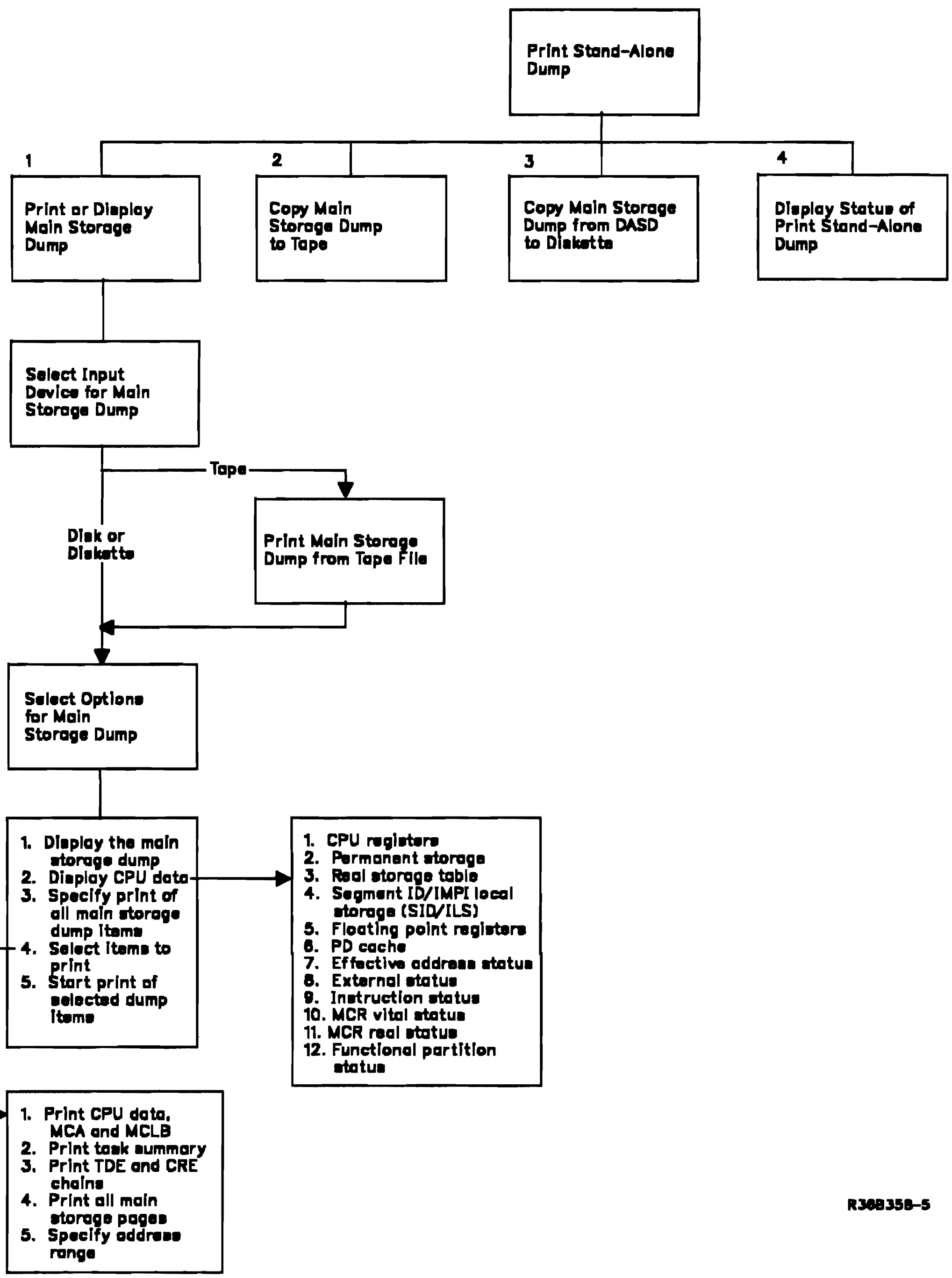

Figure 12-53. Print Stand-Alone Dump Menu Flow

Options: The options on the Print Stand-Alone Dump menu are:

1. Print or display (all or partial) main storage dumps from auxiliary storage, tape, or diskette

   Selecting this option causes the Select Input Device for Main Storage Dump Menu to appear. When you select the input device and press the Enter key, the Select Options for Main Storage Dump menu appear. When you select a specific item on this display to be printed and press the Enter key, the display is shown again with a message stating that the selection was added to the list of items to dump. For more information about this menu, see "Select Input Device for Main Storage Dump Menu."

2. Copy main storage dump to tape

   When you select this option, the Copy Main Storage Dump to Tape display appears. On the display, enter the volume ID of the volume to write the dump to and the sequence number of file. For more information, see "Select Input Device for Main Storage Dump Menu."

3. Copy main storage dump to diskette

   The request is submitted and the message 'Dump request submitted' appears.

4. Display status of print stand-alone dump

   The option displays a status to indicate the number of incomplete dump requests. Press the Enter key to display current status information. A completion code is shown if the dump ends abnormally. For more information about completion codes, see Appendix A.

   To recover from a print stand-alone dump that ended abnormally, press F3 to return to the Print Stand-Alone Dump menu, and select the option again.

Print stand-alone dump is a main task which sets up three subtasks that may be running at the same time:

- Print dump requests
- Copy to tape requests
- Copy to diskette requests

Function Keys: F3 and F12 have the following functions:

Key	Function
F3	Displays the Print Stand-Alone Dump menu
F12	Displays the previous menu or cancel

Pressing F3 and F12 on the Print Stand-Alone Dump menu ends the print stand-alone dump and returns you to either SST or DST. A warning message appears if a task is still running. The task does not end until you press F3 or F12 again.

Select Input Device for Main Storage Dump Menu:

Options: The Select Input Device for Main Storage Dump menu has the following options:

1. Storage
2. Tape

   Selecting the *Tape* option causes the Print Main Storage Dump from Tape File display (Figure 12-54) to appear.

3. Diskette

For more information about copying main storage dump data and initializing tapes, see page 16-5.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

```
                  Print Main Storage Dump from Tape File

 Type choices, press Enter.

   Volume ID . . . . .  _____     Identifier of volume to read dump from

   Sequence
   number  . . . . . .  ___       Sequence number of file










 F3=Exit    F12=Cancel
```

Figure 12-54. An Example of a Print Main Storage Dump from Tape File Display

After the *Storage* and *Diskette* options are chosen and for the *Tape* option, the previous display for tape is shown, the Select Options for Main Storage Dump menu appears. For more information about this menu, see "Select Options for Main Storage Dump Menu."

Select Options for Main Storage Dump Menu: After you select the input device for the main storage dump from the Select Input Device for Main Storage Dump menu, the Select Options for Main Storage Dump menu appears.

Options: The Select Options for Main Storage Dump menu has the following options:

1. Display the main storage dump

   This option displays the main storage dump.

2. Display CPU data

   This option displays the Select CPU Data to Display menu. For more information about this menu and option, see "Display CPU Data" on page 12-58.

3. Specify print of all main storage dump items

SST

This option prints all dump items.

4. Select items to print

   This option displays the Select Items to Print menu. When you select a specific item to be printed and press the Enter key, the display is shown again with a message stating that the selection was added to the list of items to dump. For more information about selecting items to print, see page 12-58.

5. Start print of selected dump items

   This option prints the dump items that you have selected.

Display CPU Data:

| *Options:* The Select CPU Data to Display menu has the following options:

1. CPU registers

   For more information about this option, see page 12-58.

2. Permanent storage
3. Real storage table
4. Segment ID/IMPI local storage (SID/ILS)

   For more information about this option, see page 12-58.

5. Floating-point registers
6. PD cache
7. Effective address status
8. External status
9. Instruction status
10. MCR vital status
11. MCR real status
12. Functional partition status

SST

Display CPU Registers: The following is an example of the Display CPU Registers display.

```
                              Display CPU Registers
               1         2
00 OP 00     IL 00     IAR 0000        00
00      0000000000000000               00
00      0000000000000000               00
          IS 000000000000              00
EX 00  3
EASTAT 0000       00  CC 00            00
ESSTAT 00         00     00          0000
ISTAT  00         00  MG 00
TRAP   00    MC   00  L  00  4
                                    5
     0000   3 00     000000000000       M               0000
  00     0000000000000000 00    X 0000   N 0000         000000000000
  00     0000000000000000 00    Y 0000   J 0000

Press Enter to continue.



 F3=Exit    F12=Cancel
```

Figure 12-55. An Example of a Display CPU Registers Display

Significant fields are:

Field	Description
1 IL	Length of current instruction
2 IAR	Address of the next instruction
3 EX	Current IMPI instruction (not always valid)
4 L	May contain indication of cause of machine check
5 M	May contain indication of cause of machine check

See the *Service Guide* for more information about how to interpret the field indicators to see what caused the problem or problems.

Display Segment ID/IMPI Local Storage Display: The following is an example of the Display Segment ID/IMPI Local Storage display.

```
                  Display Segment ID/IMPI Local Storage

  6       7          8
Number   SID         ILS        Number   SID         ILS
  0      01234567    0123         8      01234567    0123
  1      01234567    0123         9      01234567    0123
  2      01234567    0123         A      01234567    0123
  3      01234567    0123         B      01234567    0123
  4      01234567    0123         C      01234567    0123
  5      01234567    0123         D      01234567    0123
  6      01234567    0123         E      01234567    0123
  7      01234567    0123         F      01234567    0123

Press Enter to continue.



 F3=Exit    F12=Cancel
```

Figure 12-56. An Example of a Display Segment ID/IMPI Local Storage Display

The meanings of the fields are:

Field	Description
6 Number	IMPI processor base register number
7 SID	Segment identifier
8 ILS	Offset into the SID

See the *Service Guide* for more information about how to interpret the field indicators to see what caused the problem or problems.

Select Items to Print: For an example of a step-by-step procedure for printing selected items of main storage dump, see page 12-61.

Options: The Select Items to Print menu has the following options:

1. Print CPU data, MCA, and MCLB
2. Print a task summary

   For more information about this option, see page 12-59.
3. Print TDE and CRE chains

   All of the TDEs and CREs chained to the TDE anchor in the MCA are printed. The TDEs are printed in the order that they appear in the TDE chain; each TDE is followed by the CREs chained to it.
4. Print all main storage pages

   The pages are printed in virtual address order. Each page is preceded by a header that contains the real address of the page, its status and PIN count (from the PD entry), and the storage pool that the page was in at the time of the dump.
5. Specify address range

   This option prompts you for the address ranges (maximum of 5 ranges) to be printed.

Address ranges print before all main storage pages if both options 4 and 5 are selected from the Select Items to Print menu.

The printing is handled by a subtask, so you can display information or dump status while the dump is printing. When the subtask is ended, the following message is displayed:

```
Dump to printer completed normally
```

Or, if you are copying to tape or a diskette, the following message is displayed:

```
Copy completed normally
```

You can select the same dump items multiple times. However, the dump items are printed only once (except for address range selections when printing the main storage dump).

Print Stand-Alone Dump Task Summary: The task summary from the print stand-alone dump is built from the task dispatching element (TDE) chain and the in-use call return elements (CRE). Figure 12-57 on page 12-60 shows the summary containing two lines for each TDE and one line for each in-use CRE chained to the TDE.

The *first* line for a task contains:

1 Name of the task or process

2 Type of task (MI, VLIC, or HLIC)

3 Address of the TDE

4 Type of queue (SRQ, SRC, TDQ) the task is using as its current queue

12 Address of the current queue

16 Queue name

The *message* line contains:

5 A message found between the first and the second TDE lines, contains:

- The current internal microprogramming (IMP) registers, printed for the active TDE only
- Storage management flag bits

The TDE lines contain:

6 Type of code being executed (VLIC, HLIC, or MI)

7 Module or program identifier and name

Note: If a main storage stand-alone dump and the module has been removed from main storage, the name and program identifier are blank.

8 Module or program offset

The CRE lines contain:

9 Cause of the CRE:

- Exception
- Supervisor linkage (SVL)
- Execution of an implicit SVL

10 A two-character code identifying:

- Exception
- Implicit SVL
- MI router instruction number

11 Description of exception or SVL

13 Type of code being executed (VLIC, HLIC, or MI)

14 Module or program identifier and name (see note)

Note: If a main storage stand-alone dump and the module has been removed from main storage, the name and program identifier are blank.

15 Module or program offset

17 Current IMPI registers

These registers are printed only for the active TDE unless the process is in wait state.

If a field is blank, it may be blank because the data associated with it was removed from main storage and is, therefore, not available for analysis. When the dump contains inadequate information to properly identify the cause of the CRE, no exception is identified.

```
     PRINT STANDALONE DUMP - MSSD  2                3             4                      15/12/89   15:36:21   PAGE     1
1 QCONSOLE  QSYSOPR   007370     : MI   TASK      AE6D7700 0100       SRC NAME:                                   0000040E C0A0
          5 9335 ERP ACTIVE
      6 TDE  VLIC MODULE: 7 #SMNERP2  OFFSET 038A  8                        9   10        11              12
        CRE  VLIC MODULE:   #RMSACS   OFFSET 06A0  15                       IMPLICIT: E8   PPR   STORAGE MANAGEMENT
     13 CRE MI    PROGRAM: 14 QSRSVPRE                      OFFSET   21DA    MI ROUTER: 71   SET ACCESS STATE
LU04      QUSER     007368       : MI   TASK      AE6D5900 0100            NAME:                                   AE6B4900 1530
     TDE  VLIC MODULE:   #CFRWTO   OFFSET 030E
       CRE MI    PROGRAM:                                   OFFSET   0CCA    EXCEPTION: 00   NO EXCEPTION
LU03      QUSER     007367       : MI   TASK      AE6D4A00 0100            NAME:                                   AE6B4900 0FB0
     TDE  VLIC MODULE:   #CFRWTO   OFFSET 030E
       CRE MI    PROGRAM:                                   OFFSET   0CCA    EXCEPTION: 00   NO EXCEPTION
LU02      QUSER     007366       : MI   TASK      AE6D3B00 0100       SRC NAME:                                   0000040E C0A0
          9335 ERP ACTIVE
     TDE  VLIC MODULE:   #SMNERP2  OFFSET 037C
       CRE VLIC MODULE:  #DBINSIM  OFFSET 0AC8                              IMPLICIT: E8   PPR   STORAGE MANAGEMENT
       CRE MI    PROGRAM:  QSPBPPRT                         OFFSET   0814    MI ROUTER: 12   INSERT DATA SPACE ENTRY
LU01      QUSER     007365       : MI   TASK      AE6D2C00 0100            NAME:                                   AE6B4900 14B0
     TDE  VLIC MODULE:   #CFRWTO   OFFSET 030E
       CRE MI    PROGRAM:                                   OFFSET   0CCA    EXCEPTION: 00   NO EXCEPTION
QRJE      QSYSOPR   007364       : MI   TASK      AE6D1D00 0100            NAME:                                   AE6B4900 15B0
     TDE  VLIC MODULE:   #CFRWTO   OFFSET 030E
       CRE MI    PROGRAM:  QMRASCTL                         OFFSET   1CB4    EXCEPTION: 00   NO EXCEPTION

SCPF      QSYS      000000       : MI   TASK      AE6B6B00 0100       SRQ NAME:                                   AE6B4900 0230
     TDE  VLIC MODULE:   #CFRWTO   OFFSET 030E
       CRE MI    PROGRAM:  QWCISCFR                         OFFSET   2DC8    EXCEPTION: 00   NO EXCEPTION
CHNPCI                           : VLIC TASK      00000100 1B00            NAME:  STORAGE MANAGEMENT I/O WAIT     00000100 45E0
          MAIN STOR. MANAGEMENT CRITICAL                                  16
     TDE  VLIC MODULE:   #SVE8PPR  OFFSET 1A12
       CRE VLIC MODULE:  #LOCHPCI  OFFSET 073A                             EXCEPTION: 12   PAGE FAULT       AE6B4B01 2400
                                 : VLIC TASK      00000100 1600            NAME:  STORAGE MANAGEMENT I/O WAIT     00000100 45E0
          MAIN STOR. MANAGEMENT CRITICAL
     TDE  VLIC MODULE:   #SVE8PPR  OFFSET 1A12
       CRE VLIC MODULE:            OFFSET 02B0                             EXCEPTION: 12   PAGE FAULT       AE6B5900 0000
     PRINT STANDALONE DUMP - MSSD                                                            15/12/89   15:36:21   PAGE     6
CURRENT IMPI REGISTERS
                              IAR      6E8C           REG 0  00000100 67D8          MODULE:  #RTIMCH
17   REG 1  00000100 082C   REG 2  00000000 0001   REG 3  00001601 4C88   REG 4  00000100 0B00   REG 5  00000100 4E50
     REG 6  00001601 4A00   REG 7  00000103 5E00   REG 8  00000100 0000   REG 9  00001601 4B95   REG A  00001601 0100
     REG B  00000100 4E50   REG C  00000102 082C   REG D  00000115 0000   REG E  00000100 6E7E   REG F  00000100 67D8
     TDE  VLIC MODULE:   #SMDUMP   OFFSET 0250
       CRE VLIC MODULE:  #SMNERPV  OFFSET 02D6                              IMPLICIT: 0D   ERROR NOT USED
SMAI02                           : VLIC TASK      00000100 0C00            NAME:  STORAGE MANAGEMENT I/O WAIT     00000100 45E0
          MAIN STOR. MANAGEMENT CRITICAL
     TDE  VLIC MODULE:   #SVE8PPR  OFFSET 1A12
SMMSP0                           : VLIC TASK      00000100 0D00            NAME:  STORAGE MANAGEMENT I/O WAIT     00000100 45E0
          MAIN STOR. MANAGEMENT CRITICAL
     TDE  VLIC MODULE:   #SVE8PPR  OFFSET 1A12
       CRE VLIC MODULE:  #SMPOT    OFFSET 01D0                              IMPLICIT: E8   PPR   STORAGE MANAGEMENT
SMFOBT                           : VLIC TASK      00000100 0E00       SRC NAME:                                   00000100 FF90
     TDE  VLIC MODULE:   #SMFOBTO  OFFSET 0016
•-0000                           : HLIC TASK      00000100 0F00       SRC NAME:  OU TASK QCT COUNTER             00000100 5610
     TDE  HLIC CSAR:  1B00

VLIC TASK NAME NOT FOUND         : VLIC TASK      00000100 3100       SRQ NAME:  SCA I/O QUEUE                   00000100 4680
     TDE  VLIC MODULE:             OFFSET 031E
LOMUPS                           : VLIC TASK      00000100 3200            NAME:  NO CURRENT QUEUE                00000000 0000
     TDE  VLIC MODULE:             OFFSET 0000
BUSYTD                           : VLIC TASK      00000100 3300       SRC NAME:  SRC FOR THE INTERVAL TIMER      00000100 6060
     TDE  VLIC MODULE:   #RMBSYX   OFFSET 0040
SMMSP2                           : VLIC TASK      00000100 7400       SRC NAME:                                   00000103 609C
     TDE  VLIC MODULE:   #SMPOT    OFFSET 006E
SMMSP3                           : VLIC TASK      00000100 7500       SRC NAME:                                   00000103 609C
     TDE  VLIC MODULE:   #SMPOT    OFFSET 006E
SMMSP4                           : VLIC TASK      00000100 7600       SRC NAME:                                   00000103 609C
     TDE  VLIC MODULE:   #SMPOT    OFFSET 006E
****** END OF DUMP ******
                                                                                                                  R36B453-1
```

Figure 12-57. An Example of a Print Stand-Alone Dump Task Summary

SST

Example of Printing Selected Items of Main Storage: All of the functions performed by the print stand-alone dump are obtained by following menus and prompts. Each of them follows a flow similar to the following example:

1. Select the *Start a service tool* option from the System Service Tools menu or the *Work with service tools* option from the Dedicated Service Tools menu.
2. Select the *Print stand-alone dump* option from the Start a Service Tool menu.
3. Select the *Print or display the main storage dump* option from the Print Stand-alone Dump main menu.
4. Select the *Storage* option from the Select Input for Main Storage Dump menu.
5. Select the *Select items to print* option from the Select Options for Main Storage Dump menu.
6. Select the *Specify address range* option from the Select Items to Print menu.
7. Fill in the address range on the *Specify Address Range* prompt and press the Enter key (the address range is added to the print list).
8. Press F12 to return to the Select Items to Print menu.
9. Press F12 to return to the Select Options for Main Storage Dump menu.
10. Select the *Start print of selected dump items* option.

    The following message is displayed:

    ```
    DUMP REQUEST SUBMITTED
    ```
11. Press F3 to return to the Print Stand-Alone Dump menu.

    You may display the status of the print stand-alone dump. A message is displayed when the dump is complete. Press F3 or F12 to end the dump. If the dump is not complete, a warning message appears. The task does not end until you press F3 or F12 again.
12. After receiving one of the completion messages, press F3 or F12 to end the print stand-alone dump and return to the DST or System Service Tools menu.

Display Hardware Configuration

This option displays the hardware attached to the system and shows the status of the hardware. This option displays:

- The input/output buses
- The cards on the input/output buses that consist of:
  - Input/output processors (IOPs)
  - Input/output adapters (IOAs)
  - Bus extension drivers (BEDs)
  - Bus extension receivers (BERs)
- Controllers, devices, and communication ports associated with an input/output processor
- Main storage cards
- Processor cards

Menu Flow:

This option is available in SST and DST. Select the *Display Hardware Configuration* option from the Start a Service Tool menus. The *Start a service tool* option is selected from the System Service Tools menu and from the Dedicated Service Tools menu.

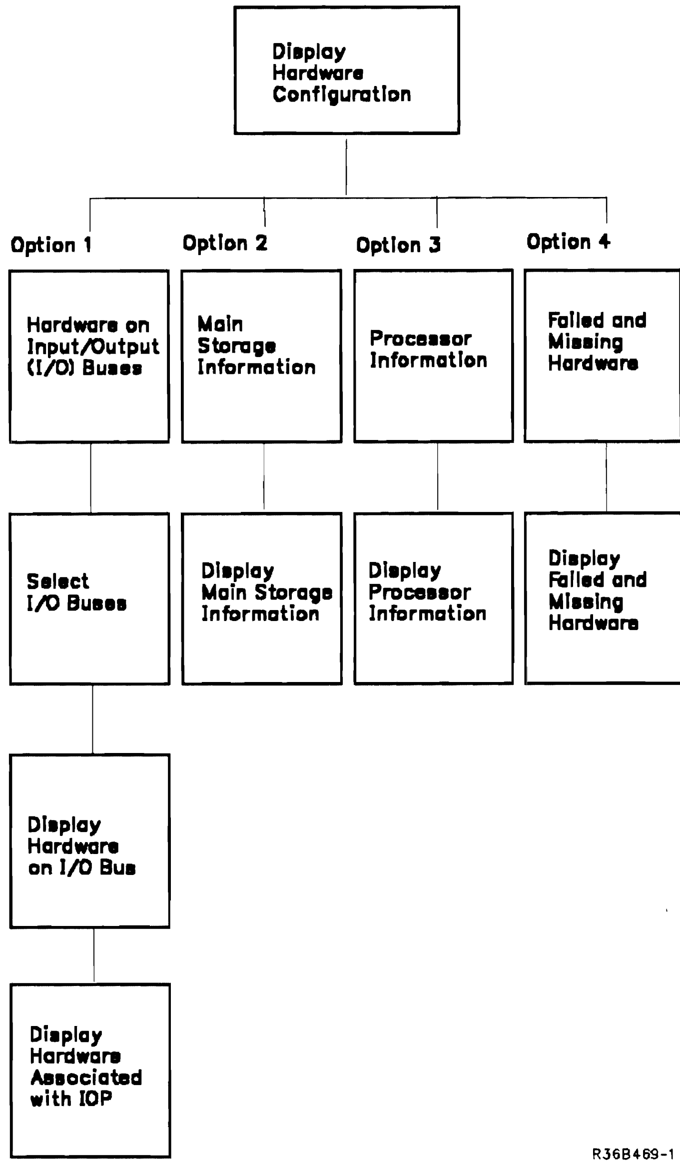

Figure 12-58. Display Hardware Configuration Menu Flow

Options: The options on the Display Hardware Configuration menu are:

1. Hardware on input/output (I/O) buses

   This option lets you select I/O buses, display the hardware on an I/O bus, and display hardware associated with an IOP. To do this:

   a. Select this option to list the I/O buses on the AS/400 system.

b. When the list of I/O buses appears, enter a 1 next any of the I/O bus or buses to display the hardware on each of the I/O buses you selected.

   For an example of a list that is displayed, "Select I/O Buses."

   For more information about what is displayed for each of the I/O buses you selected, see "Display Hardware on I/O Bus."

c. When the list of the cards associated with each of the buses appears, enter a 5 in the option field on the line that contains the letters IOP. All IOPs are listed under the description field. Information about the hardware associated with the IOP appears after you press Enter.

   For more information about what is displayed with each IOP, see "Display the Hardware Associated with an IOP" on page 12-63.

2. Main storage information

   This option displays the main storage cards on the system, the status of the cards, and indicates if a main storage card slot appears to be empty. For more information about this option, see "Main Storage Information" on page 12-64.

3. Processor information

   This option displays the processor cards on the system. For more information about this option, see "Processor Information" on page 12-65.

4. Failed and missing hardware

   This option displays the hardware that failed, card slots on the input/output buses that appear empty, and main storage card slots that appear empty. For more information about this option, see "Failed and Missing Hardware" on page 12-65.

SST

Hardware on Input/Output Buses: Selecting this option from the Display Hardware Configuration menu displays the I/O buses on the system. The Select I/O Buses display appears when you select this option.

Select I/O Buses: The Select I/O Buses display appears when you select the *Hardware on input/output (I/O) buses* option on the Display Hardware Configuration display.

In the example display shown in Figure 12-59, the system has three I/O buses. Type in a 1 in the *Option* field **1** to display the hardware on the buses shown in the *Bus* field **2**.

You can select more than one bus and display the hardware on each bus without returning to this display.

```
                        Select I/O Buses

Type options, press Enter.
  1=Select
1              2
Option         Bus
  _             0
  _             1
  _             2







F12=Cancel
```

Figure 12-59. An Example of Select I/O Buses Display

Display Hardware on I/O Bus: The Display Hardware on I/O Bus display appears when you select an I/O bus on the Select I/O Buses display (Figure 12-59).

The display in Figure 12-60 shows examples of cards that you might find on I/O bus 0. The PF keys defined at the bottom of the display let you display additional information about the hardware.

If you selected more than one bus on the Select I/O Buses display, you can display the hardware on these buses without returning to the Select I/O Buses display.

You can select more than one IOP and display the hardware associated with each IOP without returning to this display.

```
                        Display Hardware on I/O Bus

3 I/O bus . . . . . . :      0
4 Bus status . . . . . :     Operational

Type options, press Enter.
  5=Display hardware associated with input/output processor (IOP)

                          7
5        6                 Card           8           9
Option   Address           Type       Description   Status
  _      0010-FFFF      *  6110          IOP        Operational
  _      0020-FFFF         6110          IOP        Operational
  _      0030-FFFF      ** 6040          IOP        Operational
  _      0040-FFFF         6041          IOP        Operational
  _      0050-FFFF         6018          BED        Operational
  _      0001-FFFF         6019          BER        Operational
  _      0011-----         ----          ---        Missing
                                                              More...
10 *  - Load source I/O processor
   ** - Work station console I/O processor

F3=Exit         F9=Display next I/O bus       F10=Display previous I/O bus
F11=Display model/serial/part numbers         F12=Cancel
```

Figure 12-60. An Example of Display Hardware on I/O Bus Display

The fields for each of the cards associated with an I/O bus are:

Field	Description
3 I/O bus	This field is the number of input/output bus that you selected to display.

4 Bus status

This field describes the status of the input/output bus. The status can be:

Status	Description
Operational	The input/output bus is operational.
Failed	The input/output bus failed.

5 Option — This field allows the hardware associated with an input/output processor to be displayed by entering a 5 on a line that contains IOP in the description field.

6 Address — This field identifies the location of the cards on the I/O bus. The first two positions are the bus number, the third position is the card slot, the fourth position is the board number, and the last four positions are the unit address. This field should be used with the system or rack configuration list to determine the physical location of the card.

If dashes are shown in the last four positions of the address or card slot field, the card slot identified by the first four positions might be empty. If the card slot is not empty, either the card is not seated properly, or the card or some related hardware failed. The dashes also appear in other fields if a card slot appears to be empty.

7 Card type

This field is a number that identifies the card in the card slot. If one asterisk (*) appears before the card type, this card is the load source input/output processor. If mirrored protection is in place for the load source input/output processor, the asterisk (*) is present for two magnetic storage input/output processors. If two asterisks (**) appears before the card type, this card is the work station console input/output processor. If the card type is blank, the failing hardware is an input/output processor, but its type cannot be determined.

8 Description

This field is an abbreviated description of the card. The valid card descriptions are:

Abbreviated Description	Meaning
BED	Bus extension driver
BER	Bus extension receiver
IOA	Input/output adapter
IOP	Input/output processor

9 Status — This field describes the status of the card if present in the card slot. The status can be:

Status	Description
Operational	The card is usable.
Failed	The card is not usable.
No power	There is no power coming from the bus extension driver card.
Missing	The card slot appears to be empty.

10 Asterisks

The asterisks explain the meaning of the asterisks used on this display.

Display the Hardware Associated with an IOP: The Display Hardware Associated with IOP display appears when you key a 5 in the *Option* field of the Display Hardware on I/O Bus display (Figure 12-60 on page 12-62).

The display in Figure 12-61 shows examples of the hardware associated with an IOP. The PF keys defined at the bottom of the display let you display additional information about the hardware.

If you selected more than one IOP on the Display Hardware on I/O Bus display, you can display the hardware on these IOPs without returning to the Display Hardware on I/O Bus display. Press the Enter key to display the hardware on these IOPs.

```
                  Display Hardware Associated with IOP

11 I/O bus . . . . . . :      0
12 Bus status . . . . . :    Operational
13 IOP card type  . . . :    6110
14 Card address . . . . :    0010-FFFF


15                           16         17
Address                      Type       Status
0010-FFFF                    6110       Operational
  0010-00FF                    9332     Operational
    0010-0000             *      9332   Operational
  0010-7FFF                    9347     Operational
    0010-0700             **     9347   Operational

18 *  - Load source disk unit
  ** - Alternative IPL tape unit


Press Enter to continue.

F3=Exit                              F10=Display previous IOP
F11=Display descriptions             F12=Cancel
```

Figure 12-61. Example of Display Hardware Associated with IOP Display

The fields for each of the hardware associated with an I/O bus are:

Field	Description
11 I/O bus	This field contains the number of the input/output bus that was selected to be displayed.

SST

12 Bus status

This field describes the status of the input/output bus. The status can be:

Status	Description
Operational	The input/output bus is operational.
Failed	The input/output bus failed.

13 IOP card type
This field is the card type of the IOP selected from the list of hardware on the I/O bus.

14 Card address
This field is the address of the IOP selected from the list of hardware on the I/O bus.

15 Address
This field identifies the location of the resource. The first two positions are the bus number, the third position is the card slot, the fourth position is the board number, and the last four positions are the unit address. This field should be used with the system or rack configuration list to determine the physical location of the resources.

The first line displayed is the address of the input/output processor selected from the list of hardware on the I/O bus. This IOP is the first level of hardware. The remaining lines displayed contain the addresses of the hardware associated with the IOP. This hardware is the second or third level of hardware.

The address of the IOP is always left justified.

Each level of hardware associated with the IOP has the address indented 2 spaces to the right.

For some examples of resource configuration records, see page 10-1.

16 Type
This field is a number that identifies the hardware. Each level of hardware associated with the IOP has the type indented 2 spaces to the right. If one asterisk (*) appears before the type, this is the load source disk unit. If mirrored protection is in place for the load source disk unit, the asterisk (*) appears for two disk units. If two asterisks (**) appears before the type, this is the alternate IPL tape unit. If the type is blank, the failing hardware is an input/output processor, but its type cannot be determined.

17 Status
This field describes the status of the hardware. The status can be:

Status	Description
Operational	The hardware is operational.
Failed	The hardware failed.

18 Asterisks
The asterisks explain the meaning of the asterisks used on this display.

Main Storage Information: The Display Main Storage Information display appears when you select the *Main storage information* option on the Display Hardware Configuration display.

The display in Figure 12-62 shows examples of the location, card type, and storage size of the main storage cards on the system, and the status of the cards. It also shows if a main storage card slot seems to be empty.

```
                 Display Main Storage Information

 19          20          21
 Card        Card        Storage      22
 Location    Type        Size         Status
   1         3060          16         Operational
   2         3060          16         Failed
   3         ----           0         Missing
   4         3060          16         Errors detected

 Press Enter to continue.

 F3=Exit   F12=Cancel
```

Figure 12-62. An Example of Display Main Storage Information Display

For each card, this option displays the:

Field	Description

19 Card location
This field is the slot the main storage card is in.

20 Card type
This field is the number of the main storage card.

21 Storage size
This field specifies the main storage size, in megabytes, of the storage card. For example, 16 megabytes is 16,777,216 bytes.

22 Status
This field specifies the status of the main storage card, or indicates if the main storage card slot appears to be empty. This field can have the following values:

Value	Description
Operational	The main storage card is operating without detected errors.

SST

Errors detected	The main storage card has errors detected on it, but the card is still useable.
Failed	The main storage card failed and is not usable.
Missing	The main storage card slot appears to be empty.

Processor Information: The Display Processor Information display appears when you select the *Processor information* option on the Display Hardware Configuration display.

The display in Figure 12-63 shows examples of the type, description, model, serial number, and part number of the processor cards in the system.

```
                        Display Processor Information

                                           26              27
 23        24                    25            Serial          Part
 Type      Description           Model     Number          Number
 2503      System Processor       B60      10-8012091      0000021F5000
 2505      Service Processor      002      10-8017061      0000021F3426
 2506      Bus 2 Controller       003      10-8029050      0000092X4396










 Press Enter to continue.

 F3=Exit    F12=Cancel
```

Figure 12-63. Example of Display Processor Information Display

For each card, this option displays the:

Field	**Description**
23 Type	This field is the number of the processor card.
24 Description	This field describes the processor card.
25 Model	This field identifies the feature level of the card.
26 Serial Number	This field is a number assigned to the processor card when it was made.
27 Part Number	This field is a number assigned to the processor card when it was made.

Failed and Missing Hardware: The Display Failed and Missing Hardware display appears when you select the *Failed and missing hardware* option on the Display Hardware Configuration display.

The display in Figure 12-64 shows examples of:

- Hardware that has failed
- Card slots on the I/O buses that seem to be empty
- Main storage card slots that seem to be empty

The PF keys defined at the bottom of the display let you display additional information about the hardware.

```
                      Display Failed and Missing Hardware

 28
 Address
 or Card          29                     30
 Slot             Type                   Description
 0001-FFFF        6019                   Bus Extension Receiver
 0011-----        ----                   Missing
 0031-FFFF        6018                   Bus Extension Driver
 0220-0000        6034                   Port
 0230-FFFF                               Input/Output Processor
    2             3060                   Main Storage
    3-----        ----                   Missing






 Press Enter to continue.

 F3=Exit    F11=Display model/serial/part numbers    F12=Cancel
```

Figure 12-64. An Example of Display Failed and Missing Hardware Display

For each device, bus, or slot, the following fields appear:

Field	**Description**
28 Address or card slot	This field is the address or card slot of the failing or missing hardware. If the first position of this field is not blank, this field is an address used to identify the location of the resource. The first two positions are the bus number, the third position is the card slot, the fourth position is the board number, and the last four positions are the unit address. If any of the first three positions of this field are blank, this field is used to identify the slot of the main storage card. This field should be used with the system or rack configuration list to determine the physical location of the resource or main storage card. If dashes are shown in the last four positions of the address or card slot field, the card slot identified by the first four positions might be empty. If the card slot is not empty, either the card is not seated properly, or the card or some related hardware failed. The dashes also appear in other fields if a card slot appears to be empty.

SST

29 Type — This field is a number that identifies the hardware. If type is blank, the failing hardware is an input/output processor, but its type cannot be determined. If type is 6018, there is no power from the bus extension driver card to a bus extension receiver card.

30 Description — This field describes the card. If the card slot is empty, the word missing appears.

If an IOP reports a blank serial because of a bad module, resource management will use the VPD from the resource file stored earlier when the module was working. If an IOP reports blank serial from a slot previously not occupied, it is assigned a new resource name unless it is the only IOP of this type on the system.

An IOP reporting blank serial number will be totally transparent until that IOP is moved to a new slot and there are other IOPs of the same type on the system.

An IOP reporting blanks as the type must be replaced.

6110 IOPs cannot be installed in bus extensions (5030).

Swapping of work station controllers and communication IOPs breaks the configuration since devices are attached to the resource name using the device descriptor. Swapping DASD IOPs does not affect resource management or storage management.

The 9347 tape unit does not report its serial number with its VPD and must be manually entered into the configuration.

Work with Active Service Tools

You can select this option from the System Service Tools menu. This option lists active service tools and their status. Service tools can be started from the System Service Tools menu and left active while you start another service tool. From this list of active service tools you can enter again the service tool that you left active or end an active service tool.

The following is an example of the Work with Active Service Tools display:

```
                    Work with Active Service Tools

Type option, press Enter.
1=Select service tool          4=End service tool

Option     Service Tool                  Status
  _        Display/alter/dump            Active
  _        VLIC log                      Active
  _        I/O processor LIC             Ending
  _        Trace vertical LIC            Active






F3=Exit    F3=Refresh    F12=Cancel    F16=SST main menu
```

Figure 12-65. An Example of a Work with Active Service Tools Display

Options

The Work with Active Service Tools menu has the following options:

1. Select service tool

   This option lets you re-enter an active service tool. You can select only one active service tool at a time. If you select more than one service tool, only the first one selected is displayed.

2. End service tool

   This option ends an active service tool.

If a service tool is canceled from this display, an abnormal end results, an error message is displayed on the terminal, and the service tool may not clean up or restore devices to a state usable for the customer. To correctly cancel a tool, select the service tool and use the *End* option on its initial menu.

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Work with Disk Units

You can select this option from the SST main menu and the DST main menu. In the limited paging environment, you can use this option for adding, removing, or replacing disk units. The *Work with Disk Unit* options of SST and DST are the same in the full paging environment. When DST is in the full paging environment, DST looks like SST. Only display functions are shown in full paging environment of DST and SST. Most DASD functions are in DST and work only in a limited paging environment. For more information about the paging environments, see "Paging Environment of the AS/400" on page 18-4.

Menu Flow

Figure 12-66 shows the menu flow for the *Work with disk units* option.

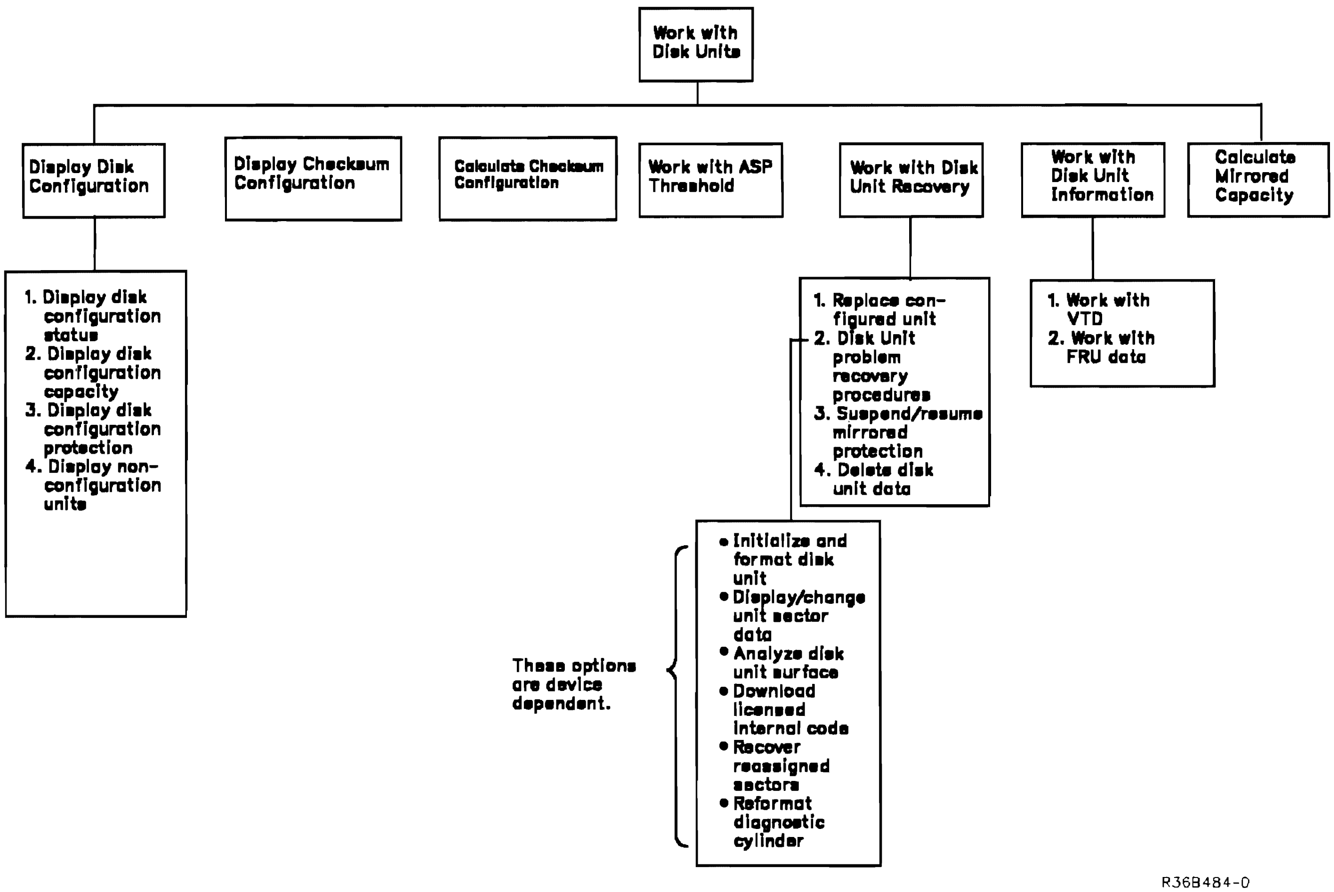

Figure 12-66. Work with Disk Units Menu Flow

Options

You can select the following option from the Work with Disk Units menu:

1. Display disk configuration

   This option displays the system's current disk configuration and any non-configured disk units. Non-configured disk units are disk units that are installed, but not configured in the system's disk unit configuration. For more information about this option, see "Display Disk Configuration" on page 12-68.

2. Display checksum configuration

   This option displays checksum configuration information for a checksummed ASP.

3. Calculate checksum configuration

   This option calculates the checksum configuration for an ASP. You can calculate the checksum configuration for an existing ASP, an existing ASP with changes you provide, or an ASP you want to create. Although you can calculate a checksum configuration for any ASP, the system will only checksum ASP 1.

4. Work with ASP threshold

   This option displays or changes the amount of storage in use for every ASP on the system. The default value of the threshold is 90 percent of the storage in use on each unit in the ASP. The system notifies you when the threshold value is reached.

5. Work with disk unit recovery

   This option performs service functions on disks. Some of the service functions available are:

- Replace a disk unit with another disk unit
- Run disk unit problem recovery procedures
- Suspend or resume mirroring protection on a disk unit
- Delete disk unit data from a disk

For more information about this option, see "Work with Disk Unit Recovery."

6. Work with disk unit information

   This option lets you work with either the vital product data (VPD) or to work with field replacement unit (FRU) data. You can specify which units you want to work with.

   This option is used to recover from repair actions. VPD is data stored in every unit that makes up the system. It is the data that identifies that particular unit to the system. When hardware units are added to the system or after some repair actions, the VPD may be invalid. This option lets you update the VPD for some devices or units of the system. The repair action instructions tell you if and when you need to use this option. This option is available in SST and DST.

7. Calculate mirrored capacity

   This option calculates the mirrored capacity for an ASP. Calculation is based on the current configuration or a configuration that you specify.

Display Disk Configuration

This option is selected from the Work with Disk Units menu. From this option you can select to work with status, capacity, and protection of the ASPs and units of the system configuration. You can also display the non-configured units.

Options: You can select the following options from the Display Disk Configuration menu:

1. Display disk configuration status

   This option displays the status of all the ASPs and disk units configured on the system. They will be displayed in unit number sequence within the ASP they are assigned to.

2. Display disk configuration capacity

   This option displays the threshold and overflow values of each ASP and its units. The amount of protected and unprotected storage for each entry is also shown.

3. Display disk configuration protection

   This option shows the type of protection of each ASP and disk unit. Units with checksum protection show set number.

4. Display non-configured units

   This option shows the serial number, type, model, and address of all non-configured disk units. Their status will always be shown as non-configured.

Work with Disk Unit Recovery

This option is selected from the Work with Disk Units menu. From this option you can select to work with status, capacity, and protection of the ASPs and units of the system configuration. You can also display the non-configured units.

Options: You can select the following options from the Work with Disk Unit Recovery menu:

1. Replace configured unit

   This option lets you exchange a configured disk unit for which mirrored protection has been suspended with a non-configured unit. Selecting this option clears all the units in the ASP in which the disk unit is being exchanged unless that ASP has checksum protection or the disk unit being exchanged is a suspended unit of a mirrored pair.

2. Disk unit recovery procedure

   This option lets you select options that help in problem isolation and repair actions. Only those options that are valid for a specific disk unit are shown. You can use this option on disk units that are non-configured or that have had mirrored protection suspended.

   This option lets you:

   - Initialize and format a disk unit

     This option runs when the 9332 or 9336 disk unit reference code indicates that reallocations have failed because no alternative space is available. All of the ID fields on the disk unit are written again. The disk unit is formatted to 520 bytes in each sector. Running this option erases all of the data from the disk unit. Be sure to save the disk unit data to tape before you run this option.

   - Display or change unit sector data

     This option sets the block size of the disk unit to 520 bytes per sector. This option is used as follows:

     – The results of the *Analyze disk unit surface* option show which sectors have data check conditions. You can use the *Display/change unit sector data* option to assign those sectors to new locations on the disk.

     – You can examine and change the 8 bytes of sector header, if necessary.

     – You can examine and change the 512 bytes of sector data, if necessary.

     The *Display/change unit sector data* option has the following functions:

     – Reads the data from a selected sector.

     – Displays the data in hexadecimal and EBCDIC formats.

     – Lets the hexadecimal data be changed and rewritten to the sector.

- Displays the 8-byte sector header in formatted form.
- Lets the 8-byte sector header be changed and rewritten to the sector.
- Lets the sector be assigned to a new location on the disk.
- Displays the disk unit reference code after each operation.

- Analyze disk unit surface

  This option performs a read verify operation on the selected range of sectors. The block size of the disk unit is set to 520 bytes per sector during this operation. Sectors that report disk unit reference codes indicating data check errors should be assigned to new locations on the disk using the *Display/change unit sector data* option.

- Download licensed internal code

  This option moves the licensed internal code that controls the operation of the disk unit from system storage to the disk unit. The disk unit controller is reset to activate the licensed internal code.

- Recover reassigned sectors

  This option runs when the 9335 disk unit reference code indicates that reallocations have failed because no alternative space is available. The recover function will attempt to recover the sectors that have been assigned to new locations on the disk and alternative sectors that have not been used. When all usable sectors have been recovered, an ending display appears.

- Reformat diagnostic cylinder

  This option runs when the 9335 disk unit reference code indicates the ID fields of the sectors on the diagnostic cylinder should be rewritten. The block size of the diagnostic cylinder is set to 520 bytes per sector during this operation. When all the ID fields of the sectors on the diagnostic cylinder are rewritten, an ending display is presented.

Note: This option performs functions that assist in problem determination and repair. Only those functions that are valid for a particular unit will be made available.

3. Suspend or resume mirrored protection

   This option lets you start or stop mirroring protection on a particular logical unit.

4. Delete disk unit data

   This option lets you erase all the data from a non-configured disk unit.

Work with Diskette Data Recovery

Warning: This option should only be used when directed by your service representative.

You can select this option from the System Service Tools menu.

This option lets you read data from a diskette containing cyclical redundancy check (CRC) errors. CRC errors occur when unreadable data is found on a diskette during a read operation. Normally, when an CRC error is found you are not able to read the diskette past the point of the failing sector. Using this option, diskettes containing sectors with CRC errors can be read.

The AS/400 system can use diskettes for saving and restoring system objects. One or more objects can be stored on a diskette. Whenever the AS/400 system encounters a diskette containing a bad sector during a read operation, the operation ends. A faulty diskette sector, which produces a cyclical redundancy check (CRC) error, can result from defects in the diskette or from improper handling.

The *Work with Diskette Data Recovery* option lets you do the following:

- Read the physical contents of a diskette into a system space object while tolerating diskette sectors read with data CRC errors.
- Write the contents of the system space object to a new diskette.
- Print reports identifying the contents of the diskette and presence or absence of failing sectors.
- Display a sector of diskette data.
- Alter a sector of diskette data.

The *Work with Diskette Data Recovery* option lets you read data in from a diskette, alter any failing sectors present on the diskette to correct the failing sectors, and then write the new or correct data out to a new diskette.

Processing Limitations

The *Work with Diskette Data Recovery* option limits you to the type of diskette processing that can be done. This option:

- Cannot duplicate diskettes containing data sets which have data set directories of the diskette in the data area

  Deleted sectors are accepted by the read option and are identified by the print operation. The write operation compresses the data set in which the deleted sectors are encountered. Compression must occur before the write operation because there is no MI interface to write a deleted sector. The automatic compression preserves all data sets beginning with extent sector addresses. When applicable, the *Work with Diskette Data Recovery* option adjusts

SST

end-of-extent, and end-of-data addresses. Diskettes containing data sets, which have data set directories of the diskette within the data area, cannot be duplicated because the automatic compression could destroy sector addressability of the data set directory. Any modification made to the volume table of contents (VTOC) area should not change the sector size as determined by the read operation; compression logic assumes the same sector size.

- May not read VTOC and/or data set identification sectors into a space object.

  The *Work with Diskette Data Recovery* option accepts I/O media errors associated with the sectors read during a read volume table of contents command. Because the IOP does not always return sectors read in error, the VTOC and/or data set identification sectors may not be read into the space object. You can construct valid sectors in place of those sectors that are not read back into the space object because of sector errors. The write operation checks the volume and first data set identification sectors to verify if they are present or absent.

Options

The following options are available on the Work with Diskette Data Recovery menu:

Option Description

2 Alter diskette data

This option lets you alter diskette data. For more information about this option see "Altering Diskette Data."

3 Read data from diskette

Select this option first. This option reads cylinder 0 sector by sector and cylinders 1 through 74 with one read request. This option is tolerant of data CRC and deleted, or sequentially relocated sector feedback responses. When a data CRC or a deleted or sequentially relocated sector is encountered, the read operation contructs an error summary record and continues reading until it reaches an end-of-volume.

4 Write data to diskette

This option writes the VTOC (volume table of contents) and the data sectors from the image contained in the space object. The diskette is written in either ASCII or EBCDIC as determined by the read option. If the operation receives a bad feedback response code from the REQIO instruction, this option ends, and an error message is produced. If the write operation is successful, the output diskette is given the same volume serial number and content as the original diskette.

5 Display diskette data

This option lets you display the diskette data. For more information about this option see "Displaying Diskette Data."

6 Print reports

This option prints the reports selected from the Print Diskette Reports display. The reports are keyed by sector address (CCHRR). For more information about this option, see "Printing Diskette Reports" on page 12-71.

Altering Diskette Data: The following display appears when the *Alter Diskette Data* option is selected from the Work with Diskette Data Recovery display.

```
                          Alter Diskette Data

 Starting sector address  . .  ____   CCHRR

 Type changes, press Enter.

 0000     00000000  00000000  00000000  00000000     *  ................  *
 0010     00000000  00000000  00000000  00000000     *  ................  *
 0020     00000000  00000000  00000000  00000000     *  ................  *
 0030     00000000  00000000  00000000  00000000     *  ................  *
 0040     00000000  00000000  00000000  00000000     *  ................  *
 0050     00000000  00000000  00000000  00000000     *  ................  *
 0060     00000000  00000000  00000000  00000000     *  ................  *
 0070     00000000  00000000  00000000  00000000     *  ................  *
 0080     00000000  00000000  00000000  00000000     *  ................  *
 0090     00000000  00000000  00000000  00000000     *  ................  *
 00A0     00000000  00000000  00000000  00000000     *  ................  *
 00B0     00000000  00000000  00000000  00000000     *  ................  *
 00C0     00000000  00000000  00000000  00000000     *  ................  *
 00D0     00000000  00000000  00000000  00000000     *  ................  *
                                                                      More...
 F3=Exit   F5=Refresh   F12=Cancel   F14=Previous sector
 F15=Next sector
```

Figure 12-67. An Example of the Alter Diskette Data Display

You can advance one sector at a time by pressing the F15 key or back up to the previous sector by pressing the F14 key. Also, you can type over the sector address field. This field gives you direct access to any sector on the diskette.

Displaying Diskette Data: The following display appears when the *Display Diskette Data* option is selected from the Work with Diskette Data Recovery display.

SST

```
                         Display Diskette Data

 Starting sector address  . .  ____   CCHRR

 Type changes, press Enter.

 0000    00000000 00000000 00000000 00000000    * ................ *
 0010    00000000 00000000 00000000 00000000    * ................ *
 0020    00000000 00000000 00000000 00000000    * ................ *
 0030    00000000 00000000 00000000 00000000    * ................ *
 0040    00000000 00000000 00000000 00000000    * ................ *
 0050    00000000 00000000 00000000 00000000    * ................ *
 0060    00000000 00000000 00000000 00000000    * ................ *
 0070    00000000 00000000 00000000 00000000    * ................ *
 0080    00000000 00000000 00000000 00000000    * ................ *
 0090    00000000 00000000 00000000 00000000    * ................ *
 00A0    00000000 00000000 00000000 00000000    * ................ *
 00B0    00000000 00000000 00000000 00000000    * ................ *
 00C0    00000000 00000000 00000000 00000000    * ................ *
 00D0    00000000 00000000 00000000 00000000    * ................ *
 Press Enter to continue                                       More...
 F3=Exit   F5=Refresh   F12=Cancel   F14=Previous sector
```

Figure 12-68. An Example of a Display Diskette Data Display

The contents of sector 1 on cylinder 0, track 0 are displayed first. You can advance one sector at a time by pressing the Enter key or back up to the previous sector by pressing the F14 key. Also, you can type over the Sector Address field. This field gives you direct access to any sector on the diskette.

Printing Diskette Reports: The Print Diskette Report display appears when the *Print Diskette Report* option is selected from the Work with Diskette Data Recovery display. The following summary reports can be printed or options can be selected from the Print Diskette Report display:

- Volume label report

  This report is produced from the space object by virtual address in a standard hexadecimal and character format. This option formats the volume label fields. The volume label field contains a field description, hexadecimal field offset into the sector, and the field contents.

- Data set label report

  For each data set on the diskette, a data set label report is produced from the space object by virtual address in a standard hexadecimal and character format. This option formats the data set label fields. The data set label field contains a field description, hexadecimal field offset into the sector, and the field contents.

- Load/dump object descriptor report

  The AS/400 system save and restore options specify a list of system objects that contains the database in the RD (request descriptor) part of the SSR (source/sink request) data utilized by the REQIO instruction. For each object specified by the REQIO instruction, the load/dump IOM writes on the diskette a load/dump object dump descriptor containing a synopsis of the system environment from which the object was dumped. For each load/dump object dump descriptor contained on the diskette, the descriptor sector is dumped from the space object by virtual address in standard hexadecimal and EBCDIC format. This option formats the load/dump object dump descriptor fields. The descriptor field contains a field description, hexadecimal field offset into the sector, and the field contents.

- Failing sector report

  This report is produced from the sectors that encountered read (or CRC feedback response code) errors after the *Read Data from Diskette* option is selected. The secttors are formatted to provide the sector address (CCHRR—cylinder, head, record), data set identifier, hexadecimal data offset into the sector, and the sector contents. Because the data CRC can be anywhere in the failing sector, the failing sector report shows where to place the failing sector in it appropriate context.

- Sector range report

  This report is produced from the sectors within the specified sector range. Each sector is formatted to contain the sector address (CCHDRR), the data set identification, load/dump object type, subtype, and object name (if applicable). The sector is dumped from the space object by virtual address in standard hexadecimal and EBCDIC format. You must enter a starting and and ending sector address to print a sector range report.

How to Use

To recover from diskette data errors:

1. Select the *Work with Diskette Data Recovery* option from the SST main menu. The Work with Diskette Data Recovery display appears.

```
                    Work with Diskette Data Recovery

 Warning:  Work with Diskette Data Recovery should only be used when
 directed to by your service representative.

 Type option, press Enter.
   2=Alter diskette data       3=Read data from diskette
   4=Write data to diskette    5=Display diskette data     6=Print reports

 Opt     Unit
  _      DKT01
  _      DKT02
  _      DKT03
  _      DKT04
  _      DKT05
  _      DKT06
  _      DKT07
  _      DKT08
  _      QDKT


 F3=Exit   F12=Cancel
```

Figure 12-69. An Example of a Work with Diskette Data Recovery Display

   This display lists the devices that you can work with.

2. Insert a diskette with read errors into the desired disk device.

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3. Read the diskette device of your choice. The read option transfers the contents of the diskette to a system space object where the contents of the diskette can be displayed or altered.
4. After the diskette is read into the system space, print the contents of the diskette by selecting the *Print reports* option from the Work with Diskette Data Recovery display. Printing the contents of the diskette helps you locate the presence or absence of the failing sectors and the address of the system space object where the diskette contents can be altered.
5. Select a diskette summary report. Print the summary reports in any combination by typing a 6 in front of the desired summary report.

   Note: The type of summary report you want to print depends on the type of diskette you are working with. All diskettes have volume headers and data set headers; therefore, you may want summary reports for these areas. The number of read errors determine whether you should look at the failing sector summary. If read errors have been encountered, you should look at the failing sector summary. For diskettes performing save/restore operations, the load/dump object descriptor summary should be used.
6. Specify the start and end sector address for the sector range if you are printing the sector range report. If a sector address is not specified, no sectors are printed in the print range sector area of the report.
7. Display the contents of the diskette by selecting the the *Display diskette data* from the Work with Diskette Data Recovery display or change the failing sectors by selecting the *Alter diskette data* option from the Work with Diskette Data Recovery display.
8. Replace the diskette with read errors with one of the same type and format.
9. Write the changed data to the new diskette by selecting the *Write data to diskette* option. The *write data to diskette* option is used to return the altered system space object back to the diskette.

SST

Chapter 13. Dedicated Service Tools (DST)

The dedicated service tools (DST) allow you to run one or more VLIC service functions under the control of VLIC separately from the operating system. This allows you to perform service functions if the system service tools (SST) is not available or before initialization of the operating system is completed.

DST is part of the vertical licensed internal code. It resides on the load source DASD. Much of the data that DST handles is also located on the load source DASD.

DST runs in both the limited and full paging environments. The paging environment brings DST into main storage for processing; however, the limited paging environment runs more DST options than the full paging environment.

DST provides support for servicing HLIC and VLIC code, service the DASD hardware, create, change, and recover the configuration of the system. Both the OS/400 and the application software can be serviced by DST if the full paging environment is active.

Because OS/400 is spread across more of the DASD devices than just the load source, it may not be possible to get all of pages necessary to accomplish a request. The operating system is not available in the limited paging environment. For more information about paging environments, see page 18-4.

Refer to Table 2-1 on page 2-3 and Table 3-3 on page 3-3 for some of the problems that can be solved using some of the service tools described in this chapter. For more information about DST, see the applicable *Service Guide*.

DST Requirements

Before you use DST, you must have:

- The disk containing the licensed internal code (the load source disk)
- An operational work station on one of the following:

  For twinaxial work stations:

  – First work station card, port 0, address 0, bus 0 (primary console)
  – First work station card, port 1, address 0, bus 0 (alternative console)
  – Second work station card, port 0, address 0, bus 0 (alternative console)

  For ASCII work stations:

  – First work station card, port 0, bus 0 (primary console)
  – Second work station card, port 0, bus 0 (alternative console)

  For more information about the system use of a console during IPL, see Chapter 19. For more information about primary and alternative consoles, see the chapter in the *Service Guide* about determining a primary or alternative console.

- A printer attached to the same work station controller as the console as required by some service tools. ASCII printers are not supported by DST.

  Note: The printer used with DST to print service tool output must be an SCS data stream printer. Intelligent printer data stream printers (IPDS) are not supported by DST.

- A tape or diskette device as required by some service tools
- A valid password to sign on to DST

DST Passwords

DST has three levels of authorization. The levels are:

- Basic (Default password is 11111111.)

  This level allows you to:

  – Use VLIC trace
  – Use print stand-alone dump
  – Run error log analysis
  – Use work with licensed internal code
  – IPL the system

- Full (Default password is 22222222.)

  This level allows you to use all of the service functions except that you cannot change DST passwords. This is the default password for service personnel.

- Security (Default password is QSECOFR).

  This level allows you to use all of the service functions, including changing DST passwords

Each level of authorization has a separate level of access to DST and VLIC service functions and DST options. Each level has one password.

Note: DST passwords are not related to the operating system passwords.

All passwords can be changed. When a password is changed, the old password is replaced. When the current and new passwords are entered, they are not shown on the display. If the default passwords do not work, check with customer for the actual passwords used. After entering a valid password, the DST main menu appears.

You can use the *Work with passwords* option under DST, to reset the QSECOFR user profile password. This option changes the password to its default value of QSECOFR. The password is changed to QSECOFR during the next IPL. The new password of QSECOFR is used and in effect until the password is changed using the CHGUSRPRF or CHGPWD commands. Only the QSECOFR user profile password is reset when the DST option is used.

If the QSECOFR password is changed to another value and the system is IPLed again, then the password for QSECOFR remains unchanged unless the DST option to reset the QSECOFR password is taken again.

Select the *Work with DST environment* option from the Dedicated Service Tools main menu to change passwords. For more information about this option, see page 13-5.

How to Access DST

DST is accessed in one of three ways:

- Perform an IPL of the system with the Keylock switch in the Manual position. The System IPL/Install sign on display (as described under the "Work Control Displays" on page 18-19) appears on the primary console. From this display, select the option to access DST. Then enter a valid password to sign on to DST. For more information about passwords, see page 13-1. After entering a valid password, the Dedicated Service Tools main menu appears and all power off and extended panel functions are available for use.

  If you want to get to DST in full paging environment, you must go through the limited paging environment first. Follow the procedures just described. From the DST main menu, select the *Select DST console mode* option. Select the *Enter DST debug mode* option from the Select DST Console Mode menu. You can then continue the IPL from the DST main menu. For more information about using DST to debug an IPL or an install, see "Select DST Console Mode" on page 13-19.

- Enter function code 21 (Bring up DST) on the control panel during system operation with the Keylock switch in the Manual position. The DST Sign On display appears on the primary console. If function 21 is used and the primary console is powered off or not usable, the DST Sign On display appears on one of the alternate consoles. If the primary console is an ASCII work station, reference code 5003 appears on the control panel. If the primary console is an twinaxial work station, reference code 5004 appears on the control panel. The job that is running at that work station is canceled if you did not perform an IPL of the system in debug mode. For more information about primary and alternative consoles, see "Primary and Alternate Consoles."

  Warning: DST cannot be selected by entering function 21 on the control panel if the system is in the restricted state. If this is done, the system stops. Function 21 should be used to access DST only if SST is not available (such as, if the IPL will not complete or if the operating system is not functioning). The use of Function 21 has no affect on other jobs except if the system is in the restricted state. Loss of the console job in restricted state will cause machine processing to end.

- If DST debug mode was previously selected when you performed an IPL of the system, press the System Request key and type DST (in uppercase) on the system request line and press Enter. This causes the DST main menu to appear on the primary console. The job that is running at that work station is suspended.

  If function 21 from the control panel is used and DST debug mode was previously selected, the DST main menu appears on the primary console. The job that is running at the work station is suspended. For more information about using DST debug mode, see "Select DST Console Mode" on page 13-19.

When the system IPL is done with the Keylock switch in the Normal position, the DST IPL menu does not appear unless the system is configured for attended operation. The first display to appear on the console is the OS/400 Sign On display. The system cannot be powered off from the operator panel when the Keylock switch is in Normal position. However, extended operator panel functions are available. For more information about the extended operator panel functions, see Chapter 14.

Primary and Alternate Consoles

The primary console may be an ASCII or a twinaxial work station.

The primary console for a twinaxial work station has address 0 on port 0 of the first work station controller on bus 0. The primary console for an ASCII work station has no address but must be on port 0 of the first work station controller on bus 0.

The *first* alternative console is the display station with address 0 on port 1 of the first work station controller on bus 0. An ASCII work station cannot be a first alternative console.

The *second* alternative console can be a twinaxial work station with address 0 on port 0 of the second work station controller on bus 0. The ASCII alternative console is on port 0 of the second console controller.

The OS/400 can only be installed from the primary console. For more information about the system use of a console during IPL, see Chapter 19.

Using Online Help while in DST

Because DST is not part of the operating system, cursor sensitive help and second level help for messages is not available under DST; however, help is available by pressing the Help key from any display in DST.

DST

Ending DST

Press the F3 or F12 key on the DST main menu to end dedicated service tools. All service tools or functions started in DST end. You must sign on again to run DST again. If the operating system has not been initialized, the IPL menu appears. If the system has been initialized to the operating system, then the previous operating system Sign-on display appears.

Suspending a Service Tool

Press the F16 key to return to the DST main menu from a service function running in DST without canceling the action of the service function. Press the System Request key and type DST on the System Request line to return to the DST main menu from the work station debug mode without canceling an active job. The key is active only if an IPL of the system is performed in DST console debug mode.

Recovering from Errors in DST

SST and DST uses the same VLIC code; however, there is limited operating system support in the DST. Because there is limited operating support, there is limited error handling support. Most errors in DST are catastrophic to the function running, however, DST should continue to function. VLIC logs are created only if the system is in full paging environment. In the limited paging environment, you are limited to error messages sent to the display or the SRC on the control panel. For more information about the error log, see page 12-3.

Most options available in DST are described in Chapter 12. Even though the options are described in Chapter 12, you should go to "Intervention Display I/O Manager Return Codes" on page 13-18 if an error occurs while dumping information to tape or diskette.

Function Keys

DST has the following function keys:

Key	Description
F3	This key returns you to the Dedicated Service Tools (DST) main menu.
F12	This key returns you to the DST display that preceded the display shown.
F16	This key returns you to the Dedicated Service Tools (DST) main menu from the service function you are in. The active service function is not canceled.
System Request	This key returns you to the Dedicated Service Tools (DST) main menu from the work station in debug mode when you have keyed in DST on the system request line. The active user job is not canceled. This key is active only if an IPL of the system was performed in DST console debug mode.

Menu Flow

DST is selected from the System IPL/Install menu. Figure 13-1 on page 13-4 shows the options you can select from the DST main menu.

DST

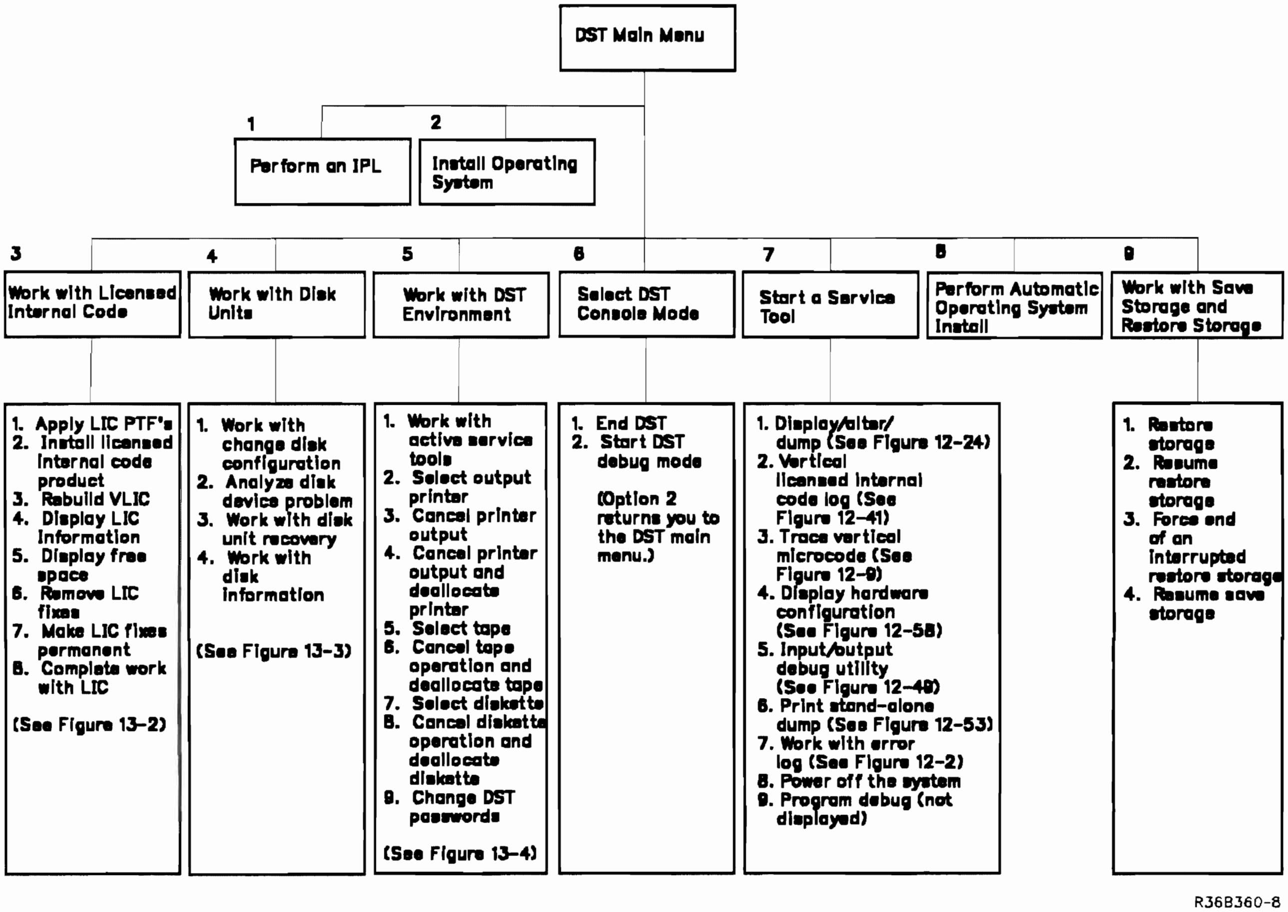


Figure 13-1. DST Main Menu Flow

DST

Options

The DST main menu has the following options:

1. Perform an IPL

   This option does the VLIC recovery phases and passes control to the operating system. The operating system is loaded. This option is the same as selecting the *Start DST debug mode on IPL* from the Select DST Console Mode menu. For more information about the DST console mode, see page 13-19. For more IPL information, see Chapter 18 and the applicable *Service Guide*.

2. Install operating system

   This option is used to install the operating system from tape. This option is the same as the *Perform an IPL* option except that the the operating system is loaded from the load-source tape device. The current operating system (if any) is replaced. This option is used for installing a new release of the currently installed operating system or for installing the operating system after a failure. This must be run from the console.

   This option is not available under basic authority of DST. For more information about installing OS/400, see Chapter 18, and Chapter 19 in this manual and the *Licensed Programs and New Release Installation Guide* and *Backup and Recovery Guide* as described in the *Information Directory*.

3. Work with licensed internal code

   This option is sometimes referred to as link/loader. This option lets you to display and temporarily apply fixes to the system licensed internal code (from tape or diskette) when the operating system is not available. This option may also be used to remove or permanently apply fixes which are temporarily applied. It also lets you rebuild the VLIC nucleus or display information about PTFs or loadable code groups (LCGs).

   Note: There are two types of some licensed internal code on the load-source disk device. It is the intial program load (IPL) type (A or B) that selects which licensed internal code level your system runs with. For more information about types A and B, see "Applying PTFs" on page 2-4.

   This option is not available under SST. For more information about this option, see the *Service Guide*. Also, instructions to use this option come with an install PTF package.

4. Work with disk units

   This option shows a menu of functions that can be run for disk units. You can work with disk configuration, analyze disk device problem, work with disk unit recovery, or work with disk unit information.

   This option is not possible with basic authority. For more information about this option, see 12-67. Also, refer to the *Service Guide* to do an analysis of disk device problems using this option.

5. Work with DST environment

   Because DST is a limited operating system, this option allows you to select printers, tape units, and diskette devices to be used by DST, control active service functions, and control DST security. Any DST tool needing a printer, tape, or a diskette is referred to this option. If you have DST security authority, you can change DST passwords and override the operating system passwords.

   You may also want to have multiple service functions operating. You can transfer from one function to another. Be careful with this option. There is only one invocation of DST available, and only one invocation of any particular function. For more information about this option, see the *Service Guide*.

6. Select DST console mode

   This option allows the operating system to share the system console work station with DST. This option also specifies the disposition of the work station being used by DST during an IPL of the system. For example, selecting this option after beginning to IPL the system in DST console debug mode causes DST to give control of the display to the operating system.

   This option is not possible with basic authority and is available only in limited paging environment of DST. For more information about this option, see page 13-19 and the *Service Guide*.

7. Start a service tool

   This option shows a menu of service functions available under DST. You can select and start a service function from this menu. For more information about this option, see page 13-21.

8. Perform automatic operating system install

   This option allows you to install the operating system without showing any displays. The system determines all the options needed to complete the install. For more information about how the system does an install, see page 18-12.

9. Work with save storage and restore storage

   This option restores all system auxiliary storage, except licensed internal code, from tape. This option also allows you to resume a save storage or restore storage that was interrupted. This option is not possible with basic authority. This option is not available when the IPL of the operating system has started. For more information about this option, see the *Backup and Recovery Guide* and applicable *Service Guide*.

DST

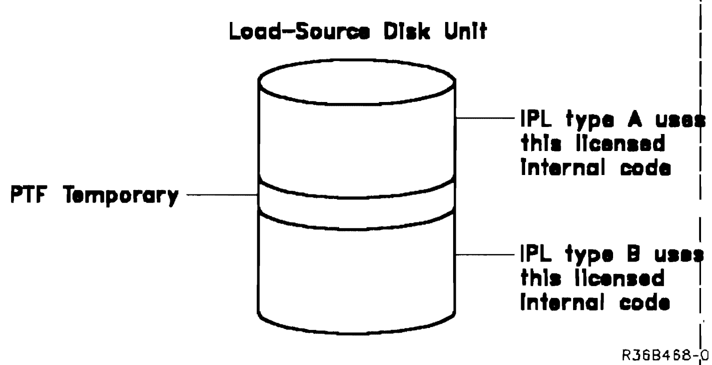
Work with Licensed Internal Code

This option is selected from the DST main menu.

There are two versions (types A and B) of some licensed internal code on the load-source disk device. The IPL type (A or B) makes known which licensed internal code level your system will run with.

To apply licensed internal code Program Temporary Fixes (PTFs), you must perform an IPL type A. Then, load and apply the PTFs.

When PTFs are applied to the licensed internal code, they are applied to the inactive copy of the licensed internal code. The IPL type is switched automatically by the system. The *Work with Licensed Internal Code* option sets the IPL type to B automatically when licensed internal code PTFs are applied temporarily. When this happens, the next IPL is from B. After PTFs are applied permenantly, this option sets the IPL mode to A. When this happens the next IPL is from A.



To run with the PTFs, you must perform an IPL type B. These PTFs can now be made permanent. When the PTFs are made permanent, you will return to performing an IPL type A for normal operations.

To determine which side the system will IPL on:

1. Select the *Display/alter/dump* option from the Start a Service Tool menu of SST.
2. Select the *Display/alter storage* option from the Display/Alter/Dump Output Device display.
3. Select the *VLIC data* option from the Select Data menu.
4. Select the *MCA* option from the Vertical Licensed Internal (VLIC) Data menu.
5. Look at offset hex 01C3 in the MCA. If it is 01 then the IPL is done on the A side. If it is 02, then the IPL is done on the B side.

For more information about PTFs, see "Problem Circumvention and Repair" on page 2-3.

Menu Flow

Figure 13-2 on page 13-7 shows the menu flow of the *Work with licensed internal code* option.

Options

You can select the following options from the Work with Licensed Internal Code menu:

1. Apply licensed internal code PTFs

   This option places PTFs in the system licensed internal code from either a tape unit or a diskette unit. These PTFs are placed in the inactive (change) copy of the vertical licensed internal code.

   Note: There are two types of some licensed internal code on the load-source disk device. It is the IPL type (A or B) that selects the licensed internal code level your system will run with. When PTFs are placed in the licensed internal code, the IPL type is automatically changed so that the next IPL will be from the copy with the changes.

2. Install licensed internal code product

   This option installs a new licensed internal code product into the system.

3. Rebuild licensed internal code
4. Display licensed internal code information
5. Display free space

   This option displays space available for storing new modules on the system.

6. Remove licensed internal code PTFs

   To remove PTFs, the system has to be running on the copy without the changes (primary copy.) When these changes are removed, the replaceable units (RUs) from the primary copy are loaded over the changes that were placed in the changed copy of vertical licensed internal code.

7. Make licensed internal code PTFs permanent

   To make licensed internal code PTFs permanent, the system has to be running on the copy with the changes. When these changes are made permanent, they are loaded into the primary copy of the vertical licensed internal code.

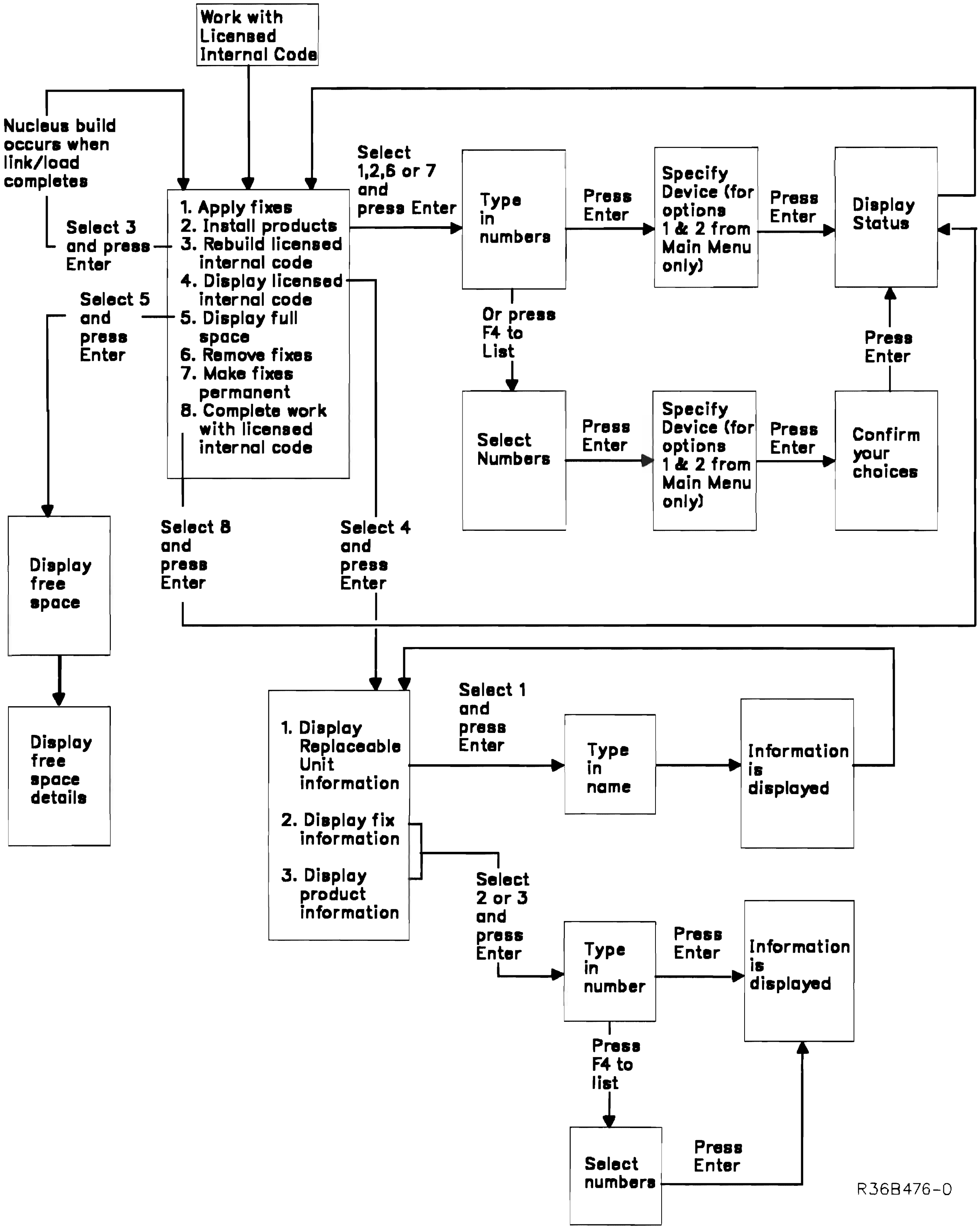


Figure 13-2. Work with Licensed Internal Code Menu Flow

Work with Disk Units

The work with disk unit options let you manage DASD. This option, sometimes referred to as DASD management option, lets you work with the system's configuration and service the DASD subsystem.

This option can be used in the limited paging environment. In the limited paging environment, you can service DASD and alter the system configuration while protecting the customer's data. Some of the options available in the limited paging environment are also available in the full paging environment. For example, you can display the disk configuration in both the full and limited paging environments. In contrast, you can only add disk units in the limited paging environment.

For more information about the SST options that are available with the *Work with disk unit* option, see page 12-67.

This DST option lets you perform the following:

- Analyze a device for potential problems
- Recover from repair actions to get the system running again
- Create the initial DASD configuration
- Plan and implement changes to a configuration
- View or display the logical structure of the DASD subsystem

  The logical structure consists of the disk units and the ASPs that make up the DASD subsystem. The layout of the logical structure affects the availability recoverability, and performance of the system.
- Configure checksum sets and user auxiliary storage pools (ASPs)
- Perform problem isolation on the disk and storage controller
- Observe or change vital product data (VPD) for disk

Note: To avoid conflicting operations, only one version of DASD management is allowed in the system.

DST

Menu Flow

The *Work with disk units* option is selected from the DST main menu or the SST main menu, but the function available is limited after the IPL of the operating system is started. Figure 13-3 on page 13-9 shows the menu flow for the Work with Disk Units menu.

Options

You can select the following options from the Work with Disk Units menu:

1. Work with disk configuration

   For more information about this option, see "Work with Disk Configuration" on page 13-9.
2. Analyze disk device problem

   This option lets you:

   - Display a list of items that make up the storage subsystem.
   - Check the most recent entries in the error log for units of the storage subsystem from both a simple and a more detailed view.
   - Run tests on selected storage device I/O processors to find errors or verify their operation.

   For more information about this option, see "Analyze Disk Device Problem" on page 13-11.
3. Work with disk unit recovery

   This option performs service functions on disks. Some of the service functions available are:

   - Replace a disk unit with another disk unit
   - Run disk unit problem recovery procedures
   - Suspend or resume mirroring protection on a disk unit
   - Delete disk unit data from a disk

   For more information about this option, see "Work with Disk Unit Recovery" on page 13-11.
4. Work with disk unit information

   This option lets you observe and update vital product data when exchanging a disk unit and lets you display or change a failing field replaceable unit (FRU). For more information about this option, see "Work with Disk Unit Information" on page 13-14.

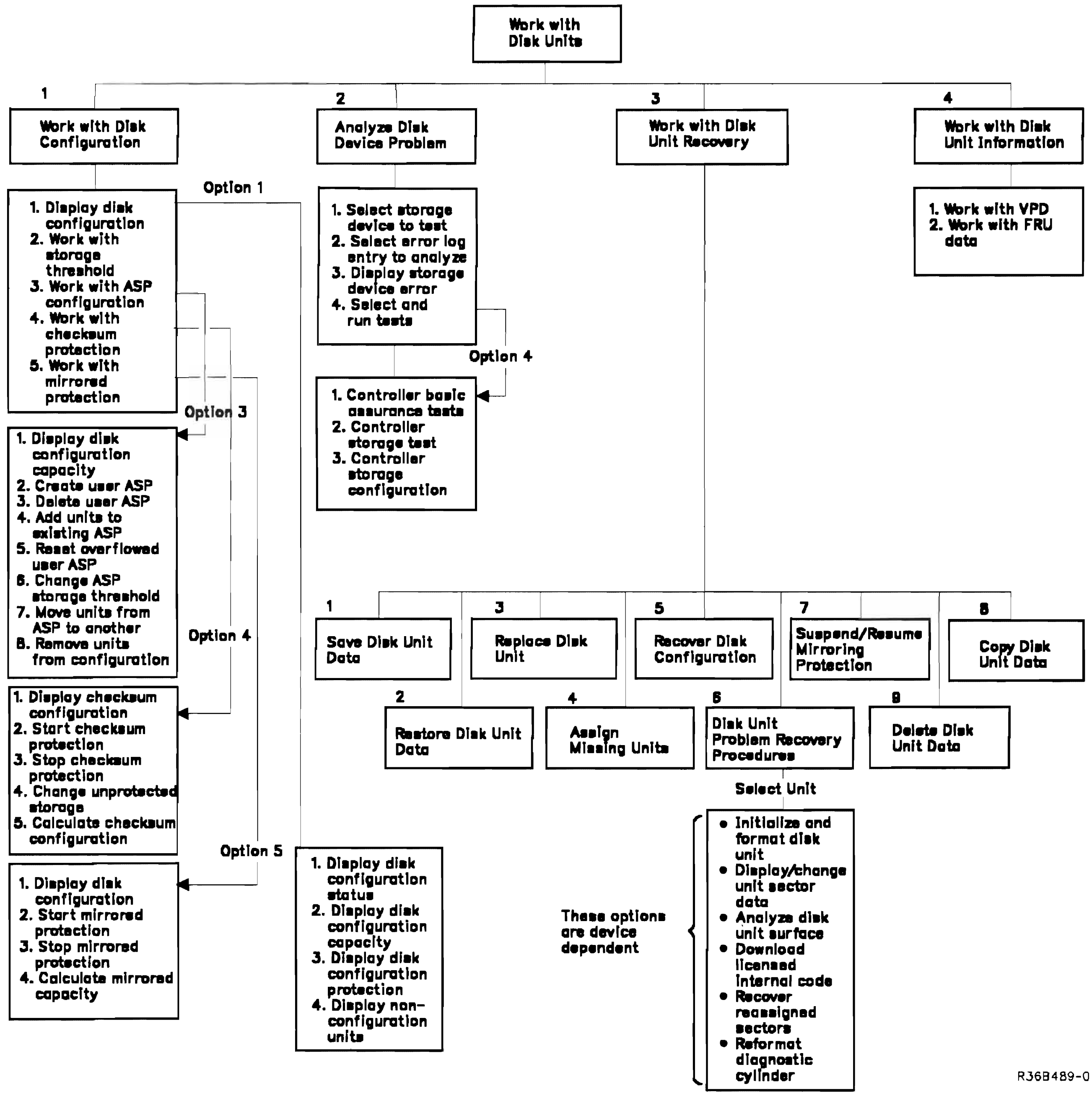


Figure 13-3. Work with Disk Units Menu Flow

Work with Disk Configuration

Options

1. Display disk configuration

   Select this option to display the system's present disk configuration and any non-configured disk units. The configuration display shows which disk units are assigned to the system storage and auxiliary storage pools. The level of mirrored protection of each disk unit, its status, and the amount of storage used can also be displayed. For more information about this option, see "Display Disk Configuration" on page 13-10.

2. Work with ASP threshold

   Select this option to display or change the amount of storage in use for every (system or user) ASP on the system. The default value of the threshold is 90 percent of the storage in use on each unit in the ASP. The system notifies you when the threshold value is reached.

3. Work with ASP configuration

   Select this option to:

   - Display all ASP configurations
   - Create user ASP
   - Delete user ASP

- Add units to existing ASP
- Reset overflowed user ASP
- Change or set ASP storage threshold
- Move units from one ASP to another
- Remove units

ASP 1 is the system ASP. You can only display or change it. ASP 2 through ASP 16 are user ASPs that you can define or create, change, delete, and display.

4. Work with checksum protection

   Select this option to:

   - Display checksum configuration
   - Start checksum protection
   - Stop checksum protection
   - Change unprotected storage
   - Calculate checksum configuration (using SST or DST)

   For more information about this option, see "Work with Checksum Protection."

5. Work with mirrored protection

   Select this option to start or stop mirrored protection, to calculate the DASD size provided by mirrored protection, and to display, change, or plan the mirrored protection of ASPs. For more information about this option, see "Work with Mirrored Protection."

Display Disk Configuration: This option is selected from the Work with Disk Configuration menu. From this option you can select to work with status, capacity, and protection of the ASPs and units of the system configuration. You can also display the non-configured units.

Options: You can select the following options from the Display Disk Configuration menu:

1. Display disk configuration status

   This option displays the status of all the ASPs and disk units configured on the system. They will be displayed in unit number sequence within the ASP they are assigned to.

2. Display disk configuration capacity

   This option displays the threshold and overflow values of each ASP and its units. The amount of protected and unprotected storage for each entry is also shown.

3. Display disk configuration protection

   This option shows the type of protection of each ASP and disk unit. Units with checksum protection show set number.

4. Display non-configured units

   This option shows the serial number, type, model, and address of all non-configured disk units. Their status will always be shown as non-configured.

Work with Checksum Protection: This option is selected from the Work with Disk Configuration menu.

Options: The Work with Checksum Protection menu has the following options:

1. Display checksum configuration

   This option displays the current configuration for a checksummed auxiliary storage pool (ASP).

2. Start checksum protection

   This option starts checksum protection. Only the system auxiliary storage pool (ASP) can be protected by checksum. When checksum protection is started, it clears all data from the checksummed ASP.

3. Stop checksum protection

   This option stops checksum protection. Stopping checksum protection does not affect any data on the system.

4. Change unprotected storage

   This option lets you change the amount of unprotected storage in a checksummed auxiliary storage pool (ASP). If you increase the amount of unprotected storage, the data is cleared from the ASP. If you decrease it, the data is not affected.

5. Calculate checksum configuration

   This option lets you view possible checksum configurations for both existing disk units and disk units you may want to add in the future.

Work with Mirrored Protection: This option is selected from the Work with Disk Configuration menu.

Mirrored protection is a system-provided function that protects data by keeping two copies of it. Each copy is kept on a different unit. The two units become *mirror* images of each other and are called a mirrored pair. Each half of the mirrored pair is called a subunit, and when combined, make a logical unit. This option lets you access the tools that let you start and stop mirroring and help you plan a mirrored system.

Options: The Work with Mirrored Protection menu has the following options:

1. Display disk configuration

   This option displays the system's current disk configuration and any non-configured disk units or units not configured in the system's disk unit configuration.

2. Start mirrored protection

   This option begins mirrored protection on one or more auxiliary storage pools (ASP) in the system. The system will be IPLed during this process.

3. Stop mirrored protection

   This option ends mirrored protection on one or more ASPs in the system. The system will be IPLed during this process.

4. Calculate mirrored capacity

   This option lets you calculate the mirrored capacity for an ASP. You will be able to calculate based on the current configuration or a different configuration.

Analyze Disk Device Problem

This option is selected from the Work with Disk Unit menu. Use this option to analyze errors on any disk device.

Devices and reference codes are displayed for the errors being analyzed or for the device that was selected to be tested. This option also runs disk or storage controller tests.

Select this option from the Work with Disk Units display, which is selected from the DST main menu.

When an error occurs on any disk unit, all the needed error information is logged. The operating system decides if the system needs to be powered off and an IPL of the system performed again. If the system needs to be powered off, a reference code appears on the control panel.

The Analyze Disk Device Problem display has the following options:

1. Select storage device to test
2. Select error log entry to analyze
3. Display storage device error
4. Select and run tests

Options: You can select the following options from the Analyze Disk Device Problem menu:

1. Select storage device to test

   This option displays all the devices that make up the disk subsystem for the AS/400 system. I/O processors are displayed next to the device. You can select a storage device to test from the display, but only if that device gives support to tests. Most devices that can be attached to the AS/400 system have very defined initial error reporting and do not need tests. Currently, only the I/O processors on a 9406 System Unit that do not have the load source device attached to it have this support.
2. Select error log entry to analyze

   This option displays part of the limited paging environment error log. Storage device errors are shown. The limited paging environment error log is a list of the most recent system errors.

   When you select this option, only the storage device errors will appear. You can then analyze these storage device errors.

   You cannot get to the full-system error log when using the *Analyzing disk devices* option.

   For more information about error logs, see page 12-3. To analyze the SRCs or URCs, see the applicable *Analyzing Problems Guide*.
3. Display storage device error

   This option displays the storage device and the error codes for the device error now being analyzed. The reference code and additional error data are displayed if needed. To analyze the SRCs or URCs, see the applicable *Analyzing Problems Guide*.
4. Select and run tests

   This option lets you select a test to be run, if needed, for a particular disk unit. You can select all or some of the available tests. The test will be run, and the results will be displayed when the test is completed.

   For example, you can run the storage device controller test on a 6110 which does not have the load-source disk unit attached to it. That test initiates the card and device BATs which were run as part of the IPL process. These are the only online diagnostics available for the 6110.

   The options on the Select and Run Test menu are:

   - Controller basic assurance tests
   - Controller storage test
   - Controller storage configuration test

   Note: The controller storage test and the controller storage configuration test run until an error is detected or they are canceled.

Work with Disk Unit Recovery

The Work with Disk Unit Recovery display is selected from the *Work with disk units* option on the DST main menu.

Most disk units have checkout procedures. These procedures can be accessed through this option. Also you can save and restore disk units, find and assign units that have disappeared from the configuration, replace a particular unit, and recover the system's configuration if it gets lost, destroyed, or accidentally changed. Most of these options are only available in the limited paging environment of DST.

Options: You can select the following options from the Work with Disk Unit Recovery menu:

1. Save disk unit data
2. Restore disk unit data
3. Replace configured unit
4. Assign missing unit
5. Recover configuration
6. Disk unit problem recovery procedures
7. Suspend or resume mirrored protection
8. Copy disk unit data
9. Delete disk unit data

Save Disk Unit Data: This option is run when the disk unit reference code (URC) indicates the disk enclosure should be exchanged.

Before the disk enclosure is removed and a new disk enclosure is installed, the data from the disk units in the disk enclosure should be saved to tape.

When all of the disk unit data has been saved to the tape, an ending display is presented.

This option does not save the VLIC or HLIC on the load-source disk unit. After a load-source disk enclosure replacement, the install licensed internal code function (24 on the control panel) must be run to write the VLIC to the load-source disk unit.

After a save is performed, you can perform an IPL to OS/400, but the data saved on tape is not restored if the IPL to OS/400 was already started. This prevents the system from having a down-level disk unit.

Restore Disk Unit Data: This option reads the data from the tapes created during the Save Disk Unit operation and writes the data on the disk unit. The data can be stored again only to a disk unit of the same type as was saved. The block size of the disk unit is set to 520 bytes per sector during this operation. When all data has been restored to the disk unit, an ending display is presented. When the load source is restored, the system will perform an IPL to DST when the restore is complete.

Replace Configured Unit: This option is part of the disk recovery procedures that let you exchange a configured disk unit with a non-configured unit. This option will result in clearing all the units in the ASP in which the disk unit is being exchanged unless that ASP has checksum protection or the disk unit being exchanged is a suspended unit of a mirrored pair.

Assign Missing Unit: This option reports any missing units (the units that were part of the system during the last IPL, but have been disconnected accidentally or are configured differently). When a unit is selected to be assigned, the system will attempt to find one or more valid non-configured disk units. Use the *Replace disk unit* option if none are found.

Warning: The *Assign missing unit* option is a dangerous option in DST; therefore, use caution when using this option.

There are many reasons why a disk unit could be missing. A couple of reasons are:

1. A disk unit did not report in to the system because:
   - A disk unit is powered off.
   - A disk unit is disabled.
   - The cabling to the disk unit is incorrect.
   - The DST environment becomes active before the racks containing the disk devices complete their power-up cycle.

   The symptoms are:
   - At the DST Sign On display, the bottom line says `All disk devices are not on line - IPL not allowed.`
   - SRC in the control panel at word 11 is A600 5090 or at word 12 is 0002 0000.

   To resolve, correct the power/cable/disable-switch problem.
2. The storage management reserved sector is not readable or does not contain valid information because:
   - A new disk enclosure had been inserted in the device.
   - A data check error exists on the reserved sector.
   - A hardware condition exists in the disk device which prevents the data reads from completing successfully.

   The symptoms are:
   - At the DST Sign On display, the bottom line says `All disk devices are not on line - IPL not allowed.`
   - SRC in the control panel at word 11 is A600 5090 or at word 12 is 0002 0000.

   To resolve:
   - If a new disk enclosure is installed and the data from the failing unit is saved to tape, then restore the data.
   - If a new disk enclosure is installed and the data from the failing unit is not saved to tape, then select the option to replace the disk unit. The ASP is cleared.
   - Assign the missing disk unit. Make sure that you select the correct unit to assign by checking the:
     - Serial number
     - Address
     - Type and Model

Each disk unit has one sector (sector hex 000020) which VLIC storage management uses to determine how the disk unit resides in the single level store. Some of the information in the reserved sector of VLIC storage management is: disk unit number, configuration identifiers, free space counts, IPL counters and operation-in-progress flags. After the system has completed an IPL to DST, the VLIC storage management determines if all of the disks which are part of single-level store have reported in and if the information at sector hex 000020 is valid. If any disk units which are part of the single-level store are missing, the symptoms previously described are shown.

This option rewrites sector hex 000020 with VLIC storage management constructed data to make that selected unit the logical unit. The VLIC storage management assumes that all of the data on the unit is intact and in the locations (sectors) as described in all of the directories. If the *wrong* disk unit is selected as the *assign* target, the data in the disk unit sectors does not match what the VLIC storage management expects to reside there. This causes many damaged objects, machine checks, and unpredictable results.

DST

An Example for Using the Assign Missing Unit Option: For example, a disk unit develops a hard read error on sector hex 000020. During an IPL to DST, the VLIC storage management cannot read the reserved sector information (because of the data check). When the IPL to DST is complete, VLIC storage management notices that one configured disk unit is not located. The unit is considered missing. The disk unit is displayed on the DST screens as a non-configured unit. This *Assign missing unit* option writes the sector hex 000020 (and corrects the data check condition).

Recover Configuration: This option aids in the recovery of a system by recovering the correct system configuration in cases where the load source was damaged, and the device configuration table was lost.

Disk Unit Problem Recovery Procedures: This option lets you select functions that help in problem isolation and repair actions. Only those functions (or options) that are valid for a specific disk unit are shown.

Options: You may select the following options, depending on the disk unit, from the Disk Unit Problem Recovery Procedures display:

- Initialize and format disk unit

  This option runs when the 9332 or 9336 disk unit reference code indicates that reallocations have failed because no alternative space is available. All of the ID fields on the disk unit are written again. The disk unit is formatted to 520 bytes in each sector. Running this option erases all of the data from the disk unit. Be sure to save the disk unit data to tape before you run this option. You cannot use this option to initialize and format a load source. If a load source unit is selected, this option is not shown. In the full paging environment, this option is limited to non-configured and suspended mirrored units.

- Display/change unit sector data

  This option sets the block size of the disk unit to 520 bytes per sector.

  This option is used as follows:

  - The results of the *Analyze disk unit surface* option show which sectors have data check conditions. You can use the *Display/change unit sector data* option to assign those sectors to new locations on the disk.
  - You can examine and change the 8 bytes of sector header, if necessary.
  - You can examine and change the 512 bytes of sector data, if necessary.

  The *Display/change unit sector data* option has the following functions:

  - Reads the data from a selected sector.
  - Displays the data in hexadecimal and EBCDIC formats.
  - Lets the hexadecimal data be changed and rewritten to the sector.
  - Displays the 8-byte sector header in formatted form.
  - Lets the 8-byte sector header be changed and rewritten to the sector.
  - Lets the sector be assigned to a new location on the disk.
  - Displays the disk unit reference code after each operation.

- Analyze disk unit surface

  This option performs a read verify operation on the selected range of sectors. The block size of the disk unit is set to 520 bytes per sector during this operation. Sectors that report disk unit reference codes indicating data check errors should be assigned to new locations on the disk using the *Display/change unit sector data* option.

  The analyze results can be:

  - Printed (all disk unit errors detected can be printed).
  - Displayed on the console (up to 999 detected errors can be displayed.)

- Download licensed internal code

  This option moves the licensed internal code that controls the operation of the disk unit from system storage to the disk unit. The disk unit controller is reset to activate the licensed internal code.

- Recover reassigned sectors

  This option runs when the 9335 disk unit reference code indicates that reallocations have failed because no alternative space is available. The recover function will attempt to recover the sectors that have been assigned to new locations on the disk and alternative sectors that have not been used. When all usable sectors have been recovered, an ending display appears.

- Reformat diagnostic cylinder

  This option runs when the 9335 disk unit reference code indicates the ID fields of the sectors on the diagnostic cylinder should be rewritten. The block size of the diagnostic cylinder is set to 520 bytes per sector during this operation. When all the ID fields of the sectors on the diagnostic cylinder are rewritten, an ending display is presented.

Suspend/Resume Mirrored Protection: This option lets you suspend or resume mirrored protection on a specific disk unit.

Copy Disk Unit Data: This option supports mirroring. This option lets you copy all the data from a configured disk to a non-configured disk unit. This action can take the place of save disk unit data to tape and a restore disk unit data. After the operation is complete, the target disk unit (the one copied to) takes the place of the original disk unit in the system's configuration.

DST

Delete Disk Unit Data: This option lets you delete all the data from a non-configured disk unit. This option is limited to non-configured and suspended mirrored units.

Work with Disk Unit Information

The Work with Disk Unit Information display is activated from the *Work with disk units* option on the DST main menu. This option is used to recover from repair actions. VPD is data stored in every unit that makes up the system. It is the data that identifies that particular unit to the system. When hardware units are added to the system or after some repair actions, the VPD may be invalid. This option lets you update the VPD for some devices or units of the system. The repair action instructions tell you if and when you need to use this option. There is an example of how to use this option in the *Service Guide*. This option is available in SST and DST.

Options: You can select the following options from the Work with Disk Unit Information menu:

1. Work with vital product data (VPD)

   This option displays or lets you change the vital product data of a disk unit. Vital product data uniquely identifies the disk unit such as type, model, and serial number. You must change the vital product data only when the service information for the disk device directs you.
2. Work with field replaceable unit (FRU) data

   This option displays or lets you change data for field replaceable units. When you replace FRUs in some devices, you may have to change the data describing the new part. This is the option you use to do that.

Updating the Serial Number for a 9331 Diskette Unit: A configured diskette device did not report a valid serial number. This is usually a device that was just added to the system or was just repaired.

1. Set the keylock switch on the control panel to the Manual position.
2. Perform an IPL and start DST (see Chapter 13 on page 13-1).
3. Select the *Work with disk units* option.
4. Select the *Work with disk unit information* option.
5. Select option 9 (not visible) to work with 9331 vital product data (VPD).

   If more than one 9331 diskette unit is NOT connected, continue with the next step.

   If more than one 9331 diskette unit is connected, select the device with the serial number that is not valid by typing in a 2 next to the device needing change and pressing the Enter key. Continue with the next step.
6. Correct the serial number field by keying in the new value. Then, press the Enter key.
7. Return to the Work with Disk Units display.
8. Return to the DST main menu.

Error Recovery Procedures

If an option from the Work with Disk Units menu does not perform:

1. Provide a task dump using display/alter/dump.

   For more information about display/alter/dump, see page 12-27.
2. Display the task SFDM to get the DASD list SID.

   At offset hex 44 is a pointer to the IWA for the task. If the SID number ends in F, the DASD list SID is the IWA SID plus 2; otherwise, the DASD list SID is the IWA SID plus 1. For example, if IWA SID number is A001 59xx xxxx then the DASD list SID number is A001 5A00 0000. If IWA SID number is A069 AFxx xxxx then the DASD list SID number is A069 B100 0000.

If the task is destroyed:

1. Provide a task dump using display/alter/dump, if possible.

   For more information about display/alter/dump, see page 12-27.
2. Find the IWA SID number before invoking the function
3. Find the DASD list SID as described in the previous procedure.
4. Dump both the IWA SID and DASD list SID immediately after the task disappears.

If it takes a long time to add a disk unit it might be because the disk is being initialized and formatted. If you cannot assign a missing unit it might be because the unit that is being assigned is not a valid candidate.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

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Work with DST Environment

This option can be used to select printers, tape units, and diskette units used by DST. If you are logged on with DST security authority, you can also change DST passwords and override the operating system passwords.

You can select the DST Environment option from the DST main menu.

Menu Flow

Figure 13-4 shows the menu flow for the *Work with DST environment* option.

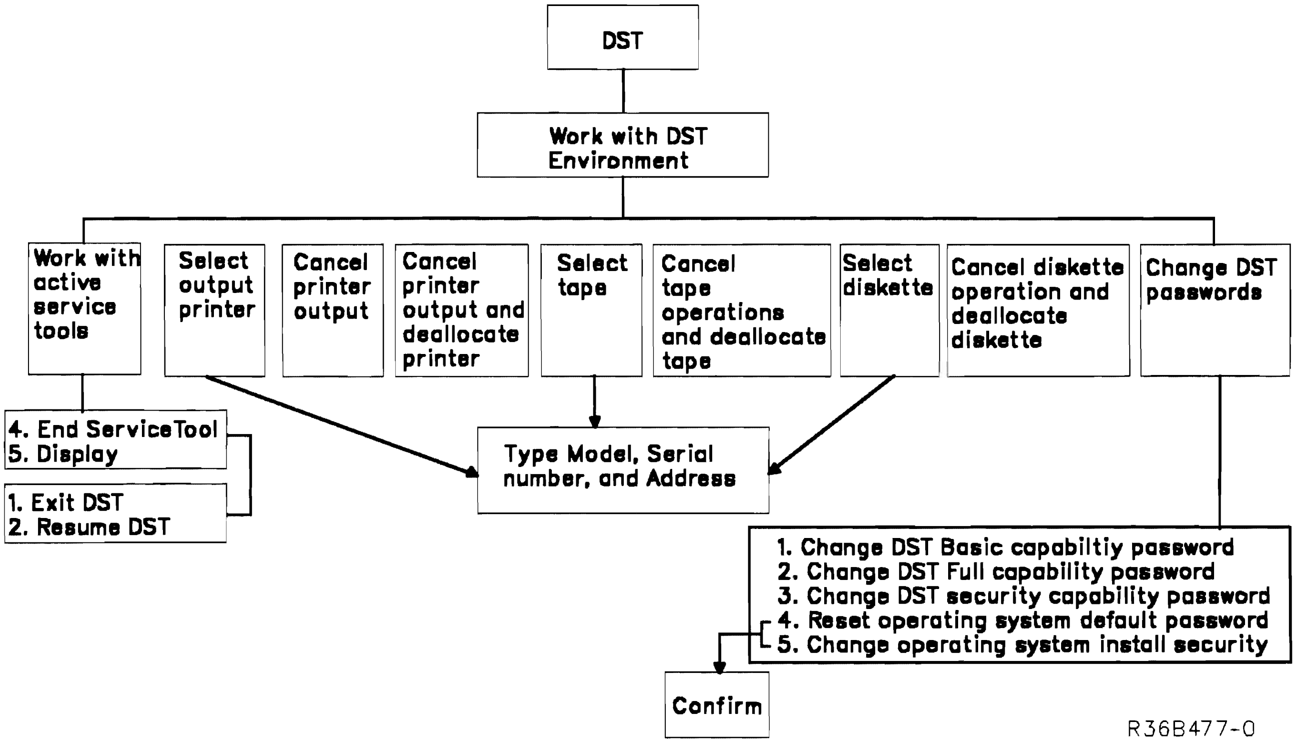

Figure 13-4. Work with DST Environment Menu Flow

Options

You can select the following options from the Work with Dedicated Service Tools Environment menu:

1. Work with active service tools

   This option lists active service functions and their status. Service functions can be started and left active while you start another service function. Use this option to enter a service function you left active or to end an active service function. The status of a service function can show as active or ending. For more information, see "Work with Active Service Tools" on page 13-16.

2. Select output printer

   This option displays a list of printers connected to the system. You need to select from this list the printer to be used by a service tool. All printers attached to the same work station controller as the DST display are shown.

   Note: Selecting a printer that is allocated to the operating system displays a warning display. If the printer is then selected, the job using that printer is ended. For more information, see "Select Output Printer, Tape, or Diskette" on page 13-16.

3. Cancel printer output

   This option cancels the existing print job for a service tool. The printer remains allocated to DST and in use by the service tool.

4. Cancel printer output and deallocate printer

   This option cancels the existing print job for a service tool and deallocates the printer from DST and the service function.

5. Select tape

   This option displays a list of tape units connected to the system. You need to select from this list the tape unit to be used by a service tool.

   Note: Selecting a tape unit that is allocated to the operating system displays a warning display. If the tape unit is then selected, the job using that tape unit is ended. For more information, see "Select Output Printer, Tape, or Diskette" on page 13-16.

6. Cancel tape operation and deallocate tape

DST

This option cancels the existing tape job for a service tool and deallocates the tape unit from DST and the service tool.

7. Select diskette

   This option displays a list of diskette units connected to the system. You need to select from this list the diskette unit to be used by a service tool.

   Note: Selecting a diskette unit that is allocated to the operating system displays a warning display. If the diskette unit is then selected, the job using that diskette unit is ended.

   For more information, see "Select Output Printer, Tape, or Diskette."

8. Cancel diskette operation and deallocate diskette

   This option cancels the existing diskette job for a service tool and deallocates the diskette unit from DST and the service tool.

9. Change DST passwords

   This option allows you to change DST passwords.

   Note: This option is available with DST security level authorization only.

   For more information about this option, see "Change DST Passwords."

Work with Active Service Tools

This option is selected from the Work with DST Environment display, which you can select from the DST main menu.

A list of active service tools and their status is shown on this display. The status of a service tool can be active or ending. A service function in the process of ending cannot be selected until the ending process is complete. The following options are available:

Option Description

4 End service tool

This option ends an active service function.

5 Display

This option lets you enter an active service tool again. You can select only one active service tool.

Key in the desired option number in this field next to the active service tool name you are displaying or ending.

Select Output Printer, Tape, or Diskette

This option is selected from the Work with DST Environment display, which you can select from the DST main menu.

If you have a printer device available, ensure that it is connected and configured to the work station controller you are using with this work station. If you have a tape or diskette device available, ensure that it is installed, connected to the system, and configured correctly. Then, select the *Select output printer* option on the Work with Service Tools Environment display. On the Select Output Printer display, the Tape display, or the Diskette display, fill in the following fields if the system has not already done so:

Field	Description
Type	A number assigned by the manufacturer to identify a specific type of printer, tape, or diskette device.
Model	The model number of the printer, tape, or diskette device.
Serial	A number assigned by the manufacturer to identify a specific printer, tape, or diskette device.
Address	(1234-5678)

1-4 For a printer, this identifies the location of the work station controller card. For a tape or diskette device, this identifies the location of the storage device controller card. See the Rack Configuration List in the binder with the *Operator's Guide* for the physical location of the card.

5-6 For a printer, this identifies the port number of the twinaxial work station attachment. For a tape or diskette device, this identifies the tape or diskette device functional controller if needed. For tape or diskette, this matches the switch setting.

7-8 This identifies the device by the address switch setting on the device for printers only.

If you do not have a printer available for this work station controller, you must select a different output device for the service tool to use (such as a tape or diskette unit). If you do not have an available tape or diskette device controller, you must select a printer for the service tool to use.

If the device you selected is already being used by a job, you can:

- Press the Enter key to cancel the job and use the device for the service tool, or
- Press F12 (Cancel) to cancel this device selection. Then, select a different device.

Change DST Passwords

This option is selected from the Work with DST Environment display, which you can select from the DST main menu.

DST passwords controls access to DST functions and vertical licensed internal code service functions. When a password is changed, the old password is exchanged with the new one.

DST

There is only one password for each level of authorization. When you key in the existing and new passwords, they are not displayed on the display. For more information about DST passwords, see "DST Passwords" on page 13-1.

Options: You can select the following options from the Change DST Passwords menu:

1. Change DST basic capability password

   Basic lets you:

   - Use trace vertical licensed internal code.
   - Use print stand-alone dump.
   - Run work with error log.
   - Use work with licensed internal code.
   - Perform an IPL of the system.

2. Change DST full capability password

   Full lets you use all of the service functions, except you cannot change DST passwords.

3. Change DST security capability password

   Security lets you use all of the service functions, including changing DST passwords.

4. Reset operating system password (see the *Security Concepts and Planning* manual.)

   Note: Password reset is in effect for one IPL. If the password is not set again, the password stored on the system is used.

5. Change security for the *Install operating system* option of DST.

   The customer uses this option to allow only users with DST full authority or DST security authority to install the OS/400 operating system (see the *Security Concepts and Planning* manual).

Check for Device Intervention Required

In addition to the device address, type, model, and serial number, the following information is shown:

- I/O manager code

  This is the error code from the I/O manager program. For more information about these codes, see "Intervention Display I/O Manager Return Codes" on page 13-18.

- Controller reference code

  The reference code for the controller is the unit reference code of the I/O device controller card that failed.

- Device reference code

  The reference code for the device is the unit reference code of the device that failed.

- Action

  Select the intervention action from the choices listed and place your selection in the *Action* field.

- Volume or file name loaded

  The *Volume or file name loaded* field shows the tape volume or diskette file that is mounted in the tape or diskette device. If this is the wrong tape or diskette, install the correct tape or diskette or key in the new volume or file name in the next field.

- New volume or file name requested

  Key in the name of the new tape volume or diskette file in the *New volume or file name requested* field if you had the wrong volume mounted.

Intervention Display I/O Manager Return Codes:

Some errors in DST require your intervention. Sometimes an intervention is needed while reading and writing a file using an option under DST. When an intervention is required, a Handle Tape or Diskette Intervention display, similar to the following appears:

```
                    HANDLE TAPE OR DISKETTE INTERVENTION

  Device Type . . . . . . . . . . . . . . . . . . . :   9347
  Device Model . . . . . . . . . . . . . . . . . . :   001
  Device Serial Number . . . . . . . . . . . . . . :   00-0000000
  Device Address . . . . . . . . . . . . . . . . . :   0010-0700
  I/O Manager Code . . . . . . . . . . . . . . . . :   E0100006
  Reference Code:
    I/O Controller . . . . . . . . . . . . . . . . :   0000
    Device . . . . . . . . . . . . . . . . . . . . :   0000
  Volume or File:
    Loaded . . . . . . . . . . . . . . . . . . . . :   JOHNB
    Requested  . . . . . . . . . . . . . . . . . . :   JOHNB

  Type Choice, Press Enter.

    Action . . . . . . . . . . . . . .          1=Cancel

                                                3=Retry


  F3=Exit         F12=Previous
  Media is Write Protected
```

Figure 13-5. An Example of a Handle Tape or Diskette Intervention Display

If the intervention is a critical error, cancel is the only option available on this display.

If intervention is needed, in addition to the *Cancel* option, the *Ignore*, *Retry continue*, and/or *Initialize* options appear. The intervention code controls which options appear on the intervention display. The following is a list of intervention codes that could appear:

Code	Description
8000 0001	Device not ready. Check to be sure the media is loaded and door is closed. If tape, check to see if device is online.
8000 0002	Device not ready; system appears stopped. An error occurred and recovery is not possible. Task will end.
8000 0003	Volume ID does not match. Volume ID specified for the read operation does not match the one mounted in the device.
8000 0004	Volume ID does not match. Volume ID specified for the write does not match the one mounted in the device.
8000 0005	Volume sequence on tape or diskette. The sequence number is not the one expected. A multivolume file may have a tape or diskette out of order.
8008 0005	Tape file sequence for a write operation. The file sequence number specified on the open request is either larger or smaller than the next file sequence number on the media. The *Ignore* option writes the file with the expected sequence number.
8008 8005	This volume is not the first in a multivolume sequence. Overwriting the first file on this tape destroys the existing multivolume file. To preserve the file, insert the first volume and select the *Retry* option.
8000 0006	Tape or diskette read error. Format not supported for a diskette read. Blank tape on a read operation.
8000 0007	Tape or diskette write error. Format not supported for a diskette write. Tape mounted has no labels (blank).
8000 0008	For a write operation, media mounted does not match the format of the first volume in the sequence.
8008 0008	For a read operation, media mounted does not match the format of the first volume in the sequence.
8000 0009	Unexpired files were found on the media.
8000 0010	File requested does not exist on the media.
8000 0011	A LUD or CUD vary on failed, task ends.
8008 0011	A CD vary on failed, task ends.
8000 0012	A LUD activate failed, task ends.
8000 0013	A LUD resume failed, task ends.
8000 0014	Request timed out.
8000 0015	The diskette is currently full of unexpired files. The tape has nonstandard labels and should be initialized before using again.
8000 0016	File expiration dates are out of order. The first file on the tape should be the last to expire. Selecting the *Ignore* option may result in unexpired files being overwritten in the future.
8000 0017	The encoding on the volume mounted does not match the encoding of the first volume. An ASCII-to-EBCDIC or EBCDIC-to-ASCII transition occurred. To continue, insert the proper tape.
8008 0017	The encoding on the volume inserted does not match the encoding of the first volume.

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	An ASCII-to-EBCDIC or EBCDIC-to-ASCII transition occurred. Insert a tape with the proper encoding specified, or choose the initialize option to change the encoding of the tape currently mounted.
8000 FFFF	Some unexpected error occurred, task ends.
C001 0000	Marginal diskette.
	Read or write operation required several attempts to complete. Consider replacing the diskette.
C014 0000	The tape has gone past the end-of-tape mark and may be off the reel. For a diskette, a device transition occurred. The door may have been opened and a new diskette inserted.
C016 0000	A tape mark was sensed or end of file reached on a diskette.
C00B 0000	The I/O manager task is not able to continue. The tape or diskette task ends. Select a device and submit the request again.
C017 0000	End of volume encountered; load the next tape or diskette. The file exists across multiple tapes or diskettes.
C018 0000	The drive was not able to immediately process a ready command. The task ends.
E010 0001	Invalid operation on a one-sided diskette.
E010 0002	Tape failure, task ends.
E010 0010	Diskette failure, task ends.
E010 0006	Media is write protected.
	Write enable the media and continue or cancel the operation.
E010 0007	A data check occurred during formatting of a diskette. Task ends. Device cannot support the recording format on the tape mounted. To attempt again, mount a tape with a format that the device supports.
E010 0009	A data check occurred. The data set on the diskette is damaged. The read or write operation cannot continue. Consider replacing the diskette.
E010 0018	The device is not operational.
E010 0019	A data check occurred. The data set on the tape is damaged. The read or write operation cannot continue. Consider replacing the tape.
E010 001A	A data check occurred while executing a read operation on a 1/4-inch tape drive. The data set is damaged. The read operation cannot continue.
E010 000F	Sector was missing or relocated. Ignore continues with the sector immediately following the one which produced the error.

Select DST Console Mode

This option is selected from the Use Dedicated Service Tools (DST) display.

This option causes the operating system to share the console workstation with DST when an IPL of the operating system is performed. Operating system displays are displayed until either:

- Function 21 (Bring up DST) is entered from the control panel.
- A system request is made by typing in DST
- A breakpoint is hit by the Program Debug service function.

When you press System Request and type in DST the operating system display appearing at the time is saved and the Use Dedicated Service Tools (DST) display appears. DST operations may then be performed.

Selecting the *Select DST console mode* option causes the operating system display to be restored. Any active service functions remain active, and any device allocated to the service tool is still allocated. When a breakpoint is hit by the Program Debug service function, the breakpoint hit display appears. The workstation is then in DST mode.

This option enables the availability of DST when the system leaves the limited paging environment. It is very useful in helping to debug VLIC, but, probably not used very much in the servicing environment. This option also impacts the how an IPL runs. If you do a step-mode IPL out of DST and selected the DST debug option, DST can be invoked again between IPL steps. It can also be invoked on the console when OS/400 is running.

You can use the *DST console mode* option to interrupt IPL to debug install problems. To use this option, it is important to understand and distinguish between what working environment you are in: DST itself, a service function, or the operating system. A service function may be started, suspended, or ended independently from DST. The operation of a service function is suspended by taking its service function display away from it and returning control to the DST main menu. The operating service function continues to run until it requests another display. The DST console debug mode allows the operating system to share the console device with DST. Selecting this option after beginning to IPL the system in DST console debug mode causes DST to give control of the display to the operating system. DST still retains physical control of the device.

Options

You can select the following options from the Select DST Console Mode menu:

1. End DST

   Service functions will not interrupt the system console display if debug mode has not been set before. Sign-on is necessary to access DST. All active service functions are terminated.

2. Enter DST debug mode

   Service functions can interrupt the normal operating system process to display debug information. When an operating display is being displayed, and you want to enter DST, press System Request, type in DST and press the Enter key. This displays the Use Dedicated Service Tools (DST) display without having to log on to DST.

How to Start DST Debug Mode

For an IPL and/or install, perform the following procedures to start DST Debug Mode for gathering error information about an unsuccessful IPL. Note that the *Start DST debug mode* option can leave DST active on the console for later problem analysis.

1. Select the *Work with dedicated service tools* option from the IPL/Install the System display.
2. Enter your DST password. For more information about passwords, see page 13-1. After the correct password is entered, the Dedicated Service Tools main menu appears.
3. Select the *Select DST console mode* option from the Dedicated Service Tools main menu.
4. Select the *Start DST debug mode on IPL* option from the Select DST Console Mode menu. The Dedicated Service Tools main menu appears again.

DST

How to Debug an IPL or Install Using Step Mode

To debug an IPL or an install using the step mode:

1. If you are doing an IPL, select the *Perform an IPL* option from the Dedicated Service Tools main menu.
2. If you are doing an IPL, select the *Normal IPL* option from the Select IPL menu to perform a normal unattended IPL. However, select the *Step-mode IPL* option from the Select IPL menu to perform an attended IPL if you need to get to DST during the VLIC phase of an IPL. For example, you need to get to DST if you are attempting to display or dump the start OS/400 data object (QWCSCPF) after a directory recovery. For more information about viewing the QWCSCPF, see Chapter 21 on page 21-1.
3. If you are doing an install, select the *Install the operating system* option from the Dedicated Service Tools main menu. A series of displays appear to confirm your choice to install the operating system and to let you select the system language. For more information about these confirmation and language displays, see the *Licensed Programs and New Release Installation Guide* as described in the *Information Directory*.

For more information about using the step mode of IPL, see the following discussion. For more information about the displays that appear during an attended IPL, see "Work Control Displays" on page 18-19.

Returning to DST while in Step Mode

Normally, the steps of the VLIC phase of an IPL run without any operator intervention or DST displays showing. Use the *Step-mode IPL* option when you need to use DST during the VLIC phase of an IPL. At the beginning of each step of the VLIC phase of an IPL you are prompted to press the Enter key to continue that step without intervention if you selected the *Step-mode IPL* option for an IPL or install. Press the F16 key instead of the Enter key to suspend operation of a service function by taking its display away from it and returning control to the DST main menu. The service function continues to execute until it requests another display.

After pressing F16, the Dedicated Service Tools main menu appears. From this menu you can select any DST option. For example, IPL in the step mode until the context rebuild step of a VLIC phase is complete and then switch to DST to use the *Display/alter/dump* option to display, alter, or dump an MI object that resides in a context. You might not have been able to access an MI object before reaching the context rebuild step if you had not used the *Display/alter/dump* option of DST.

To continue the VLIC phase of an IPL, select the *Work with DST environment* option. From the Work with DST Environment menu, select the *Work with active service tools* option. An active service tool called IPL service function appears. Enter a 1 before the IPL service function and press the Enter key. This returns you to the step of the VLIC phase you left. Press the Enter key to continue the step and the IPL.

After the *start the operating system* step completes, the Dedicated Service Tools main menu appears again. Select the *Select DST console mode* option to present the Sign On display.

If the console is being used in debug mode, the following differences from normal use of the system console apply:

- Varying off or varying on the console device descriptions do not perform the identical functions on the actual device or work station controller.
- Changing the attributes of the device description keyboard do not affect the console operation until the next IPL without using debug mode.

If the primary system language is changed, the attributes of the console keyboard do not change until you have signed off DST and performed an IPL to the operating system, or until you do an IPL again without using debug mode.

For more information about DST, see Chapter 19.

Start a Service Tool

This option is selected from the Dedicated Service Tools main menu.

Options

The DST Start a Service Tool menu has the following options:

1. Display/alter/dump

   This option lets you display or change virtual storage data. The data can be copied to tape, a diskette, or a printer. The data can then be printed. For more information about this option, see page 12-27 under SST and the applicable *Service Guide*.

2. Vertical licensed internal code log

   This option lets you display vertical licensed internal code log information. You can dump all or part of the VLIC log entries to tape, a diskette, or a printer. You can also clear the VLIC log.

   For more information about this option, see page 12-46 under SST, Chapter 31, and the applicable *Service Guide*.

3. Trace vertical licensed internal code

   This option shows a menu that lets you start or stop a trace of vertical licensed internal code. You can also display, dump, allocate, or clear the trace tables where the vertical licensed internal code trace is recorded. Also, select this option to collect data about the internal operation of VLIC.

   For more information about this option, see page 12-10 under SST and the applicable *Service Guide*.

4. Display hardware configuration

   This option displays the configuration and status of the hardware attached to the system. The list of hardware is obtained from the resource configuration record (RCR), which is built by the system during an IPL. More specifically, you can display the input/output processors (IOPs) input/output adapters (IOAs), bus extender drivers (BEDs), and bus extender receivers (BERs). You can display the controllers, devices, and communication ports attached to the processors and adapters. You can also display information about the main storage and processor cards. For more information about resource configuration records (RCRs), see page 10-1. For more information about this option, see page 12-61 and the applicable *Service Guide*.

5. I/O debug utility

   This option shows a menu that lets you display, trace, or set a breakpoint in the I/O licensed internal code. I/O processors control the storage devices, work stations, and communications data links on your system.

   For more information about this option, see page 12-50 under SST and the applicable *Service Guide*.

6. Print stand-alone dump (sometimes called print main storage dump)

   This option lets you display a main storage dump, or copy the dump to tape, a diskette, or a printer.

   For more information about this option, see page 12-55 under SST, and the applicable *Service Guide*. For more information about main storage dumps, see page 16-1.

7. Work with error log

   This option displays or prints errors that have occurred (such as in disk and tape units, communications, processors, and work stations). This option has less function than the Work with error log option under SST. SST lets you work with tape and diskette statistics; whereas, the limited paging environment of DST will not. Under the limited paging environment of DST, you cannot work with error log sizes, work with tape or diskette statistics, or examine session or lifetime counters for a specific volume or removable media type.

   A *shadow* error log is maintained by VLIC on the load source disk. The 64 K-byte shadow log contains a duplicate of the most recent or latest errors that occurred before IPL began and those errors that were logged since the beginning of IPL. The *Work with error log* option uses the shadow log when the system is operating in limited paging environment.

   If error log initialization (ELI) is not complete, only the shadow log is accessible to this option. Also, the Work with Error Log menu offers only a subset of all the Work with error log options. The main menu informs the user that ELI has not completed, that all error log records are not accessible, and to IPL OS/400 to complete ELI. If ELI completes after the *Work with error log* option has been selected, then the *Work with error log* option must be selected again to make all *Work with error log* options available for use and to generate reports that show all the error log entries.

   For more information about this option, see page 12-3 under SST. For more information about error logs, see page 15-1, and the applicable *Service Guide*.

8. Power off the system

   This option is used to do a clean take-down and forces the system to power off. This option is much like useing the PWRDWNSYS command. This option is only available in limited paging environment of DST.

9. Program debug (not shown on display)

   This option shows a menu that lets you define stop points in a program while you are debugging vertical licensed internal code or machine instruction (MI) programs. Status is displayed when the stop point is reached by the program.

For more information about program debug, see 13-22. This option is similar to OS/400 Program Debug except OS/400 Program Debug does not run at IMPI and MI level. For more information about OS/400 Program Debug, see page 23-1.

Program Debug

This option is accessed by selecting the undisplayed option 9 on the Start a Service Tool main menu. The *Start a service tool* option is selected from the Dedicated Service Tools main menu.

This *Program debug* option is not displayed because incorrect use of this tool can cause damage to data in the system and is intended for use only by an experienced operator with direction from an IBM support-level service representative.

Program debug allows you to stop at any licensed internal code instruction in a program (called a breakpoint) so you can receive control to display or modify variables to debug your programs. The following functions are performed by program debug:

- Setting or clearing of breakpoints in VLIC programs
- Setting or clearing of breakpoints in MI programs
- Displaying information and suspending or resuming of a program at a breakpoint
- Displaying and modifying virtual storage
- Finding VLIC modules by name
- Finding MI objects by name
- Calling an MI program
- Finding MI objects (if program is observable)

| The function is ended by pressing the F3 key.

| **Note:** The OS/400 operating system is not shipped as an
| observable program. Program debug has limited
| functions on the the OS/400 operating system.

For more information about this Program debug option, see the *AS/400 System Support: Diagnostic Aids Addendum*[1].

DST

[1] Object Code Only (OCO)—IBM Confidential Restricted.

Chapter 14. The Control Panel

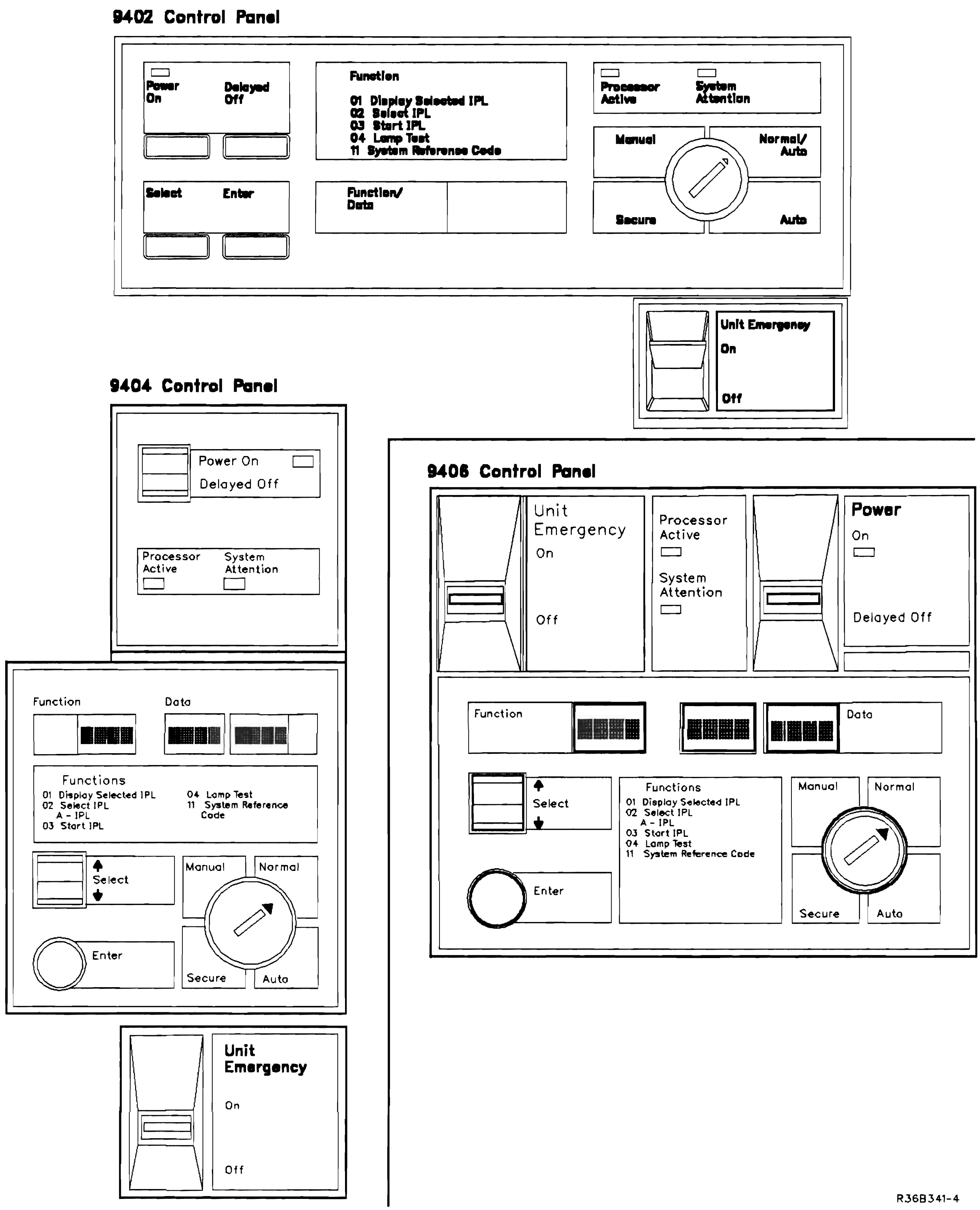


Figure 14-1. AS/400 Control Panels

For information about the control panel:

- Interfaces, see page 14-2
- Functions, see page 14-4
- Displays, see page 14-17
- Switches, see page 14-17
- Lights, indicators, or LEDs, see page 14-21
- Controlling system power, see page 14-21
- Using the control panel to IPL the System, see page 14-23

In addition to this chapter, see the *Operator's Guide* and *Service Guide* for more information on the control panel switches, lights, and functions.

Interfaces

The control panel is your initial interface to the system. From it you can:

- Power on or off the system

  The control panel drives the power on or off signals to the power supply. Power on or off, power status, uninterruptible power supply or battery status, is controlled or monitoried and reported by the panel to the service processor and is passed on to the system. For more information about controlling power, see page 14-21.

- Display and read status or error codes

  The SRCs displayed may be informational, attention, or error status SRCs. For more information about SRCs, see Appendix C.

- Select and display functions to affect system actions

  For example, you can select an IPL mode to do a start IPL which is also know as warm IPL, soft IPL, or load IPL. A start IPL is different from a power on in that the system is already powered on and the load signal only goes to the hardware of the service processor, resetting the service processor hardware (except service processor memory).

  When the system is being powered on, it automatically starts to IPL. There is no need to select the start IPL function (3). If you do select it, the service processor BATs end in a machine check.

The control panel acts as an interface to the power supply, an IPL, and the service processor. For more information about an IPL and service processor activities in an IPL, see Chapter 18. Figure 14-2 on page 14-3 shows how the control panel interfaces with an AS/400 Model A40.

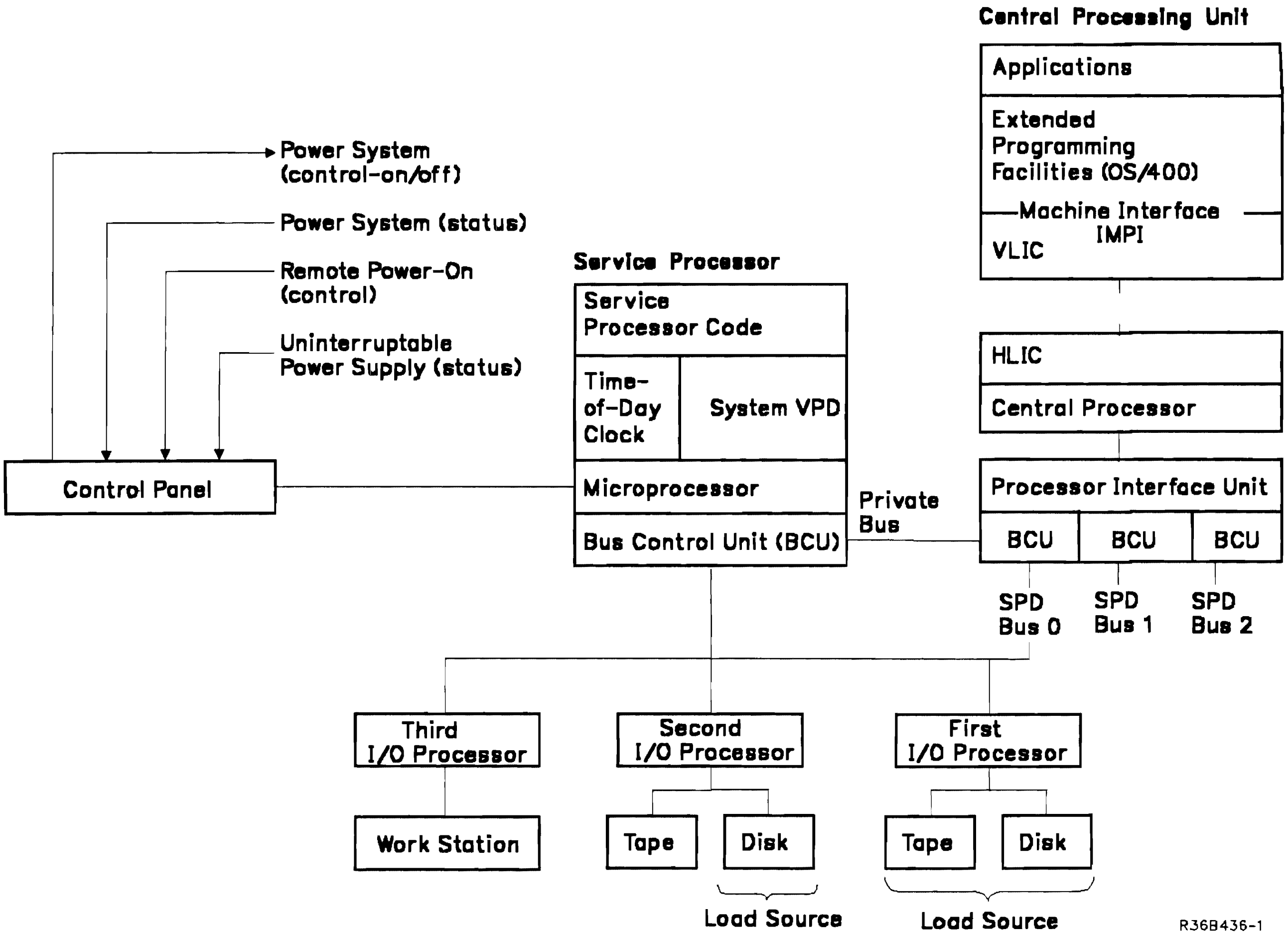


Figure 14-2. Control Panel Interfaces to the System

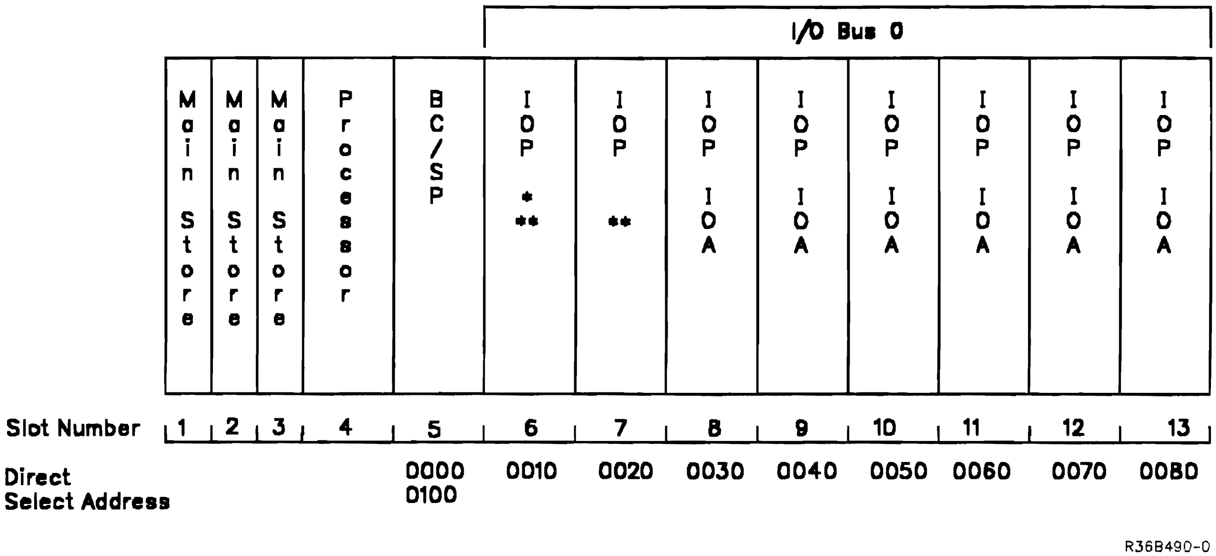
Logical addresses are used by the licensed internal code but all references to cards are translated to bus, board slot type address.

The alternate IPL (IPL type D) tape device can be attached to the IOP in IOP card slot 6 (for models 50 or less) or 10 (for models 60 and above). The following IOPs can be attached:

- 6110 DASD on IOP's bus 0 as device address 7 (for example, 9347)
- 2601 (for example, 9346)
- 2602 (for example, 2440)
- 2604 (for example, 2440)

The load source DASD is always address 0 of the first 6110 IOP and the first 6110 IOP must be in either the first or second IOP slot. The first or second slot is 6 or 7 on models 50 or less and 10 or 11 on models 60 and above. Figure 14-3 on page 14-4 shows an example of how cards are plugged into a 9406 System Unit for Models 30 through 50. For other examples of card locations, see the *Service Guide*.

The minimum DASD required for the load-source is 320 megabytes on one spindle; therefore, a 200 megabyte 9332 cannot be a load-source device.



* Required position of the IOP that drives the alternative IPL tape unit.
** Possible position of the IOP that drives the load-source disk unit.

Figure 14-3. 9406 System Unit Card Plug Chart (Models 30 through 50)

Functions

The functions are grouped as follows:

Group	Description
01-19	Normal panel functions For more information about these functions, see "Normal Panel Functions."
20-49	Extended panel functions For more information about these functions, see "Extended Panel Functions" on page 14-5.
50-53	Service panel functions For more information about these functions, see "Service Panel Functions" on page 14-8.
54-58	Low-level debug panel functions For more information about these functions, see "Low-Level Debug (LLD) Panel Functions" on page 14-9.
59-69	These functions are undefined
70	This has the same description as for functions 50 through 53 except this function is available on the 9404 System Unit and AS/400 9402 System Unit only.

Normal Panel Functions

These functions that are enabled when the Keylock switch is in any position. Extended SRC words are enabled only when there are actual words to be displayed.

The following are considered normal panel functions. Functions 02 and 03 are enabled only when the Keylock switch is in the Manual position.

Functions **Description**

01 Display selected IPL

This function displays the currently selected IPL type in the third character position of the Data display. The IPL types are:

Type	Description
A	IPL from disk (Keylock switch in the Normal position)
B	IPL from disk (Keylock switch in the Manual position)
C	Reserved
D	IPL from tape

02 Select IPL type

This function is used to select the IPL type. For more information about IPL types A and B, see Figure 2-1 on page 2-4. An IPL type D uses the tape device used to install or restore the operating system as the load source device. The licensed internal code is loaded from the media loaded in the tape device. The load source disk unit is not used. To use the stand-alone utilities, you must set the IPL type to D.

When Enter is pressed with 02 in the Function display, the presently selected IPL type is displayed in the third character position of the Data display. The IPL type can be changed by using the Select switch.

	When Enter is pressed again, the newly selected IPL type is stored for use during the next IPL.
03	Start IPL
	This function initiates an IPL type (A through D) using the selected IPL mode when the Enter switch is pressed. All the licensed internal code is loaded into the IOP. The system must be powered on before a selection can be made.
04	Lamp test
	All displays and indicators are turned on when the Enter switch is pressed. This function continues until the Select switch is pressed.
05-10	Reserved
11-18	System reference code (SRC)
	These functions allow you to view the SRC if an SRC is present on the control panel. For an example of the SRC formats, see Appendix C.
19	Reserved

For more information about the functions 1-19, see the applicable *Analyzing Problems Guide* and *Unit Reference Code Guide*.

Extended Panel Functions

These functions are enabled when the Keylock switch is in the Manual position. Selection followed by pressing Enter causes the function to be activated; selection itself does not activate the function number in the Function display. The following is a list of all the extended panel functions and a description of each.

Functions	Description
20	No operation function
	This function always returns a 'FFFF ' on the 9406 System Unit and 9404 System Unit and '20 FF' on the AS/400 9402 System Unit as a response without any other actions. For more information about this function, see page 14-6.
21	Start DST
	This function presents the DST Sign On display. Any job that was running is canceled. For more information about this function, see page 14-6.
22	Dump main storage
	A dump of the IMPI main storage is done. For more information about this function, see page 14-6.
23	Restore licensed internal code
	This function copies licensed internal code from tape to a load-source disk device. This function is sometimes referred to a **slip** install. The IPL type must be set to D. For more information about this function, see page 14-7.
24	Install licensed internal code
	This function erases all load source disk device information, including customer data, and then copies licensed internal code from tape to the load source disk device. The disk is initialized. The IPL type must be set to D. This function is sometimes referred to a **scratch** install. For more information about this function, see page 14-7.
25	Service switch 1
	This function is the first step necessary to enable functions 50 through 59 and 70. Select this function and press the Enter switch. The 9406 System Unit and 9404 System Unit returns 25 0000 0000 and the AS/400 9402 System Unit returns '25 00'.
	This function and function 26 must be set to on to access functions 50 through 59 and 70. If functions 50 through 59 and 70 are enabled this function disables them. If this function is used to disable these functions, then function 26 is not needed to disable them. For more information about this function, see page 14-7.
26	Service switch 2
	This function is the second step necessary to enable functions 50 through 59 and 70. Select this function and press the Enter switch. The 9406 System Unit and 9404 System Unit returns 25 0000 0001 and the AS/400 9402 System Unit returns '25 A '.
	If functions 50 through 59 and 70 are enabled this function disables them. If this function is used to disable these functions, then function 25 is not needed to disable them. For more information about this function, see page 14-7.
27-28	Reserved for stand-alone utilities (SAU)
29	Load model-unique licensed internal code
	This function copies only the model-unique licensed internal code from tape and replaces any existing model-unique licensed internal code on the load source disk device. For more information about this function, see page 14-7.
30-31	Reserved for the stand-alone utilities (SAU)
32	Download disk licensed internal code
	This option downloads the disk licensed internal code to the load-source disk. Use this function when the disk licensed internal code needs changing. For more information about this function, see page 14-8.
33-49	Reserved

Extended panel functions are accessed from the control panel when the Keylock switch is in the Manual position. Information generated from using these extended control panel functions is needed when submitting an APAR or LICTR for service processor licensed internal code problems. See Chapter 5 for information about procedures for handling licensed internal code problems.

The three possible immediate responses for all functions greater than 18 are as follows:

Table 14-1. Function 18 Responses

On the 9404 System Unit and 9406 System Unit	On the AS/400 9402 System Unit
• 'FFFF ' (function is not available now) Functions 54 through 58 respond with this code if they are not enabled. Functions 59 through 69 are reserved and respond with this code.	• 'YY FF' (function is not available now) Functions 54 through 58 respond with this code if they are not enabled. Functions 59 through 69 are reserved and respond with this code.
• 0000 0000 (function is attempted)	• 'YY 00' (function is attempted)
• XXXX XXXX (actual data)	• XXXXXXXX (actual data)
	Note: YY is the function number.

Function 20 — No Operation: The no-operation function always displays 20 'FFFF ' on the 9406 System Unit and 9404 System Unit and '20 FF' on the AS/400 9402 System Unit to indicate the function is not available. The intention of function 20 was to prevent accidental selection of a customer function when viewing the words of a current SRC (11 through 19).

Function 21 — Start DST: This function starts DST on the machine default console display. For a twinaxial work station, DST starts when:

- A primary console, a display with address 0 on port 0 of the first work station controller on bus 0
- An alternative console, a display with address 0 on port 1 of the first work station controller on bus 0 (if using a twinaxial work station controller)
- A second alternative console, a display station with address 0 on port 0 of the second work station controller on bus 0

For an ASCII work station, DST starts when:

- A primary console, a display on port 0 of the first work station controller on bus 0
- A second alternative console, a display station on port 0 of the second work station controller on bus 0

DST can be selected from an IPL menu during an attended IPL mode or DST is started by selecting this function and pressing the Enter switch when the system is hung and the Keylock switch is in Manual position.

Warning:

Function 21 should only be used when SST is not available. If there is a job active at the console device when function 21 is selected, that job ends abnormally. Function 21 marks the device as not usable for OS/400. If F3 or F12 is pressed before the job ends, the device does not get back to the signon screen. If this happens, wait until the job or jobs associated with the console device have ended and then select function 21 followed by F3 or F12 to get back to the Sign On display.

See Chapter 13, Chapter 18, and Chapter 19 for more information about DST.

Function 22 — Dump Main Storage: This function is operated only when a main storage dump is necessary. This function dumps the IMPI main store memory to the load source DASD device. When the function is available, you receive a 0000 0000 data response followed by several informational SRCs and ending with an attention level SRC. The attention level SRC either requests further action or indicates a failure in attempting the dump. The attention light indicates whether an SRC requires attention or is for informational purposes.

Depending on how large storage is, allow up to 35 minutes for this function to complete.

How to Execute a Main Storage Dump: Do the following procedures for taking a main storage dump if OS/400 is inoperable:

1. On the system control panel, set the Keylock switch to the Manual position.
2. Set the Select switch to display function 22.
3. Press the Enter key.
   - SRCs D1XX 3XXX and C1XX XXXX indicate a dump is in progress. This process takes 6 to 30 minutes.
   - SRCs A1XX 300X indicate a dump is successfully finished. The system attention light is on.
   - SRCs B1XX XXXX or 25XX XXXX indicate a dump failure. To recover, see "Error Recovery Procedure" on page 16-6.

   Note: See the applicable *Unit Reference Code Guide* for possible values of X.

Do the following procedures for copying a main storage dump:

4. IPL the system to DST for one of the following conditions:
   - If the system is powered on, set the Keylock switch to the Manual position, set the Select switch to display function 3, and press the Enter switch.

   Or,

   - If the system is powered off, set the Keylock switch to the Manual position. Set the Power switch to on.

Control Panel

Note: If the system does not IPL to DST, repair the system before capturing the dump.

5. Select the *Work with service tools* option from the DST main menu.
6. Select the *Print stand-alone dump* option from the Work with Service Tools menu.
7. Obtain a main storage dump tape and mount it on the tape unit. Then select the *Copy main store dump to tape* option from the Print Stand-Alone Dump menu.

   Notes:

   a. If you do not have a special main storage dump tape, you may change your tape volume name to DMS while using print stand-alone dump using intervention screens.
   b. A tape that is not initialized does not work.
   c. If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

See the *Analyzing Problems Guide* for more information about how to execute a dump.

For more information about how the information for this function is displayed and the format of the SRCs that appear, see "Main Storage Dump" on page 16-1.

Function 23 — Restore Licensed Internal Code: This function copies licensed internal code from tape to a load source disk device. This function is used only after an alternate IPL (type D IPL).

For a description of how to run the licensed internal code restore, see the *Service Guide*.

Function 24 — Install Licensed Internal Code:
Warning: Using this function requires reloading of all customer data and reconfiguration of all DASD on the system. Use this function only when absolutely necessary.

This function erases all information, including customer data, on the load source disk device and then copies licensed internal code from tape to the load source disk device. This function is used only after an alternate IPL (type D IPL).

To determine if this install was done:

1. Select the *Display/alter/dump* option from the Start a Service Tool menu of SST or DST.
2. Select the option to display an address and enter 00008A00 0000. This is the start SID where the install table is located.
3. Look at the table at address 00008A00. This table contains the steps used for an install. It has 16 entries of 64 bytes each, representing the install steps.
4. Go to displacement 020A. This is a 2-byte entry containing the relative record number of the last entry in the table. For example: 0003 is the third entry in the table that was last updated.
5. Go to displacement 400 of the SID. This is the start of the table.
6. Scroll forward to find the entry number from step 2.
7. Scroll backward to find COPY DIR in the table. If this install was done then the next previous entry is LOAD SOURCE DASD INITIALIZED. If this entry is missing then this install was not done.

For a description of how to run install licensed internal code, see the *Service Guide*.

Functions 25 and 26 — Service Switches 1 and 2: To enable these functions, select functions 25 and 26 sequentially. Press Enter after each selection.

For 9406 System Unit, Service switches 1 and 2 can be used to enable or disable functions 50 through 58. (Functions 54 through 58 are only visible if enabled by the service processor.) For the AS/400 9402 System Unit and the 9404 System Unit, Service switches 1 and 2 enable all functions 50 through 70; however, only those functions that are enabled can be used. All others return a message of 'FFFF ' or 'YY FF' (where YY is the function number) at the panel.

If the service functions 50 through 59 and 70 are enabled, selection and entry of either service switch 1 or 2 disables functions 50 through 58 and 70. If functions 50 through 58 and 70 are disabled, selection and entry of Service switch 1 followed by Service switch 2 enables functions 50 through 58 and 70.

When function 25 is selected and entered, the following display appears:

On the 9404 System Unit and 9406 System Unit	On the AS/400 9402 System Unit
25 0000 0000	'25 00'

After function 26 is selected and entered, function 01 and the IPL type (A through D) are displayed.

Functions 27 and 28: Reserved for stand-alone utilities (SAU).

Function 29 — Load Model-Unique Licensed Internal Code: This function copies only the processor model-unique licensed internal code from tape and replaces any existing model-unique licensed internal code on the load source disk device. This function is used only after an alternate IPL (type D IPL).

It is important that the serial number of the model-unique licensed internal code (MULIC) matches the serial number of the CPU. All violations of MULIC must be reported. It is permissible to borrow MULIC from another customer with the same model and use it in an emergency where a particular customer's tape is missing or damaged.

The model unique licensed internal code comes with the system on a separate tape and is not saved or restored with the rest of the system code.

For a description of how to run this function, see the applicable *System Upgrade Guide* listed in the *Information Directory*.

Function 30 and 31 — Reserved for Stand-Alone Utilities (SAU)

Function 32 — Download Disk Licensed Internal Code: This option downloads the disk licensed internal code to the load-source disk. Figure 14-2 on page 14-3 shows that the load-source can be a disk unit (if there is one) or controller attached to the first IOP on bus 0 or the second IOP on bus 0. A tape load-source can only be on the first IOP.

Use this function when the device is replaced or has the wrong level of code and only after a type D IPL.

Note: Functions 23, 24, and 27 through 32 are used with the Stand-alone Utilities (SAU). SAU is invoked using a type D IPL.

The stand-alone utilities (SAU) can be used anytime the machine does not come up on the load source. The system does not start because of one of the following:

- There is no data on disk.

  You must install the licensed internal code to restore data on disk and upgrade to the next release of licensed internal code.

- A problem exists in the load source subsystem or the load source DASD device has been replaced.

  You failed to IPL to DST, the licensed internal code is on a replacement disk, or the ability to service the system is restricted to the load source. The DASD needs to be checked out and loaded again. Use function 23 or 24 to install or restore the licensed internal code.

When you have no data on disk, you need to be able to initialize the disk or try to determine if the disk is usable. SAU provides the support to do this. SAU runs only from tape, runs entirely from the system control panel using a type D IPL, and contains its own limited operating system.

Some of the common SRCs for SAU are:

- SRCs that start with A6 are inquiry or instructional messages, for example:

  Select utility
  Destroy disk data confirmation
  Tape device not working
  Mount new tape volume
  Mount correct tape volume

- SRCs that start with B6 show fatal errors. For example, SRC B600 6151 indicates that a standard label tape was not used.
- SRCs that start with C6 and D6 show the status of SAU. For example, SRC C6XX 6201 indicates the SAU is running.

For more information about SAU, see "Using the Stand-Alone Utilities to do an IPL" on page 18-3, the applicable *Analyzing Problems Guide*, and *Backup and Recovery Guide*.

Service Panel Functions

These functions are enabled when the Keylock switch is in the Manual position and functions 25 and 26 are selected. The following is a list of all the service panel functions and a description of each.

Functions	Description
50	IMPI CPU stop This function stops the system CPU. For more information about this function, see page 14-9.
51	IMPI status This function displays the following values: • Base zero (B0) register contents • System IAR address • Current TDE contents The data may be displayed 8 digits at a time using the subfunction entry as the offset into the data. For more information about this function, see page 14-9.
52	IMPI CPU start This function starts the system CPU (after it has stopped). For more information about this function, see page 14-9.
53	Reserved This function resets communication between the service processor and the control panel. It should be used with the supervision of IBM. For more information about this function, see page 14-9.
70	Loadsource IOP dump (9404 System Unit only) This function dumps the load source IOP. For more information about this function, see page 14-9.

Note: Selection followed by pressing the Enter switch causes the function to be run; selection itself does not affect the function number in the function field.

Service functions 50 through 70 are available for selection when the Keylock switch is in the Manual position and the Service switch 1 (function 25) has been selected and entered followed by the selection or entry of Service switch 2 (function 26). The service functions may be disabled again by selecting and entering either Service switch 1 (function 25) or Service switch 2 (function 26). The service functions are composed of two categories:

- Commonly used functions 50 through 53 and 70 (9404 System Unit and AS/400 9402 System Unit only) that can be always selected.
- Low-level debug 54 through 58 functions may be selected if a severe error exists. For more information about these low-level debug functions, see page 14-9.

Subfunctions are used with functions 51 and 54 through 58. After selecting and entering the function, the subfunction field appears with two asterisks. You may now select and enter a subfunction value. When selected and entered, actual data or 'FFFF ' on the 9404 System Unit and 9406 System Unit and 'YY FF' (where YY is the function number) on the AS/400 9402 System Unit is displayed. The 'FFFF ' or 'YY FF' response indicates that no data is present for this subfunction value. The data is displayed as 8 hex digits which is 4 bytes of data.

These steps may be repeated for different subfunction values. To exit subfunctions, select and enter the two asterisks for the subfunction value. Table 14-2 shows an example of a subfunction data display.

Table 14-2. An Example of a Subfunction Data Display

Function	Subfunc-tion	Data Display (Length)
51	**	Subfunction mode entered
51	00	IAR (2 bytes) and base register 0 (2 bytes)
51	01	Base register 0 (4 bytes)
51	02	Current TDE (4 bytes)
51	03	Current TDE (2 bytes) and reserved (2 bytes)

Function 50—IMPI CPU Stop: It is necessary to stop the IMPI CPU before viewing the status information of function 51. Function 50 stops the IMPI CPU. When the function is available, you receive a 0000 0000 data response followed by an informational SRC or attention level SRC. The informational SRC indicates when the CPU stops.

When function 50 is selected and entered, SRCs D100 900F or D100 9016 are displayed. These SRCs indicate IMPI processor was successfully stopped.

Function 51—IMPI Status: This function uses subfunctions for viewing IMPI status data. Stop the IMPI CPU (function 50) before viewing the status information. Table 14-3 shows the IMPI status information that you can view.

Table 14-3. IMPI Status Information

Subfunction (Hex)	Data (Length in Decimal)
00	IAR (2 bytes)
00-01	Base register zero (6 bytes)
02-03	Current TDE (6 bytes)
03	Reserved (2 bytes)

Function 52—IMPI CPU Start: This function starts the IMPI CPU. When the function is available, you receive a 0000 0000 data response followed by an informational or attention level SRC. The informational SRC indicates when the CPU starts.

When function 52 is selected, SRCs D100 9010 or D100 9017 are displayed. These SRCs indicate IMPI processor was successfully started.

Function 53—Reserved: This function resets communication between the service processor and the control panel. It should be used only with proper supervision.

Function 70—Load Source IOP Dump (9404 System Unit Only):

Warning: This function stops the system; therefore, use this function with supervision from your next level of support.

This function dumps the load source IOP. Before starting this function you must enable functions 25 and 26. For more information about enabling these functions, see "Functions 25 and 26—Service Switches 1 and 2" on page 14-7.

To start a load source dump, select function 70 on the panel and press the Enter switch. The panel responds with a 0000 0000 and in about 10 seconds the SRC B100 8ABF should appear. At this or any critical SRC, the low-level-debug functions 54 through 58 are enabled and the attention light should be on.

If an SRC indicating the system is stopped appears immediately after entering function 70, the dump most likely failed. The system must be IPLed after this terminating SRC appears. Otherwise, if the SRC B100 8ABF appears in about 10 seconds after selecting function 70, the dump probably succeeded. There is no indication that it completed successfully.

Low-Level Debug (LLD) Panel Functions

These functions are enabled when the Keylock switch is in the Manual position, the system is stopped, and functions 25 and 26 are selected. These functions are used for analyzing bus failures on bus 0. The following is a list of all the low level debug (LLD) panel functions and a description of each.

Functions	Description
54	Display configuration table The I/O configuration table (ICT) contains the state of every I/O bus unit (IOBU) and bus extended unit (BEU) found on the system's bus 0. Using this function helps determine the status of the load source IOP at the time of failure. Enter a subfunction as a word (4 bytes) offset between hex 00 and FF to view the information in this area. For more information about this function, see page 14-10.
55	Display service processor log buffer (SPLB) Enter a subfunction as a word offset between hex 00 and 3F to view the information in this area. For more information about this function, see page 14-14.
56	Display service processor communications area The service processor communications area (SPCA) contains the state of the system processor and service processor at the time of failure. This area contains things such as the failing LID (load ID) which indicates what LID the service processor wanted from the load source IOP. Enter a subfunction as a word offset between hex 00 and FF to view the information in this area. For more information about this function, see page 14-14.
57	Display IPL message area The IPL message save area (IMSA) is a first-in-first-out queue of messages sent to the service processor before the time of failure. This area is useful in determining sequence of events on the system I/O bus before the failure. Enter a subfunction as a word offset between hex 00 and FF to view the information in this area. For more information about this function, see page 14-16.
58	Display IPL parameter area Enter a subfunction as a word offset between hex 00 and FF to view the information in this area. For more information about this function, see page 14-16.

To isolate a bus problem, select function 25 and 26 from the control panel. Then select functions 54, 56, or 57 and scroll through the subfunction data. 1K byte of data is accessable, one word at a time.

Function 54 — Display Configuration Table: This function uses subfunctions for viewing the configuration table data.

Note: The data displayed is bit sensitive and is requested only by IBM when needed.

Use the Select key on the control panel to scroll through the displayed data.

For 9406 System Unit, this LLD function is enabled only when the system stopped. Under normal conditions this function is not usually visible on the control panel. This function is visible when it has been enabled by the service processor; otherwise, it does not show up when you scroll through the functions. For 9404 System Unit and AS/400 9402 System Unit, when functions 50 through 53 and 70 are enabled, this function is only enabled after the stop occurs.

The service processor responds with 'FFFF ' on the 9406 System Unit and '20 FF' on the AS/400 9402 System Unit and 9404 System Unit (this function not enabled) when this function is selected on the control panel after functions 50 through 53 and 70 are enabled. See "Functions 25 and 26 — Service Switches 1 and 2" on page 14-7 for more information about enabling this function.

Control Panel

IPL I/O Configuration Table: The configuration table is built on each IPL. Figure 14-6 on page 14-13 shows an example of the configuration table. The zero entry in the table is the bus extension unit (BEU) table. The 8-byte entry is divided up with 1-byte per BEU. The first 4 bits represent the card address (0 through F). The board address depends on the BEU's position in the table. The next 4 bits indicate one of these states:

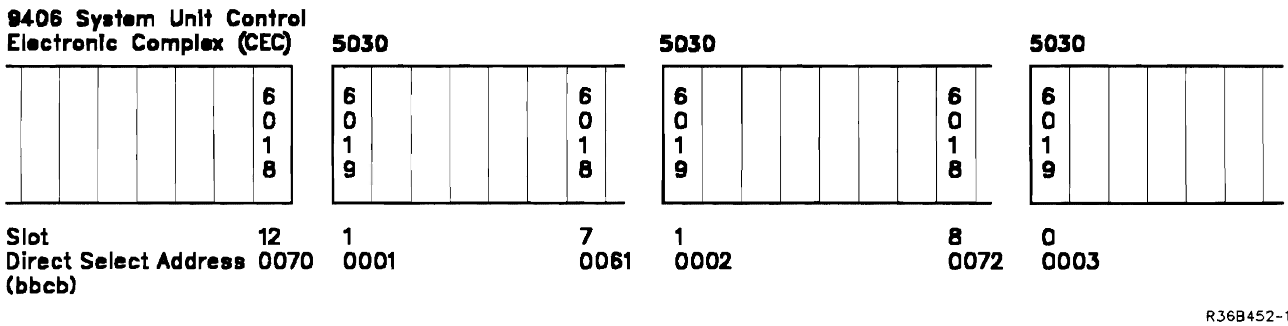
Address assigned,
Entry inuse,
Power good
Secondary BEU connected.

The bus unit entry is 8-bytes. The first byte is the direct select address. (The direct select address is the position on the bus the IOP was found at. For an example of a direct select address, see Figure 14-3 on page 14-4.) The next 3 bytes are state flags. The last 4 bytes represent the IOP's immediate status or last bus message status.

Figure 14-6 on page 14-13 shows an example of a configuration table as shown on the control panel. Verify the sequence of addresses. Because of a severe problem, online PAR is not available. If you can, check for an asynchronous error report (AER) indication, parity check, unit check, invalid messages and so on.

An Example of Interpreting Function 54: Function 54, IPL configuration table, is used for bus 0 only. The IPL configuration table is made up of 8-byte entries. The zero entry is 5400 through 5401, the first entry is 5402 through 5403, the second entry is 5404 through 5405, and so on. The zero entry is a special entry in that it is a table itself (a table within a table). Each byte in the zero entry represents a potential bus extention unit. Figure 14-4 shows an example of a bus on the 9406 Model B50.

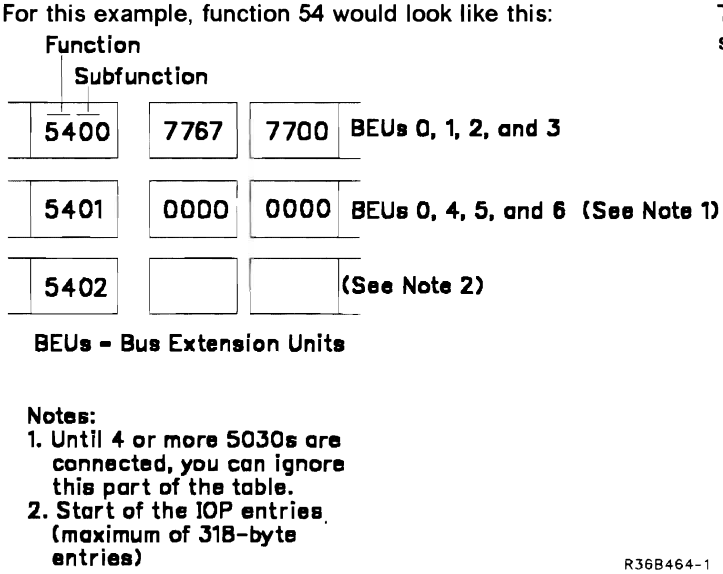
Function 54 Subfunction 00 and 01:



Where: bb = bus, c = card, and b = board.

Figure 14-4. An Example of a Bus on a 9406 Model B50

For this example, function 54 would look like this:



See Figure 14-6 on page 14-13 for the rest of this table. See Table 14-4 on page 14-12 for an example of words 1 and 2.

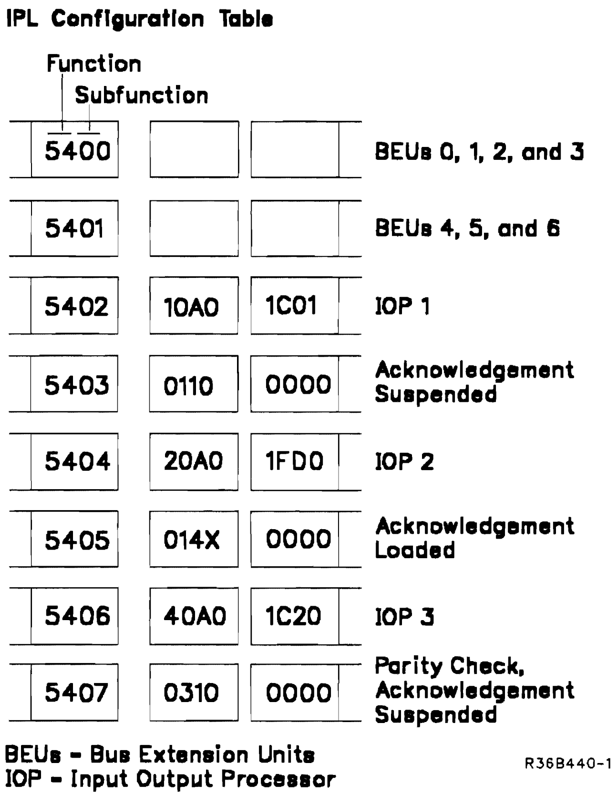
Figure 14-5. An Example of Function 54 on the Control Panel

Table 14-4 on page 14-12 shows what the zero entry shown in Figure 14-5 looks like.

Table 14-4. Example of Words 1 and 2 in Function 54 for a Bus Extension Unit (BEU)

Word	Byte	Bit	Value	Description
0	0	0-3	7	Card direct select address (byte 0 implies on board 0)
		4-7	7	Status bits: 4=0 Address assigned (1=disconnected by a timeout). The address is assigned to the 6018-6019 pair sequentially, for example, the 6018 on board 0 (5021) is assigned address 1. This sets up the 6019 hardware with a direct select board address of 1; therefore, the cards in the first 5030 can now be selected as 00x1. 5=1 In use, for example, a 6018 was found on this board. When this bit is on the rest of the bits in this byte are valid. If this bit is off, then this byte and all subsequent bytes in zero entry are invalid (for example, no BEU was detected.) 6=1 Power good, 6019 is powered. 7=1 Extention connected, 6018 and 6019 have a good connection (bit 6 comes on first).
0	1	0-3	6	Card direct select address (byte 1 implies on board 1)
		4-7	7	Status bits: 4=0 Address assigned (1=disconnected by a timeout). The address is assigned to the 6018-6019 pair is assigned address 2. This sets up the 6019 hardware with a direct select board address of 2, thus the cards in the second 5030 can now be selected as 00x2. 5=1 In use, for example, a 6018 was found on this board. When this bit is on the rest of the bits in this byte are valid. If this bit is off, then this byte and all subsequent bytes in zero entry are not valid (for example, no BEU was detected.) 6=1 Power good, 6019 is powered. 7=1 Extention connected, 6018 and 6019 have a good connection (bit 6 comes on first).
0	2	0-3	7	Card direct select address (byte 2 implies on board 2)
		4-7	7	Status bits: 4=0 Address assigned (1=disconnected by a timeout). The address is assigned to the 6018-6019 pair is assigned address 3. This sets up the 6019 hardware with a direct select board address of 3; therefore, the cards in the third 5030 can now be selected as 00x3. 5=1 In use, for example, a 6018 was found on this board. When this bit is on the rest of the bits in this byte are valid. If this bit is off, then this byte and all subsequent bytes in zero entry are not valid (for example, no BEU was detected.) 6=1 Power good, 6019 is powered. 7=1 Extention connected, 6018 and 6019 have a good connection (bit 6 comes on first).
0	3	0-3	0	Card direct select address (byte 3 implies on board 3).
		4-7	0	Status bits: 5=0 In use, for example, no 6018 was found on this board. This byte and all subsequent bytes in zero entry are invalid (for example, no BEU was detected.).
1	0	0-3	0	Card direct select address (byte 4 implies on board 4)
		4-7	0	Status bits
1	1	0-3	0	Card direct select address (byte 5 implies on board 5)
		4-7	0	Status bits
1	2	0-3	0	Card direct select address (byte 6 implies on board 6)
		4-7	0	Status bits
1	3		00	This entry is always zero.

Function 54 Subfunction Greater Than 01:



See Figure 14-5 on page 14-11 for an example of the BEUs not shown here. See Table 14-5 for the bit definitions for this ICT.

Figure 14-6. An Example of an IPL Configuration Table (ICT)

Table 14-5 defines the bits of configuration table as shown on the control panel shown in Figure 14-6.

Table 14-5. Bit Definitions of the Configuration Table

Byte	Bit(s)	Contents
		Direct select position:
0	0-3	Card address.
	4-7	Board address.
1	8-15	*IPL state flags:*
		8 IOP address written
		9 IOP disabled
		10 Entry is assigned
		11 Error report from IOP
		12 IOP timeout on bus
		13 IOP sent or receive undefined message
		14-15 Not used
2	16-23	*IPL state flags (continued):*
		16 Interface reset D
		17 Unit reset D
		18 Destructive reset needed
		19 Message wrap
		20 Initiate bus test
		21 Initiate self load
		22 Operational load complete
		23 Query LID
3	24-31	*IPL state flags (continued):*
		24 Get LID
		25 Cancel get LID
		26 Nonload source bus unit
		27 Query or get LID successful
		28 Not used
		29 Command sent failed
		30 Command sent rejected
		31 Command sent acknowledgement due
4-5	0-15	*Immediate status 0 (first half):*
		0 Bus master when timeout occurred
		1 Bus slave when timeout occurred
		2 Bus slave when timeout occurred
		3 Acknowledge bus poll out
		4 Synchronous check
		5 Bus unit check
		6 Parity check
		7 Acknowledge
(5)	8-15	(Bus operation end status if the command is rejected)
		8 Not used
		9 Loaded
		10 Not used
		11 Suspended
		12 Not used
		13-15 Line length
6-7	16-31	*Immediate status 1 (second half)*
		16 The following: 0 = One FRU; 1 = FRU ID follows
		17 The following: 0 = FRU ID not valid; 1 = FRU ID valid
		18-23 FRU isolation data
		24-31 Reserved

***VLIC I/O Configuration Table*:** The I/O configuration table (ICT) in VLIC:

- Has same format as the IPL or service processor ICT.
- Is always current; whereas, the service processor's ICT is updated only at IPL.
- Has one bus per table.

To find the ICT for a bus, do the following:

1. Select the *Start a service tool* option from DST main menu or the *Start a service function* option from the SST main menu.
2. Select the *Display/alter/dump* option from either the Start a Service Function menu or the Start a Service Tool menu.
3. Select the *Display/alter storage* option from the Display/Alter/Dump menu. The Select Data Menu display appears.
4. Select the *Starting address* option from the Select Data Menu. Enter an address to display it. Display the addresses for:

Bus	**Address**
0	8000 0006 03BE
1	8000 0006 05BE
2	8000 0006 07BE

5. The Display Storage display appears. Type a P on the first on the first non-zero character and press Enter.
6. The following is an example of the VLIC ICT and the display that appears:

```
                         Allocate General Trace Table

Control . . . . . . .                   nnnnn, Pnnnn, E1111, .1111
Address . . . . . . .   80000006 2A00

2A00      00000000 00000000 10A0FE20 11100000       * ................*
2A10      20A0FF90 01100000 30A0FE20 01100000       * ................*
2A20      40A0FE20 01100000 60A0FE20 01100000       * ................*
2A30      80A0FE20 01140000 00000000 00000000       * ................*
2A40      00000000 00000000 00000000 00000000       * ................*
2A50      00000000 00000000 00000000 00000000       * ................*
2A60      00000000 00000000 00000000 00000000       * ................*
2A70      00000000 00000000 00000000 00000000       * ................*
2A80      00000000 00000000 00000000 00000000       * ................*
2A90      00000000 00000000 00000000 00000000       * ................*
2AA0      00000000 00000000 00000000 00000000       * ................*
2AB0      00000000 00000000 00000000 00000000       * ................*
2AC0      00000000 00000000 00000000 00000000       * ................*
2AD0      00000000 00000000 00000000 00000000       * ................*
2AE0      00000000 00000000 00000000 00000000       * ................*
2AF0      00000000 00000000 00000000 00000000       * ................*
F3=Exit        F4=Alter labels    F5=Refresh           F6=Display stack
F9=Pop stack   F10=Push stack     F11=Alter storage    F12=Cancel
```

Figure 14-7. An Example of an Allocate General Trace Table Display

Warning: Do not alter main storage data in the VLIC I/O configuration table. This could cause a machine check.

Function 55—Display Service Processor Log Buffer (SPLB):

This function uses subfunctions for viewing the log buffer (SPLB) information. Table 14-6 shows the SPLB information that you can view.

Use the Select key on the control panel to scroll through the displayed data.

Table 14-6. Service Process Log Buffer (SPLB) Status Information

Subfunction (Hex)	**Data (Length in Decimal)**
00	SRC word size (2 bytes)
00	Not used (2 bytes)
01-08	8 SRC words (1 word each)
09-1A	Reserved (18 words, 1 word each) **Note:** A **word** is 4 bytes or the amount of data that can be displayed on the control panel).
1B	Service processor program counter, first and second halfword (2 bytes each)
1C-3F	Reserved (36 words, 1 word each)

For 9406 System Unit, this LLD function is enabled only when the system stopped. Under normal conditions this function is not usually visible on the control panel. This function is visible when it has been enabled by the service processor; otherwise, it does not show up when you scroll through the functions. For 9404 System Unit and AS/400 9402 System Unit, when functions 50 through 53 and 70 are enabled, this function is only enabled after the stop occurs.

The service processor responds with 'FFFF ' on the 9406 System Unit and '20 FF' on the AS/400 9402 System Unit and 9404 System Unit (this function not enabled) when this function is selected on the control panel after functions 50 through 53 and 70 are enabled. See "Functions 25 and 26—Service Switches 1 and 2" on page 14-7 for more information about enabling this function.

Only when requested, record the data displayed and submit with your APAR.

Function 56—Display Service Processor Communications Area (SPCA):

This function uses subfunctions for viewing the SPCA data. Use the Select key on the control panel to scroll through the displayed data.

Note: Only when requested, record the data displayed and submit with your APAR.

For 9406 System Unit, this LLD function is enabled only when the system stopped. Under normal conditions this function is not usually visible on the control panel. This function is visible when it has been enabled by the service processor; otherwise, it does not show up when you scroll through the functions. For 9404 System Unit and AS/400 9402 System Unit, when functions 50 through 53 and 70 are enabled, this function is only enabled after the stop occurs.

The service processor responds with 'FFFF ' on the 9406 System Unit and '20 FF' on the AS/400 9402 System Unit and 9404 System Unit (this function not enabled) when this function is selected on the control panel after functions 50 through 53 and 70 are enabled. See "Functions 25 and 26—Service Switches 1 and 2" on page 14-7 for more information about enabling this function.

Figure 14-8 shows an example of a service processor communication area (SPCA) as shown on the control panel. The state flags show are far IMPI got into the IPL. The immediate status shows the state of IMPI hardware. The IMPI message save area contains the last message received from IMPI.

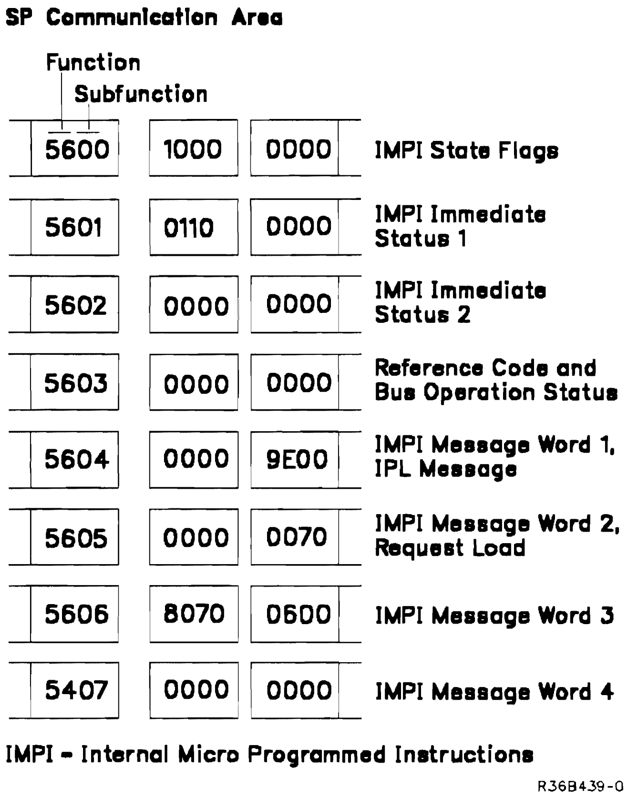


Figure 14-8. An Example of a Service Processor Communications Area

Table 14-7 shows the defines the bits of the service processor communications area as shown on the control panel.

Table 14-7. Bit Definitions of the Service Processor Communications Area (SPCA)

Word	Bit(s)	Contents			
0	0-31	*IMPI state flags:*			
		0	HLIC initialization complete		
		1	VLIC operational		
		2	HLIC stopped.		
		3	IMPI stopped		
		4-6	Reserved		
		7	IMPI in disabled state		
		8	Participant in bus timeout		
		9	Rejected message with invalid status		
		10	IMPI in error state		
		11	Error state signal working		
		12-15	Resets sent to IMPI		
		16	Panel function 51 valid		
		17	Main Storage Dump (MSD) failed		
		18	0 = Full MSD, 1 = Partial MSD		
		19-31	Reserved		
1	0-31	*Immediate status word 0:*			
		0	Bus master when timeout occurred		
		1	Bus slave when timeout occurred		
		2	Bus slave when timeout occurred		
		3	Acknowledge Bus Poll Out (ABPO)		
		4	Synchronous check		
		5	Bus unit check		
		6	Parity check		
		7	Acknowledge		
		8	Not used		
		9	Loaded		
		10	Not used		
		11	Suspended		
		12	Not used		
		13-15	Line length		
		16-31	Reserved		
2	0-31	*Immediate status 1 - FRU_data*			
		0	*The following:*		
			0	*One FRU*	
			1	*FRU ID follows*	
		1	*The following:*		
			0	*FRU ID invalid*	
			1	*FRU ID valid*	
		2-7	*FRU isolation data*		
		8-31	*Reserved*		
3	0-15	Return code from last bus op			
	16-31	Reserved			
4		Bus status			
		0	Data end		
		1	Invalid command		
		2	Buffer not available or invalid storage address		
		3	Unit check		
		4	Not ready		
		5	Line length check		
		6-31	Reserved		
5-8		IMPI message save area			
9-21		Service Processor related data			

Function 57—Display IPL Message (IMSG) Area: This function uses subfunctions for viewing the IMSG. Use the Select key on the control panel to scroll through the displayed data.

Note: Only when requested, record the data displayed and submit with your APAR.

For 9406 System Unit, this LLD function is enabled only when the system stopped. Under normal conditions this function is not usually visible on the control panel. This function is visible when it has been enabled by the service processor; otherwise, it does not show up when you scroll through the functions. For 9404 System Unit and AS/400 9402 System Unit, when functions 50 through 53 and 70 are enabled, this function is only enabled after the stop occurs.

The service processor responds with 'FFFF ' on the 9406 System Unit and '20 FF' on the AS/400 9402 System Unit and 9404 System Unit (this function not enabled) when this function is selected on the control panel after functions 50 through 53 and 70 are enabled. See "Functions 25 and 26—Service Switches 1 and 2" on page 14-7 for more information about enabling this function.

Figure 14-9 shows an example of an IPL message save area as shown on the control panel. The messages that are saved in the IPL message save area are either asychronous error report (AERs), IPL messages with invalid status, or invalid/unexpected messages. The most likely message is the AER.

The following describes the data displayed in the SRC of function 57:

aa This is the origin address. Its an assigned address and may be used as an index into the configuration table. The configuation table entry contains the direct select address (bbcb) from which you can determine which card is being implicated.

bb This is the bus command. It is either a 9C service command, a 9E IPL command, or invalid.

sscc This is the second word of the message. It contains the status and subcommand. If the subcommand is an AER (71), ignore the status and look for the reference code in the fourth word. Otherwise a nonzero status tells why the message failed. In any case, locate the configuration table entry as described above and look at the status flags and bus status or immediate status fields for that entry for addition information.

xxxx This is the third word of the message. It may contain data specific to the subcommand and may be requested.

rrrr This is the fourth word of the message. It contains the reference code. To make any sense of the reference code you need to determine the card type to determine where to look-up the reference code in the service quide. This is accomplished by using the origin address as described above and locating the configuration table entry and finding the direct select address of the card. From the direct select address and the service quide for your system you should be able determine what slot the card is in on the 5021 or 5030 card unit. Labels on the card or your hard copy configuration data should identify the card type.

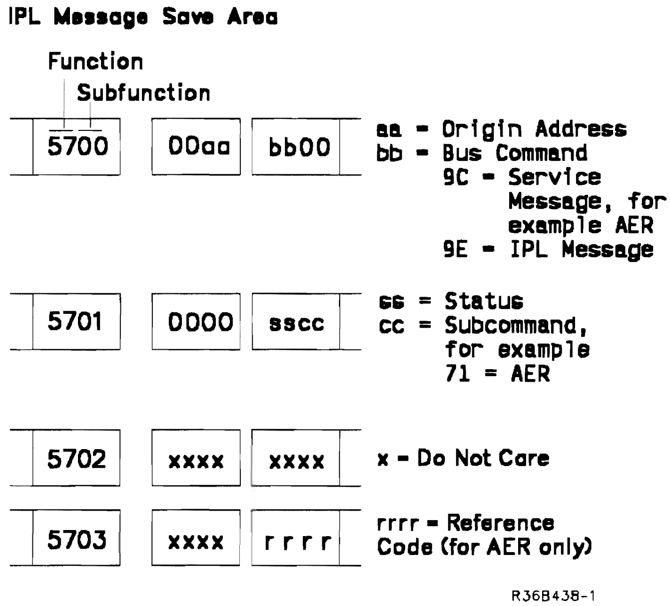


Figure 14-9. An Example of an IPL Message Save Area

Function 58—Display IPL Parameters Area (IPARMS): This function uses subfunctions for viewing the IPARMS data. Use the Select key on the control panel to scroll through the displayed data.

Note: Only when requested, record the data displayed and submit with your APAR.

For 9406 System Unit, this LLD function is enabled only when the system stopped. Under normal conditions this function is not usually visible on the control panel. This function is visible when it has been enabled by the service processor; otherwise, it does not show up when you scroll through the functions. For 9404 System Unit and AS/400 9402 System Unit, when functions 50 through 53 and 70 are enabled, this function is only enabled after the stop occurs.

The service processor responds with 'FFFF ' on the 9406 System Unit and '20 FF' on the AS/400 9402 System Unit and 9404 System Unit (this function not enabled) when this function is selected on the control panel after functions 50 through 53 and 70 are enabled. See "Functions 25 and 26—Service Switches 1 and 2" on page 14-7 for more information about enabling this function.

Displays

The two displays on the control panel are:

- Function
- Data

For the 9406 System Unit and 9404 System Unit, the Function display appears to the left of the Data display. For the AS/400 9402 System Unit, the Function and Data display is combined. Press the Function key until the desired function is displayed. Press the Enter switch to display the data for the function. Continue to press the Enter switch to toggle between the function and data. Press the Select switch to advance to the next function.

Function Display

The Function display consists of four 5 by 7 dot matrix characters that are illuminated with ultra-green backlighting. Function numbers 01 through 99, which are selected using the Select switch, are displayed in the left 2 character positions.

When the subfunction mode is requested, the additional 2 characters on the right are used to display the hexadecimal subfunction location. These character positions are blank when the control panel is not displaying subfunctions.

Data Display

The Data display consists of eight 5 by 7 dot matrix characters that are illuminated with ultra-green backlighting. The Data display is capable of displaying eight hexadecimal characters for system reference codes (SRC) or other pertinent system information.

The Data display clears whenever the Select switch is pressed or a different function shown on the Function display. (The AS/400 9402 System Unit displays the function number and clears the rest of the display.) This avoids displaying invalid data for the function number being displayed. Once the Enter switch is pressed, the Data display is used again to display data.

Switches

The switches on or near the control panel are:

- Emergency Power Off (This switch is on the rack.)
- Power
- Unit Emergency
- Keylock
- Select
- Enter

Emergency Power Off Switch

The rack Emergency Power Off (EPO) switches are in series so that switching any one off turns all of the racks off. All EPO switches should be turned on before beginning an IPL of the system.

Power Switch

The manual Power switch can be placed in the Power On position to start the system or the Delayed Off position to stop the system. The Power On switch and one Delayed Off switch are two separate switches on the AS/400 9402 System Unit.

Note: Normally, you should use the Power Down System (PWRDWNSYS) command to stop the system. If you use the Power switch to turn off your system, an error may occur with your data files. For more information about stopping the system and using the PWRDWNSYS command, see page 14-21 and the *Operator's Guide*.

If you have a 9406 System Unit and the Keylock switch is in the Manual or Normal position, the system unit and the racks, if attached, do an IPL when the Power switch is moved to the On position. Similarly, if the Keylock switch is in the Manual position when the Power switch is moved to the Delayed Off position, the system unit and racks, if attached, turn off.

Note: If there is a power failure, the 9406 System Unit and the racks also turn off.

If you have a 9404 System Unit or AS/400 9402 System Unit and the Keylock switch is in the Manual or Normal position, the system unit and the Expansion Unit (for 9404 System Unit only), if attached, do an IPL when the Power switch is moved to the On position. Similarly, if the Keylock switch is in the Manual position when the Power switch is moved to the Delayed Off position, the system unit and Expansion Unit, if attached, turn off.

Note: If there is a power failure, the 9404 System Unit and AS/400 9402 System Unit turn off along with any diskette or tape unit contained in the 9404 or 9402 and the Expansion Unit, if one is attached.

Unit Emergency Switch

Warning: If you use the Power switch to turn off the system, data files may have unpredictable results.

The Unit Emergency switch is provided only for unit emergency power off (UEPO) and is not intended for use as a power on or off switch. This switch has priority over all other controls. The rack UEPO switch controls AC power to all devices in the rack. In a multiple rack configuration, each rack has a UEPO switch. However, the rack UEPO switches are in series such that turning any one of them off powers down all of the racks. More specifically, on the 9404 System Unit, this switch controls the power to all units and devices attached to or contained in the system unit.

On the 9404 System Unit and AS/400 9402 System Unit, this switch controls the power to the system unit and the Expansion Unit (for 9404 System Unit only), if one is attached. The Expansion Unit also has a Unit Emergency switch (located in the same relative position as the switch on the system unit), which controls the power to the Expansion Unit only.

Keylock Switch

A Keylock switch is provided on the control panel to give the operator security control over the functions which may be activated or deactivated from the control panel and control over data which may be accessed from the control panel.

The Keylock switch has four positions: secure, manual, normal, and auto (automatic operation). The key can be moved clockwise or counter clockwise; there are no stops.

The key may be removed or inserted in any of the four positions, and the key must be used to change the lock from one position to another.

Display of selected IPL, lamp test, and SRC information (if available) is possible in all positions of the Keylock switch. You can stop the system by using the PWRDWNSYS command when the Keylock switch is in any position.

Keylock Switch Positions: Table 14-8 on page 14-19 shows the functions that are available for each of the four positions. The following information explains the figure and describes the four positions:

Position **Description**

Manual This position of the Keylock switch allows all manual IPLs, and all manual power control functions. An operator attending an IPL from disk or tape is an example of a manual IPL. Selecting an IPL or displaying the kind of IPL the system is set to run is an example of a manual power control function. Automatic power control functions, with the exception of Delayed Power-Off, are inhibited in the Manual position. Some automatic operations that you cannot do are:

- Starting a remote system by using a remote initial program load (remote IPL)
- Starting this system on a specific time and day by using a timed initial program load (timed IPL)
- Restarting this system automatically (if it should turn off abnormally as a result of a power failure) by using an automatic initial program load (automatic IPL)

If the Keylock switch is in the Manual position, you can power off the system by moving the Power switch down to the Delayed Off position. (On the AS/400 9402 System Unit, press the Power Off switch.) Notice that the Power switch moves back to the center position when you release the switch.

Note: To prevent accidentally moving the Power switch to the delayed off position and cause the system to stop, return the Keylock switch to the Normal position (or to the Secure or Auto position if one of these positions was the original position) after you are done using the Manual position.

Normal This position of the Keylock switch allows Manual Power-On and each of the *automatic operations* as shown in Table 14-8 on page 14-19. Delayed Off, IPL method selection, and Start IPL are not allowed. When the Keylock switch is in the Normal position, you can start the system:

- By moving the Power switch up to the Power On position
- By using a remote initial program load (remote IPL) to start a remote system
- On a specific time and day using a timed initial program load (timed IPL)
- By using an automatic initial program load (automatic IPL) to start the system when an abnormal power down sequence has occurred

More specifically, when the Keylock switch is in the Normal position, you cannot:

- Stop the system by moving the Power switch to the Delayed Off position

  You can only stop the system by using the Power Down System (PWRDWNSYS) command for program control from a display station.
- Select a different IPL method using the Select switch
- Start an IPL

Auto The Auto position of the Keylock switch allows for automatic operations. The automatic operations are remote power-on, processor power-on, and program power-off. Manual power-on or delayed off, IPL method selection, and start IPL are not allowed in this position.

More specifically, when the Keylock switch is in the Auto position, you can:

- Starting a remote system using a remote initial program load (remote IPL)
- Starting your system on a specific day and time using a timed initial program load (timed IPL)
- Automatically starting your system using an automatic initial program load (automatic IPL) when an abnormal power down sequence occurs

When the Keylock switch is in the Auto position, you cannot:

- Start an IPL
- Start the system by moving the Power switch to the Power On position
- Stop the system by moving the Power switch to the Delayed Off position
- Select a different IPL method using the Select switch.

Secure This position of the Keylock switch inhibits all functions provided by the control panel. The Secure position locks the control panel on the system unit. You can only stop the system by using the PWRDWNSYS command from a display station.

| **Note:** The PWRDWNSYS *IMMED command is not affected by the Keylock switch.

Table 14-8. Keylock Positions for Manual and Automatic Operations

Operation or Function	Manual Keylock Switch Position	Normal Keylock Switch Position	Auto Keylock Switch Position	Secure Keylock Switch Position
Manual Operations				
Manual power-on or turn on system	Allowed	Allowed	Not allowed	Not allowed
Delayed off	Allowed	Not allowed	Not allowed	Not allowed
Display IPL selection	Allowed	Allowed	Allowed	Allowed
Display SRC	Allowed	Allowed	Allowed	Allowed
Functions 12 through 19	Allowed	Allowed	Allowed	Allowed
Functions 20 through 99	Allowed	Not allowed	Not allowed	Not allowed
Lamp test	Allowed	Allowed	Allowed	Allowed
Select IPL	Allowed	Not allowed	Not allowed	Not allowed
Start IPL	Allowed	Not allowed	Not allowed	Not allowed
Automatic Operations				
Remote power-on or IPL	Not allowed	Program control allowed	Program control allowed	Not allowed
Service processor power-on • Timed power-on or IPL • Automatic power restart	Not allowed	Program control allowed	Program control allowed	Not allowed
Program power-off using the PWRDWNSYS command	Program control allowed	Program control allowed	Program control allowed	Program control allowed

Note: If the position of the Keylock switch is changed when the system power is on, the system remains on. If the system power is off when the position of the Keylock switch is changed, system power may be turned on if the processor or remote power-on function is active and the Keylock switch is moved to either the Normal or Auto positions.

Safely Use the Keylock Switch for Servicing System: Set the Keylock switch to the Manual or Secure position to prevent an unexpected power on from happening when servicing the system. If you do not, the system may power on without warning when the Keylock switch is set to the Normal or Auto position. The system may power on without warning when the Keylock switch is set to the Normal or Auto position because of:

- A timed power on
- A remote power on
- The automatic restart function causes the system to power on when ac power is restored, if the system powered off abnormally. An abnormal power off can include but is not limited to:
  - A power failure.
  - Setting the mainline circuit breaker CB1 to the Off position
  - Disconnecting the main ac power cable.

Select Switch

| The AS/400 9402 System Unit Select switch is different from the 9406 System Unit and 9404 System Unit Select switches.

| **The Select Switch on the AS/400 9402 System Unit:** The Select switch is a dark grey push button switch. The switch can be used to increment the number indicated in the Function field. Only those numbers of functions which can be performed with the present keylock position are displayed.

| This switch has a typomatic function. When the switch is first pressed, the Function field is incremented to the next enabled function or subfunction. If the switch is held in the

same position for 400 to 440 milliseconds, the Function field is incremented to the next enabled function number or subfunction. If the switch is held longer, the Function field is incremented to the next enabled function number or numbers at a rate of one per every 180 to 210 milliseconds. After the maximum enabled function is reached, the display wraps around and displays the minimum enabled function.

The Select switch is also used to change the subfunction displayed in the Function field. When a function number appears with a subfunction, press the Enter switch. Two asterisks (**) appear with the function. Use the Select switch to scroll through the subfunctions. To exit the subfunctions, press the Enter switch when the display with the two asterisks appears again. For an example of a function that has a subfunction, see "Function 51 – IMPI Status" on page 14-9.

The service processor controls the maximum range of a subfunction. If the maximum specified is 4 and the function is 51 then the display can be scrolled with the Select key displaying 51**, 5100, 5102, 5104, 51**, 5100 through 51**, and so on.

The selected function or subfunction is acted on or sent to the service processor after you press the Enter switch.

The Select Switch on the 9404 System Unit and 9406 System Unit: The Select switch is a three position momentary contact switch with center null. The switch rocker arm is dark gray. The switch can be used to increase or decrease the number indicated in the Function display. Only those numbers of functions that can be done in the present position of the Keylock switch are displayed.

When the maximum or minimum enabled function is reached, the display wraps around and displays the minimum or maximum enabled function when the select switch is pressed.

The Select switch is also used to change the subfunction location displayed in the Function display.

The Select switch has a typomatic function. When the switch is first pressed, the function number in the Function display is increased or decreased to the next enabled function or subfunction location. If the switch is held in the same position before releasing, the Function display continues to increase or decrease to the next enabled function number or subfunction location.

When the Select switch is pressed, the Data display is cleared. The Select switch can be used to change the data shown in the Data display when you are selecting an IPL function.

Notes:

1. Only the numbers of those functions that can be done in the present position of the Keylock switch are displayed.
2. When the Function display has reached its maximum function number and the Select switch is pressed again, the next number shown is the minimum function number. Similarly, when the Function display has reached its minimum function number and the Select switch is pressed again, the next number shown is the maximum function number.
3. The selected function or subfunction is not sent to the service processor until the Enter switch is pressed.

Enter Switch

The AS/400 9402 System Unit Enter switch is different from the 9406 System Unit and 9404 System Unit Enter switches.

The Enter Switch for the AS/400 9402 System Unit:
The Enter switch is a dark grey push button switch. The function number or subfunction selected with the Select switch is acted on or sent to the service processor when you press the Enter switch.

For most functions, when the Enter switch is pressed the Function/Data display toggles back and forth between the function number and the data associated with the function number.

If the Enter switch is pressed after a function is selected, one of the following occurs:

- The requested data is displayed in the Function/Data display
- The control panel enters subfunction mode

  See "Function 51 – IMPI Status" on page 14-9 for an example of a function code that has a subfunction. The function field is updated to display the selected function and two asterisks (**).
- If the function shown is function 2 then the *select IPL type* mode begins. Press the Select switch to scroll through the valid IPL modes. Press the Enter switch again. This saves the IPL type for the next IPL.

If the control panel was in subfunction mode and the Enter switch is pressed, one of the following occurs:

- The requested data is displayed in the Function/Data display
- If the function and ** are displayed, the control panel exits the subfunction mode and only the function number is displayed.

The Enter Switch for the 9406 System Unit and 9404 System Unit: The Enter switch is a white single pole, single throw pushbutton switch. The function number or subfunction location selected with the Select switch is acted on and/or initiated when the Enter switch is pressed.

If the function shown is function 2 then the *select IPL type* mode begins. Press the Select switch to scroll through the valid IPL modes. Press the Enter switch again. This saves the IPL type for the next IPL.

Lights, Indicators, or LEDs

The three light emitting diodes (LEDs) on the control panel are:

- Power On
- Processor Active (Run Light)
- System Attention (Attention Light)

Power On LED

This green light is lit when the system unit power supply is on and providing power to the system unit.

Notes:

1. For the 9406 System Unit, this light blinks when the system is being turned off.
2. For the AS/400 9402 System Unit and 9404 System Unit, this light blinks when the system is being started up or turned off.

Processor Active LED (Run Light)

This green light is lit when the IMPI processor is not waiting. It blinks when programs are running.

System Attention LED (Attention Light)

This light is lit whenever a system error or user attention or intervention is needed by the service processor, VLIC, or the control panel licensed internal code.

Controlling System Power

The control panel is the focal point for controlling power on the system. When the Power On switch is pressed and the Keylock switch is in Manual or Normal position, the panel processor powers on the processing unit. It then turns control over to the rack power controller which powers on the remaining devices in the primary rack. After the primary rack is powered on, the secondary racks are powered on in sequential order.

The control panel is powered by the control supply located in the processing unit power supply.

The battery located at the control panel is used to provide power to battery-backed circuits on the control panel and on the service processor time-of-day clock during an ac outage.

On the 9406 System Unit and 9404 System Unit the battery is a nickel-cadmium rechargeable assembly. The charger circuit is located in the processing unit power supply. On the AS/400 9402 System Unit the battery pack consists of three 1.5 volt disposable batteries.

Power On Methods

The power on methods are as follows:

- Manual (using the Power On switch)
- Modem ring indicator (or remote power on)
- Service processor power on (timed or automatic power restart)
- Power down with automatic restart

For more information about an IPL, see Chapter 18.

Manual Power-On: Manual power-on allows an operator to power the system on using the Power On switch on the control panel. The Manual Power-On powers on the system when the Keylock switch is in the Manual or Normal position.

For the 9406 System Unit and 9404 System Unit, the Power switch is a three position momentary contact switch with center null. For the AS/400 9402 System Unit, the Power switch is a push button switch. The color of the switch bat handle is white. When the Power switch is pressed to the On position, the panel powers on the processing unit. It then turns control over to the Rack Power Controller which powers on the remaining devices within the primary rack. After the primary rack is powered on, the secondary racks are powered on in sequential order.

The Rack Ready LED blinks to indicate a rack is being powered on. When rack power is complete, the Rack Ready LED is on without blinking.

The Rack Power LED is on when the system is on and is off when the system is off.

Remote Power-On: The Remote Power-On allows an external signal to initiate a system power on. This function must be enabled and the Keylock switch must be in the Normal or Auto position to power on the system by this means.

An example of a possible Remote Power-On is a ring indicator signal in a communications modem interface (pin 22 of an RS 232 connector).

The active level of this signal must be a positive voltage between +3V and +15V.

A remote power on requires:

- A modem connected to the panel using a special cable,
- The system to tell the panel to enable the function
- For the AS/400 9402 System Unit and 9404 System Unit, the remote power on is a ring indicator signal from the modem that is also used for the ECS connection.

Service Processor Power-On: The service processor has the capability to initiate a system power on provided that the Keylock switch is in the Auto or Normal position. With power off, the service processor can initiate a power on at a specified time. The control panel battery provides battery-backed power to a real time clock located on the service processor. The IPL method last selected (using function 2 on the control panel) is used to IPL the system when the system is powered on.

Processor Power-On is inhibited by the control panel if a battery failure is detected after AC power has been lost and then restored (temporary loss of all power to real time clock).

Note: The Remote Power-On is inhibited if either a Power Supply failure condition exists or if an uninterruptible power supply (UPS) utility failure signal is active. Only Manual Power-On can be attempted under these circumstances.

A timed power on requires the system to set a date and time to power on. This data is passed to the Service Processor which sets a time-of-day (TOD) comparitor. When the comparitor equals the TOD, a signal is sent to the panel. The panel then powers up the system.

Power Off Methods

Review how to safely use the Keylock switch on page 14-19. The power off methods are as follows:

- Delayed Off
- Program power-off

Delayed Off: The Delayed Off switch on the control panel allows an operator to power the system off. Delayed Off powers the system off only when the Keylock switch is in the Manual position.

The system powers off immediately if any one of the following condition exists:

- The control panel cannot communicate with the service processor (SRC 11 0000 CCCC).
- Machine check interrupt (SRC 11 F000 0000).
- IPL timeout (SRC 11 0000 EEEE).

If none of these conditions exist, the control panel sends a message to the service processor informing it of the Delayed Off request. The Power On LED starts to blink as soon as the Delayed Off command is accepted at the control panel. Once the service processor has been informed of this condition, the control panel waits for a Program Power-Off message from the service processor to power off the system.

When the service processor receives the Delayed Off message from the control panel, the service processor attempts to inform VLIC of the manual power-off attempt. The Service processor then gives VLIC some time to send the Program Power-Off message. The system then stops in one of the following ways:

- VLIC sends the Program Power-Off message before the time limit expires and the system powers off successfully.
- The service processor times-out waiting for the Program Power-Off message and the service processor forces a main storage dump of IMPI to help isolate the problem. The system powers off after completing a main storage dump.
- VLIC machine checks while attempting to shut down the system and the system powers off.

  Note: VLIC may have invoked a main storage dump of IMPI following the machine check. The system powers off after the main storage dump of IMPI completes. See "Main Storage Dump" on page 16-1 to determine if a main storage dump of IMPI was done.

If the Delayed Off message does not complete successfully, an abnormally long IPL is needed to recover from the abnormal end.

When the Delayed Off message is received, the panel powers off the processing unit (Power On LED goes off) and sends a power off request to the Rack Power Controller.

Only on the 9406 System Unit, the rack Ready LED blinks for 40 seconds to indicate that the rack or racks are being powered off. The rack Ready LED goes off when rack power off is complete.

Note: No keystrokes are accepted at the control panel after the the Delayed Off is initiated, until the rack Ready LED goes off when rack power off is complete.

Program Power-Off: Program Power-Off is initiated by the operating system using the Power Down System (PWRDWNSYS) command. The service processor sends a message to the control panel which, in turn, signals the power supply to turn off.

Using the Control Panel to IPL the System

The following information describes how to get your system operational before and during power-on, and for normal and abnormal shutdowns. For more information about system start and stop problems, see page 3-18. **Review how to safely use the Keylock switch on page 14-19** . Also, for more information about an IPL, see Chapter 18.

Before Power-On

1. Examine the devices in the system rack or racks. The emergency power off (EPO) switches should be on. The power switches on the DASD units, tape drives and diskette drives should all be on.
2. Power on the system console and alternate console work stations attached to the system. The system console is attached to port 0 with switch setting 0 on the first work station controller. The first alternative console is attached to port 1 with switch setting 0 on the first work station controller. The second alternative console is attached to port 0 with a switch setting of 0 on the second work station controller.
3. Look at the processor's control panel:
   a. The Keylock switch should be in the Normal position.
   b. Select function 1 on the control panel (if not already selected). A letter appears in the data field. This is the IPL type. This value should be either A or B. To change this value:
      1) Move the Keylock switch to the Manual position.
      2) Select function 2 and press the Enter switch.
      3) Using the Select switch, select the desired IPL type and press the Enter switch.
      4) Select function 1 and press the Enter switch to confirm your selection.
      5) Move the Keylock switch to the Normal position.
   c. Use the Power On switch to power on the system.

During Power-On

After powering on the system, several things should happen:

- The control panel should begin displaying status SRCs for function 11.
- The rack should begin its power-on sequence. When the rack Ready LED stops flashing, the devices in the rack have successfully powered on. The next rack also begins to power on.

Watch for the following warning signs during this phase:

- The System Attention LED comes on and stays on.

  If the SRC displayed is 6110-0A00, the DASD subsystem failed. If the SRC displayed is B100-1800, the system did not find its load source. Insure that the storage device containing the load source is cabled properly to the first storage controller and that its switch setting is 0. Also, if the unit does not have continuous processor power, make sure that the storage device is powered on after you power on the processor.
- SRCs stop changing for at least 30 seconds except when the SRC C100 1004 remains on the control panel display longer than 2 minutes. This indicates that IPL is waiting for all racks to power on. Ensure that all racks have power and try the IPL again.

The DST main menu should appear on the system console. To complete the IPL process, select: the *Perform an IPL* from the DST main menu.

You can ignore the subsequent information shown on the work station. If the last system shut down was abnormal, watch for the following warning signs during this phase:

- The System Attention LED comes on and stays on.
- The Processor Active LED stays completely on or off for at least 1 minute and the SRC display does not change.

If everything goes well, a Sign On display should appear on the console work station. Sign on the system and correct the system's date and time. Do not change the other values. Press the Enter key. Again, if the last system shut down was abnormal, it may be a while before any console display appears.

Normal Shutdown or Power-Off

This section describes how to power down your machine. With the proper authority and from any work station, enter the following commands:

1. ENDSBS *ALL *IMMED

   If anyone other than yourself was signed on to the system, their job is ended. However, the system first displays a message on their work station and waits for about 30 seconds.

   This step is complete when the message, `System terminated to restricted state`, appears on the QSYSOPR message queue. Use the command DSPMSG QSYSOPR to display this message queue.
2. PWRDWNSYS *IMMED

   This command powers down the processor unit. The process takes between 30 to 45 seconds. When the Power-On LED goes off, this step is complete.
3. Only for the 9406, wait for the rest of the devices on the system to power off. This takes about 40 seconds. To IPL the system again, see "Before Power-On."

Abnormal Shutdown or Power-Off

Note: The following steps should not be used to fix a problem with your system. You should power off only after performing all of the possible problem analysis procedures.

Control Panel

If the system cannot be powered off normally, do the following:

1. Set the Keylock switch to the Manual position.
2. Select function 21 on the control panel and press the Enter switch. The DST Sign On display appears.
3. Try to execute the following steps. If the work station does not respond, go to step 4.
   a. Select the *Start a service tool* option
   b. Select the *Power off the system* option
   c. Press the Enter key. A confirmation that the system is powered off is displayed.
   d. Press F11 to power off the system.

   Watch the Processor Active LED on the control panel. It flashes for about 60 seconds and then stays completely off. When the LED stays off, set the Keylock switch to Normal position. If the system power offs, the next steps are not necessary.
4. Turn the Keylock switch to the Manual position.
5. Press the Delayed Power-Off switch on the control panel.
6. Turn the Keylock switch to the Normal position.
7. Wait for the rest of the devices on the system to power off. This takes about 40 seconds. To IPL the system again, see "Before Power-On" on page 14-23.

Control Panel

Part 4. AS/400 Logs, Dumps, and Traces

Logs

Chapter 15. System Logs

The system logs described in this chapter are as follows:

Table 15-1. An Overview of How and When to Use System Logs

Log Name or Type	How to Obtain	Use For
Error log, see page 15-1	PRTERRLOG Work with error log option of SST or DST	• Hard stops • Incorrect output • Messages
Job log, see page 15-5	DSPLOG (QSYSVAR,job)	• Communications problems • Incorrect output • Job loops • Job waits
History log, see page 15-8	DSPLOG QHST	• Incorrect output • Messages • Job loops • Job waits
Message log	DSPMSG QSYSOPR	• Incorrect output • Job loops • Job waits
Problem log, see page 15-10	WRKPRB	• Incorrect output • Messages
VLIC log (VLOG), see "Work with Vertical Licensed Internal Code (VLIC) Log" on page 12-46 and Chapter 31	PRTINTDTA Work with VLOGs option of SST or DST	• Hard stops • Incorrect output • Jop loops • Job waits • Messages • System loops • System waits

Error Log

To compare the error and problem logs, see page 15-14.

The error log is used by the VLIC input or output routines to record input or output device hardware errors, licensed internal code tracking errors, and hardware-detected machine checks. The error log may be useful in determining the causes of intermittent errors.

The error log is a informational and statistical database for logging captured first failure data. This information is used to create entries in the problem log. If online problem analysis and resolution and software documenatation fail to isolate and resolve a problem, you can use the error log to obtain the history of an error.

The error log is divided into separate logs for different types of subsystems and VLIC components. These logs for the different components and subsystems are:

- Communication subsystems (all error notifications)
- Storage subsystems (all error notifications except for volume statistical data)
- Work station subsystems (all error notifications)
- Processor (VLIC components)
- Discrete volume statistics (error notifications from storage subsystems with volume statistical data)
- Log information traces, performance data from any subsystem or service processor, and/or software tracking records
- Dumps with large records mostly from the IOPs (For more information about printing large error log entries see 15-4.)

A 64K byte shadow log of the error log is maintained by VLIC on the load source DASD. The shadow log contains a duplicate copy of the most recent errors. The *Work with error log option* under DST uses the shadow log when an IPL to DST is performed.

The size of each log (except the shadow log under DST) can be adjusted. Either the system operator or the service representative can access the entries in the error log from the *Work with error log* option on the DST or SST main menus.

See the "Work with Error Log" on page 12-3 on how to use the error log.

Location of Error Log Data

The system reserves space for various kinds of error information. The following table shows the virtual address (segment identifier or SID) location and the type of data stored there.

Virtual Address	Type of Data Stored
0000 2600 0000	Processor related error log entries
0000 2700 0000	Local work station related error log entries
0000 2800 0000	Storage (disk, tape, and diskette) related error log entries
0000 2900 0000	Communications related error log entries
0000 2A00 0000	Dumps, traces, and tracking information
0000 2B00 0000	Index over other error log segments
0000 5100 0000	Discrete volume statistics for tape and diskette (session entries)
0000 5A00 0000	Dumps with large records
0000 8300 0000	Shadow error log entries viewable in limited paging environment before error log initialization (64K maximum size)

Logs

Error Logging

Errors are logged by VLIC. VLIC components send error records to the error log. The error records are logged by the VLIC I/O managers (IOMs) and components such as the common class I/O manager (CCIOM), machine check handler, and others.

Input or output processors (IOPs), such as the storage device controller, also send error data to the system to be logged in the error log. The error data from the IOPs is handled by the RAS focal point CCIOM task in VLIC.

The following list describes the kind of error data that is logged:

- Permanent errors that do not stop the system
- Machine check data when available on the next IPL (if power was not turned off before the next IPL)
- Any temporary errors necessary for problem determination
- Some dump and trace data
- Volume statistical data records
- Licensed internal code tracking errors
- Inter-process communications facility (IPCF) error information and bus level asynchronous error reports (AERs)

The error log entries consist of header information and device specific information. The header information is used to catalog the error log entry, and to identify the component or device reporting the error. The component specific information identifies the problem being reported. This information is independent for each device or component that logs errors.

Note: Currently, the component specific information starts at offset 128 or hex 80 in each individual error log entry.

The reference code and reference code translate table ID are used to search a system table for a short textual description of the error when the error log entry is displayed using the Work with Error Log option of DST or SST. If an error is logged without this information, no description is available. The error log entry is primarily used for tracking or provides information about an event.

Briefly, the error data appears in the following format:

- Asynchronous error report (AER).

  This is a *bus level* record that is used when the IOP has detected a critical failure. AERs are used when the IOP cannot communicate with VLIC or the service processor using IPCF.

  The format of the error data fields is as follows:

Number of Bytes	Description
1	Length of record
2	Control bytes
2	IOP/IOA type number
2	IOP/IOA level or model
2	IOP/IOA reference code
2	IOP direct select address
2	Unit address
2	Outboard unit type
2	Outboard unit level model code
2	Outboard unit reference code
4	Serial number
4	Unit specific data
var	Reserved

  These error data fields are appended to the error log record and logged by CCIOM.

- Error notification record (EN).

  This is an *error* record that is reported to the system from the IOP after the inter-process communications facility (IPCF) connections are established. This error data is available in the hex dumps. The hex dumps are available using the *Work with Error Log* option under SST and DST.

  The format of the error data fields is as follows:

Number of Bytes	Description
8	Detector
8	Reserved
N	Reference code data
N	Configuration data
N	Additional data
N	Associated data

- Log information record (LI).

  This is an *informational* record reported to the system after the IPCF connections are established. Software tracking records, dumps, and so on are logged using the LI format.

  The format of the performance data is as follows:

Byte(s)	Description
0-3	Error log ID
4-6	Reserved
7	Local name type
8-15	Local name
16-31	Reserved
32-N	Counter data

  The format of the dump data is as follows:

Byte(s)	Description
0-3	Error log ID
4	Dump session ID (DSID)
5-6	Reserved
7	Local name type
8-15	Local name
16-31	Reserved
32-N	Dump data

  The format of the trace data is as follows:

Logs

Byte(s)	Description
0-3	Error log ID
4	Trace session ID (TSID)
5	Trace data type
6	Reserved
7	Local name type
8-15	Local name
16-31	Reserved
32-N	Trace data

CCIOM routes the asynchronous error report (AER), error notification (EN) record, and log information (LI) record data from the RAS focal point to the error log. A formatted version of the error log records is available by using the Print Error Log (PRTERRLOG) command or by selecting the *Work with error log* option from the DST or SST main menus. See the "Work with Error Log" on page 12-3 and the applicable *Service Guide* on how to use and interpret the error log.

Error Log Resource Names and Addresses

If the error log records do not contain object names, the *Work with error log* option uses default generic names to help clarify what resource the entry refers to as logged by the unit address.

These generic names are summarized below:

Subsystem	Possible Names Used
Processor	IOP or SYSTEM
Magnetic media	IOP, CNTL, or DEVICE
Local work station	IOP, PORT, or DEVICE
Communications	IOP, IOA, or PORT

For example, if an error is logged with a unit address of 01FF in the magnetic media subsystem and no object name was specified in the log entry the *Work with error log* option puts CNTL in the resource field.

Ways to Look at Error Log Data

Table 15-2 on page 15-4 shows various ways to look for error log data.

Entries made to the log are created by hardware devices and their underlying support mechanisms that track actual or potential problems. The log entries are to capture all the data at the time of failure. The system collects and stores the data. The paging environment this is done in is very important. The following describes how the log is processed in the different paging environments.

- Nonpaging environment:

  The logs cannot be accessed in this environment because they are in virtual storage and cannot be paged in or out. The hardware must save any new log entries until the paging environment becomes active. The IOPs usually activate the paging environment.

- Limited paging environment:

  When the limited paging environment is reached, the IOPs send their log entries to the system to handle. A VLIC component gets control of the error log after the limited paging environment is established. The component moves all the logs from the IOPs into an error log of the limited paging environment. Every error that comes from a hardware unit is initially put into the log. This log is the only one available to DST in the limited paging environment. This log is commonly referred to as the shadow log.

  Error log entries can get lost if the limited paging environment is not reached.

- Full paging environment:

  When the full paging environment is reached, the error log component in VLIC checks every entry of the error log in the limited paging environment (or shadow log) and moves any new ones into the error log of the full paging environment. This error log is referred to as the real error log. Then, as each new error log is collected it is placed into both the shadow and the real error logs.

  The shadow error log is 64K bytes long and it wraps. This wrapping can cause entries to be lost, both real and imaginary. Real losses can happen when you stay in limited paging environment for an extended period. This loses the error log entries whose combine length exceeds 64K. Imaginary losses are those that appear in the real error log, but have been wrapped outside of the shadow error log.

For more information about environments, see "Paging Environment of the AS/400" on page 18-4.

Logs

Table 15-2. Various Ways to Look for Error Log Data

Machine State	Use	Specific Option or Command	The Option or Command is Used For
OS/400 licensed program is operational.	SST	*Work with error log* option	Viewing or printing the contents of the error log.
		Print Error Log (PRTERRLOG) command	Printing error log reports. This command can be put into a CL program to generate daily, weekly, and other reports.
		Work with Problem Log (WRKPRB) command	Finding a single error to determine the failing conditions that are at fault.
		Do a test request (error recording and print, ERAP) by depressing the Command and Backspace keys on a local or remote work station from the Sign-on display.	Viewing or printing controller and work station errors. Use the 52XX or 329X service manual (for example, *IBM 5291 Display Station Maintenance Library*, SY31-0661) that comes with the display for information on ERAP).
OS/400 licensed program is not operational.	DST	Work with error log	Viewing or printing the contents of the shadow log at virtual address or SID 0000 8300 0000. Only the most recent errors (including those logged during IPL) are available until a full IPL is completed. For more information about this option under DST, see "Start a Service Tool" on page 13-21.

Printing Large Error Log Entries

Unless you chose to print the data by error log ID, all printing and displaying of error log information is truncated to 4800 bytes. To print or spool large entries (greater than 4800 bytes):

1. Find the error log ID in truncated entry by displaying or printing the detailed error report.
2. Select the *Get data by error log ID* option from the Work with Error Log menu.
3. Enter the error log ID on the Get Data by Error Log ID display.
4. Select the *Print* option on the Get Data by Error Log ID display. Only the *Print* option does not truncate large entries.
5. Specify yes on the Get Error Log ID display to include hexadecimal data in the report.

Instead of using the menus and displays, specify the PRTERRLOG command. Enter this command with the error log identifier and the PRTFMT hexadecimal data parameters. The report is printed automatically when the PRTERRLOG command is used.

Note: Most error log entries are less than 4800 bytes; however, some may be larger than 4800 bytes. For example, an entry in the I/O debug dump may be as large as 1 megabyte or more. Large entries may take some time to print or spool.

Job Log

The ways to display or get a job log depend on the status of the job.

- Job ended

  If the job has ended and the job log has not printed, use either the Display Spooled File (DSPSPLF) or Work Output Queues (WRKOUTQ) commands. For example,

  - DSPSPLF FILE(QPJOBLOG) JOB(job-number/user-profile/job-name)
  - WRKOUTQ library name/output-queue-name

    The output queue-name is the name of the output queue where the output for the job was directed.

  Enter a 5 before the job log that you want to display.

- Job active

  If the job is still an active batch or interactive job or if the job is on a job queue and has not started yet, use the Display Job Log (DSPJOBLOG) command.

  - DSPJOBLOG JOB(job-number/user-profile/job-name)

  To display the job log of your own interactive job, do one of the following:

  - Enter the DSPJOBLOG command.
  - Enter the DSPJOB command and select the *Display the job log* option from the Display Job menu.
  - Press F10 from the Command Entry display. This displays the messages that appear in the job log.
  - If the input inhibited light on your work station is on and remains on, do the following:

    1. Press the System Request key; then press the Enter key.

       On the System Request menu select the *Display current job* option.
    2. On the Display Job menu, select option 10 (job log, if active or on job queue).
    3. On the Job Log display, DSPJOB appears as the executing request. Press F10.
    4. On the Display All Messages display, press the Roll Down key to see messages that were received before you pressed the System Request key.

- Sign off the work station, specifying LOG(*LIST) on the Sign Off (SIGNOFF) command.

When you use the Display Job Log (DSPJOBLOG) command, you see the Job Log display. This display shows commands with special symbols, as follows:

Symbol	Description
>>	The executing command or the next command to be executed. For example, if a CL or high-level language (HLL) program was called, the call to the program is shown.
>	The command has completed executing.
..	The command has not yet executed.

On the Job Log display, you can do the following:

- Press F10 to display detailed messages. This can show the commands or operations that were executed within an HLL program or within a CL program for which LOGCLPGM is activated.
- Roll up to get to the end of the job log. To get to the end of the job log quickly, then press F18. After pressing F18, you might need to roll down to see the command that is processing.

| Figure 15-1 on page 15-6 and Figure 15-2 on page 15-7 show how to work with and print a job.

| ***Changing the Logging Level***: To change the logging level, see "Changing the Logging Level" on page 3-8.

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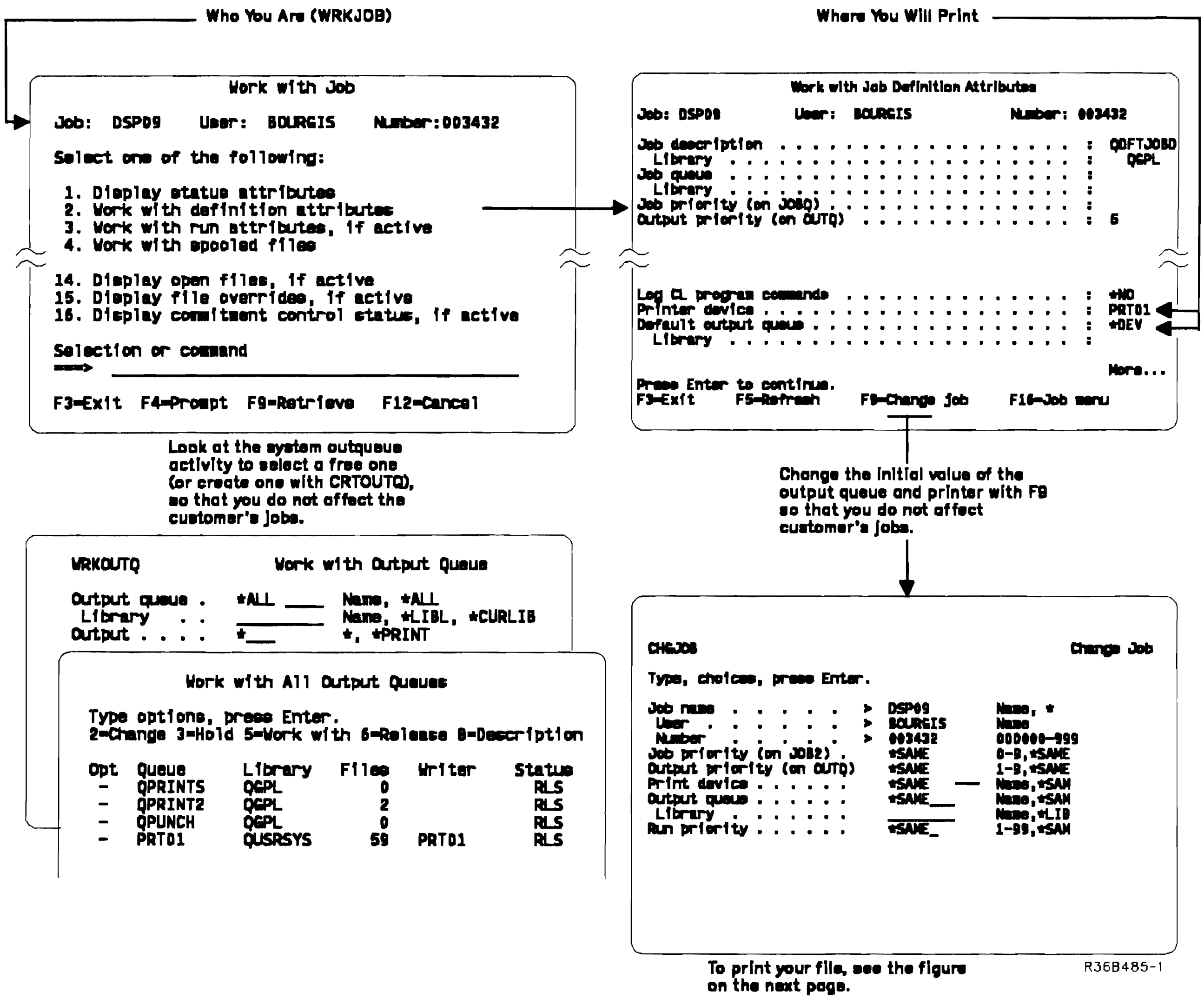

Figure 15-1. How to Work with a Job

```
The Device Must Be On:                          Use the WRKCFGSTS command
                                                to determine the printer
                                                status.  For example,
                                                the following display
                                                shows PRT04 varied off.

                    Work with Configuration Status

 Type options, press Enter.
 1=Vary on 2=Vary off 5=Work with job 8=Work with description
 9=Display mode status

 Opt  Lin/Ctl/Dev/Mod  Status            ---------- Job ---------
  -        IMP8         VARIED OFF
  -        PRT01        ACTIVE/WRITER    PRT01   QSPLJOB  001845
  -        PRT04        VARIED OFF


The Output Queue Must Be Released:              Enter WRKOUTQ command
                                                with option *ALL

                    Work with All Output Queues

 Type options, press Enter.
 2=Change 3=Hold 5=Work with 6=Release 8=Description

 Opt     Queue      Library     Files     Writer     Status
  -      IMP8       QUSRSYS        0                  RLS
  5      PRT01      QUSRSYS      181      PRT01       RLS
  -      PRT04      QUSRSYS        0                  RLS

The Output Queue Files Must Be Released:

                    Work with Output Queues

 Type options, press Enter.
 1=Send 2=Change 3=Hold 4=Delete 5=Display 6=Release 7=Message
 8=Attributes 9=Work with printing status

 Opt  File      User    User Data  Sts  Pages  Copies  Form Type pty
  -   QSYSPRT   QSECOFR            RDY      1       1   *STD      5
  -   RSTSEP1390                   WTR      4       1   *STD      5
  -   HLPMBRR                      HLD    122       1   *STD      5


The Writer Must Be Active:                  Enter the WRKWTR command

                       Work with All Printers

 Type options, press Enter.
 1=Start  2=Change  3=Hold  4=End  5=Work with  6=Release
 7=Display messages 8=Work with output queue

 Opt  Device  Sts   Sep    Form Type    File   User   User Data
  -   IMP8    END
  -   PRT01   STR   *FILE  *ALL
  -   PRT04   END

   Note:  The QSPL subsystem must be running.               R36B486-1
```

Figure 15-2. How to Print a Job

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History Log

Figure 15-3 on page 15-9 shows an example of a history log. The history log is obtained or viewed by:

1. Selecting the *Problem handling* option on the System Main Menu followed by selecting the *Display the history log* option from the Problem handling display.

Or:

2. Entering DSPLOG QHST on any display with a command line. QHST is the default.

The messages displayed can be selected by date and time, job and message ID. When the recommended action in an alert is to view the history log, additional information is provided about which message to look for in the log.

The recommended actions for an alert generally point to the history log for software and application errors. The history log is also useful for viewing informational and diagnostic messages that give warnings about impending problems; for example, disk and storage problems, number of recoverable errors for a particular communications adapter, and so on.

The history log provides a high-level audit trail of the activities performed on the system. The history log may be used by the system operator, the data processing manager, and the service representative.

Two permanent system objects, the history log message queue and history log file description are created in the QSYS library. A new history file is created by the system using the file descriptions specified in the file descriptions object. As each new file is created, a message is sent to the history log message queue. The name of the new file is identified in the logged message. All logged messages are contained in the message queue object.

As logging starts and progresses, versions of the history log database file are created as needed; the size of each version is specified by the system value QHSTLOGSIZ. The system is shipped with a size of 5000 records. The size can be changed by authorized users, but the change does not affect the size of the current version. Each version of a history file is named:

```
QHSTyydddn
```

where:

yyddd Is the Julian date on which the file was created

n Is a sequence letter or number (A through Z or 0 through 9) for that date

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History File Information

The history log is made up of history files. The following information is always sent to the history file by the system:

- Authorization violations information, see page 15-8
- Changes in device status information, see page 15-8
- Database information, see page 15-8
- Job-level information, see page 15-8
- PTF information, see page 15-8
- Subsystem information, see page 15-8
- System-level information, see page 15-9
- System operator messages information, see page 15-9

Authorization Violations Information: Information for authorized violations may be found in the *Security Concepts and Planning*.

Changes in Device Status Information The history log indicates the:

- Creation, change, or deletion of line, control unit, and device descriptions
- Changes in status of lines, control units, and services (power and vary)

Database Information The history log has:

- Size increments to physical files
- Files past their expiration date at open
- Files requiring compression at close
- File full indications
- Access path rebuilds
- File recovery information
- File damage indicators
- Member created with noncontiguous storage or not on specified unit when these options are requested

Job-Level Information The history log has:

- Creations of job descriptions
- Indications of:
  - Job starts
  - Job end
  - Hold or release commands and by whom
  - Change job commands and by whom (if executed within job being changed)

PTF Information: A message is sent to the history log when PTFS are loaded on, applied to, or removed from the system temporarily or permanently. See the *Operator's Guide* to display the history log to review PTF activity. Also, see "Problem Circumvention and Repair" on page 2-3.

Subsystem Information The history log has:

- Subsystem descriptions
  - Creations
  - Change activity
  - Recovery activity
- Start subsystem information
  - Startup of subsystem
  - Final status of subsystem startup

- Type of subsystem termination

System-Level Information The history log has:

- Start OS/400 information, including the following:
  - Start OS/400 information following all terminations
  - A manual or automatic indication
  - Machine initialization status information
  - Completion status information
  - Job data on lost batch jobs following abnormal termination
  - Database recovery information, including files:
    - That were open
    - That were damaged
    - Whose access path was rebuilt or not rebuilt
  - Operator input information and data
- System authorization violations
- Type of system termination

System Operator Messages Information The history log has:

- All messages sent to the system operator message queue, including the following:
  - Messages from user programs
  - Messages from work station operators
  - Messages from spooling readers and writers for which QSYSOPR was specified as the receiver of messages
  - Mount messages when the tape or the disk is in place, the device volume changes, and the device intervention requests
- All replies to inquiry messages by a system operator
- All inquiry messages sent for which QSYSOPR is the receiving message queue
- Indications of:
  - End Job (ENDJOB) command and by whom
  - Change Job (CHGJOB) command and by whom if not executed in the job being changed
  - Hold Job (HLDJOB) command
  - Release Job (RLSJOB) command

History Log Example

Figure 15-3 shows an example of a history log. For an example of IPL messages that are contained in this log, see Figure 19-1 on page 19-8. For more information about managing old versions of history logs, see the *Operator's Guide*.

```
                                               HISTORY LOG - QHST                                         PAGE- 0001
MSGID    SEV MSG TYPE
CPF1164  00  COMPLETION   Job WS0406/SMITH/003522 completed 09/30/87 00:03:32; 4 seconds CPU time, termination code 0.
                   WS0406     SMITH      003522                09/30/87 00:03:32
CPF1164  00  COMPLETION   Job WS0606/THOMP/003521 completed 09/30/87 01:05:03; 14 seconds CPU time, termination code 0.
                   WS0606     THOMP      003521                09/30/87 01:05:03
CPF2677  40  INFO         Lost contact with device WS0606.
                   QSYSARB    QSYS       003452                09/30/87 01:05:07
CPF1124  00  INFO         Job WS0604/QSECOFR/003523 started 09/30/87 01:09:21 in subsystem QBASE.QGPL; entered system 09/30/87 01:0
                   WS0604     QSECOFR    003523                09/30/87 01:09:21
CPA4263  99  INQUIRY      Mount vol  on dev TAP1 and press START. (C R)
                   WS0504     QSECOFR    003526                09/30/87 06:34:10
             VALID RPY    C
                   WS0600     QSECOFR    003528                09/30/87 06:34:10
CPD2645  40  DIAGNOSTIC   Line QEDLIN22 already varied on.
CPF3770  30  ESCAPE       No objects saved or restored for library P5728999 at 09/30/87 07:09:43.
                   $SCXG038   QSECOFR    003539                09/30/87 07:09:43
CPF3770  30  ESCAPE       No objects saved or restored for library P5728SS1 at 09/30/87 07:09:45.
                   $SCXG038   QSECOFR    003539                09/30/87 07:09:45
CPA5806  99  INQUIRY      Manually dial &5 for controller &24 line &23. (C G)
CPA5806  99  INQUIRY      Manually dial &5 for controller &24 line &23. (C G)
                   QSYSARB    QSYS       003452                09/30/87 08:53:50
             VALID RPY    C
                   WS2204     QSECOFR    003647                09/30/87 08:53:50
             SNDR COPY    Greg ...... How about lunch at 12 ??????!!!!!!!!!!!!!!!!!!
                   WS0406     JONES122   003649                09/30/87 13:05:08
             REPLY        OK, will meet you then !!!!!!!!!!
                   WS2301     GSH        003669                09/30/87 13:05:08
CPF1164  00  COMPLETION   Job WS0505/SMITH/003859 completed 09/30/87 22:35:40; 4 seconds CPU time, termination code 0.
                   WS0505     SMITH      003859                09/30/87 22:35:40
CPF1124  00  INFO         Job WS0505/VENDR/003864 started 09/30/87 22:35:53 in subsystem QBASE.QGPL; entered system 09/30/87 22:35:
                   WS0505     SMITH      003864                09/30/87 22:35:53
CPF1164  00  COMPLETION   Job WS0406/VENDR122/003771 completed 09/30/87 22:36:58; 647 seconds CPU time, termination code 0.
                   WS0406     JONES122   003771                09/30/87 22:36:58
```

Figure 15-3. History Log Example

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Problem Log

The problem log is used to manage the problem records created by online problem analysis. Figure 1-6 on page 1-7 shows an overview of how problems are managed by the problem log.

The problem log is central to the AS/400 service philosophy. The problem log can be used to determine the level of analysis performed, to find the locations of the hardware fixes associated with the problem, and to access any notes associated with the problem. Specifically, service support can use the log to determine if PTFs that correspond to the problem have been ordered and received.

The problem log provides a consistent means of tracking both user detected and system detected problems from initial definition through resolution. The tracking mechanisms indicate the state of the problem including if the problem has been previously analyzed.

A problem record includes the problem state, hardware and/or software VPD, initial or post isolation of possible causes and part location information, impact on customer operations, and actions taken from reporting the problem through your service support system. Also notes can be kept for each individual problem and a problem can be updated to indicate that it has been resolved. The records are removed at the user's request after being kept for a minimum time period. This time period is specified in the QPRBHLDITV system value.

The problem log also contains detailed information about the problem, including:

- SRCs associated and identified with the problem.
- FRUs lists and details to help solve the problem.
- Status of the problem, for example: opened or sent.
- Notes about the problem that are entered by anyone at anytime starting when the problem occurred and ending at the time the problem is solved. These notes can be sent to the next level of support for review.

A record in the problem log includes, but is not limited to:

- A ten character problem identifier
- The current status of the problem
- A description of the problem
- The message ID that identifies the problem, if available
- The severity of the problem
- The failing program ID, version, release, and modification level
- The symptom string generated when the problem analysis was run
- The date and time the problem was reported and to which system it was reported
- The history of operations performed for the problem

This information helps you determine the cause of the problem and allows you to make the decisions necessary to resolve it.

You can use the problem log to:

- Run online problem analysis
- After a fix is installed, run verify procedures if they are available. Verify procedures can also by run to test logic cards when the system is powered on
- View or print problem records
- Define a new problem
- Analyze an existing problem
- Report a problem
- Add notes to a problem record
- Recover from a problem
- Verify that a problem has been corrected
- Mark a problem as corrected
- Delete one or more problem records

The problem log is used to manage the problem records created by the problem analysis facility. For more information about accessing the problem log, see "For Existing Problems" on page 11-12. To delete information from the problem log, see the *Operator's Guide*. For more information about the problem log, see the online help text or see the WRKPRB command in the *CL Reference* manual.

How to Use

Before doing any problem analysis, the message queue must be in *BREAK mode.

All messages with problem analysis routines assigned to them have an asterisk (*) in front of them and are stored in the problem log. To display and work with the * messages or to enter the problem log:

- Select the *Work with problems* option on the Problem Handling menu.
- Enter the Work with Problems (WRKPRB) command.

Or,

- Move the cursor to the message with an asterisk (*) and press F14.

Using the Problem Log Commands

The following explanations of the problem log commands do not provide descriptions of the individual parameters. For more detailed information about a particular command and its associated parameters, see the *CL Reference* manual.

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Work with Problem (WRKPRB) Command: The work with problems command and option lets you work with the problem log to solve known or existing problems. To work with a problem or problems from the list of problems in your system's problem log, type the Work with Problem (WRKPRB) command on any command line. If you specify any of the parameters, you can work with a specific problem or group of problems. After the option is selected or the command is entered, select the problem you want to work with.

When you run the WRKPRB command, the Work with Problems display is shown with a list of all the problems logged on the system or a specific group of problems you requested when you specified the parameter values. From the Work with Problems display you can:

- Display or print the details about a problem
- Delete a problem record
- Work with the alert associated with a problem
- Enter or edit your own notes about a problem
- Work with an individual problem (problem management tasks)

The following displays show the default values for the parameters of the WRKPRB command. Use the parameters to display a specific problem or group of problems rather than the entire list.

```
                          Work with Problem (WRKPRB)

 Type choices, press Enter.

 Status type . . . . . . . . .   *ALL          *ALL, *OPENED, *READY...
               + for more values
 Severity . . . . . . . . . . .  *ALL          *ALL, 1, 2, 3, 4
               + for more values
 Period:
   Start time and date:
   Start time . . . . . . . . .  *AVAIL        Time, *AVAIL
   Start date . . . . . . . . .  *BEGIN        Date, *BEGIN, *CURRENT
   End time and date:
   End time . . . . . . . . . .  *AVAIL        Time, *AVAIL
   End date . . . . . . . . . .  *END          Date, *END, *CURRENT
 Hardware:
   Device type  . . . . . . . .  *ALL          Character value, *ALL
   Model number . . . . . . . .  *ALL          Character value, *ALL
   Serial number  . . . . . . .  *ALL          Character value, *ALL
 Resource name  . . . . . . . .  *ALL          Name, *ALL
                                                                More...
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

```
                          Work with Problem (WRKPRB)

 Type choices, press Enter.

 Licensed program:
   Program identifier . . . . .  *ALL          Character value, *ALL
   Release  . . . . . . . . . .  *ALL          Character value, *ALL
   Modification level . . . . .  *ALL          Character value, *ALL
 Function . . . . . . . . . . .  *ALL
 Program  . . . . . . . . . . .  *ALL          Name, generic*, *ALL
 Message identifier . . . . . .  *ALL          Name, generic*, *ALL
 Origin:
   Network identifier . . . . .  *ALL          Name, *ALL, *NETATR
   Control point name . . . . .  *ALL          Name, *ALL, *NETATR
 Service number . . . . . . . .  *ALL          Character value, *ALL




                                                                 Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

The problem log can also be used after running problem analysis. The problem log records the information about the user-detected problem. If the problem is not resolved, a list of symptoms are gathered and a symptom string is built for problem reporting. The report can be used to do more problem analysis by your next level of support.

The WRKPRB command has search parameters available to control the range of problems that is displayed. Pressing F4 displays the search parameters. One of these parameters is SRVID, which is the PMR number returned from RETAIN when the problem was reported. Some other examples of search parameters are time range, type of failing hardware, and resource name of failing hardware.

Each entry in the problem list that WRKPRB displays contains a unique, ten-digit problem identification (ID). This ID appears on all displays for a specific problem and in the PMR for the problem in RETAIN. The problem list has a field that you can use to specify the problem ID that you want to go to directly.

Examples of Using the Work with Problem Command: The following examples illustrate the use of the WRKPRB command with several combinations of parameters used to selectively display the list of problems in the problem log. All of these examples are acceptable for the Display Problem (DSPPRB) command as well. For the DSPPRB command, you could include any acceptable combination of the OUTPUT, OUTFILE, OUTMBR, and TYPE parameters.

To show the Work with Problems display with a list of only problem records with a status of OPENED or READY that identify a failing device of type 9347, you would type:

```
WRKPRB  STATUS(*OPENED *READY) HDW(9347)
```

If you wanted to show the Work with Problems display with a list of all problem records created in the problem log for a specific service requester, you would type:

```
WRKPRB  ORIGIN(CUSTNET1 CHICAGO1)
```

To display a list containing only the problem records for some specified hardware that has been assigned a severity of High or Medium while preparing the problem for reporting. You would type:

```
WRKPRB  SEV(1 2) HARDWARE(9347 001 '10-75234')
```

To display a list containing problem records that have been opened in the period from midnight to noon of the current day, have not yet been analyzed, and identify a specified program product ID and program name as the cause of the failure, you would type:

```
WRKPRB  STATUS(*OPENED) PERIOD((*AVAIL *CURRENT)
  (120000 *CURRENT))
  LICPGM(5728SS1 03 00) PGM(QNOPGM)
```

To display a list of problem records containing machine detected problems that were opened because message CPF6788 was sent to the system operator message queue

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and for which problem analysis ran and determined the resource name of the device involved with the failure is TAP01, you would type:

```
WRKPRB  RESOURCE(TAP01) MSGID(CPF6788)
```

(The list of problems shown by the example above also includes user-perceived problems for which you specified the resource name and message ID using the Analyze Problem (ANZPRB) command.)

To display a list of problem records containing only problems that have been reported to IBM service and have been assigned a specified service number (PMR number) by IBM service, you would type:

```
WRKPRB  SRVID(12345)
```

Display Problems (DSPPRB) Command: The Display Problems (DSPPRB) command allows you to display, print, or create an output file for a list of selected problem records and the corresponding problem information.

Output files allow you to write CL and other high level language programs specifically for your environment. The following list provides you with ideas for programs you could write using the problem log output files.

- Create a program to delete the problem records for all closed PTF orders (or service requests).
- Create a program to create a report listing all network maintenance activities for a specified period of time.

The parameters for the Display Problems (DSPPRB) command are the same as the parameters for the WRKPRB command described previously with four additions. The Display Problems display is shown below with the default values for the parameters listed.

Delete Problem (DLTPRB) Command: The Delete Problem (DLTPRB) command allows you to delete problem records from the problem log. The following display shows the default values for the Delete Problem (DLTPRB) command.

```
                              Delete Problem (DLTPRB)

 Type choices, press Enter.

 Problem identifier . . . . . . .   *ALL          Character value, *ALL
 Status type  . . . . . . . . . .   *ALL          *ALL, *OPENED, *READY...
               + for more values
 Days . . . . . . . . . . . . . .   30            0-999
 Origin:
   Network identifier . . . . . .   *NETATR       Name, *NETATR, *ALL
   Control point name . . . . . .   *NETATR       Name, *NETATR, *ALL









                                                                      Bottom
 F3=Exit   F4=Prompt   F5=Refresh   F12=Cancel   F13=How to use this display
 F24=More keys
```

To delete problems having any status other than CLOSED, the problems must be OPENED longer than the number of days specified by the system value QPRBHLDITV. To delete problems with a status of CLOSED, the problems must be CLOSED longer than the number of days specified by the system value QPRBHLDITV. You can set this system value using the Change System Value (CHGSYSVAL) command. The default value for QPRBHLDITV is 30 days. IBM Service recommends keeping problem data for 30 days.

The Delete Problem (DLTPRB) command also has parameters that allow you to specify a problem or group of problems that you want to delete. For example, if you want to delete all problems added to the problem log earlier than 15 days ago that have a status of OPENED, READY, or SENT, you would type:

```
DLTPRB  STATUS(*OPENED *READY *SENT) DAYS(15)
```

Problem records should be deleted on a regular basis to conserve storage space. When you delete problem records from the problem log, you should use the Reorganize Physical File Member (RGZPFM) command to recover the storage space from the deleted problem records.

Journal receivers also require maintenance. Journal receivers should be changed periodically (for example, once every 30 days) and old journal receivers should be deleted.

A space management utility is available on the AS/400 system in the QUSRTOOL library. See member TSPINFO in library/file QUSRTOOL/QATTINFO.

Working with a Problem

To work with a particular problem, use the Work with Problem (WRKPRB) command to display the problem log, (or use the parameters to look at a specific problem or group of problems) and type the option number to work with a problem in the option column of the problem with which you want to work. The Work with Problem menu is displayed. From this display you can:

- Analyze the problem
- Report the problem
- Run recovery procedures
- Verify the problem has been corrected
- Answer the problem
- Send a response to the service requester who sent a service request
- Close the problem

Some of the options listed above are conditionally displayed. The explanations below describe the operations you can perform and the conditions under which the operations are available.

The Report problem option is displayed only if the operator is authorized to the Send Service Request (SNDSRVRQS) command. Use this option to enter information necessary for a service request. The status of the problem is then changed to PREPARED. You can then continue and send the service request to the next level service provider. If the problem has already been prepared, you are shown the Prepare Service Request display again with any prior changes shown.

The Run recovery option is displayed only if recovery procedures are available and the problem is not in OPEN or CLOSED status.

The Verify problem corrected option is displayed only if the problem is not in OPENED or CLOSED status. This option allows you to run verification procedures if they are available. You can also confirm with the service requester the problem has been corrected and change the status to VERIFIED.

The Close problem option is available on all AS/400 systems and allows you to close problems on which work is complete. If you close a problem, the Work with problem option is no longer available and you can no longer perform any update operations for that problem.

Understanding Problem Status Transitions

Problem Status helps you keep track of where you are in the process of working with a problem. The following section describes each status followed by a table that shows the final status given the starting status and the various operations you can perform.

Problem Statuses Problems in the log are logged as having one of the following statuses:

Status — **Description**

Opened — The system detected a problem. The problem needs to be analyzed. Problem analysis needs to be run.

When a problem has a status of OPENED, this means the problem has been reported and further information about the problem can be obtained by running problem analysis from the problem record.

When a record is first created for a system-detected problem, its status is OPENED.

A problem in OPENED status can be reported to an AS/400 service provider, however, you cannot report a problem in OPENED status to IBM Service.

Ready — Problem analysis has run; the problem is ready and waiting to be prepared for transmission to the service support system.

READY status indicates that problem analysis information has been added to the problem record.

An problem record is created at READY status when the problem record is created through the Analyze Problem (ANZPRB) command. An OPENED problem record changes to READY status when problem analysis is run on the problem. A problem record with PREPARED status changes back to READY by running problem analysis again.

Prepared — Information relating to a service request was added and the problem is prepared for sending to the service support system.

A problem record with a status of PREPARED indicates the problem record has had information added for reporting it using the Send Service Request (SNDSRVRQS) command.

The status of a problem can change to PREPARED from any other status except CLOSED using the Report problem option on the Work with Problem menu.

Sent — The problem was sent to the service support system. After problem analysis is run, you can send the problem as often as you need to.

SENT status indicates an acknowledgement has been received from a service provider that the service request was received, however, no answer to the problem was returned.

The status of a problem record is changed to SENT when the Report problem option is selected from the Work with Problem menu or the Send Service Request (SNDSRVRQS) command is run and the Send service request now option or Send service request by voice options are selected.

Answered — This status indicates that the solution for the problem is known and that an answer to the service request has been received. If the answer involves PTFs, the list of PTFs is available. The actual PTFS may or may not exist on the system. You can view the status of the PTFs using the Work with PTF option on the Work with Problem menu to see if they are available on the system.

Verified — This status indicates the PTFs have been installed or the equipment has been repaired and the operator has verified that the problem is corrected.

You can change a problem record's status to VERIFIED by selecting the Verify fix option from the Work with Problem menu.

You can use a problem record with VERIFIED status to send a response to the service requester.

Logs

Closed — This status indicates that problem tracking is complete for this problem. All the information pertaining to this problem record can still be viewed, but no other operations or status transitions are allowed.

Any problem record with any status may be changed to CLOSED by selecting the Close problem option from the Work with Problem menu.

Table 15-3 summarizes the status transitions of a system problem that has been recorded in the problem log. All the operations shown are available at the service provider except for system detection, which creates a problem record on the system where the problem originated and PTFs ordered, which creates a problem record on the system from which the PTFs were ordered. The Answer problem, Change Answer, and Send response operations are not available on the service requester.

Table 15-3. Status Transition Table. Problem Record Status Transitions Based on Operations Performed

	STARTING STATUS							
OPERATIONS	**NO RECORD**	**OPENED**	**READY**	**PREPARED**	**SENT**	**ANSWERED**	**VERIFIED**	**CLOSED**
System Detects Problem	O							
Run ANZPRB	R							
PTF Ordered	R							
Analyze Problem		R	–	R	–	–	–	X
Report (send now)		S	S	S	S	S	S	X
Run recovery		X	X	–	–	–	–	X
Verify corrected		X	X	V	V	V	V	X
Answer problem		X	A	A	A	X	A	X
Change answer		X	X	X	X	–	X	X
Close problem		C	C	C	C	C	C	X
Report (send later)		P	P	P	P	P	P	X
Report (voice)		S	S	S	S	S	S	X
Send response		X	X	X	X	–	–	X

Note:

- O = OPENED
- R = READY
- P = PREPARED
- S = SENT
- A = ANSWERED
- V = VERIFIED
- A = CLOSED
- AF = Answer from fix database
- – = No state change
- X = Not allowed
- blank = No state change

Tracking Problems

One of the tasks you want to do when working with problems from systems in a network is track the problem. You may want to look at the time the problem first occurred, how many times problem analysis was run, or whether the problem was answered and verified. Checking the history of a problem can keep the operator or a service provider aware of the progress made on resolving the problem and prevent operations such as problem analysis from being performed more times than necessary.

To display the history of a problem from the time the problem record was created by this system to the current date and time,

- Type the WRKPRB or DSPPRB command on any command line and press the Enter key. If you can narrow down the list of problems using the parameters of these commands, it may help you find the problem you are looking for more easily.
  1. Type the option number to display the problem details in the option column of the problem for which you want to display the history and press the Enter key. The Display Problem Details display is shown with detailed information about the problem you selected.
  2. Press the function key provided to display the tracking data. The Display Tracking Data display is shown.

Comparing the Error and Problem Logs

When VLIC detects a critical error, VLIC informs the OS/400 of the failure. OS/400 logs this information into the error problem logs and sends a message to the system operator's message queue. You can see the following.

- First level text or a one line text description of the failure. Use the DSPMSG QSYSOPR command to view the first level text. Press the Help key to view the second level text.
- Second level text or recovery actions to be performed by customer.

You can use the F14 key to enable any message that has problem analysis procedures available for it. Messages that have problem analysis procedures are shown with an asterisk (*) to the left of it. Using the F14 key is similar to using the Work with Problem (WRKPRB) command.

The error log ID in the error log shows up in the second level message text and in the problem log under detailed information about the problem. The description of the problem in the problem log entry is the same one (without message replacement text) that is sent to the QSYSOPR message queue. The error log ID in the problem log can be displayed to confirm a match. The error log ID can also be used on a parameter of the PRTERRLOG command.

Note: Not all error log entries are contained in the problem log. In contrast, the error log does not have user-detected problems.

Logs

Chapter 16. System Dumps

The system dumps described in this chapter are as follows:

Table 16-1. An Overview of How and When to Use System Dumps

Dump Name or Type	How to Obtain	Use For
IOP dump, see page 16-1	Work with I/O debug utility option of DST or SST Work with error log option of SST or DST PRTERRLOG	• Hard stops • Incorrect output • Jop loops • Jop waits • Messages (error)
Job dump	DMPJOB	• Incorrect output • Job loops • Job waits
Main storage dump, see page 16-1	Display/alter/dump option of DST or SST Print stand-alone dump option of DST or SST Function 22 on the control panel	• Hard stops • System loops • System waits
Object dump	Display/alter/dump option of DST or SST DMPSYSOBJ	• Incorrect output • Job loops • Job waits
Task dump	Display/alter/dump option of DST or SST	• Hard stops • Incorrect output • Job loops • Job waits

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Input/Output Processor (IOP) Dump

The input/output processor (IOP) dump or sometimes referred to as the process dump is provided by the I/O debug utility. The service representative should not use this utility without supervision.

The IOP dump function collects, displays, prints, and saves data from the memory, hardware registers, and error logs of an IOP. All this activity takes place at hardware bus level. This activity may be used to gather data from failing IOPs.

The type of data in the IOP dump must be provided for all failing IOPs. The IOPS may need to be reset. Caution must be taken when reseting the IOP. If a reset is issued for an active processor, the processor becomes inactive. If this happens, customer data could be lost. An IPL of the system may be needed again.

The dump taken is written to a temporary space on DASD. If you exit the I/O debug utility, the dump is lost. Take extra precaution to preserve this data because it is often the only data available for resolving IOP problems.

For more information about the I/O debug utility, see page 12-50.

Main Storage Dump

A main storage dump records the status of the system when a failure occurs. Main storage dump may be written to disk by a machine check or by selecting function 22 on the control panel. There are two kinds of main storage dumps:

Dump	Description
Automatic	This is a dump that the system takes for many machine checks or errors that occur on the system. If the system determines that the dump may be useful in diagnosing an error or recovering the system on the next IPL, then the dump data is written automatically to disk before the system quits working. See the following dump verification procedure to determine if a dump was written automatically.
Manual	This is a dump that you take when you select function 22 on the control panel. You can select function 22 to help diagnose a problem with the system. This dump is recommended for diagnosing system loop problems or those problems that the system did not write an automatic dump for. See the following dump verification procedure to determine the status of a manual dump.

For solving job and system loop problems using main storage dump, see "Diagnosing and Solving Hang and Loop Problems" on page 16-6. For solving problems relating to a component, see Chapter 4. For more information about function 22, see page 14-6.

Determining Dump Status

The status of a main storage dump is shown on the control panel if the system is still powered on, the attention light on, and and an SRC is on control panel. See Figure 16-1 on page 16-2 to determine the status of the main storage dump or the SRC that caused the system to quit working.

Dumps

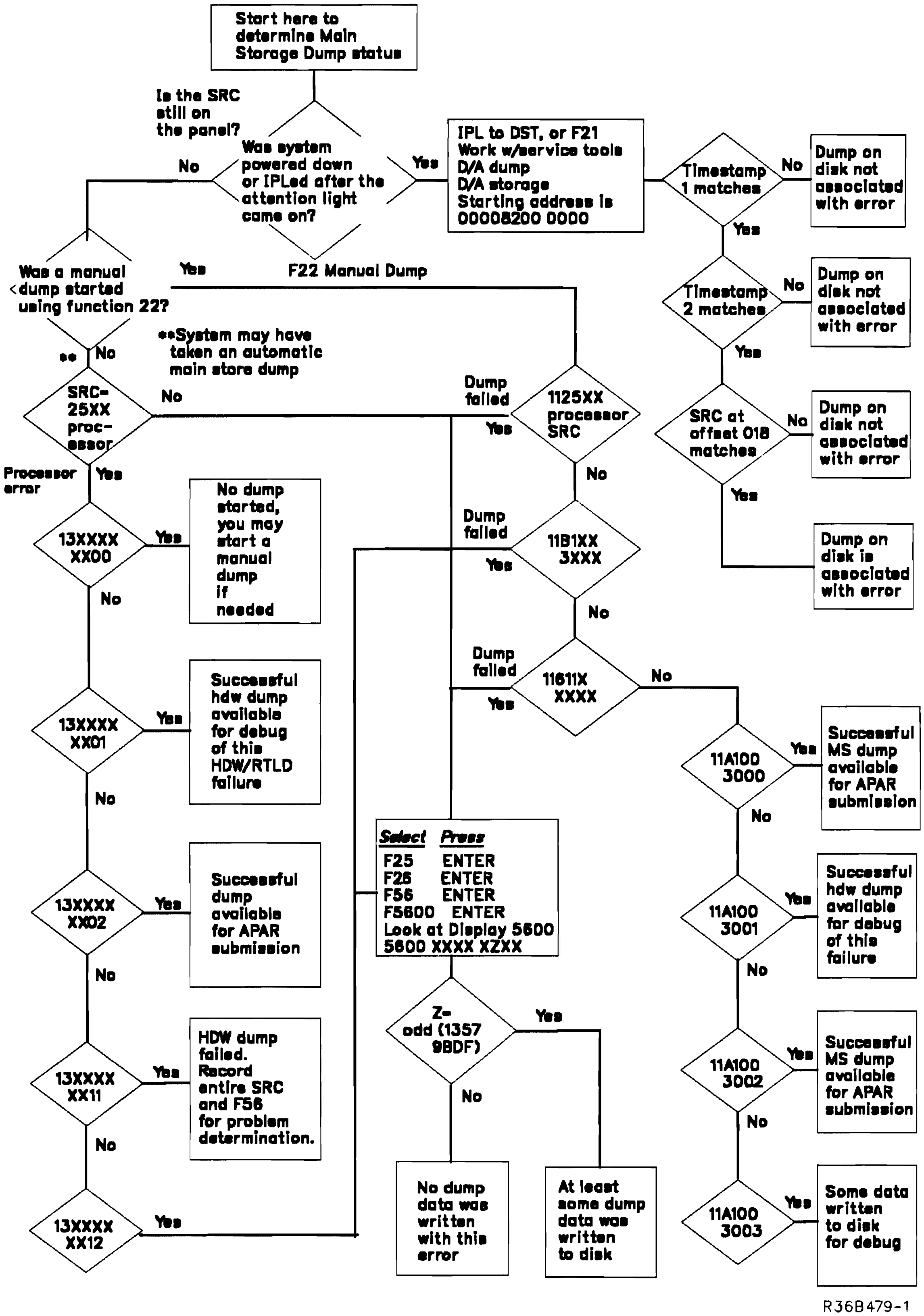


Figure 16-1. Flowchart for Determining Status of a Main Storage Dump

Dumps

If the Dump Was Taken Automatically: If the dump was taken automatically (with a system error) before the system stopped working, then more data is needed to determine the status of the main storage dump.

Main storage dumps to DASD are usually taken automatically with errors that have the processor SRCs, 11 25XX XXXX (function 11 on the control panel). Three of the most common licensed internal code problems in the processor area (SRCs that begin with 11 25XX XXXX), have the following unit reference codes in word 12 of the SRC:

12 XXXX 80E0	Diagnostic HLIC code problems
12 XXXX 80F2	Runtime HLIC code problems
12 XXXX 30XX	Hardware problems

The dump was initiated because of a hardware or HLIC error. Use the following table and go to function 13 on the control panel to determine if main storage dump was taken automatically for any function 11 SRC that begins with 25 (for example, 11 25XX XXXX). Function 13 must be shown to determine if a main storage dump exists. The last 2 digits of function 13 shows the status of the main storage dump:

SRCs	Meaning
13 XXXX XX00	No dump to disk was initiated
13 XXXX XX01	Partial dump to disk successful (valid for APAR submission)
13 XXXX XX02	Full dump to disk successful (valid for APAR submission)
13 XXXX XX11	Partial dump to disk failed
13 XXXX XX12	Full dump to disk failed

The dump was initiated by a request from the VLIC machine check handler. The VLIC reference codes, 11 B6XX XXXX, (function 11 on the control panel) must be found in the applicable *Unit Reference Code Guide*. If the procedure for the reference code in the applicable *Unit Reference Code Guide* instructs you to copy a main storage dump to tape, then assume that the main storage dump is written to DASD automatically. Otherwise, do the following to determine if how much of the dump was written to disk if a second IPL of the system has not been performed and SRC B6XX XXXX is still shown in function 11:

1. Enter the service mode by doing the following:
   a. Display function 25 in the Function display on the control panel and press the Enter switch.
   b. Display function 26 in the Function display on the control panel and press the Enter switch.
2. Display function 56 in the Function display on the control panel and press the Enter switch.
3. Display subfunction 5600 in the Data display on the control panel and press the Enter switch.

   The Data display shows eight digits: XXXX XZXX. Use these digits to determine if any dump data was written do disk.
4. Look at the sixth digit on the Data display.

   If the sixth digit (Z, as shown above) of the data shown in the Data display is 1, 3, 5, 7, 9, B, D, or F, then at least some dump data has been written for this SRC.
5. If necessary, retrieve this data using print stand-alone dump and submit this information with an APAR.

   To copy a main storage dump, see page "Copying Main Storage Dump Data from Disk" on page 16-5. To submit an APAR, see Chapter 6.

If the Dump Was Taken Manually: One of the following SRCs appear on the control panel only if the main storage dump was started using function 22. Use these SRCs to determine how much of the main storage dump was written. Each SRC has the following meaning:

SRC	Meaning
11 A100 3000	A full dump written successfully to disk.
11 A100 3001	A partial dump written successfully to disk.
11 A100 3002	A full dump completed, but not enough space was allocated for the main storage data. A valid dump does exist and the service processor writes all the dump it can to the allocated space on disk. Print stand-alone dump shows the full contents of the main storage dump as it was written to disk. As much of the dump that can fit in the available space on the load source DASD is taken. During the next IPL, VLIC extends the dump segments.
11 A100 3003	A full dump completed, but no space was allocated for the main storage data. Some valid data does exist in SID82, but no main storage data was written to disk. This can happen if the system has never been IPLed through storage management.
11 B1XX 3XXX	The dump was not successful because of a service processor machine check. See analyzing a problem with an SRC in the *Analyzing Problems Guide* for the reference code 3XXX in function 11 on control panel.
11 25XX XXXX	The dump was not successful and problem analysis is done. See the reference code in word 12 of the SRC.
11 611X XXXX	The dump was not successful and problem analysis is done. See the reference code in word 12 of the SRC.

If the System Was Powered Off or an IPL Was Done: Display the main storage dump status area on the load-source disk to determine the dump status if the system has been powered off or an IPL was done. Use the information in the status area to see if the dump data on disk matches the current error condition. To display the main storage dump status area on the system console:

1. IPL to DST
2. Select the *Work with service tools* option
3. Select the *Display/alter dump* option
4. Select the *Display/alter storage* option
5. Select the *Starting address* option
6. Enter the address 00008200 0000
7. Always ensure you are working with a dump that matches the current error conditions.

Note: To see this information already copied from disk to tape, you should display the first block on the tape. This copied information is in the main storage dump status area of the printed dump.

Do the following to check the dump image matches the current error:

- Verify the time stamps

  The first 16 bytes are divided into 2 time stamps. Each time stamp has the following format:

  YYYY|SE|MI|HR|DW|DY|MO

  Time stamp 1 begins at offset 0 and time stamp 2 begins at offset 8. The time stamps and their associated bytes are as follows:

  – Timestamp for the dump of hardware data (located at offset 0000 in SID 82):

Bytes	Description
0-1 (YYYY)	Year (all 4 digits are given)
2 (SE)	Seconds (00 through 60 possible)
3 (MI)	Minutes (00 through 60 possible)
4 (HR)	Hours (00 through 24 possible)
5 (DW)	Day of the week (01 through 07 possible)
6 (DY)	Day of the month (01 through 31 possible)
7 (MO)	Month of the year (01 through 12 possible)

  – Timestamp for the dump of main storage (located at offset 0008 in SID 82)

Bytes	Description
8-9 (YYYY)	Year (all 4 digits are given)
A (SE)	Seconds (00 through 60 possible)
B (MI)	Minutes (00 through 60 possible)
C (HR)	Hours (00 through 24 possible)
D (DW)	Day of the week (01 through 07 possible)
E (DY)	Day of the month (01 through 31 possible)
F (MO)	Month of the year (01 through 12 possible)

  Validate these time stamps for approximate time and date the dump should have been taken.

- Verify the last SRC

  At offset hex 18 in the status area of the main storage dump is the SRC that initiated the automatic dump to disk. Verify that this SRC matches the SRC reported as the last SRC for the current error.

Tasks of Main Storage Dump

The following tasks are associated with main storage dump (MSD):

1. VLIC storage management allocates disk space.
2. The service processor writes the main storage data to disk.
3. The print stand-alone dump service function copies a main storage dump from disk to diskette or tape.

Allocating Space on Disk: During each IPL, VLIC storage management allocates disk space for main storage dump data. VLIC automatically determines how much main storage is on the system and reserves this amount of space on the load source DASD.

Restrictions:

- No space is allocated for actual main storage data if an IPL is not done by storage management. For example, no space is allocated for installations. However, if a main storage dump (MSD) is taken before installation is complete, some data is preserved in segment ID 82 (SID82) or virtual address 00008200 0000.
- Allocated space can be too small if main storage has been upgraded and the system has not been IPLed through storage management; however, the dump to disk uses all of the space allocated. That part of the dump contained in the amount of space allocated is available for use in debug, but VLIC storage management is not able to use the dump for directory recovery during the next IPL.
- If the load source DASD is mirrored, the main storage dump is also mirrored. The service processor writes data of the main storage to one load source DASD. During the next IPL the data of main storage dump is synchronized.

Writing Main Storage Dump Data to Disk: The service processor writes main storage dump data to disk. The procedure for writing main storage dump is as follows:

1. Start writing the data to disk

   Main storage dump is started automatically by some machine checks or is started manually by function 22 on the control panel.

2. Writing main storage dump to disk

   The status SRCs that appear on the control panel are:

Status	Description
D1XX 31XX	Saving critical main storage data to be used by a special HLIC. These SRCs show for about 6 minutes.
C1XX XXXX	IPLing with a special HLIC.
D1XX 31FF	SID82 wrote to disk.
D1XX 32XX	Writing main storage data to disk using a special HLIC. This takes about 15 seconds per megabyte of main storage.

See the *Analyzing Problems Guide* for more information about taking (writing) a main storage dump to disk.

3. Main storage dump data is written to disk

   The format of main storage dump data appears on disk as:

SID	Description
71-7F, 81	Contains actual main storage data
82	Contains main storage dump status area

   The following is an example segment ID (SID):

```
SID82 = virtual address  00008200 0000
```

   For more information about successful and unsuccessful SRCs that appear after a main storage dump was manually or automatically taken, see "Determining Dump Status" on page 16-1.

4. Data ready for printing, displaying, or copying using the print stand-alone dump service function.

Protecting Main Storage Dump Data: In addition to allocating space on a disk, storage management:

1. Uses the main storage dump data to do directory recovery

   Note: IPLing takes less time if a valid dump is available.

2. Turns off the dump-valid bit when directory recovery is finished.

The main storage dump data collected on DASD is only protected until the next IPL. During the next IPL, the dump is used by VMC to run directory recovery and VLIC turns off the bit that protects the MSD from being written over. The bit that protects MSD is called the dump-valid bit. The dump-valid bit is located in the main storage dump status area. The dump data on disk is not over-written as long as the dump-valid bit is on. The dump-valid bit is turned on when the dump data is successfully written to disk. The dump-valid bit is turned off when directory recovery finishes during IPL. These procedures protect and save the original dump data. The saved data is used for debugging the original failure *until the system is IPLed past DST*.

If a dump is needed, it must be copied to removable media (for example, tape) as soon as possible (for example, before the next IPL) to prevent the dump from being overlayed by another dump. Each time the system IPLs past DST, VLIC storage management resets the dump valid bit to Off. This allows the current dump data to be overlaid with new dump data if a main storage dump is taken. (The original dump is not saved and is replaced by the latest dump.)

IPL to the print stand-alone dump function of DST. For more information about print stand-alone dump, see page 12-55.

Copying Main Storage Dump Data from Disk: Copying of main storage dump data is completed by the print stand-alone dump service function. This function allows you to interface with the disk image.

The print stand-alone dump service function formats and labels the dump data. The dump includes any requested hardware data (first few pages) followed by all requested main storage data. Do the following to copy main storage dump data:

1. IPL to DST

   Use print stand-alone dump to copy the data to tape, diskette, or printer

   Note: If the system does not IPL to DST, repair the system to successfully IPL to DST before using or manipulating the data.

2. Go to SST

   Use print stand-alone dump to display the main storage dump data.

   Note: In SST the dump-valid bit is off and the the dump data is susceptible to being overlayed if a machine check occurs. To protect your main storage dump data, see page 16-5.

Initializing Main Storage Dump Tapes: Use the following to initialize main storage dump tapes:

- A new tape volume or any previously initialized tape volume

  The tape function manager of DST and SST automatically initializes the tape.

- A tape that is free of defects

If AS/400 system is installed and operable:

1. Place a tape that is free of defects in one of the tape drives.
2. Enter the INZTAP command on any display with a command line.
3. Enter the parameters:
   - NEWVOL(volume name)

     The volume name is needed for screen input. The file name is DMS when the dump is written.

   - Sequence number 0001

     Use sequence 0001 to indicate the first file when printing the dump. For more information about printing the dump, see "Print Stand-Alone Dump" on page 12-55.

Note: The sequence number is not a parameter for INZTAP, but rather an input number entered on the display for printing the dump.

See the *CL Reference* manual if you need help using the Initialize Tape (INZTAP) command.

Diagnosing and Solving Hang and Loop Problems

For hangs, loops, wait conditions, and so on, it may be beneficial to diagnose the problem before initiating a main storage dump. The following functions are available for these situations:

Control Panel Function	Use
21	This function starts DST on the machine default console terminal (first locally attached work station on bus zero).
22	This function automatically stops the processor and dumps the main storage contents to DASD.
50	This function stops the CPU.
51	CPU status, base register zero, and current task dispatching element (TDE) are displayed.

See Chapter 3 for more information about solving hang, wait, and loop problems.

Error Recovery Procedure

Unsuccessful manual dumps to DASD end in a SRC (25XX XXX format or B1XX XXX format), which identifies the reason the dump did not complete successfully. For unsuccessful SRCs during printing or displaying main storage dump data from tape, see Appendix C.

Use the applicable *Unit Reference Code Guide* to find more information about these failures. Send to your next level of support the dump you just obtained along with any program exceptions and causes listed in Chapter 29. The main storage dump helps to find the program exception and causes. Together, the dump and the program exceptions and causes help diagnose the system problem.

Unsuccessful automatic dumps to DASD must be identified using one of the methods described in "If the System Was Powered Off or an IPL Was Done" on page 16-4.

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18

Dump Data from Database File

To dump the data from a database file:

1. Dump the object type file and enter:

   ```
   DMPOBJ OBJ (lib/name) OBJTYPE (file)
   ```

2. Find, within the listing, the virtual address of the object type data space.
3. Use the DST or SST display/alter/dump with the address found in step 2 and dump the machine interface object data space to the printer.

Dump Index of Database File

To dump the index of a database file:

1. Dump the object type file and enter:

   ```
   DMPOBJ OBJ (lib/name) OBJTYPE (file)
   ```

2. Find, within the listing, the virtual address of the object type data space index.
3. Use the DST or SST display/alter/dump with the address found in step 2 and dump the machine interface object data space index to the printer.

Dump Work Control Block Table

To dump the work control block table, enter:

```
DMPSYSOBJ OFFSET (10)
```

Damaged Object Recovery

To recover from problems, which result from damaged objects, refer to the *Licensed Programs and New Release Installation Guide*.

Damaged Objects

When the AS/400 system issues messages to indicate that damaged objects exist in the system, the specific damaged object is not always apparent. To find the object, or any object that had the damage bit set during the last IPL, you can display the VLIC log entries. A VLIC log entry, major code 300, is made each time a damaged object is encountered.

The service representative can dump the entry and use the information to determine which object is damaged and the type of damage that occurred.

Chapter 17. System Traces

The system traces described in this chapter are as follows:

Table 17-1. An Overview of How and When to Use System Traces

Trace Name or Type	How to Obtain	Use For
Communications trace, see page 12-20	Work with communications trace option of SST	• Incorrect output • Jop loops • Jop waits • Messages (error)
IOP (static/dynamic)	Work with I/O debug utility option of SST or DST	• Hard stops • Incorrect output • Job loops • Job waits • Messages (error)
Job information, see page 17-7	TRCJOB	• Incorrect output • Job loops • Job“waits
Licensed internal code	Trace vertical licensed internal code option of SST or DST TRCINT	• Incorrect output • Job loops • Job waits • Messages • System loops • System waits
Program debug, see page 23-1	ADDTRC	• Incorrect output • Job loops • Job waits

Note: If intervention is required when dumping information to tape or diskette and you are in DST, see "Intervention Display I/O Manager Return Codes" on page 13-18.

Tracing Intersystem Communications Function Operations and Functions

You can use the Trace Intersystem Communications Function (TRCICF) command to save information about the language operations and communications functions directed to an ICF file. The trace information can be collected in the current job or in the job being serviced as a result of the Start Service Job (STRSRVJOB) command.

The Start Service Job (STRSRVJOB) command allows you to collect trace records for jobs started from other work stations or for batch jobs. After the STRSRVJOB command has been entered, the TRCICF command must be entered to start the trace.

The End Service Job (ENDSRVJOB) command is used to end the service job request. No parameters are used with this command. The trace must be stopped before this command can be entered. The *CL Reference* has more information about the STRSRVJOB and ENDSRVJOB commands.

Trace ICF traces all ICF I/O operations that occur in the job in which the command was entered. During the time that TRCICF is active, all programs that run in the job are monitored by TRCICF. TRCICF can be entered within different jobs, and the trace for one job runs independently of the trace for another job.

The Trace ICF function can be started, stopped, or ended. You can start the Trace ICF function from a system menu, by typing the TRCICF command on a command line, or from a control language (CL) program within a job. After the trace is started, trace records are collected and stored in an internal trace storage area. When the trace is stopped, the trace records can either be directed to the spooled printer file, QPIFTRCF, or sent to a database output file that you specify. When the trace is ended, all trace records are deleted. Details about starting, stopping, and ending the Trace ICF function are discussed in this chapter.

Starting the Trace

The Trace ICF (TRCICF) function can be started before running a job or after the job is active (as in a remote job). You can start TRCICF from a system menu, by typing TRCICF *ON on any command line, by adding the command to a CL program, or by typing TRCICF on a command line and pressing F4 (Prompt). If the latter method is used, an initial prompt is displayed for the *Trace option setting*. If *ON is specified and you press the Enter key, the following display appears:

```
TRCICF                     Trace ICF

Type choices, press Enter

Trace option setting . . . . . . . . . *ON       *ON, *OFF, *END
Maximum storage to use . . . . . . . . 200       1-16000 K
Trace full . . . . . . . . . . . . . . *WRAP     *WRAP, *STOPTRC
User data length . . . . . . . . . . . 128       0-4096









                                                           Bottom

F3=Exit  F4=Prompt  F5=Refresh
F12=Cancel  F13=How to use this display  F24=More keys
```

Figure 17-1. Starting the Trace

Trace option setting
Specify whether collecting trace information is to be started, stopped, or ended.

*ON
: Trace ICF is to be started. This is the default value for this prompt.

*OFF
: Trace ICF is stopped. No other trace information is recorded and the current information is written to the spooled printer file or a database file.

*END
: Trace ICF is ended. All trace information is deleted.

Maximum storage to use
Specify the maximum amount of storage to use for the trace information collected. This prompt only appears if you have selected *ON for the *Trace option setting* prompt.

200 K
: The number of bytes (1 K equals 1024 bytes) of maximum storage. This is the default value.

1-16000 K
: The valid range for the number of bytes of maximum storage.

Trace full
Specify whether new trace records are to replace the old trace records or to stop the trace function when the maximum storage specified has been reached. This prompt only appears if you have selected *ON for the *Trace option setting* prompt. Valid values are:

*WRAP
: When the trace storage area is full, new trace information is written over the oldest information, starting at the beginning of the storage area. This is the default value.

*STOPTRC
: No new trace information is saved when the trace storage area is full. You must turn the trace off to get the output.

User data length
Specify the maximum length of user data to be saved for each trace record in the storage area. This prompt only appears if you have selected *ON for the *Trace option setting prompt.*

128
: The number of bytes for the user data length. This is the default value.

0-4096
: The valid range of bytes for the user data length.

Stopping the Trace

Trace ICF continues to collect trace records until you stop the trace, or until the trace storage area is full. When you stop the trace, the trace records that have been created are either directed to the spooled printer file, QPIFTRCF, or to a database output file that you specify. If the output file specified already exists, it must have the same attributes as the system-supplied file QAIFTRCF.

You can stop the trace from a system menu, by typing TRCICF *OFF on any command line, by adding the command to a CL program, or by typing TRCICF and pressing F4 (prompt). If the latter method is used, and you specify *OFF for the *Trace option setting*, you are prompted for the OUTPUT parameter. If you specify the *OUTFILE option for the *Output* prompt, the following display appears:

```
TRCICF                    Trace ICF

Type choices, press Enter

Trace option setting . . . . . . . . . *OFF       *ON, *OFF, *END
Output . . . . . . . . . . . . . . . . *OUTFILE   *PRINT, *OUTFILE
Output file  . . . . . . . . . . . . .            Name
  Library  . . . . . . . . . . . . . . *LIBL      Name, *LIBL, *CURLIB
Output member options:
  Member to receive output . . . . . . *FIRST     Name, *FIRST
  Replace or add records . . . . . . . *REPLACE   *REPLACE, *ADD




                                                           Bottom
F3=Exit  F4=Prompt  F5=Refresh
F12=Cancel  F13=How to use this display  F24=More keys
```

Figure 17-2. Stopping the ICF Trace

Output
Specifies whether the trace information is to be stored in a spooled file or saved in a database file. This display only appears if *OFF is specified for the *Trace option setting* prompt. Valid values are:

*PRINT
: The trace information is sent to the spooled file QPIFTRCF in the output queue associated with the job being traced. The spooled file can be viewed or printed. Refer to Figure 17-3 on page 17-4 for an example of the spooled trace records. This is the default value.

*OUTFILE
: The trace records are to be directed to a database file. Refer to Figure 17-4 on page 17-6 for a description of trace records directed to a database file. The *OUTFILE value for the *Output* prompt is only valid if a value is

specified for the *Output file* prompt.

Output file
Specifies the name of the database file to which the trace records are to be sent. This prompt only appears if you have selected *OFF for the *Trace option setting* prompt and *OUTFILE for the *Output* prompt. If the file does not exist, the system creates a new database file with the specified name in the library to which the file is to be added. The new file has the same attributes as the system-supplied file QAIFTRCF. If the file already exists, it must have the same attributes as the system-supplied file QAIFTRCF. Possible library values are:

Name	The name of the library where the file is located.
*LIBL	The file is located in the library list.
*CURLIB	The file is located in the current library for the job. If no current library entry exists in the library list, the library QGPL is used.

Output member options
Specifies the name of the file member that is to receive the trace information. This prompt only appears if you have selected *OFF for the *Trace option setting* prompt and *OUTFILE for the *Output* prompt. If the output file is to be created by the system, an output member is also created and given the name specified in the *Member to receive output* prompt. If *FIRST is specified for the *Member to receive output* prompt, a member is created and given the name specified in the output file. If the output file exists, but the output member does not, a member with the specified name is created. The options for the *Output member options* prompt are:

Member to receive output
Type the name of the member to receive the output. Valid values are:

*FIRST	The first member in the output file receives the trace information. This is the default.
Name	The specified member receives the trace information.

Replace or add records
The trace information is either added to the file or replaces existing trace information. Valid values are:

*REPLACE	New trace information replaces what is already in the file member. This is the default.
*ADD	New trace information is appended to the end of data already in the file member.

Trace Records Sent to a Spooled File: When you select *OFF for the *Trace option setting* prompt and press F4, you are presented with the option on the *Output* prompt to send the trace records to a spooled file (*PRINT) or to a database file (*OUTFILE). The default value is *PRINT. If you choose the *PRINT value for the *Output* prompt, the trace information is sent to the spooled file QPIFTRCF. Figure 17-3 on page 17-4 shows the format of the spooled trace records.


```
 5728SS1 R03 M00 900610                        AS/400 Trace ICF Information              11/08/90  9:56:10        PAGE   1
 ----------------Table of Function Codes----------------
1 Function Codes     Meaning
     ACQ             Acquire
     AWT             Allow-Write
     CFM             Confirm
     CLS             Close File Prior to REL or EOS
     CNI             Cancel-Invite
     CNL             Cancel
     DET             Detach
     EGP             End-of-Group
     EOA             End-of-Session-Abnormal
     EOS             End-of-Session
     ERR             Error: Function Not Valid
     EVK             Evoke
     FAL             Fail
     FMH             Function-Management-Header
     FMT             Format-Name
     FRC             Force-Data
     GTA             Get-Attributes
     INV             Invite
     NRP             Negative-Response
     OPN             Open with Acquire-Program-Device
     RCF             Respond-to-Confirm
     RCV             Receive
     REL             Release
     RFI             Read-From-Invited-Program-Devices
     RST             Restore
     RWT             Request-to-Write
     SDV             Subdevice-Selection
     SND             Send
     SPD             Suspend
     TMR             Timer
     TRN             Turn-Around
 5728SS1 R03 M00 900610                        AS/400 Trace ICF Information              11/08/90 15:40:47        PAGE   2
2 Job . . . :   DSP10    3 User . . . :   QUSER  4 Number . . . . :   006267
5 Program . . . . :   ICFTEST   /ICFMAIN         6 Program File  . . . . :   ICFTEST   /ICFTSTCF
                                                7 Opened File   . . . . :  ICFLIB    /ICFTSTITF
8 Program     9 Record     10 Return    11           12 Response     13 Data    14 Remote     15
  Device        Format        Code         Function      Indicator       Length      Location       Time

 DEV1                        0000         ACQ                              0        Chicago        15:37:00.857
 DEV1         EVOKENOV       0000         EVK                              0        Chicago        15:37:08.284
 DEV1         NOVARLEN       0001         SND,INV                         80        Chicago        15:37:38.798
 DATA:
   THIS IS A PUT WITH INVITE.
 DEV1         NOVARLEN       0308         RCV           DET                0        Chicago        15:37:50.097
 DEV1         EVOKENOV       0000         EVK                              0        Chicago        15:38:08.887
 DEV1         NOVARLEN       0001         SND,INV                         80        Chicago        15:38:38.912
 DATA: 16
   THIS IS ANOTHER PUT WITH INVITE.
 DEV1         NOVARLEN       0308         RCV           DET                0        Chicago        15:38:52.835
 DEV1                        0000         EOS                              0        Chicago        15:40:43.580

                              * * * * *  E N D   O F   L I S T I N G  * * * * *
                                                                                                       R36B454-2
```

Figure 17-3. An Example of Spooled Trace Records

1 This first page of the spooled trace records is a table of the function codes used for each ICF operation. The function code is printed in the Function and Response Indicator columns.

Notes:

1. The suspend (SPD) and restore (RST) function codes are used in the System/36 environment. These function codes are part of the read-under-format (RUF) support. If two programs using the RUF support do not run in the same job, then the Trace ICF function does not trace both programs unless Trace ICF is started for both jobs.
2. The function code OPN indicates that the program opened a file that automatically acquired a program device. CLS indicates that the program closed the file prior to releasing or ending the session.

2 This is the job name of the job in which your program is running.

3 This is the user identification (User ID) used to start the job (either the user ID used to sign on the work station or the user ID received on the program start request).

4 This is the number assigned to the job step when your program started.

5 This is the name of the library where the program resides, and the name of the program that issued the operation that is being traced.

6 This is the program file name of the library where the ICF file named in the program resides, and the name of the ICF file named in the program.

7 This is the opened file name of the library where the ICF file opened by your program resides, and the name of the ICF file opened by your program.

Note: If you used the OVRICFF command to temporarily override the file named in the program, the name specified for the Opened File will be different from the Program File name.

8 This is the program device name assigned to the session to which the language operation or communications function was directed. This is the name specified in the Add ICF Program Device Entry (ADDICFDEVE) or Override ICF Program Device Entry (OVRICFDEVE) commands.

9 This is the record format name of the record format used when the communications function is issued. The record format can either be a user-defined data description specification (DDS) or a system-supplied format.

10 This is the major and minor return code issued to indicate the success or failure of each operation.

11 This is the function code assigned to represent the language operation or communications function issued by the program. Only operations associated with your ICF sessions are traced. File open and close operations are not traced except when a program device is acquired or released as a result of an open or close operation.

12 This is the function code assigned to represent the DDS response indicator that indicates status information about the input operation.

13 This is the length of data sent or received by the program. If the function indicates a send and receive operation, then this field represents the length of data received by the program.

14 This is the name of the remote location with which a communication session is established.

15 This is the time that the language operation or communication function was completed by the communications type. The time is displayed in hours, minutes, seconds, and milliseconds.

16 This is the data sent or received by the program. The amount of data traced depends upon the value specified for the *User data length* prompt (DTALEN parameter) of the TRCICF command. If the function indicates a send and receive operation, then the data received by your program appears.

Trace Records Sent to a Database File: When you select *OFF for the *Trace option setting*, you are presented with the option either to send the trace records to a spooled file (*PRINT) or send the records to a database file (*OUTFILE). If you choose the *OUTFILE value for the *Output* prompt, the trace information is sent to the database file that you specify. If you specify a file that already exists, it must match the attributes of the system-supplied file QAIFTRCF.

Figure 17-4 on page 17-6 shows the layout of the trace records sent to a database file. The database file has a fixed record length of 4337 decimal bytes. The record format name is QIFTRC. Each record in the file contains all the information related to the language operation or communications function, as well as the length of data traced. The length of data traced is less than or equal to the value specified on the *User data length* prompt (the DTALEN parameter) of the TRCICF command.

```
 * TRACE ICF OUTFILE RECORD FORMAT FOR TRCICF
 *
A          R QIFTRC                    TEXT('TRCICF Record          ')
A            IFJOB         10          COLHDG('JOB     ' 'NAME      ')
A                                      TEXT('Name of Job          ')
A            IFUSER        10          COLHDG('USER       ' 'NAME      ')
A                                      TEXT('Name of User         ')
A            IFNBR          6          COLHDG('JOB     ' 'NUMBER      ')
A                                      TEXT('Number of Job          ')
A            IFPGM         10          COLHDG('PROGRAM        ' 'NAME      ')
A                                      TEXT('Name of Program          ')
A            IFLIB         10          COLHDG('LIBRARY        ' 'NAME      ')
A                                      TEXT('Programs Library          ')
A            IFPGMF        10          COLHDG('PROGRAM        ' 'FILE       ' 'NAME      ')
A                                      TEXT('Program File          ')
A            IFPGML        10          COLHDG('PROGRAM        ' 'FILE       ' 'LIBRARY          ')
A                                      TEXT('Program Files Library                ')
A            IFOPNF        10          COLHDG('OPENED        ' 'FILE       ' 'NAME      ')
A                                      TEXT('Opened File          ')
A            IFOPNL        10          COLHDG('OPENED        ' 'FILE       ' 'LIBRARY         ')
A                                      TEXT('Opened Files Library             ')
A            IFPGDV        10          COLHDG('PROGRAM        ' 'DEVICE         ')
A                                      TEXT('Program Device          ')
A            IFRCFM        10          COLHDG('RECORD        ' 'FORMAT         ')
A                                      TEXT('Record Format          ')
A            IFMJMN         4          COLHDG('RETURN        ' 'CODE       ')
A                                      TEXT('Return Code          ')
A            IFOPCD        48          COLHDG('FUNCTION        ' 'CODE       ')
A                                      TEXT('Function Code          ')
A            IFRSPI        36          COLHDG('RESPONSE        ' 'INDICATOR          ')
A                                      TEXT('Response Indicator               ')
A            IFDTLN         2B         COLHDG('DATA       ' 'LENGTH        ')
A                                      TEXT('Data Length          ')
A            IFRLOC         8          COLHDG('REMOTE        ' 'LOCATION          ')
A                                      TEXT('Remote Location              ')
A            IFCENT         1
A                                      COLHDG('CENTURY        ')
A                                      TEXT('Century of Entry              ')
A            IFDATE         6          COLHDG('DATE       ')
A                                      TEXT('Date of Entry          ')
A            IFTIME         9S 0       COLHDG('TIME       ')
A                                      TEXT('Time of Entry          ')
A            IFSYS          8          COLHDG('SYSTEM        ' 'NAME       ')
A                                      TEXT('System Name          ')
A            IFDTTR         2B         COLHDG('TRACED        ' 'DATA       ' 'LENGTH        ')
A                                      TEXT('Traced Data Length             ')
A            IFCENT         1          COLHDG('CENTURY          ')
A                                      TEXT('Century of Entry')
A            IFDATE         6          COLHDG('DATE')
A                                      TEXT('Date of Entry')
A            IFSYS          8          COLHDG('SYSTEM' 'NAME')
A                                      TEXT('System Name')
A            IFRES         11          COLHDG('RESERVED          ')
A                                      TEXT('Reserved         ')
A            IFDATA      4096          COLHDG('DATA       ')
A                                      TEXT('Data       ')
```

Figure 17-4. An Example of Trace Records Sent to a Database File

Ending the Trace

You can end TRCICF from a system menu, by typing the TRCICF *END command on any command line, by adding the command to a CL program, or by typing TRCICF and pressing F4 to show the *Trace option setting* prompt on the Trace ICF display. Type *END and press the Enter key. This causes Trace ICF to end and all trace records to be deleted.

Additional Considerations

Trace ICF traces only those operations that are associated with your ICF sessions. File open and close operations are not traced except when a program device is acquired or released as a result of an open or close operation. The following restrictions apply to the trace of open and close operations that occur in a given job:

- When an open of an ICF file is issued without implicit acquire of the program device, the explicit acquire of the program device (ACQ) will be traced and not the open (OPN) operation.
- An open of an ICF file with implicit acquire of the program device is traced as an open operation (OPN).
- When the close of an ICF file is preceded with an end of session (EOS), the end of session is traced but not the close (CLS).
- When the close of an ICF file is preceded by a release operation (REL), the release operation is traced but not the close operation (CLS).
- When a close of an ICF file is not preceded by an EOS or release operation, it is traced as a close (CLS) operation.

Trace Job Information

Trace job information is obtained by:

1. Selecting the *Problem handling* option on the System Main Menu. Then, from the first Problem Handling display, selecting the *More problem handling* option. From the second Problem Handling display, select the *Programming language debug* option. Then select the trace command.
2. Enter GO CMDTRC on any display with a command line.
3. Enter the Trace Job (TRCJOB) command on the Command Entry display.

   The default parameters for this command are to turn on the trace and to provide a large enough trace table for most situations. These default parameters can be modified by supplying the desired parameters in the command or by prompting. Specifying TRCJOB *OFF deactivates tracing and causes a spool file to be created in the OUTQ specified in the job description.

Or:

4. Enter STRSRVJOB command from the command while in another job.

   This command specifies which job is to be serviced. Succeeding TRCJOB commands operate against the specified job. The ENDSRVJOB command ends the servicing of the job specified by the STRSRVJOB command.

How to Trace a Job

Sometimes a problem cannot be pinned down to a specific program. In this situation, the trace job facility maybe more useful than STRDBG with breakpoints.

The Trace job (TRCJOB) command logs all of the called programs. You can trace module flow or OS/400 data acquisition (including CL commands) or both.

As the trace records are generated, the records are stored in an internal trace storage area. When the trace is ended, the trace records can be written to a spooled printer file (QPSRVTRC) or directed to a database output file.

A sample trace scenario is as follows:

- `TRCJOB SET(*ON) TRCTYPE(*ALL) MAXSTG(2000) TRCFULL(*WRAP) EXITPGM($SCFTRC)`
- `CALL QCMD`
- `TRCJOB SET(*OFF) OUTPUT(*PRINT)`
- `WRKOUTQ output-queue-name`

Note: The maximum storage size allowed is 16000 decimal kilobytes. An error message is issued if more than 16000 decimal kilobytes is specified.

You should see a spool file with a name of QPSRVTRC. The spool file contains your trace. An example of a trace is shown next.

A Trace Job Example

The trace job information output is composed of two parts:

- Headings
- Trace entries

Following the examples of the different types of trace points is a typical trace job information output. Figure 17-5 on page 17-10 shows the headings, trace entries, and some trace points.

Headings: The trace job information output starts with a heading. The heading contains the following information:

1 TRACETYPE is the types of trace output that was printed. The types of trace output are *FLOW, *DATA, or *ALL. If the trace output is *ALL it is a combination of *FLOW and *DATA.

2 MAX STORAGE is the amount of storage allocated for the trace table in decimal kilobytes.

3 EXIT PROGRAM is the program name of the user-written exit program. If there is no exit program, the word *NONE appears here.

Note: The preceding information is specified by parameters on the trace job command. For more information about what can be specified by the parameters, see the *Programming: Control Language Reference*.

4 RECORD COUNT is the number of trace records processed (or number of trace points encountered while the trace is on) in decimal. The record count can be found at the beginning and end of the the trace job information.

5 START TIME is the start time of the job trace information. It is given in hours, minutes, and seconds.

6 JOB is the fully qualified name of the job being traced.

Trace Entries: The trace output consists of these types:

- Flow entries
- Data entries

Flow Entries: The following trace entries are *FLOW entries except for the entry named DATA (which is a *DATA entry), SSPTRC, and RSMTRC entries, which are always included regardless of the type of trace output specified.

7 TIME is the time of day for the trace entry. The sequence number of time is given in hours, minutes, seconds, and fractions of a second.

8 SEQNBR is the sequence number of the trace entry. The sequence number of the last entry is equal to the record count **4** in the heading of the trace job output.

9 FUNCTION is what caused the trace entry to be recorded. The possible trace entries are:

Trace Entry	Description
CALL	Call external
DATA	A data trace
EVENT	Event handler
EXTXHINV	External exception handler
EXTXHRET	Invocation ended because of a return from an exception
INTXHINV	Internal exception handler
INTXHRET	Return from exception
INVEXIT	Invocation because of an invocation exit routine
ITERM	Intervening invocation ended
ITRMXRSG	Invocation ended because of a re-signaling exception
PTRMTPP	Process ended
PTRMUNHX	Ended because of an unhandled exception
RETURN	Return external
RSMTRC	Trace resumed
SSPTRC	Trace suspended
XCTL	Transfer control

10 PROGRAM is the name of the program for the entry.

11 LIBRARY is the library name that the program associated with the trace entry is in.

12 ENTRY is the instruction number, in the program, where the program was given control. This is true for when a program is nonobservant and observant.

13 EXIT is the instruction number, in the program, where the program gave up control.

14 CALL LVL is the call level of the program.

15 00001 RECORDS DELETED BY is the number of consecutive records deleted by the exit program at this point in the trace.

Data Entries: The data trace points can be one of the following types:

- Command analyzer transfer to a program
- Command analyzer transfer to a CPP
- Control language transfer to a program
- Control language transfer to a CPP
- Send message from the message handler
- Send status from the message handler
- Send reply from the message handler
- Exception handler of the message handler
- Data management open
- Data management close
- Data management acquire
- Data management release
- Other or undefined

  16 This is an example of other or undefined data. This example uses T3 component data. For more information about T3 components, see page 26-3.

These data entries contain the same information for the flow entries **7** through **9**. Depending on the data entry type, the data entries may also contain the following information:

- Command analyzer transfer to a program
- Command analyzer transfer to a CPP
- Control language transfer to a program
- Control language transfer to a CPP

17 PGM is the command name and the library of the command definition.

18 CMD is the program and library name of the program invoked.

- Send message from the message handler
- Send status from the message handler
- Send reply from the message handler
- Exception handler of the message handler

19 MSID is the message identifier and the type of message sent.

20 SEV is the severity code of the message.

21 MSGQ is the name of the message queue that the message is on.

22 INV is the invocation level of the message target queue.

23 This is the SSPTRC record that shows the trace is suspended after an automatic dump is taken because of an unmonitored escape message.

24 This is the RSMTRC record that shows tracing is resumed after the dump is finished.

25 FILE is the name of the file opened or closed.

- Data management open
- Data management close

26 ACT FILE is the file and library name of the actual file used.

27 DEV/MBR is the device or member name (*N = NONE).

```
5728SS1 R03 M00 900610              AS/400 TRACE JOB INFORMATION                        10/21/90 00:07:57      PAGE    1
                 1                            2                  3
 TRACE TYPE  - *ALL      MAX STORAGE- 00128      EXIT PROGRAM-              .TRCLIB/$SCFTRC
                 4                            5              6
 RECORD COUNT- 000809    START TIME - 00:07:12   JOB- 003340     /QSECOFR   /WS0500

   7                 8        9         10         11          12    13    14                      DB    NON-DB    PAGES    NUMBER
  TIME             SEQNBR  FUNCTION  PROGRAM     LIBRARY     ENTRY EXIT  CALL LVL      CPU TIME  READS  READS   WRITTEN   WAITS
         15 00001 RECORDS DELETED BY THE EXIT PROGRAM
  00:07:12.548     000002  CALL      QMHRCMSS    QSYS        0001  037F    03           0.028      0      0        0        0
  00:07:12.561     000003  CALL      QMHGSD      QSYS        0001  0397     04          0.016      0      0        0        0
  00:07:12.578     000004  CALL      QWSPUT      QSYS        0001  0B9D      05         0.036      0      0        0        0
  00:07:12.617     000005  XCTL      QWSGET      QSYS        0001  027E      05         0.012      0      0        0        0
  00:07:12.630     000006  CALL      QT3REQIO    QSYS        0001  0055       06        0.045      0      0        0        1
  00:07:12.644     000007  DATA   16 FF      E3F360C5D5E3D9EB4040007300000331000001A0002B000000003  *T3-ENTRY Ē             *
  00:07:12:645     000008  DATA      FF      C4E2D7F0F14040404040000000000000000000000F5F64000000000  *WS0500          56     *
  00:07:12.647     000009  DATA      FF      E3F360D9C5D8C9D64040000000000000000000008B000100020003  *T3-REQIO         H     *
  00:07:23.536     000010  DATA      FF      E3F360C4C5D8E4C5E4C500000000000000000000000000000020003  *T3-DEQUEUE             *
  00:07:23.549     000011  RETURN    QWSGET      QSYS        027F  0093      05         0.016      0      0        0        0
  00:07:23.564     000012  RETURN    QMHGSD      QSYS        0398  001C     04          0.016      0      0        0        0
  00:07:23.579     000013  RETURN    QMHRCMSS    QSYS        0380  038E    03           0.012      0      0        0        0
  00:07:23.592     000014  CALL      QMHFLTR     QSYS        0001  004E     04          0.012      0      0        0        0
  00:07:23.609     000015  RETURN    QMHRCMSS    QSYS        03BF  005A    03           0.016      0      0        0        0
  00:07:23.621     000016  RETURN    QCMD        QSYS        0154  016B   02            0.008      0      0        0        0
  00:07:23.632     000017  CALL      QCADRV      QSYS        0001  002C    03           0.008      0      1        0        0
  00:07:23.688     000018  CALL      QCANPARS    QSYS        0001  0085     04          0.012      0      1        0        0
  00:07:23.725     000019  RETURN    QCADRV      QSYS        002D  0030    03           0.008      0      0        0        0
  00:07:23.732     000020  CALL      QCARULE     QSYS        0001  00BB     04          0.008      0      0        0        0
  00:07:23.743     000021  RETURN    QCADRV      QSYS        0031  004C    03           0.008      0      0        0        0
  00:07:23.750     000022  CALL      QCAPOS      QSYS        0001  00D9     04          0.012      0      0        0        0
  00:07:23.761     000023  RETURN    QCADRV      QSYS        004D  009E    03           0.004      0      0        0        0
  00:07:23.768     000024  CALL      QCAFLD      QSYS        0001  00E4     04          0.012      0      0        0        0
  00:07:23.779     000025  RETURN    QCADRV      QSYS        009F  00B4    03           0.004      0      0        0        0
  00:07:23.782     000026  XCTL      QCACALL     QSYS        0001  005B    03           0.020      0      0        0        0
  00:07:23.785     000027  DATA                                                     COMMAND ANALYZER TRANSFER TO PROGRAM
                                                                                 17 CMD      -QSYS38     /CALL
                                                                                 18 PGM      -TRCLIB     /TRCPT
  00:07:23.803     000028  XCTL      TRCPT       TRCLIB      0001  0004    03           0.008      0      0        0        0
  00:07:23.811     000029  CALL      QCLRSLV     QSYS        0001  00A0     04          0.008      0      0        0        0
  00:07:23.819     000030  RETURN    TRCPT       TRCLIB      0005  000E    03           0.008      0      0        0        0
  00:07:23.826     000031  CALL      QCADRV      QSYS        0001  0030     04          0.004      0      0        0        0
  00:07:23.833     000032  CALL      QCARULE     QSYS        0001  0160      05         0.016      0      0        0        0
  00:07:23.850     000033  INTXHINV  QCARULE     QSYS        00FE  010E      05         0.008      0      0        0        0
  00:07:23.858     000034  CALL      QLIROHDL    QSYS        0001  00A3       06        0.012      0      0        0        0
  00:07:23.867     000035  RETURN    QCARULE     QSYS        010F  00BB      05         0.012      0      0        0        0
  00:07:23.879     000036  RETURN    QCADRV      QSYS        0031  004C     04          0.008      0      0        0        0
  00:07:23.891     000037  CALL      QCAPOS      QSYS        0001  00D9      05         0.012      0      0        0        0
  00:07:23.903     000038  RETURN    QCADRV      QSYS        004D  009E     04          0.008      0      0        0        0
  00:07:23.910     000039  CALL      QCAFLD      QSYS        0001  00E4      05         0.012      0      1        0        0
  00:07:23.984     000040  RETURN    QCADRV      QSYS        009F  00A8     04          0.008      0      0        0        0
  00:07:23.992     000041  CALL      QCAIFLD     QSYS        0001  001D      05         0.012      0      0        0        0
  00:07:24.001     000042  RETURN    QCADRV      QSYS        00A9  00B5     04          0.004      0      0        0        0
  00:07:24.005     000043  XCTL      QCATRS      QSYS        0001  006F     04          0.016      0      0        0        0
  00:07:24.017     000044  DATA                                                     COMMAND ANALYZER TRANSFER TO CPP
                                                                                    CMD      -QSYS38     /SNDPGMMSG
                                                                                    PGM      -QSYS       /QMHSNPGM
  00:07:24.025     000045  XCTL      QMHSNPGM    QSYS        0001  0037     04          0.008      0      0        0        0
  00:07:24.032     000046  CALL      QMHSNSTA    QSYS        0001  0087      05         0.008      0      0        0        0
  00:07:24.040     000047  CALL      QMHRTMSS    QSYS        0001  0065       06        0.008      0      0        0        0
5728SS1 R03 M00 900610                 TRACE JOB INFORMATION                            10/21/90  0:07:58      PAGE    2
                                                                                               DB    NON-DB    PAGES    NUMBER
  TIME             SEQNBR  FUNCTION  PROGRAM     LIBRARY     ENTRY EXIT  CALL LVL      CPU TIME  READS  READS   WRITTEN   WAITS
  00:07:24.048     000048  CALL      QMHMFSRH    QSYS        0001  00A5  07             0.012      0      0        0        0
  00:07:24.061     000049  RETURN    QMHRTMSS    QSYS        0066  0136       06        0.016      0      0        0        0
  00:07:24.078     000050  RETURN    QMHSNSTA    QSYS        00B8  0070      05         0.016      0      0        0        0
  00:07:24.085     000051  DATA                                                     MESSAGE HANDLER SEND STATUS
                                                                                 19 MSGID    -CPD0172    DIAGNOSTIC
                                                                                 20 SEV      -30    MSGQ-QCL 21               INV-0002 22
                                                                                                                        R36B404-5
```

Figure 17-5 (Part 1 of 2). An Example of Trace Job Information

```
    00:07:30.566  000357 DATA     FF   E3F360C5D5E3D9EB007700000057000000000000000000000002  *T3-ENTRY I   T          *
    00:07:30.569  000358 DATA     FF   C4E2D7F0F14040404040000000000000000000F5F64000000000  *WS0500              56  *
    00:07:30.572  000359 RETURN   QWSDSMSG   QSYS      0071 00B0         11      0.065    0     2      0    0
    00:07:30.677  000360 RETURN   QMHSNSTA   QSYS      00A9 00A9        10       0.008    0     1      0    0
    00:07:30.717  000361 RETURN   QMHAPD     QSYS      01BB D3D7      D9         1.233    0    10     29    0
 5728SS1 R03 M00 900610                     TRACE JOB INFORMATION                  10/21/90  0:07:58       PAGE    9
                                                                                       DB  NON-DB  PAGES   NUMBER
    TIME          SEQNBR FUNCTION PROGRAM    LIBRARY   ENTRY EXIT  CALL LVL    CPU TIME  READS  READS  WRITTEN  WAITS
    00:07:30.723  000362 SSPTRC                                              TRACE SUSPENDED DURING DUMP 24
    00:07:33.222  000363 RSMTRC 23                                           TRACE RESUMED FOLLOWING DUMP
    00:07:33.238  000364 RETURN   QMHUNMSG   QSYS      00DA 0119    08           0.008    0     0      0    0
    00:07:33.246  000365 EVENT    QMHIREH    QSYS      0001 D09A      D9         0.004    0     0      0    0
    00:07:33.250  000366 CALL     QMHRSTPR   QSYS      0001 D00B        10       0.008    0     0      0    0
    00:07:33.258  000367 CALL     QMHSNSTA   QSYS      0001 D0B7         11      0.004    0     0      0    0
    00:07:33.262  000368 CALL     QMHRTMSS   QSYS      0001 D065           12    0.004    0     0      0    0
    00:07:33.266  000369 CALL     QMHMFSRH   QSYS      0001 D0A5  13             0.008    0     0      0    0
    00:07:33.276  000370 RETURN   QMHRTMSS   QSYS      0066 D136           12    0.008    0     0      0    0
    00:07:33.283  000371 RETURN   QMHSNSTA   QSYS      00B8 D0AB         11      0.008    0     0      0    0
    00:07:33.286  000372 DATA                                                MESSAGE HANDLER SEND STATUS
                                                                              MSGID   -CPI9801   STATUS
                                                                              SEV     -00  MSGQ-QMHRSTPR     INV-0010
    00:07:58.288  000591 CALL     QDMCLOSE   QSYS      0001 D06F        D4       0.008    0     0      0    0
    00:07:58.298  000592 CALL     QWSCLOSE   QSYS      0001 D0D8         D5      0.008    0     0      0    0
    00:07:58.307  000593 CALL     QT3REQIO   QSYS      0001 D055           D6    0.016    0     0      0    0
    00:07:58.314  000594 DATA     FF   E3F360C5D5E3D9EB4040007400000000000000000000000000002  *T3-ENTRY È               *
    00:07:58.318  000595 DATA     FF   C4E2D7F0F14040404040000000000000000000F5F64000000000  *WS0500              56  *
    00:07:58.323  000596 RETURN   QWSCLOSE   QSYS      00D9 D076         D5      0.020    0     1      0    0
    00:07:58.374  000597 RETURN   QDMCLOSE   QSYS      0070 D124        D4       0.020    0     0      0    0
    00:07:58.386  000598 DATA                                               DATA MANAGEMENT CLOSE
                                                                         25 FILE                /QDPTDSP
                                                                         26 ACT FILE QSYS       /QDPTDSP
                                                                            DEV/MBR             /WS0500
    00:07:58.395  000599 RETURN   QPTPARML   QSYS      0037 D040      D3     27  0.012    0     0      0    0
    00:07:58.407  000600 CALL     QMHDLMS    QSYS      0001 D00A        D4       0.008    0     0      0    0
    00:07:58.415  000601 RETURN   QPTPARML   QSYS      0041 D02B      D3         0.004    0     0      0    0
    00:07:58.422  000602 XCTL     QCADRV     QSYS      0001 D09E      D3         0.008    0     0      0    0
    00:07:58.430  000603 CALL     QCAFLD     QSYS      0001 D0E4        D4       0.012    0     0      0    0
    00:07:58.439  000604 RETURN   QCADRV     QSYS      009F D0AB      D3         0.008    0     1      0    0
    00:07:58.477  000605 CALL     QCAIFLD    QSYS      0001 D01D        D4       0.008    0     0      0    0
 5728SS1 R03 M00 900610                     TRACE JOB INFORMATION                  10/21/90  0:07:58       PAGE   14
                                                                                       DB  NON-DB  PAGES   NUMBER
    TIME          SEQNBR FUNCTION PROGRAM    LIBRARY   ENTRY EXIT  CALL LVL    CPU TIME  READS  READS  WRITTEN  WAITS
    00:07:58.486  000606 RETURN   QCADRV     QSYS      00A9 D0B5      D3         0.004    0     0      0    0
    00:07:58.490  000607 XCTL     QCATRS     QSYS      0001 D06F      D3         0.016    0     0      0    0
    00:07:58.501  000608 DATA                                               COMMAND ANALYZER TRANSFER TO CPP
                                                                              CMD     -TRCJOB    .QSYS
                   4                                                          PGM     -QSCTJOB   .QSYS
    00:07:58.508  000609 XCTL     QSCTJOB    QSYS      0001 D000      D3         0.000    0     0      0    0
                                    * * * * *  E N D  O F  L I S T I N G  * * * * *
                                                                                                        R36B405-4
```

Figure 17-5 (Part 2 of 2). An Example of Trace Job Information

Tracing Writer Jobs: On the Command Entry display, enter the Start Service Job (STRSRVJOB) command when tracing a writer job. Remember, print writers run under a job different from the job which issues the Start Print Writer (STRPRTWTR) command. Do the following to obtain a job trace of a writer's job:

- Enter the STRPRTWTR command for an output queue with no ready files.
- View the writer's message queue to find the name of the writer's job.
- Use the writer's job name when completing the STRSRVJOB command.
- Enter the Trace Job (TRCJOB) command on any display with a command line.
- Release or generate output into the writer's output queue and allow printing to continue.
- When the appropriate event is done, use TRCJOB *OFF to end the trace. Then, enter the End Service Job (ENDSRVJOB) command on any display with a command line to end the service job.
- The TRCJOB command produces the trace output.

Tracing VLIC Using the TRCINT Command

Information from tracing vertical licensed internal code (VLIC) is obtained by:

1. Selecting the *Problem handling* option on the System Main Menu. Then, from the Problem Handling display, selecting the *System service tools* option. From the System Service Tools menu, select the *Start a service function* option. From the Start a Service Function menu select the *Trace vertical licensed internal code* option.
2. Select the *Start a service tool* option from DST. From the Start a Service Tool menu select the *Trace vertical licensed internal code* option.

Or:

3. Enter the Trace Internal (TRCINT) command on the Command Entry display.

For more information about the *Trace vertical licensed internal code* option, see Chapter 12.

How to Trace VLIC

The Trace Internal (TRCINT) command is used primarily for problem analysis. It controls traces of internal events associated with the current job that occur at a level below the machine interface. Specific types of traces can be started and stopped using this command. Those that apply to devices can be limited to a particular device.

While previously started internal traces are being performed, additional internal traces can be started through this command. The output created by the trace is placed in internal storage used by the internal trace command. The records from the internal storage can be written to a spooled printer file or written to a diskette or tape.

The TRCINT command allows VLIC traces of lines, controllers, devices, and any combinations thereof. This command also allows you to change trace table sizes, set traces off, create spooled files, and save trace information to tape or diskette. This command does the same thing that the VLIC trace options under SST except that TRCINT SET(*OFF) sets all the VLIC traces off; whereas, SST allows you to choose which trace you want to set off. For more information about the *Trace vertical licensed internal code* option, see 12-10. For restrictions about using the TRCINT command, see the *CL Reference*.

Trace VLIC Types: The three groups of trace types are:

- *Component data trace codes* cause active procedures to be traced within the system. For more information about VLIC component traces, see page 3-18 and Chapter 30.
- *Call data trace codes* cause all calls and returns done within the component to be traced.
- *General trace codes* cause the tracing of the instruction supervisor, multiprogramming, or task switching functions. Table 17-2 on page 17-13 lists the different trace types. For more information about trace VLIC and its types, see Chapter 30.

Table 17-2. Trace VLIC Types

Type of Trace	Component Trace Code	Call Data Trace Code	General Trace Code
Instruction supervisor linkage (SVL) trace	—	—	030000
Multiprogramming level (MPL) trace	—	—	040000
Task switching trace	—	—	060000
APPN traces—(all)	012506	—	—
APPN control point manager	012501	052700	—
APPN control point presentation services	012504	053000	—
APPN directory services	012502	052800	—
APPN location manager	012505	053100	—
APPN topology and routing services	012503	052900	—
Authority management	010900	050200	—
Auxiliary storage management	011101	—	—
Auxiliary storage management—detailed	011104	—	—
Commit management	011700	050300	—
Common class input/output manager (CCIOM)	011900	052100	—
Common functions	011200	050100	—
Communications trace service function	012300	052500	—
Context management	011000	050400	—
Database management (events for all database files are traced)	010400	050500	—
Display station pass-through	010804	—	—
Environmental recording, editing and printing (EREP)	012200	052400	—
Error log	012100	052300	—
Event management	010600	050700	—
Exception management	010200	050600	—
Independent index management	011400	050800	—
Inter-process communications facility (IPCF)	012000	052200	—
Journal management	011600	050900	—
Link test service function	012400	052600	—
Load/dump (save/restore)	010801	052000	—
Machine observation	011300	051600	—
Machine services control point	010802	051500	—
Main storage management—details	011103	—	—
Main storage management—invocations	011102	—	—
Process management	010500	051000	—
Program management	010300	051100	—
Queue management	010700	051800	—
Recovery management	—	051700	—
Resource management	010100	051200	—
Source/sink (device support) management	010803	051300	—
Source/sink IOM	—	051900	—
Space object management	011500	051400	—
Storage management (all)	011105	—	—

Examples: Some examples of trace VLIC are as follows:

```
TRCINT  SET(*ON)  TRCTYPE(010100 010400
   050500 051200)
```

This command starts component data traces and call traces for resource management and database. All database operations associated with all database files are used to collect component data trace records.

```
TRCINT  SET(*ON)  TRCTYPE(010803)
   DEV(WS1 WS2 WS3)  LIN(L1 L2)
   CTL(C1 C2)
```

This command starts component data traces for source/sink management (device support) operations involving the devices WS1, WS2, and WS3, lines L1 and L2, and controllers C1 and C2.

```
TRCINT  SET(*END)  TRCFULL(*STOPTRC)
```

This command stops all traces and clears the trace storage. When TRCINT is used again, tracing stops when the trace storage becomes full.

Part 5. IPL and Install Information

Chapter 18. IPL Phases

This chapter describes the types and phases of an IPL.

IPL Overview

There are two types of IPLs. They are:

- An unattended IPL

  The Keylock switch is in the Normal or Auto position for:

  - A remote IPL
  - An auto power restart
  - A power on by date and time

  The Keylock switch is in the Normal, Auto, or Secure position and QIPLTYPE is 0 using the:

  - Power on switch
  - PWRDWNSYS command with restart

  After the power is turned on from an auto restart, remote IPL, timed IPL, or pressing the Power On switch, the system starts an IPL. DST and OS/400 do not present any displays during this IPL.

  Note: A type D IPL also installs the operating system. This is the same as performing an automatic install of the operating system under DST.

- An attended IPL

  The Keylock switch is in the Manual position using the:

  - Power on switch
  - Function 3 (Start IPL) on the control panel
  - PWRDWNSYS command with restart

  The Keylock switch is in the Normal, Auto, or Secure position and QIPLTYPE is 1 or 2 using the:

  - Power on switch
  - PWRDWNSYS command with restart

  When the Keylock switch is in the Manual position and QIPLTYPE is 2, the IPL is attended in debug mode.

  After the power is turned on from an auto restart, the system starts an IPL. During an attended IPL, DST and OS/400 present menus and prompts that let you:

  - Change IPL options
  - Install the operating system
  - Use dedicated service tools (DST)

When these IPLs are complete, the system Sign On display is shown on all available display stations. You can do these types of IPLs a number of different ways. They are:

- Manually

  You turn on power using the Power On switch and your system does an unattended or an attended IPL.

- Remotely

  The power is turned on from another location, and your system does an unattended IPL.

- By date and time

  On a specific time and day, the power is turned on and the system does an unattended IPL.

- PWRDWNSYS with restart
- Starting an IPL using function 3 on the control panel when the system is powered on.
- Automatically after a power failure

  When the power is restored, the system power is turned on and the system does an unattended IPL.

For more information about how to do an attended IPL or an unattended IPL, see the *Operator's Guide*. For more information about what displays appear during an attended IPL, see page 18-19. For more information about IPL types A and B, see Figure 2-1 on page 2-4. For more information about IPL type D, see "Using the Stand-Alone Utilities to do an IPL" on page 18-3. For more information about the QIPLTYPE system value, see "System Values" on page 19-5.

Each IPL goes through five phases. Figure 18-1 on page 18-2 shows the initial program load (IPL) phases. The five IPL phases are:

1. Service processor

   This automatically tests the controller and loads control storage and main storage. The service process also plays a significant role during phase 2 and 3. For more information about this phase, see page 18-6.

2. Horizontal licensed internal code (HLIC) initialization

   For the most part, this phase is handled by the HLIC layer of the architecture. For more information about this phase, see page 18-9.

3. Vertical licensed internal code (VLIC) initialization

   For the most part, this phase is handled by the VLIC layer of the architecture. For more information about this phase, see page 18-9.

4. Machine-to-program transition

   This phase utilizes both the VLIC layer and the OS/400 layer of the architecture to make the transition from the machine to the operating system programs; to make the transition across the machine interface (MI). For more information about this phase, see page 18-11.

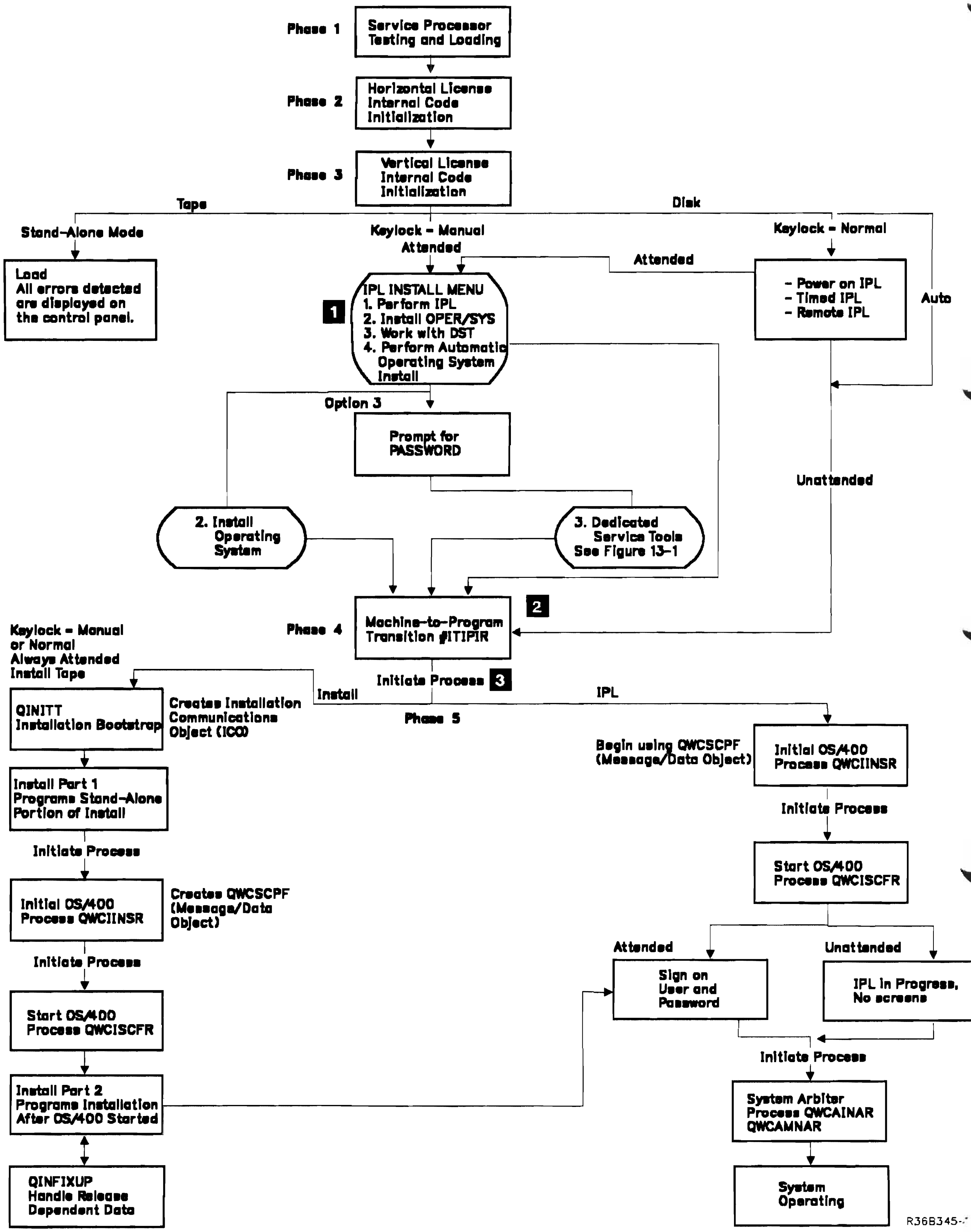
5. Installing and/or starting OS/400

   For the most part, this phase is handled by the OS/400 layer of the architecture. For more information about this phase, see page 18-12.

Figure 3-4 on page 3-12 shows the layered architecture of the system.

IPL Phases

Figure 18-1. Initial Program Load (IPL) Sequence. For an IPL overview of the tasks performed during an install and restore, see the Service Guide.



Using the Stand-Alone Utilities to do an IPL: You can use the stand-alone utilities (SAU) anytime the system does not come up on the load-source disk. This utility places the code for IPL phases 1 through 3 on the system. Use the stand-alone utilities to:

- Upgrade the system to a new release.
- Restore the system after repairing the load-source disk.
- Load the code for IPL phases 1 through 3 if the system does not IPL to phase 4.

To use the stand-alone utilities:

1. Get the latest set of ISD tapes or the latest SAVSYS tape.
2. Load the tape on the appropriate load-source tape device.
3. Set the Keylock switch to the Manual position.
4. Set the control panel to function 2 using the Select switch.

   For information about function 2, see page 14-4.
5. Press the Enter switch on the control panel.
6. Using the Select switch again, enter a D in the Data display on the control panel.
7. Press the Enter switch on the control panel.
8. Select function 3 and press the Enter switch on the control panel or press the Power On switch to start the IPL. The system begins reading the tape.

Select function 23 to restore the licensed internal code, function 24 to install the licensed internal code, or function 29 to load model unique licensed internal code. For more information about SAU, see functions 23, 24, and 27 through 32 starting on page 14-7.

Disk Informational Messages for SRC A6xx YYYY:

Table 18-1. Disk Informational Messages for SRC A6xx YYYY

YYYY	Description	Comment
6001	Select function 23, 24, or 29	Power off the control panel to stop processing.
6002	**Warning**: If the disk contains data, the data may be lost or destroyed. Select function 23 to restore, function 24 to install, or set the Power switch to off.	To determine which disk loading has been requested, display: • Function 14 for the DASD type and model • Function 15 for the DSA and unit address
6003	**Warning**: If the disk contains data not in a correct format to be a primary device, the data may be lost or destroyed. Select function 24 to install, or set the Power switch to off.	See comment for 6002.
6004	**Warning**: If the disk contains data not in a correct format to be a primary device, the data may be lost or destroyed. Select function 23 to restore, or set the Power switch to off.	See comment for 6002.
6005	Load source device not found.	Ensure that the device is cabled and the Power switch is set to on.
6011	Load model unique licensed internal code was selected	Select function 23 to load licensed internal code or select function 29 to cancel this request.
6030	Primary disk is not ready.	Make it ready.

Tape Informational Messages for SRC A6xx YYYY:

Table 18-2. Disk Informational Messages for SRC A6xx YYYY

YYYY	Description	Comment
6041	Tape drive is not operating.	See Chapter 3 or the *Operator's Guide*.
6042	Tape drive is not ready.	If xx in the SRC is: 33 Load assistance 37 Cartridge length check 3B Volume removed earlier 43 Tape not mounted FE The tape drive is powered off FF The tape drive is powered off
6043	Tape load failure.	If xx in the SRC is: 11 Door is open 12 Reel is missing 13 Reel is inverted 14 BOT mark is missing 15 Reel is not seeted 16 The load failed 1B The @ switch changed 1C The @ switch failed
6048	Mount new tape volume.	The xx in the SRC is the volume number to mount.
6049	Incorrect volume number.	The xx in the SRC is the volume number to mount.
6051	Load tape volume containing the licensed internal code.	Insert the correct tape, then make the tape ready.
6052	Inserted tape did not contain the licensed internal code.	Insert the correct tape, then make the tape ready.

Problems during IPL

Table 18-3 on page 18-4 shows that most problems that occur during IPL are machine checks. Machine checks are shown on the control panel as system reference codes (SRC). For more information about SRCs during IPL (status or machine checks), see Appendix D, Appendix C on page C-1 or the *Unit Reference Code Guide*.

When the Keylock switch is in the Manual position, errors detected before and after **1** in Figure 18-1 on page 18-2 are displayed on the control panel. To solve these errors and system errors that occur during DST or installing the operating system, see Chapter 19 and Appendix C.

Device errors that are detected during DST and during the installation of the operating system are presented on a separate error message display. Follow the instructions on the display.

When the Keylock switch is in the Manual, Auto, Secure, or Normal position, critical path errors are displayed on the control panel.

For noncritical path errors, go to the problem log, the error log, and the QHST and QSYSOPR queues. These logs and queues can be viewed after sign on is complete.

See Table 18-5 on page 18-10 for functions performed at **2** shown in Figure 18-1 on page 18-2.

See Figure 18-3 on page 18-8 and Figure 18-4 on page 18-8 for the status SRCs that appear on the control panel during an IPL. The status of an IPL is shown at **3** in Figure 18-1 on page 18-2.

System Reference Codes (SRC) on the Control Panel: Table 18-3 shows how SRCs that appear on the control panel are grouped. The SRC is a 32 byte (or 64 character) variable length structure. The SRC includes a 2-byte unit reference code and variable length configuration and supporting data. The placement of the reference code in the SRC depends on the SRC format. For more information about SRC formats, see Figure C-2 on page C-2.

The system gathers information about an error as the system detects the error. The error information is logged and stored in the error log. A system reference code (SRC) is encoded information used to evaluate or identify a system detected hardware or software error, failure, or status. The failure information may include the failing condition or FRU (or FRU group) and its location. The SRC links to the problem determination procedure when the element detecting the failure cannot isolate the failing condition. The SRC link completes the isolation process.

In summary, the SRC provides the first data capture information and is used by the customer or support representative during problem determination, repair actions, and verification. The SRC provides a link to the problem determination procedures (hard and/or soft copy). Together the SRC and the problem procedures are then used to isolate the problem.

Table 18-3. System Reference Codes (SRC) on the Control Panel

Problem	SRC	Description
Machine problems	0XXX XXXX through 9XXX XXXX	Hardware machine check
	B1XX XXXX	Service processor machine check
	B6XX XXXX	VLIC machine check
	B9XX XXXX	OS/400 machine check
	A6XX XXXX	VLIC operation intervention
	A9XX XXXX	OS/400 operation intervention
IPL status	C1XX XXXX	IPL status for the service processor (**See Figure 18-3 on page 18-8 and Figure 18-4 on page 18-8.**)
	C6XX XXXX	IPL status for VLIC (**See Table 18-4 on page 18-10 and Table 18-5 on page 18-10.**)
	C9XX XXXX	IPL status for OS/400 (**See Table 18-6 on page 18-18.**)
Other	D1XX XXXX	General status for the service processor
	D6XX XXXX	General status for VLIC

For debugging IPL problems, it is important that you have correct information. Normally, the *Analyzing Problems Guide* and the *Unit Reference Code Guide* instruct the customer or hardware service representative about error conditions that could not be corrected by completing a procedure or by replacing a part identified by the SRC.

Paging Environment of the AS/400

When all the systems are logically connected to the system, the systems software can be used to diagnose and solve problems. The amount of assistance that software can provide to you is dependent upon the IPL phase the system is in. For the purposes of this discussion, the system can be divided into four service environments. Each environment depends on the IPL phase the system is in.

All paging environments are controlled by the VLIC storage management (SM) component. There is some hardware code that assists in the process, but no paging environment can operate until storage management is operating. The service environments on the AS/400 are:

- Nonpaging environment

  The first servicing environment is when you are starting to bring the system up. This environment completely encompasses the first two IPL phases and part of the third. If any severe or terminating errors (any errors that prevent the system from achieving the limited paging environment) are encountered during this time, the errors are displayed as an SRC on the system control panel. You can find a description of the SRC formats in Appendix C. All the nonterminating errors are saved by the hardware and then passed to the system when it is able to receive and store them.

The service processor displays the errors on the control panel. The Stand-Alone Utility (SAU) is used when the service processor is not functioning properly, or the system processor is unable to IPL to the load source. SAU is the tape, type D, IPL support. Because SAU is able to create and restore a system, it has much of the same support as the initial IPL phases. For more information about SAU, see page 14-8.

- Limited paging environment

  This environment contains all the functions of the horizontal licensed internal code, only limited functions of the vertical licensed internal code, including storage management, and no operating system. This environment is only available during the final part of IPL phase 3.

  In this environment, storage management will only allow paging from the load-source device because both the horizontal and vertical licensed internal code are located on the load source. To use them, the system must be able to page their code in and out of main memory. The limited paging pages to and from the load source only. Any other data located on the load source can also be paged in and out of main storage.

  If the system can achieve the limited paging environment, the horizontal licensed internal code is fully functional and the vertical licensed internal code is functional enough that a minimum operating system can be established to look at the rest of the machine, except for the operating system. This provides the complete set of tools to DST. For example, all the options of the work with disk units (or data management) can be used in the DST limited paging environment.

  A set of tools combining the functions of the horizontal licensed internal code, the basic capabilities of all the devices physically attached to the system, and some support of the vertical licensed internal code are placed in the limited paging environment. These tools provide you functions that cannot be done in the normal processing environment. These tools are made available using DST.

  Only DST can be used to do any servicing at this level. DST can access all the non-load source devices.

  All the disk units that are attached to the system, and powered on, are accessible. This lets you perform error recovery procedures and make configuration changes. However, all the data on the system and the integrity of the system configuration need to be protected. Therefore, data management controls which functions are used for each disk unit attached to the system.

- Full paging environment

  This environment is the one used during normal operation of the system. The horizontal and vertical licensed internal code and the operating system are fully functional. This environment starts at IPL phase 4.

  This environment is achieved after storage management recovers its directories or runs directory recovery. The directories are the internal constructs that storage management uses in its paging algorithms. After this is accomplished, paging (reading and writing) is performed on all of the configured disk units. DST can still be used as a service tool; but, since some of the available tools could be destructive to the configuration and the connections which storage management assumes are present, the functions that DST can perform are restricted. For example, in the full paging environment of DST, you can only use the work with disk units options of DST that are similar to the work with disk units options displayed in SST.

- Operating system (OS/400) environment

  Finally, the operating system is available at IPL phase 5 and beyond. Problem analysis or the WRKHDWPRD command are the designated service tools at this level. However, these tools do not have all of the DST functions. Both SST and DST are available in the operating system environment. While in the limited paging environment, you can set parameters during an IPL to complete the IPL from DST,

Figure 18-2 on page 18-6 compares the limited and full paging environments.

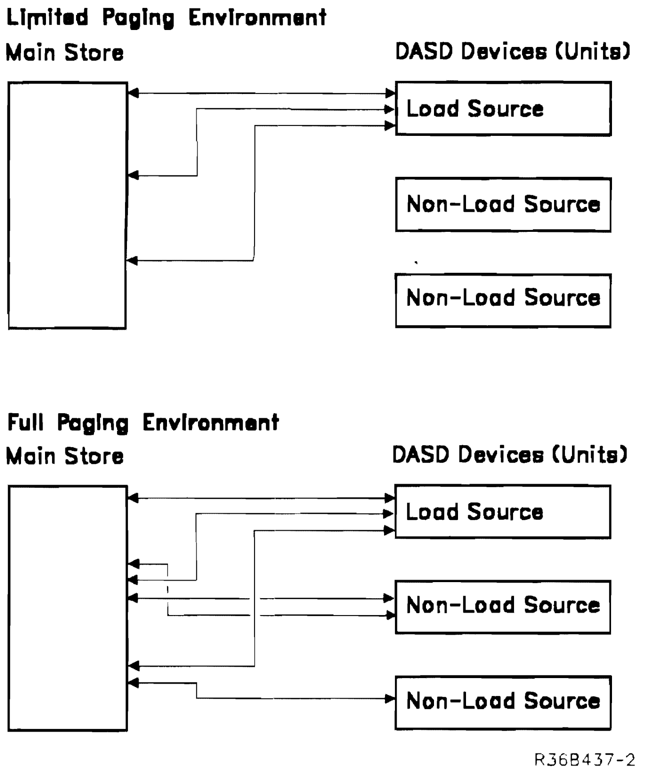


Figure 18-2. Comparing the Limited and Full Paging Environments

***Mirroring in the Environments*:** As the IPL process moves from limited paging to full paging, the options available under DST change. Without mirroring, those operations that could affect the customer's data on the system would not run. With mirroring, you can now run those operations. Those operations that you can run let you do concurrent maintenance of the system. Mirroring enables more functions in the full paging environment. This lets you service the DASD and alter the system configuration while protecting the customer's data. For more information about mirroring, see page 8-2.

Service Processor (Phase 1)

Just as the control panel is the interface to the service processor, the service processor is the interface to the control panel. The service processor begins an IPL by establishing communication with the control panel. The service processor hardware is tested, the SP RAM code is loaded, and the processor code is loaded.

The service processor provides problem analysis of IMPI hardware failures and reports these failures by showing an SRC on the control panel. A main storage dump may be provided for certain SRCs to help understand the failure. A main storage dump is available on the control panel as function 22. A main storage dump is used to capture data during a system hang or loop problem. An IPL must be performed after a capture of the dump is complete. For more information about main storage dumps, see page 16-1.

What is Initialized: The following data areas (or includes) are initialized by the service processor during IPL.

- Bus 0 configuration table
- Bus 0 IPL message save area
- IPL parameters
  - IPL mode
  - Switch setting
  - Power control status
  - Power on cause
- System vital product data (VPD)
- Time of day

Functions Performed: The following list is a general overview of the functions performed by the service processor during IPL:

- The service processor runs hardware diagnostics or basic assurance tests (BATs) on itself.
- For 9406 only, the service processor starts by doing an IPL of the load-source input/output processor (IOP).
- The service processor's code load is obtained from the load source (disk or tape) and used to do an IPL of the service processor internal licensed code.
- Next, the service processor runs processor hardware diagnostics and loads a series of HLIC diagnostics into the processor unit control storage.
- The HLIC diagnostics request the service processor to load the VLIC nucleus into main storage.
- The service processor loads HLIC run-time code. When HLIC completes initialization, the service processor starts the CPU which causes the VLIC initialization tasks that reside on the task dispatching queue (TDQ) to be dispatched.

On the 9406 System Unit, basic assurance tests (BATs) run in the control panel, service processor (SP), and every IOP. These BATs checkout the hardware on the card and any attached hardware (for example: DFCI bus, IOA cards). When BATs complete, the IOPs wait for further direction from the bus control unit (BCU). Any errors or failures detected by the BATs are logged in the IOP and sent to the system later to be entered in the system error log. If the failure prevents the IOP from performing an IPL, the IOP sends an asynchronous error report (AER) to the BCU. The service processor is the BCU during the loading of the service processor and IMPI. These AERs are logged by the service processor in the IOP message (IMSG) save area (function 57 on the control panel) which is retrieved by VLIC. For more information about AERs, see page 15-2.

The service processor BATs provide user feedback by displaying informational SRCs C1XX BXXX on the control panel.

After the service processor BATs have run, the read only storage (ROS) of the service processor begins the steps necessary to get the random access memory (RAM) of the service processor loaded. SRCs C1XX 1XXX are displayed on the control panel.

After the RAM of the service processor is loaded, the service task of the service processor begins the steps necessary to get IMPI loaded. SRCs C1XX 2XXX are displayed on the control panel.

Loading the Service Processor: The service processor (SP) only has access to bus 0. VLIC thoroughly tests all the system buses. The SP does a simple test to see if any signals are stuck at 0 or 1.

On a 9406 System Unit, the service processor attempts to read the status of the bus unit in each slot. An IPL configuration table (viewed from function 54 on the control panel) is built based on the responses. Each bus unit is assigned an address and the IOP can now send in an asynchronous error report (AER).

Then each bus unit is sent a message wrap to test its message acceptance facilities on the 9406 System Unit. This is followed by a direct memory access (DMA) request to test the master DMA facilities of the bus unit.

On a 9406 System Unit, the load source IOP must be either the bus unit in slot 1 or the bus unit in slot 2. This keeps an IPL time to a minimum and reduces the configurations needed to test.

On a 9406 System Unit and for a type D IPL, the load source must be in slot 1. The service processor directs the type D IPL to that bus unit.

On a 9406 System Unit and for a nondirected disk IPL, when the self-loading bus units are loaded, the service processor queries the units for its load. The unit that responds is the load source. The service processor directs the load source to load the service processor.

If no bus unit responds to the query, the service processor checks the status of the first two bus units to see if an AER was received or the bus unit caused a timeout on the bus. On the 9406 System Unit, the service processor attempts to retrieve the error log entry associated with the AER and generates a SRC accordingly. SRC B100 100E indicates that the service processor is looping and is attempting to retrieve a log entry. This should result in SRC C100 0000 with word 12 containing the bus address and word 13 containing the reference code from the AER)

On a 9404 System Unit, the load source must be device address 1 for a normal IPL and for a type D IPL, the tape must be at device address 7, 6, 5, or 4.

On a 9406 System Unit, the load source must be address 0 or 1 for a manaul IPL. For a type D IPL, the tape must be at address 7.

Once the RAM of the service processor is loaded, control is turned over to the RAM code. When the RAM code initialization completes the loading of IMPI begins.

Loading of IMPI: The service processor resets the IMPI hardware, issues a message wrap to test the message acceptance facility and gets the load ID (LID) from IMPI.

The service processor requests the load from the load source. The load source direct memory access's (DMA's) the load to the service processor storage. The service processor then tells IMPI to DMA the load.

The HLIC BATs check out the control storage, the processor, the bus interface, and main storage. The time it takes to run the main storage test depends on the size of the main storage.

HLIC BATs then request multiple loads for main storage. The service processor repeats the upload sequence. BATs control the DMA when main storage is loaded. BATs again request another load (run-time HLIC). The upload sequence is repeated again.

Once run-time HLIC is loaded into control storage, the run-time HLIC performs its initialization. Control storage then notifies the service processor that initialization is complete. The service processor instructs HLIC to start the CPU.

Task dispatching starts and VLIC does some of its initialization. When VLIC is ready to take control of bus 0, it sends the service processor a 'load complete' message. Bus control is switched by the service processor to the IMPI bus adapter. The service processor then tells VLIC to continue.

This is the end the loading of IMPI. VLIC retrieves (or DMA's) IPL parameters, configuration table, and system VPD from the service processor. From this information VLIC can establish connections with the load source and enter its limited paging environment.

What Is a Programmed IPL?: This is an IPL that is initiated by the PWRDWNSYS command using the RESTART(*YES) parameter. VLIC requests the service processor to perform a programmed IPL. The service processor takes control of the bus again and jumps to ROS BATs. No service processor hardware is reset. The service processor continues an IPL similar to an install.

If you experience problems with a programmed IPL, always power off and then manually power on. For more information about controlling power, see page 14-21.

Recovering from Service Processor or IMPI Problems: IMPI machine checks are caused by IMPI hardware, HLIC, or VLIC. The service processor must determine which of these caused the machine check and collect the appropriate error information from various hardware registers.

- For hardware and HLIC, the service processor formats the SRC from the information collected.
- For some errors, a partial dump is taken.
- For VLIC errors, VLIC builds the SRC in the machine check log buffer (MCLB) and the service processor just displays that SRC as is.
- For some VLIC errors, VLIC requests a dump and Service Processor automatically takes a full dump (for example, both hardware and main storage). Any errors encountered during the analysis or dump end the analysis or dump and the original failure SRC is displayed at the panel.

If the service processor is unable to post the SRC the service processor machine checks. SRC F000 0000 is displayed indicating a double failure and the interface to the panel has failed.

The full SRC is contained in the service processor's log buffer (SPLB) and displayed one word at a time on the control panel as requested. On a re-IPL or a start IPL, this SRC contained in the SPLB is retrieved by VLIC and logged in the system error log. This assists in the capture of intermittent IPL errors. Actual hard failures require a power-off. Power off causes the data to be lost.

Service Processor Dump Support: A main storage dump can be invoked automatically for problem analysis and resolution, or started by enabling function 22 on the control panel. Partial dumps can be obtained for hardware problems only and full dumps can be obtained for hardware and main storage problems. All dumps are retrieved using DST.

When doing the problem analysis, the service processor determines if a dump is needed and initiates the dump automatically. As part of the 25XX SRCs, the service processor indicates whether or not a dump was taken and if it was successful. Once a dump is taken, the service processor does not take another one until VLIC resets a flag to instruct the service processor to take one. For more information about main storage dump, see page 16-1.

Bus Isolation Support: On the control panel:

1. Select function 25 (Service switch 1) and press the Enter switch.
2. Select function 26 (Service switch 2) and press the Enter switch.
3. Select functions 54, 56, or 57 and scroll through the subfunction data. 1K of data is accessable, one word at a time. For more information about these functions, see page 14-4.

IPL Status SRCs for the 9406 System Unit

C100 B900	Start basic assurance tests (BATs) on service processor hardware.
C14x B900	Running basic assurance tests (BATs) on service processor hardware.
C1xx 1008	Service processor ROS searching for RAM load.
C100 100A	Service processor found the load source.
C100 100C	Service processor RAM is loaded.
C1xx 201x	Service processor setting IMPI again.
C100 5010	IPL diagnostics = PARROUTN running against IMPI.
C1xx 20xx	Service processor loading IMPI.
C1xx 202E	HLIC BATs performing memory tests.
C100 D009	VLIC is initialized.
C100 2034	Service processor sent a continue to VLIC.

Figure 18-3. IPL Status SRCs for the 9406 System Unit

IPL Status SRCs for the 9404 System Unit

C10x B111	Service processor BATs, control storage tests running.
C10x B112	Service processor BATs, control storage ECC status.
C10x B183	Service processor BATs, SCSI DMA path tests running.
C10x B190	Service processor BATs, SCSI DASD BATs running.
C10x B191	Service processor BATs, SCSI BATs running.
C10x B1F0	Service processor loading the service processor random access memory.
C100 20xx	Service processor loading HLIC.
C100 5010	IPL diagnostics = PARROUTN running against IMPI.
C1xx 20xx	Service processor loading HLIC.
C1xx 202E	HLIC BATs performing memory tests.
C1xx 20xx	Service processor loading IMPI.
C100 D009	VLIC is initialized.
C100 2034	Service processor sent a continue to VLIC.

Figure 18-4. IPL Status SRCs for the 9404 System Unit and AS/400 9402 System Unit

Abnormal Ends: The service processor ends the IPL whenever a condition is detected that prevents the base machine from doing meaningful work. If the IPL ends, the service processor puts an SRC on the panel display and sets the attention light. The SRC indicates the failing condition. The information leading to the failing condition is embedded in the SRC.

HLIC Initialization (Phase 2)

Control Functions: The horizontal licensed internal code runs code that resides in control storage starting at address hex 0001.

Input Descriptions: A control address table that is located at virtual or real address hex 8000 0000 0000.

Functions Performed: The following list is an overview of the functions performed by HLIC during IPL.

- HLIC sets the internal CPU registers and arrays necessary to run HLIC using data that resides in main storage reference data in the control address table data structure YYMCA. All labels with a prefix name of MCA1 are used by the HLIC run code for register and array initialization.
- When HLIC initialization is complete, HLIC signals the service processor of the event.
- HLIC enters the disabled state (task dispatcher is disabled). Once the service processor starts the CPU, the previously built VLIC task on the prime TDQ is dispatched. HLIC then does its normal execution-time functions.

Abnormal Ends: HLIC ends an IPL whenever a condition is detected that prevents the machine from doing meaningful work. If an IPL ends, a machine check status is detected by the service processor and the service processor sends the appropriate SRC to the control panel.

The SRC displayed on the control panel consists of 12 bytes. The first 4 bytes of the SRC indicate the type of licensed internal code. For example:

Code	SRC
HLIC	25XX
VLIC	A6XX, B6XX, C6XX, and D6XX
	XX is a 2-digit modifier which provides more information about the failing unit.

Conditions that cause HLIC initialization to fail are:

- HLIC hangs (loops or waits) causing an HLIC initialization time-out

  An HLIC initialization time-out occurs if HLIC hangs (loops or waits) while initializing itself. The processor times out and gives control to the service processor, which in turn ends an IPL.

- Bad data in the control address table

  The control address table in the YYMCA include, see the *AS/400 System Support: Diagnostic Aids Addendum*[1], is located at virtual or real address hex 8000 0000 0000. All addresses that start with MCA1 and map to labels in the YYMCA include are referred to by HLIC during HLIC initialization. If any of the values in these locations are bad, IPL ends with a machine check hex 1017.

- Incompatible HLIC and control storage

  Some of HLIC resides in main storage in an area known as the HLIC overlay area. MCA1RH0A is in the include YYMCA. If either this code or resident code in control storage is incompatible, IPL may end during the HLIC initialization phase.

- Bad data on file

  If bad data is not detected when read from the file, but if it is encountered by the HLIC initialization routine, IPL ends with an SRC. If bad data exists on the file, any main storage available before the IPL should be manually dumped using function 22 on the control panel. For more information about function 22, see page 14-1. The licensed internal code must be installed again to solve this problem. If the system does not complete IPL after initializing the licensed internal code again, the QFILEMCD file on the licensed internal code tape is bad. The licensed internal code tape is created by the Save System (SAVSYS) command.

- Hardware errors

  If hardware errors occur during the HLIC initialization phase, IPL ends with a hex 1016 machine check or hex 80XX reference code. If the hardware error is associated with the file, the licensed internal code may need to be installed again. Use the work with licensed internal code or stand-alone utility to install the licensed internal code again.

VLIC Initialization (Phase 3)

For information on how errors are logged, see "Error Logging" on page 15-2.

[1] Object Code Only (OCO)—IBM Confidential Restricted.

Input Descriptions:

The following are used as input to the VLIC initialization phase:

- Previous HLIC failure information
- Bad page table (pointer to table at address MCA2RBPT in the YYMCA include at hex 8000 0000 0002)

Functions Performed: Table 18-4 shows system reference codes relating to VLIC initialization and recovery (VLICIR). Besides the figure, the following list is an overview of the VLIC initialization from IPL to DST.

1. #ITVMCIR is the first VLIC module to execute. This module executes under a task named VMCIR.
2. #ITVMCIR calls #SMINIT to perform storage management initialization. #SMINIT builds the primary directory, builds storage management tables, and creates storage management tasks.
3. #ITVMCIR sends messages to bus manager tasks for bus manager initialization. The load source bus unit is identified.
4. The VMCIR task and storage management tasks start the load source DASD unit and establish the limited paging environment. Limited paging allows paging from the load source DASD unit and creation of temporary segments.
5. #ITVMCIR sends the message, `Invoke IPL`, to the bus manager. This causes all other bus units on all buses to be loaded.
6. #ITVMCIR calls component-specific modules to perform initialization functions for critical VLIC components. The next-to-the-last module, source/sink initialization (#SSINIT), creates a common class IOM (CCIOM) task.
7. CCIOM creates the dedicated service tool (DST) task. DST provides display interface for functions such as DASD management.
8. When an IPL or install is chosen or defaulted, DST creates the IPL service function (#ITSF) task. #ITSF calls storage management recovery (#SMRCVRY). #ITSF creates the initial machine process that invokes the control facility ring master (#CFRMAST) module to perform the remaining VLIC initialization and recovery functions. #CFRMAST controls the sequence of operations performed by the initial machine process during the IPL. #ITSF and #CFRMAST send messages back and forth for #ITSF to display the current IPL step and for #CFRMAST to start the next step.
9. The #CFRMAST module calls component-specific modules to perform the remaining VLIC initialization and recovery functions. It then calls the #ITIPIR module to perform the machine-to-programming transition. When the machine-to-programming transition is complete, #CFRMAST destroys its own process and the IPL service function task is also destroyed.

Table 18-4. Functions Performed in, or Requested by, the VLIC module #ITVMCIR. These SRCs are shown in the order they appear on the console.

IPL Status SRC on Panel	Function Performed	Task	Module Called	Condition Causing Function
C600 4005	Find load source DASD unit.	VMCIR	#ITLSCON	Always
C600 4006	Start bad source DASD unit.	Connection manager	#SMSLS	Always
C600 4007	Establish limited paging.	ASP manager	#SMASIT	Always
C600 4010	Initialize resource management (seize/lock and timer data areas).	VMCIR	#RMINIT	Always
C600 4008	Invoke IPL for other bus units.	BMCFBM	#BMCFBM	Always
C600 4011	Initialize exception management.	VMCIR	#EXINIT	Always
C600 4012	Initialize process and event management.	VMCIR	#PMINIT	Always
C600 4013	Initialize source/sink.	VMCIR	#SSINIT	Always
C600 4014	Transfer RAS focal point from the #ITLSCON module to CCIOM.	VMCIR	None	Always

Note: For IPL status SRCs starting with C100, see Figure 18-3 on page 18-8 or Figure 18-4 on page 18-8.

The following functions are performed by the IPL service function at **B** in Figure 18-1 on page 18-2.

Table 18-5. Functions Performed by the IPL Service Function

Function	IPL Status SRC on Panel	Machine Check Code	Module Called
Storage management recovery	C600 4021		#SMRCVRY
– Synchronization of mirrored unit	C600 4205		
– Subset checksum validation	C600 4210		
– Completion of checksum configuration	C600 4220		
– Checksum device recovery	C600 4230		
– Reclaim main storage	C600 4240		
– Subset directory recovery	C600 4250		
– Directory recovery, with or without validation of checksum data	C600 4260		
– Validation of checksum data without directory recovery	C600 4270		
– Move extents off load source	C600 4275		
– Allocate main storeage dump space	C600 4280		
Start VLIC log	C600 4022	B600 0403	#ITVLOGI
Context rebuild	C600 4023	B600 0403	#RCRBCTX
Start error log and APPN	C600 4024	B600 0403	#ITFPAGE
Authority recovery	C600 4025	B600 0405	#AUINIT
Journal recovery	C600 4026	B600 0408	#JOINIT
Database recovery	C600 4027	B600 0406	#DBINIT1
Journal synchronization	C600 4028	B600 0409	#JOISYNC
Commit recovery	C600 4029	B600 0411	#COINIT1
Database initialization	C600 4030	B600 0407	#DBINIT2
Journal IPL cleanup	C600 4031	B600 0410	#JOINIT2
Commit initialization	C600 4032	B600 0412	#COINIT2
Start the operating system	C600 4036	B600 0403	#ITIPIR

Note: For IPL status SRCs starting with C900, see Table 18-6 on page 18-18.

Output: The output generated from step 8 on page 18-10 and step 9 on page 18-10 of the VLIC initialization function consists of the following:

- Machine status information saved in the machine initialization status record (MISR) or YYMISR include. For more information about the YYMISR include, see the *AS/400 System Support: Diagnostic Aids Addendum*[2].
- IPL status codes are displayed at the control panel for long-running IPL functions. Refer to Table 18-5 on page 18-10 for these displayed functions.
- Error log and VLIC log information needed by service personnel to service the machine.

Abnormal Ends: At any point in the VLIC initialization phase, errors can occur that end machine processing during IPL. If this happens, error indicators are set in the MISR by the routine that incurred the error. The cause of the error is contained in the machine check log buffer (MCLB), VLIC log, and/or the error log.

The SRC displayed on the control panel consists of 12 bytes. The first 4 bytes of the SRC indicate the type of licensed internal code. For example:

VLIC A6XX, B6XX, C6XX, and D6XX

XX is a 2-digit modifier which provides more information about the failing unit.

If the system enters a wait or loop, the debug mode used consists of determining the cause of the wait or loop. See Chapter 27 on page 27-1 and "Problem Isolation" on page 2-2 for information about how to locate tasks in the system and how to determine their status.

If a power failure occurs and an uninterruptible power supply is installed, the rules for operating under uninterruptible power supplies are followed. See the *Backup and Recovery Guide* as described in the *Information Directory* for more information about using the uninterruptible power supply options.

Information concerning the PWRDWNSYS command can be found in the *Operator's Guide*. The information concerning the QUPSDLYTIM, QUPSMSGQ, QAUTOIPL, and QABNORMSW system values may also be helpful in diagnosing IPL failures. See the *Programming: Work Management Guide*, SC21-8078 for a description of these system values.

The critical VLIC initialization functions perform under a task named VMCIR. The address to the task's TDE can be located in the stand-alone dump. In the stand-alone dump, the VLIC initialization task may be located by searching the TDE chain (reference label MCA4RTDE in include YYMCA). The task named VMCIR resides in the TDE; refer to the TDE@PCB field if no IWA has been assigned to VMCIR. Since this is a previously built task, it initially contains no IWA. If the TDE@PCB field contains a virtual address, the task has been assigned an IWA and the task name is in the TCB of field TCBNAME in include YYTCB. (For more information about the YYTCB include, see the *AS/400 System Support: Diagnostic Aids Addendum*[3].) If the task cannot be located, the VLIC initialization function has completed and the task has been destroyed.

The first 9406 System Unit and 9404 System Unit process is initiated during IPL by the IPL service function. This process does the remaining VLIC initialization and recovery functions, and it does the machine-to-programming transition. The task associated with this process has the following characteristics:

- Does not contain OS/400-defined job structures
- Is not apparent at the system interface
- Exists only during IPL
- Initiates the first system user process (job) during an IPL or install
- Has no task name; the name at the TCBNAME field in include YYTCB is binary 0s
- Has an object name of binary 0s in the EPAHNAME field of the process control space (PCS).

Machine-to-Program Transition (Phase 4)

Control Functions: The #ITIPIR module is called by the #CFRMAST module to perform the machine-to-programming transition. The #ITIPIR module returns to the #CFRMAST module.

Input Descriptions: The following are used as input to machine-to-machine phase:

- IPL or install and attended or unattended IPL located in the IPL control table passed by DST.
- Initial process definition template, located on the DASD, if IPL. Install object templates located on the QFILEIPL file of the install tape, if install.

[2] Object Code Only (OCO)—IBM Confidential Restricted.

[3] Object Code Only (OCO)—IBM Confidential Restricted.

Functions Performed: The following list is an overview of the functions performed by phase 4.

- Checks DST input and forces install to determine whether an install is to be done.
- If an install is to be done:
  - A call is made to the #ITIAIPL module to read templates into storage that reside on the install tape. These templates consist of the user profile, the program, and the initial process definition templates.
  - The #ITIAIPL module returns control to the #ITIPIR module, which then creates system objects from the object templates. The process definition template is updated with the appropriate pointers, and an initiate process instruction is performed to activate the first system user-defined process.
- If IPL is to be done, the #ITIPIR module does an initiate process instruction using the machine attributes of the initial process definition template. The process initiated is the first user-defined process that is to receive control during IPL.
- The #ITIPIR module does some cleanup to update the YYMISR include.
- The #ITIPIR module then returns to CFRMAST. When the machine-to-programming transition is complete, #CFRMAST sends a message to the IPL service function and then #CFRMAST destroys its own process.
- The IPL service function destroys itself by returning to DST.

Output: The machine interface (MI) process is generated and activates one of the following OS/400 programs:

- QINITT (OS/400 install)
- QWCIINSR (initial OS/400 process)

Abnormal Ends: The machine-to-program transition task can end because of the following conditions:

- Machine checks

  Machine checks are presented on the control panel. Information associated with the machine check is in the machine check log buffer (MCLB). For more information, see Chapter 34 on page 34-1.
- User specification errors

  User specification errors are presented on the control panel as hex B9XX XXXX codes. For user specification errors, the machine check status indicator is not activated.
- Loop or wait conditions

  To debug loop or wait conditions, see "Problem Isolation" on page 2-2.

OS/400 Install and/or IPL (Phase 5)

An IPL of OS/400 can be initiated by one of the following:

- OS/400 install

  An install involves loading OS/400 into the system from an external storage medium (magnetic tape). For more information, see "OS/400 Install."
- Initial program load (IPL)

  An IPL involves activating OS/400 from data that resides in auxiliary storage (tape or DASD). For more information, see "OS/400 Initial Program Load (IPL)" on page 18-17.

The licensed internal code and operating system must be at the same level and both can be installed by the customer. Emergency orders for replacing or initial copies of the licensed internal code and software must be ordered through ISD using the customer number.

OS/400 Install

The install (IN) component of OS/400 is responsible for installing and initiating OS/400 in the system. The version of OS/400 that is installed can be:

- The initial OS/400 distributed by the IBM Software Distribution (ISD)
- A new OS/400 ISD release that replaces an earlier ISD release
- A copy of OS/400 that has been saved by the save/restore component of OS/400

If available, see the *OS/400 Logic Overviews and Component Description*[4] manual for more information concerning the install component.

Input Descriptions: The following are used as input to installing the OS/400:

- System status data in the machine initialization status record (MISR)
- Files from the install medium
- Machine context
- Any install options selected by the operator

Functions Performed during an Install: The OS/400 install component installs and initiates OS/400.

Installation restores programs and language objects from tape, restores language objects only, or restores no objects from tape. The install, which restores no objects

[4] The referenced manual is for IBM internal use only.

from tape, can only be done when OS/400 is already on the system. This install verifies that the system-supplied profiles, libraries, and the authorized user table are not damaged. It also builds the system entry point table again.

If IBM-supplied profiles or system libraries are found to be damaged, the operator is informed, the profiles or libraries are created again, and an install that loads system objects from tape is performed. When the authorized user table is damaged, it is destroyed and created again; however, it only contains entries for IBM-supplied profiles and passwords. The user is informed that the table is damaged, but an install that does not restore objects is not prohibited.

An install may be done with the clear job and output queues by entering a 1 (1 = YES) on the Installing Options display. This causes the system job and output queues to be deleted and created again before OS/400 becomes active. Because objects are deleted during this type of install, any user data accessed through those objects is lost.

The options that load only language objects from the tape allow you to change or update the system language objects without installing all of OS/400. This is done in addition to the checking done during an install which restores no objects.

Automatic install: An automatic install is an install that is initiated by performing a type D IPL with the key in the Keylock switch set to the Normal position, or by selecting the option to perform automatic operating system install from the DST main menu. All other installs are called manual installs. An automatic install differs from a manual install because no menus are shown. Instead of menus, all options are read from an object called the installation profile.

The installation profile is saved on the tape in file QFILEIN. The installation profile can be created by selecting install options and saved on the tape using the GO LICPGM command. You can save the operating system by using the SAVSYS command. This command saves an empty installation profile; however the empty profile cannot be used to perform an automatic install.

During an automatic install, the installation profile is read from the tape and the install is performed.

Automatic Install Failures: An automatic install is driven by the installation profile that is read from the tape into the QINSTALL library. The installation profile is opened and then the installing options are read from it into the installation profile data area in the install communications object (ICO). For more information about the fields in the ICO, see page 20-1.

If there is failure opening or reading the installation profile or an error occurs validating the installing options, then a message is displayed to terminate the automatic install. The set of tapes containing this installation profile should not be used to try the automatic install again because the same failure will most likely occur, but the tapes may be used to try a manual install.

Some messages that may occur during an automatic install are:

Message	Description
CPZ2021	This message appears after an open installation profile failure. The return code from the open is included in the message. Some examples of the return code are: **Return Code** / **Description** NF — Profile not found DM — Profile damaged
CPZ2022	This message appears after a read installation profile failure or after an error in validating the installing options. The installation profile can be displayed using DST (QINSTALL/QLPAUTO 19F4) to check if it is empty. An empty profile would contain mostly zeros in the object and cannot be used to perform an automatic install.
CPZ2023	This message appears if the requested install cannot be performed. This condition occurs, for example, when an install is requested that does not load program objects and QSYS is found damaged. In this case, only an install which loads program objects can be performed.

Tapes created either by using the SAVSYS command or by using the GO LICPGM menu and specifying *NONE for the installation profile name will contain an empty installation profile. These tapes cannot be used to perform an automatic install.

If the installation profile contains valid installing options and the automatic install fails, the automatic install may be attempted again or a manual install may be attempted.

Automatic Install after an Automatic Install Failure: During an automatic install, checkpoints are recorded in the ICO to indicate how much processing has been performed. This information is used in case of a failure during an automatic install of the operating system. If the next install is also automatic then an attempt is made to not process tape files which were already processed during the previous automatic install.

For all installs of the operating system, including continued automatic installs, the first tape of the set of install tapes must be loaded before starting the install.

At the start of an automatic install of the operating system, a check is made to determine if the prior install was a failed automatic install. If this is the case, the install code determines if it can continue the prior install or if it must start the install process from the beginning. If the prior install can be continued, a check is made to determine what tape files are to be read and if a different tape must be mounted to continue the install. If necessary, message CPA2059 is displayed requesting to load the specified volume to continue the recovery of an automatic install.

If a failure occurs during an automatic install before the first checkpoint, the next install will start processing at the beginning and the prior install is not continued. The first checkpoint is made after the installing options read from the installation profile are validated.

A continued automatic install uses the installing options from the prior automatic install saved in the ICO. These options cannot be changed during a continued install because they are not read from the media again. A continued automatic install may load objects that were already loaded in the prior install. For example, if the failure occurs during the creation of the system wide entry point table, then a program is either damaged or missing. The program objects must be loaded again to correct this situation.

If a failure occurs during an automatic install after the operating system install is complete, the next automatic install will skip the install of the operating system and continue with the loading of licensed programs.

Manual Install after an Automatic Install Failure: A manual install will always start the install process from the beginning. All required tape files will be read for the requested install. The installing options are read from the displays that appear during the install.

QINITT: This install module loads the install part 1 programs into the system. These are the programs which run in a limited paging environment before OS/400 is operational.

The install machine interface source data consists of the initial user profile template, the program template for QINITT, and the initial process definition template. This data resides on the save/restore medium in the QFILEIPL file. VLIC uses this source data to create an initial process and transfers control to the encapsulated form of QINITT.

The purpose of QINITT is to load the QFILEIN file from the save/restore medium, which contains the install part 1 programs and the installation profile. To perform this, a logical unit description (LUD) with name QINDEV is created (if the LUD exists, it is first deleted). If necessary, a controller unit description (CTLD) with name QINCTL is created (if the CD exists, it is first deleted). The install part 1 programs are then loaded into the system, in the install context QINSTALL. The install communications object (ICO) is created. The ICO is used to save error data and trace information for QINITT and the install part 1 programs; it also contains data and pointers used by the QINCPF module. For more information about ICO, see page 20-1.

If an error occurs during an install that causes the install to end, the ICO can be located and displayed to provide further debugging information along with any console message identifiers. The existence of the ICO indicates to the start OS/400 process module that an install is in progress and that a special OS/400 IPL must take place. The ICO is destroyed by QINCPF at the end of a successful install.

QINITT and the install part 1 programs provide the support to load enough of OS/400 so that it can be made active. This period before OS/400 is made active is called install part 1. The following illustrates the install part 1 programs and how they are related to one another.

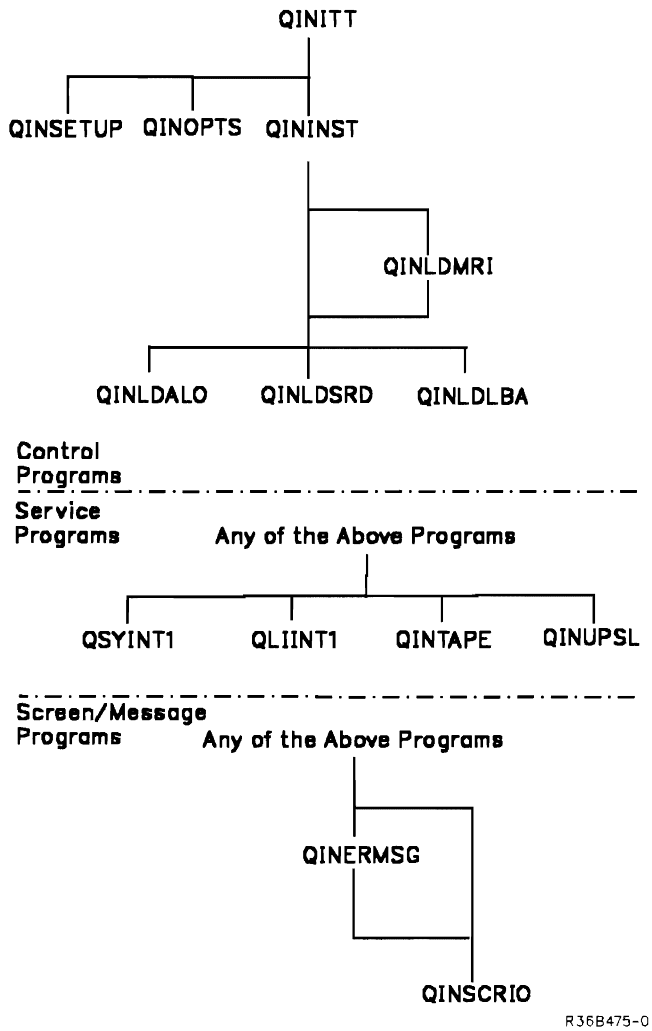


Figure 18-5. Install Part 1 Program Flow

Module	Description
QINITT	Bootstrap and part 1 control program
QINSETUP	General set-up for install
QINOPTS	Display install option screens and get operator selections, or read the options from the installation profile during an automatic install
QININST	Control selected type of install

QINLDMRI	Load part 1 MRI
QINLDALO	Load all objects from media file into library
QINLDSRD	Load save/restore descriptor for media file
QINLDLBA	Load LIB*ALL descriptor for media
QINTAPE	Tape support code
QINUPSL	Handle user profile storage limit exceeded
QINERMSG	Display message
QINSCRIO	Screen I/O support code
QLIINT1	Librarian install part 1 functions
QSYINT1	Security install part 1 functions

When the Install (IN) component is referred to before QINCPF runs, it is really a reference to one or more of these install part 1 programs.

The Install (IN) component initially resolves to the QSYS context. If this context is not found or is damaged, a new one is created. The ICO is inserted into this context.

The install part 1 programs then create the following objects, if the objects do not exist, or if they are damaged:

- Required system user profiles (calls QSYINT1)
- Authorized user table, which contains entries for the system user profiles (calls QSYINT1)
- Required system libraries (except the spooling library which is created in the start OS/400 process) (calls QLIINT1)

After the preceding objects are created, QINOPTS displays the Install the Operating System display, if this is a manual install. This display requests the date, time, and if the defaults for the install should be taken. If the defaults are taken and if OS/400 is not on the system, install loads all of the objects on tape, including system values, edit descriptions, and message reply lists. If OS/400 is on the system, the defaults load all of the objects except the system values, edit descriptions, and message reply lists.

An example of the Install the Operating System display is as follows:

```
                         Install the Operating System

Type choices, press Enter.

  Default
    option . . . . .  _                 1=Take defaults, show no
                                          other installing displays
                                        2=Change installing options


  Date:
    Year . . . . . .  __                00-99
    Month  . . . . .  __                01-12
    Day  . . . . . .  __                01-31

  Time . . . . . . .  __ : __ : __      HH : MM : SS
                                          HH is hours (00-23)
                                          MM is minutes (00-59)
                                          SS is seconds (00-59)
```

Figure 18-6. An Example of an Install The Operating System Display

Note: Help is available for the Install the Operating System display.

If the defaults are not taken, the Installing Options menu appears. The Installing Options menu can be used to specify what objects are to be restored and whether or not the system job and output queues are to be cleared. You may also request that no objects be loaded from the install medium. An example of the Installing Options menu is as follows:

```
                              Installing Options

Type choices, press Enter.

  Restore option . . . . . . .  _   1=Restore programs and languages
                                      objects from current tape
                                    2=Do not restore programs or
                                      language objects
                                    3=Restore only language objects
                                      from current tape
                                    4=Restore only language objects
                                      from a different tape


  Clear job and
    output queues  . . . . . .  _   1=Yes, 2=No
```

Figure 18-7. An Example of an Installing Options Display

Note: Help is available for the Installing Options menu.

If programs and languages are to be loaded from tape, the Restore Options menu appears. This menu is used to indicate whether or not the system values, edit descriptions, and/or message reply lists are to be restored. An example of the Restore Options menu is as follows:

```
                         Restore Options

Type choices, press Enter.

  Restore from tape:

    System values . . . . . . . . . .  _   1=Yes, 2=No

    Edit descriptions . . . . . . . .  _   1=Yes, 2=No

    Message reply list . . . . . . . .  _   1=Yes, 2=No
```

Figure 18-8. An Example of a Restore Options Display

Note: Help is available for the Restore Options menu.

If this is an automatic install, the installing options and restore options are read from the installation profile.

If program objects are to be loaded, install loads the OS/400 objects from the install tapes (in the QSYS file) and places them into QSYS. Each object is owned by the profile that owned it when the Save System (SAVSYS) command was executed.

If the language objects are to be loaded, install checks to see if the next file on tape is QSS1.LXXXX.A00, where XXXX is the language specified after install was selected from the IPL/Install menu. If this file is not the next file on tape, the tape is rewound and a message is displayed requesting the tape that contains the requested language specified on the Confirm Language Feature Selection display to be mounted. When the requested language is found, install reads the QSS1.LXXXX.A01 file.

If you chose to restore only the language objects from the current tape, install skips the QSYS file on tape and checks the next file for QSS1.LXXXX.A01.

If you chose to restore only language objects from a different tape, the tape is rewound, unloaded, and a message is displayed requesting the tape that contains the language objects to be mounted.

Then install links/loads the VLIC language object. All VLIC messages now appear in the selected language specified on the Confirm Language Feature Selection display.

The system-wide entry point table is created next. This table is a space object containing resolved system pointers to those programs whose names are specified in the space object QLINMTBL. Any previous entry point table is destroyed.

Finally, install creates the process definition template (PDT) for the initial OS/400 process. This PDT is stored in the machine attributes and starts OS/400 during an install and for subsequent IPLs. The initial OS/400 process is initiated and, when the IN component receives a process-initiated event from the machine, it ends itself.

***Install Part 2*:** When an install is in progress, the ICO exists in the system. As a result, the start OS/400 process does some extra initialization. One of the modules called is QINCPF.

If language objects are being restored, QINCPF deletes certain system-supplied database files and subsystem descriptions through an interface to the librarian component.

If language objects are being restored, the QINCPF module calls save/restore (using the RSTOBJ macro) to read the next language file, QSS1.LXXXX.A02, from the tape.

The save/restore component restores database files, subsystem descriptions, user-defined journals, journal receivers, job queues, output queues, message queues, data queues, and save files.

Then if the system language has changed for this install and the operator did not request that the system values be restored, the language-sensitive exit program is executed. This program changes the system values to the new system language default.

QINCPF then calls QINFIXUP. The QINFIXUP module creates job and output queues. Private authorities are granted for certain system objects. For objects created during part 1 of the install, object descriptions text is retrieved from the OS/400 message file and stored in the QSYS library. Also, this module does other functions that are dependent on the specific OS/400 release.

Output: The following objects are created during an install if they do not already exist or if they are damaged:

Object	Description
QICO	Install communication object This object is defined in Table 20-1 on page 20-1. This object is destroyed after a successful install.
QINDEV	Tape device description This object is destroyed after a successful install.
QINCTL	Tape controller unit description (if needed) This object is destroyed after a successful install.
QINSEPT	System-wide entry point table.
System libraries	QGPL QSRV QPFRDATA QUSRSYS QRECOVERY

System user profiles

QSYS QSECOFR QPGMR QSYSOPR
QSRVBAS QSRV QUSER QSPL QSPLJOB
QRJE QDOC QSNADS QFNC QDBSHR
QTSTRQS QGATE QDFTOWN QDSNX
QLPAUTO QLPINSTALL

In addition to the above list, program and/or language objects are restored from the tape in accordance with the install options selected by the operator.

System Entry Point Table: Each job in the system is associated with or references an entry point table. A job is always associated with the system entry table. The order in which system pointers are placed in the entry point table is specified in the QLINMTBL space object. This table has an object type of 19 and subtype C4. QINSEPT is also a space object. It has an object type 19 and subtype C3.

If a program whose address is in the SEPT becomes damaged or unusable, delete the object. Then replace the object by saving and restoring the program from another system (SAVOBJ and RSTOBJ). Another method would be to download a PTF using ECS that replaces that same module. If a download using ECS is used, the save file in library QGPL can be restored using the RSTOBJ command to restore the save file into a library by the name of P5728SS1. Then a CRTDUPOBJ command can be used to place the program in QSYS.

After either method is used, the entry point table must be patched (updated) to reflect the new address of the program or an install must be performed to rebuild the table.

Patching the SEPT: **Warning:** You should avoid changing the system entry point table unless you have a valid reason for doing so.

To patch the SEPT, the following procedure should be followed:

1. Locate the offset within the system entry point of the program address to be updated. To locate the offset, enter:

   ```
   DMPSYSOBJ  OBJ (QINSEPT) CONTEXT (QSYS)
   ```

2. Scan the spooled file for the name of the program in question. Once the program name is located, look in the extreme left-hand column to find the offset in the system entry point table that the resolved address is at. Record this offset.
3. Enter SST or DST.
4. Locate the program you just put in QSYS (MI object 02/01).
5. Record the address of the program, ignoring the last 2 bytes (4 bytes to record).
6. You also need the IPL sequence number of when the object was created. This is found in bytes hex 4 and 5 of the object.
7. Tack the IPL sequence number in front of the address and add 023F at the end to get an 8-byte hex number.
8. Now use display/alter/dump to find the entry point table. This is object QINSEPT in library QSYS. It is a space object, type 19 and subtype C3.
9. Locate the offset in the SEPT that you recorded earlier. Remember to add hex 100 to your offset to get you past the EPA header.
10. Once you have located the offset, you should be looking at a 16-byte system pointer. Alter the last 8 bytes to the new address you constructed above.
11. Use F11 to alter.
12. Place an S over the first character of the newly altered 16-byte system pointer and use F10 to scroll to this address. You should arrive at the program you restored.
13. Back out of display/alter dump.

OS/400 Initial Program Load (IPL)

OS/400 is started by selecting an option of the DST menu or setting function 3 of the control panel to begin the IPL. These settings cause the machine to initialize itself and then start the IPL of OS/400. Function 3 takes more time because it goes through all the IPL steps.

After OS/400 is installed in the system, the function then establishes the process definition template (PDT) needed for the initial OS/400 process. This PDT is stored as a machine attribute to be used during IPL. The OS/400 install function then initiates the initial OS/400 process and ends itself.

Control Functions: The following functions control the IPL process.

- QWCIINSR (initial OS/400 process), see page 18-18.
- QWCISCFR (start OS/400 process), see page 18-18.
- QWCAINAR, QWCAMNAR (system arbiter process), see page 18-22.

Figure 18-1 on page 18-2 compares the OS/400 IPL phase with the other phases of IPL.

Input Descriptions: The following are used as input to the IPL process.

- The machine initialization status record (MISR)
- Machine context, QSYS library, and OS/400 data structures
- System objects that are created by the SCPF process if they do not exist:

QCONSOLE	A description for the device at address 0 on the first work station controller.
QCTL	A controller unit description for the work station controller on which the QCONSOLE description is created.

Functions Performed during IPL: Table 18-6 on page 18-18 shows IPL status SRCs.

Table 18-6. IPL Status SRCs

Function	IPL Status SRC on Panel	Module or Macro Called
Reclaim machine context	C900 2810	QWCIINSR
Resolve system objects	C900 2820	QWCIINSR
System value object	C900 2830	QWCSCRLR
Prepare SCPF job	C900 28C0	QWCIINSR
Start system logging	C900 2910	QMHLINIT
Library and OIR cleanup	C900 2920	QLICLNUP
Database cross reference	C900 2930	QDBFIXQ
Console configuration	C900 2940	QWCIDSPR
Install complex objects	C900 2950	QINCPF
Sign on processing	C900 2960	QWCIDIOR
Database, journal, commit	C900 2970	QRCIMPLN
Storage requirements	C900 2980	QWCISCFR
Performance adjustment	C900 2990	QWCITUNR
System control block	C900 29A0	QWCISCFR
Spool initialization	C900 29B0	QSPFFACB
Work control block table	C900 29C0	QWCICLSR
Before syste arbitar	C900 2A80	QWCISCFR
Establish event monitors	C900 2B10	QWCAINAR
Resource manager	C900 2B20	QRZHRMIN
QLUS job	C900 2B30	QWCAxNAR
Device configuration	C900 2B40	QDCSTF
After system arbiter	C900 2C10	QWCISCFR
Office recovery	C900 2C20	OSIPLR
SNADS recovery	C900 2C30	ZDIPLR

Initial OS/400 Process: This process establishes a standard OS/400 job structure and the environment for a standard OS/400 process. The initial OS/400 process initiates the start OS/400 process using the established job structures and OS/400 environments. See Chapter 22 on page 22-1 for a description of job structures.

The initial OS/400 process is a transition from the environment of the machine execution to OS/400. The normal operating software of OS/400 requires the OS/400 process data structures such as the work control block (WCB), job message queue (JMQ), data management communications queue (DMCQ), and so on to complete its process.

The initial OS/400 process attempts to locate the basic OS/400 structures that allow OS/400 to function. Among these OS/400 structures are libraries, programs, and data structures. The OS/400 data structures are divided into two categories, either the data structure cannot be created by the initial OS/400 process again if it does not exist, or it can be created again. The creating of an OS/400 data structure again may mean the loss of some operational data.

If, during an initial OS/400 process, an OS/400 structure cannot be located and if it cannot be created again (it must be installed again), the initial OS/400 process ends machine processing. Also, the initial OS/400 process ends machine processing if an error condition occurs which cannot be handled.

The normal function of the initial OS/400 process initiates the start OS/400 process using the standard OS/400 job structure, and then it ends itself.

Start OS/400 Process: The start OS/400 process performs the following functions:

1. Calls the system logging function to initialize the system log queues and establishes the necessary event monitors to provide the system support during IPL.
2. Determines if this is an attended or unattended IPL. If this is an attended IPL the start OS/400 process performs the following functions:
   a. Determines if the system console is available for a user session and varies it on if it is operational.
   b. Determines if the start OS/400 portion of OS/400 install is needed and calls the routine to perform the final OS/400 install function. The start OS/400 portion of OS/400 install is necessary only after you have performed the OS/400 install function.
   c. Presents the Sign On display to you at the system console for an attended IPL and verifies you are authorized to perform the IPL.
   d. Determines if PTFs are available to be applied or removed. The PTF menu is displayed if any PTFs are installed.
   e. Shows the IPL Options display for you to set initial system date, time, and control indicators. The start OS/400 process uses date, time, and control indicators to direct system initialization functions. For more information about the IPL Options display and other displays used during IPL, see "Work Control Displays" on page 18-19.
   f. Calls the Define or Change System at IPL menu if it was requested by you on the IPL Options display. This menu is used to establish or alter the system I/O configuration before the devices and other system I/O elements are started. System values can also be changed through this menu.

      You can also select the Set Major System Options menu from the IPL Options display to set System/36 or the system default naming conventions for device names. You can also select other options.

   If this is an unattended IPL:
   a. The system applies or removes any PTFs that are identified before this IPL.
   b. The start OS/400 process uses default values for values from the IPL Options display to direct system initialization.
3. Calls the database recovery routine to process any data space index objects that may not have been accepted when the system stopped earlier. The early stopping of the system may have been an abnormal end.
4. Determines if there is enough auxiliary storage available to support the requested number of job structures. If the storage is not available, it reduces the allocation system values and notifies the system operator.

5. Creates the queue which is used to access a global pool of command analyzer positional list and work area spaces.
6. Completes the initialization of system control block and the allocation of system storage pools and multiprogramming level (MPL) classes. Also, initializes the system prototype name resolution list (NRL) and other data structures that are dependent on system values and could have been changed from the Define or Change System at IPL menu.
7. Initializes the system-wide work control block table and establishes the initial number of standard job structures specified by a system value.
8. Attempts to allocate an auxiliary storage buffer space of one megabyte. If the buffer cannot be allocated, the system is placed in the restricted state and the operator is notified that storage must be freed before additional subsystems can be started.
9. Updates the double-byte character set tables and dictionaries if the double-byte character set is installed.
10. Allocates a job structure for the system arbiter process and initiates the system arbiter (QSYSARB) process. For more information about the system arbiter process, see page 18-22.
11. Allocates a job structure for the user session, if this is an attended IPL, so that a job can be initiated in the controlling subsystem when it is operational.
12. Initiates the start of the controlling subsystem monitor process and waits for the results. The start OS/400 process stops the system if the initiation of the controlling subsystem fails.
13. Calls the database recovery routine, the second database program, if the initial database routine indicated that this function is needed.
14. Creates, if storage is available, a pool of command analyzer space pairs that is accessed using the command analyzer space queue created earlier.
15. Writes the job logs for jobs that were active or transferring when the last system stopped if N was specified for the *Clear incomplete job logs* option on the IPL Options display.
16. Remains active after IPL is completed. Start OS/400 provides the environment for handling several low priority system events. It also stops machine processing during a system power down.

Work Control Displays: The following text provides more information about the work control displays during IPL. This information follows the flow of the program logic that provides the displays and is intended to assist in understanding the events that happen during IPL.

The Sign On display appears during an attended IPL. Attended IPLs occur when the Keylock switch is in the Manual position. Attended IPLs also occur when the Keylock switch is in the Normal position if the QIPLTYPE system value is set to one and you are doing a power on from the control panel or using the PWRDWNSYS command with auto restart from a display. For more information about the Keylock switch, see page 14-18.

The Sign On display is only shown at the console device during the IPL. The purpose of this display is to verify the user's authority to IPL the system. The user enters a user profile and password (on a secured system only), which, if valid, results in the continuation of the IPL process. Optionally, a program, menu, and current library may be entered.

The Sign On displays are as follows:

For a secured system:

```
                                 Sign On
                                            System . . . . . :   XXXXXXXX
                                            Subsystem . . . . :  XXXXXXXXXX
                                            Display . . . . . :  XXXXXXXXXX

                  User . . . . . . . . . . . . . .    _______
                  Password . . . . . . . . . . . .
                  Program/procedure . . . . . . . .    _______
                  Menu . . . . . . . . . . . . . .    _______
                  Current library . . . . . . . . .    _______










 ----error message line-----            (C) COPYRIGHT IBM CORP. 1988, 1989.
```

Figure 18-9. An Example of a Sign On Display for a Secured System

For a system that is not secured:

```
                                 Sign On
                                            System . . . . . :   XXXXXXXX
                                            Subsystem . . . . :  XXXXXXXXXX
                                            Display . . . . . :  XXXXXXXXXX

                  User . . . . . . . . . . . . . .    _______

                  Program/procedure . . . . . . . .    _______
                  Menu . . . . . . . . . . . . . .    _______
                  Current library . . . . . . . . .    _______










 ----error message line-----            (C) COPYRIGHT IBM CORP. 1988, 1989.
```

Figure 18-10. An Example of a Sign On Display for a System That Is Not Secured

The subsystem name that is displayed is the subsystem being signed on. The subsystem name is taken from the system value QCTLSBSD. A change to QCTLSBSD takes affect for the current use of OS/400 when changed on the configuration menu. Therefore, you could actually be signing on to a different subsystem than the one that is displayed on the Sign On display if the QCTLSBSD system value is changed on the Define or Change System at IPL menu.

The user, program, menu, and current library appear when they are keyed in.

Normally, only a user profile is needed to sign on, but the system can be configured to require passwords as well. The password input field is a not a display field. That is, the contents of the field do not appear on the display while it is being entered or during a display again as the result of an error condition. If the password field is shown, you must enter a valid password unless the system is not secured. The password is then verified by the system.

If the verification of the password fails, the Sign On display appears again with the error message, `Password not valid for system`, on the message line.

Note: OS/400 passwords can be up to 10 characters, DST passwords can be up to 8 characters. These passwords are not related. Changing the QSRV password has no affect on DST. For more information about passwords, see the *Programming: Security Concepts and Planning*, SC21-8083.

Once a valid password has been received and verified, the entered user profile is tested to determine one of the following:

- System operator (has job control authority)
- Security officer
- Service representative

These are the only valid shipped users allowed during an attended IPL. If the user does not have one of the required authorizations that is specified above, the Sign On display appears with the error message

```
Not authorized to start OS/400 -- reenter sign on
information
```

on the message line. If not authorized to the console, an error condition exists and the error message,

```
Not authorized to system console -- reenter sign on
information
```

appears on the message line. The number of sign on attempts is constantly compared against the QMAXSIGN system value, and if the number of sign-on attempts exceeds this value, the system records this information in the history file and then stops machine processing.

The Sign On display is presented only during an attended IPL. If the console is not functioning, or if the device file used for the Sign On display is damaged, or if there is a power failure and the system contains the auto-IPL feature, OS/400 may be started in an unattended mode. When starting in unattended mode, defaults are used for the IPL Options display and sign-on processing is deferred until the controlling subsystem has been started. At that point, the normal Sign On display is shown.

After a valid sign on during IPL, the IPL Options display appears. This display contains the current system values for date, time, and the defaults for the other input fields.

The date, time, and options can be changed to control some of the processing that takes place for the rest of the IPL. The following is an example of an IPL Options display:

```
                              IPL Options

Type choices, press Enter.
  System date . . . . . . . . . . . . .  XX / XX / XX   MM / DD / YY
  System time . . . . . . . . . . . . .  HH : MM : SS   HH : MM : SS
  Clear job queues . . . . . . . . . . . N              Y=Yes, N=No
  Clear output queues . . . . . . . . .  N              Y=Yes, N=No
  Clear incomplete job logs . . . . . .  N              Y=Yes, N=No
  Start print writers . . . . . . . . .  Y              Y=Yes, N=No
  Start this device only . . . . . . . . N              Y=Yes, N=No
  Run #STRTUP1 procedure . . . . . . . . Y              Y=Yes, N=No
  Run #STRTUP2 procedure . . . . . . . . Y              Y=Yes, N=No
  Set major system options . . . . . . . Y              Y=Yes, N=No
  Define or change system at IPL . . . . N              Y=Yes, N=No




  Last power-down operation was XXXXXXXX
```

Figure 18-11. An Example of an IPL Options Display

For procedures on how to change the IPL options, see the *Operator's Guide*. The following explains each of the items on the IPL Options display:

System date
: The date shown is the current date, retrieved from the service processor. The format in which the date is displayed (for example, MM/DD/YY, YY/MM/DD, DD/MM/YY, or YY/DDD) is also indicated. The date format is controlled by the system value QDATFMT. The date separator is controlled by the system value QDATSEP. The system date may be changed by keying in new numbers on top of those shown. If an incorrect date is entered (for example, greater than 12 months), the displays appear again with an error message, and you must enter the date again.

System time
: The time shown is the time retrieved from the service processor. The system time may be changed by keying in new numbers on top of those shown. If an invalid time is entered (for example, greater than 60 seconds), the screen displays again with an error message, and you must enter the time again. If the time field is not changed, the time is not updated.

Clear job queues
: The default value N causes jobs on output queues to be retained. Overriding the default with Y causes the output queue to be cleared of any job entries.

Clear incomplete job logs
: The default value N causes the job logs for jobs that were active when the system last stopped to be produced. This option is of primary significance after an immediate system power down occurred or after an abnormal end occurred with several jobs active when the system stopped. Specify Y when the stopped jobs have large job logs that are not needed. However, for normal system stops following a controlled system power down, the SCPF job is active

when the system stopped, and this option may be used to control the production of the SCPF job log.

Start print writers
The default value Y causes the print writer or writers to be started by the auto start job. Overriding Y with N causes the print writer or writers to not be started. The start print writers value is reflected in the system value QSTRPRTWTR (Y=1 and N=0) which can only be displayed and retrieved by the user.

The program QSTRUP runs when the auto start job in the controlling subsystem checks the system value QSTRPRTWTR. Starting the print writers is depends on the CL commands in the start up program QSTRUP which tests the system value and, if set, processes the STRPRTWTR command. If this code is altered or another start up program or controlling subsystem is used, then the starting of the printers cannot be guaranteed.

Start this device only
The default for this option is N. If this field is overridden with Y, the system IPLs in a restricted state. Only the console device is operational and no other work station starts. Also, the auto start job does not run and the print writers do not start.

Run #STRTUP1 procedure
This option line displays only if System/36 environment is used (indicated in the user profile), and the #STRTUP1 procedure is found in #LIBRARY. If this options is displayed, the default is Y, and the #STRTUP1 procedure does not run by the 36 environment in the user's process. The procedure runs after the IPL but before an initial program is run. This lets the procedures present displays. If the IPL is unattended, the #STRTUP1 procedure does not run. This field can be overridden with N if the procedure is not to be run.

Run #STRTUP2 procedure
This option line displays only if System/36 environment is used (indicated in the user profile) and the #STRTUP2 procedure is found in #LIBRARY. If this option is displayed, the default is Y and the #STRTUP2 procedure does not run by the 36 environment in the user's process. The procedure runs after the IPL but before an initial program is run. This lets the procedures present displays. If the IPL is unattended, the #STRTUP2 procedure does not run. This field can be overridden with N if the procedure is not to be run.

Set major system options
This option is set to Y for installs to cause the Set Major System Options display to appear. For any other IPL, this option field is set to N. This field may be overriden. If this option is requested, the Set Major System Options display appears when exiting from the IPL Options display by pressing the Enter key. For more information about this option, see page 18-21.

Define or change system at IPL
The default value of N causes the Define or Change System at IPL menu not to appear. If you override Y with N and N was specified for the Set major system options, the Define or Change System at IPL menu appears after exiting the IPL Options display. This display allows you to enter commands that alter the configuration of your system. You may also change system values from this display, which may be useful for other system values that affect the rest of the IPL process.

Note: If Y is entered for both the Set major system and the Define or change system at IPL options, the displays appear in the following order:

1. Set major system options
2. Define or change system at IPL

For more information about the *Defining and changing system at IPL* option, see the *Operator's Guide*.

Last power-down operation
Normal and abnormal information appear on this line. Normal means that the previous power-down operation was successfully completed by the Power Down System (PWRDWNSYS) command. Abnormal indicates from a power interruption or a system failure, additional processing may be needed to complete the IPL.

The following is an example of the Set Major System Options display:

```
                        Set Major System Options

Type choices, press Enter.
  Enable automatic configuration . . . . . .   X            Y=Yes,N=No
  Device configuration naming  . . . . . . .   XXXXXXXXXX   *NORMAL, *S36
                                                              *DEVADR
  Default special environment  . . . . . . .   XXXXXXXXXX   *NONE, *S36
```

Figure 18-12. An Example of a Set Major System Options Display

For procedures on how to set major system options, see the *Operator's Guide*. The following explains each of the items on the Set Major System Options display:

Enable automatic configuration
If the system value QAUTOCFG is set to 1, a Y appears in the option field. If QAUTOCFG is set to 0, an N is displayed in the option field. This field can be overridden to enable or disable automatic

configuration. If the field is changed, QAUTOCFG is updated accordingly.

Device configuration naming
System/36 naming conventions can be used for naming devices. The system value QDEVNAMING is checked to determine what value to display. If QDEVNAMING indicates the System/36 naming convention, the option field is set to *S36 and if not, the option is set to *NORMAL. If the value for QDEVNAMING is *DEVADR the device names are derived from the resource names. If this field is overridden, QDEVNAMING is updated accordingly.

Default special environment
The system environment can be used like a System/36 environment. The system value QSPCENV is checked to determine what value to display. If QSPCENV indicates *NONE, *NONE is displayed, and if QSPCENV indicates *S36, *S36 is displayed. QSPCENV is updated according to the value entered. The shipped value for QSPCENV is *NONE.

System Arbiter Process: The system arbiter is the central process within OS/400. The system arbiter process is initiated during the start OS/400 process and remains active until the system is stopped. The system arbiter consists of many event handlers.

The arbiter exists as the process which the system-wide event handlers are to run. Therefore, the primary characteristic of the system arbiter is a collection of event handlers for many of the components of OS/400. Some of the components that have event handlers in the system arbiter process are:

Device configuration	To vary On/Off and power On/Off nonpeer LUDs
Work station	Device control and user interface
Work control	Roll over event, system arbiter input, process end, process initiation, machine check, power, machine resource, maximum CPU time, and arbiter event
Switched line	Intercomponent communication concerning switched line LUDs, CDs, and NDs
Work monitor	System request, test request, and unsolicited events

The QWCAINAR (initiation phase program) module establishes the necessary event monitors for overall system functions. The event handler module's address is resolved as part of establishing an event monitor.

QWCAINAR also calls the system resource manager (SRM) to update the resource manager data base (RMDB). For more information about system resource manager, see Chapter 7.

QWCAINAR then initiates the logical unit (LU) services process. The LU services process exists for the support of peer devices and SNA alert handling. QWCLINSR is the initiation phase program and QWCLMNSR is the problem phase program for the LU services process.

When QWCAINAR is finished, the machine allows QWCAINAR to pass control to QWCAMNAR (problem phase program). QWCAMNAR calls QDCSTF (the device configuration component module) to power on and vary on devices that have been configured as part of the system. As part of the synchronization with the start OS/400 process, an event is signaled back to the start OS/400 process.

When the system devices finish processing, control is returned to QWCAMNAR, which then goes into a wait, for an event which is never signaled. The system arbiter is then in its operational configuration, waiting to be interrupted to process any of the events for which it has established a monitor.

Subsystem Activation: Several processes, modules, and events are started when a subsystem is started. A subsystem can start:

- During the IPL
- By OS/400 while in the restricted state
- By entering the Start Subsystem (STRSBS) command

The following modules initiate the starting of the subsystem monitor job. The control modules involved are:

Modules	Description
QWCCSUUC	Start subsystem command processing program (CPP). This is the main interface module.
QWCAHNAE	System arbiter event handler handles the system arbiter input event. This module runs in the arbiter process whenever the system arbiter input event is signaled, and it retrieves the event data. The event data contains a code set by the module that signaled the event; this code determines the module to be called by QWCAHNAE.
QWCASUUM	The start subsystem message processor function runs in the system arbiter process. QWCAHNAE finds a start subsystem code in the event-related data and calls QWCASUUM.

The start function is completed by the following work monitor modules:

Modules	Description
QWTPIIPP	Initiation phase program. When the subsystem is started while OS/400 is not in the restricted state, this module receives control as the subsystem monitor's initiation phase because of the monitor process being initiated. When it completes, the machine transfers control

	to the subsystem monitor's problem phase program (QWTMSCSTP).
QWTMESBC	Subsystem monitor event handler handles the subsystem control event. When a subsystem is started from the restricted state, this event handler receives control when the subsystem control event is signaled from the arbiter process. This event handler examines the event subtype, and if the subtype indicates a monitor start up operation, it calls the start monitor module (QWTMCSTP).
QWTMCSTP	The monitor started. This module creates the environment needed by a subsystem monitor process. If the subsystem is started from the restricted state, this module only creates the portion of the environment that does not already exist and then returns to QWTMESBC.
QWTMCMNL	Monitor mainline. This module is the top level invocation in the monitor process from the time that the subsystem is started in the off state to the time that the subsystem completely ends. When this module receives control, the subsystem monitor is in its operational environment waiting to be interrupted to process any of the events for which the monitor process is monitoring.

The start subsystem command processing program (CPP), which runs in the user's process, does some initial checks to determine if the requested start subsystem can be processed. The CPP verifies that the subsystem description exists, is not already active, is not locked by the requester or any other process, and checks to see whether the subsystem description (SBSD) has been damaged. If processing is continued, the system arbiter input event is signaled with the start subsystem subtype ID to the system arbiter process. If the start subsystem operation is during the IPL, QWCISCFR signals the system arbiter input event. The system arbiter input event handler, QWCAHNAE, handles the system arbiter input event and calls start subsystem message processor QWCASUUM.

The start subsystem message processor does some final checks to determine whether the requested STRSBS command can be executed. It checks to see whether the system is ending, and if it is, the subsystem cannot be started. The message processor searches through the subsystem descriptions that are chained to the system control block to determine if a subsystem is already active. Two subsystems with the same name cannot be active simultaneously.

If no problems are indicated and the subsystem is not started from the restricted state, then the message processor allocates and assigns the job structure for the new monitor process. The process is then initiated, and QWCASUUM waits for machine instruction to signal the process initiated event. The status of the initiation is checked, and the status is communicated to the CPP.

If an End System (ENDSYS) command or End Subsystem (ENDSBS) command (with *ALL specified) has been executed, then the controlling subsystem is considered to be in the restricted state because all activity, except one job in the subsystem, has stopped.

If the controlling subsystem is started from the restricted state, then the subsystem control event (with a subtype indicating monitor start up) is signaled to the monitor that is already active. The status is then communicated back to the CPP. The message processor signals the subsystem message event to the CPP with the event related data containing an indicator of the status of the start subsystem request.

QWCCSUUC (start subsystem CPP) handles the subsystem message event, checks the event-related data, and then sends a message to the requester stating the status of the start subsystem request (for example, `SUBSYSTEM STARTED` or `SUBSYSTEM NOT STARTED`).

Abnormal Ends: The OS/400 IPL function can end because of:

- Machine checks

  Machine checks are presented on the control panel. Information associated with the machine check is in the machine check log buffer (MCLB). For more information about the machine check log buffer (MCLB), see page 34-1 and Appendix D to service these codes.

- OS/400-detected error conditions

  OS/400-detected error conditions are presented as SRCs 3000 through 3FFF. See Appendix C to service these codes.

  When a hex indicator between 3100 and 3FFF is displayed, the phase, function, and subfunction indicator can be displayed by using function 12 on the control panel.

- Loop or wait conditions

  Loop or hang conditions should be debugged using the problem isolation procedures on page 2-2.

Errors that occur during an IPL can be viewed in one or more of the following:

- Problem log, using the WRKPRB command
- Error log, using the PRTERRLOG command or by selecting *Work with error log* option from the System Service Tools menu
- Message handler, using the DSPMSG QSYSOPR command

If it is determined that OS/400 IPL has failed, the start OS/400 data object QWCSCPF contains a record of the OS/400 IPL function that was running. For more information about the start OS/400 data object QWCSCPF, see page 21-1.

Chapter 19. System Use of a Console during IPL

The system console is a locally attached display device at bus 0, port 0, on the first work station controller.

During an attended IPL, the start control program facility (SCPF, or sometimes referred to as start OS/400) process uses special *shadow* configuration descriptions for the console and console controller. The device description's name is QCONSOLE and the controller description's name is QCTL. These descriptions are not normally used after an IPL and only the system is allowed to create these descriptions. Only the QCONSOLE device description can be attached to the QCTL controller description. If these descriptions need to be deleted and created again because of a hardware failure, card or device movement, or damage; no user configuration is lost. The system value QCONSOLE reflects the name of the console device currently varied on. This system value cannot be changed. The user configuration descriptions for the console and console controller are created by auto-configuration (if QAUTOCFG is set to 1) or manually by the customer.

Because the system is driven by authority checking, IPL functions are limited by the user's authority rather than by what device the function is operating on. (An exception to this rule is the QSECOFR, QSRV, and QSRVBAS profiles. A special allowance is made by security to always allow these profiles to sign on to the console.) The console is the device where displays used to do an install and/or attended IPL appear, and it is the only work station where sign on is allowed after an End System (ENDSYS) command is issued.

The different IPLs described in this chapter, with or without problems, are:

- The first system IPL, see page 19-1.
- Attended second and subsequent IPLs, see page 19-2.
- Unattended IPLs, see page 19-3.

The First System IPL

The first system IPL is an attended IPL only. Attended IPLs are necessary to install OS/400.

With No Problems

Using DST: The system console is a locally attached display device at bus 0, port 0, on the first work station controller. DST uses the work station controller at bus 0 and the display on port 0, address 0 for a twinaxial work station, as the system console. DST displays console displays. OS/400 is installed by selecting an option from the DST main menu.

Using OS/400: The OS/400 is installed and IPL is started.

The SCPF process running in OS/400 invokes device configuration to create the descriptions used during IPL. Device configuration creates the controller and console descriptions using the attributes passed through the MISR from DST to OS/400. The OS/400 controller name is QCTL. The OS/400 console name is QCONSOLE.

When the console and controller descriptions are created, messages are sent to QHST to indicate the descriptions were created.

After creation of the OS/400 descriptions, OS/400 sets in MISR (position 1 of the array of console information) the console and controller attributes that DST originally passed (position 2 of the array of console information). This information is used by OS/400 on subsequent IPLs to check for changes with the console device and the controller. See "DST Interface during IPL" on page 19-3 for a layout of the MISR information.

The SCPF process calls device configuration to vary on the controller QCTL, then the console QCONSOLE. (The status of CN is used to vary on the console device.) The console is then used for display processing. A special call is made to device configuration because device configuration needs to know that the resource name is not to be used in varying the controller on. The resource name cannot be used because the hardware resource manager (HRM) database does not exist yet. A pointer to the console information from the MISR is passed to device configuration in the request to vary on the controller.

QCONSOLE and QCTL are varied off before the hardware resource manager is initialized. The hardware resource manager changes the resource name in the QCTL. Device configuration attempts to vary on controller QCTL and device QCONSOLE after other controller and device descriptions with ONLINE(*YES) are varied on.

Processing continues with control of the console, named in the system value QCONSOLE, being acquired by the controlling subsystem at the end of the IPL.

With Problems

Using DST: If the system console is not available, DST finds an alternative console. If the alternative console is not available, the system ends with an SRC. DST does not allow an install to be performed from an alternative console.

Using OS/400: See "Sequence of Events for OS/400 Installs" on page 19-3 for more information.

If a problem occurs while the SCPF process has control, OS/400 switches to doing an unattended IPL and continues the IPL if the QSCPFCONS system value allows OS/400 to do so. If the IPL is not allowed to switch to the unattended mode, the SCPF process stops the system and displays an SRC detailing the OS/400 failure.

Note: OS/400 does not attempt to switch to doing an unattended IPL until the installation of is complete.

Second and Subsequent Attended IPLs

With No Problems

Using DST: DST uses the work station controller at bus 0 and the first display on port 0 as the console. DST displays the console displays until OS/400 is initiated.

Using OS/400: OS/400 materializes the MISR for the console information. This consists of the console and controller information that OS/400 placed in the MISR previously, information about the device that DST is using with this IPL, and an indication that DST used the system console.

Using the OS/400 information from the MISR, OS/400 first looks to the controller description, then to the console description.

The SCPF process calls device configuration to vary on the QCTL and the QCONSOLE. (The status of CN is used to vary on the console device.) The console is then used for display processing. The call to device configuration is a special call because device configuration needs to know that the resource name is not to be used in varying the controller on. The resource name cannot be used because the hardware resource manager (HRM) database has not been initialized yet. A pointer to the console information from the MISR is passed to device configuration in the request to vary on QCTL.

QCONSOLE and QCTL are varied off before the hardware resource manager is initialized. The hardware resource manager changes the resource name in the QCTL controller description. Device configuration attempts to vary on controller QCTL and device QCONSOLE after other controller and device descriptions with ONLINE(*YES) are varied on.

Processing continues with control of the console acquired, named in the system value QCONSOLE, by the controlling subsystem at the end of the IPL.

With Problems

Using DST: If the system console is not available, DST finds an alternative console. If the alternative console is not available the system ends with an SRC.

Using OS/400: The problems are:

- DST could not use the system console but used an alternate console

  OS/400 uses only the system console and attempts to do an unattended IPL. OS/400 looks at the system value, QSCPFCONS, to determine whether or not to switch to doing an unattended IPL. The shipped default of this system value is to continue an unattended IPL. If the IPL is not allowed to switch to the unattended mode, the SCPF process stops the system and displays an SRC detailing the OS/400 failure.

- Console device description QCONSOLE was not found

  Device configuration is invoked to create a new description using the device attributes from the MISR. The name used is QCONSOLE. The QCONSOLE system value is updated with the created name.

  When device configuration creates the console description, a message is sent to QHST to indicate that a description is created.

- Controller description QCTL was not found

  Device configuration is invoked to create a new description using the controller attributes from the MISR. The name used is QCTL.

  When device configuration creates the controller description, a message is sent to QHST to indicate that a description is created.

- Console device description QCONSOLE is damaged

  Device configuration is invoked to delete and create the QCONSOLE device description again. The new description is created using the attributes of the device DST used.

- Controller description QCTL is damaged

  Device configuration is invoked to delete and create the controller description QCTL again. The new description is created using the attributes of the controller that DST used.

- Not able to vary on the controller QCTL or console QCONSOLE that is used during IPL

  If OS/400 is being installed, the SCPF process stops the system and displays an SRC. OS/400 is not allowed to switch to an unattended IPL during an install. Otherwise, the SCPF process looks at the system value, QSCPFCONS, to determine whether or not to switch to an unattended IPL. The shipped default of this system value is to perform an unattended IPL. If the IPL is not allowed to switch to the unattended mode, the SCPF process stops the system and displays an SRC detailing the OS/400 failure.

- Not able to vary on a user console after an IPL

  OS/400 continues to operate and display an SRC.

- The MISR values were reset to the defaults

If the MISR was damaged, it is built again by VLIC with default values. Installing VLIC does not reset the MISR values.

A bit in the MISR indicates to OS/400 that the MISR has been reset. Because DST creates its description to use the console each time DST is started, DST is not impacted like OS/400 when the MISR values are reset.

Because the MISR information about the console that OS/400 last used is gone, when the MISR is reset, OS/400 does not know if the existing device description matches the device description that DST specified for the console. OS/400 issues a message CPI0969 indicating that the MISR was damaged and that the previous console information is lost. OS/400 deletes the QCONSOLE console description, if a description can be found, and to create a new description using the attributes of the device that DST used.

Device configuration is invoked to delete and create the QCONSOLE device description again.

The QCTL controller is handled like the QCONSOLE console.

- QCTL or QCONSOLE type or model have changed

  QCONSOLE is a permanent description for the console. When that description does not match the current device's attributes, the requested function (for example, varying on the device) most likely fails.

  For example, attributes could change when a new device is plugged in for used as the console and the new device's type and/or model do not match the former device. If the type or model are not updated in the QCONSOLE description, the IPL recognizes the difference.

  Device configuration is invoked to delete and create the QCONSOLE device description again. The new description is created using the attributes of the device that DST used.

  The message CPI0968, stating the attributes of the controller or console device has changed since the last IPL and that the existing OS/400 description is deleted and a new description with the changed attributes is created, is sent when the attributes do not match. This indicates a mismatch.

  The QCTL controller is handled like the QCONSOLE console.

- The user's controller and console descriptions are not checked by the SCPF process during the IPL.

Unattended IPLs

Using DST: DST is bypassed. No search for a console is done for an unattended IPL.

Using OS/400: The SCPF process does nothing with the QCONSOLE or QCTL controller.

Sequence of Events for OS/400 Installs

The OS/400 install order is:

1. Install (part 1).
2. Initial OS/400 process.
3. SCPF process begins.
4. Install (part 2).
5. SCPF process completes the IPL.

Install (part 1) does not use the OS/400 created console description. DST shows the install displays. However, install (part 2, the part that loads the complex objects onto the system) uses the OS/400 created console QCONSOLE to display messages. Install (part 1) runs before the *initial OS/400* process is initiated. Install (part 2) runs after the SCPF process is initiated, but before the SCPF process presents the Sign On display.

Install needs a console to display install messages; therefore, the IPL must be attended. For the IPL to be attended, the system console must be usable. DST prevents starting an OS/400 install if an alternative console is used.

Existing QCONSOLE or QCTL descriptions are used if they can be found. If the descriptions are not found, new descriptions are created. QCONSOLE and QCTL descriptions that are restored are deleted and new descriptions are created.

DST Interface during IPL

For more information about DST, see Chapter 13. For more information about an IPL, see Chapter 18.

The DST interface is used for attended IPLs only. For unattended IPLs, neither DST nor OS/400 use the console.

DST uses the system console. If a console problem occurs, DST uses an alternative console. If there is a need for an alternative console, DST stops and the system displays an SRC on the control panel indicating DST needs to switch to using an alternative console.

OS/400 materializes the console attributes stored in the VLIC MISR. This information consists of two parts:

1. The system console OS/400 last used
2. The device DST used as the console for the IPL

Table 19-1 on page 19-4 shows the structure of the MISR interface between DST and OS/400 for console and controller information.

Table 19-1. MISR Structure between DST and OS/400

Hex Offset	Bit Offset	Field Name	Length	Description
000		MIMMSFPA(5)	CHAR(80) BDY(16)	Array of console information: First = Console information stored by OS/400 on the last attended IPL Second = Console information from DST Third—Fifth = Reserved
060		MIMLSPTR	CHAR(16)	System pointer to display LUD
070		MIMCSPTR	CHAR(16)	System pointer to CD
080		MIMCDMOD	CHAR(4)	Controller model
084		MIMCDTYP	CHAR(4)	Controller type
088		MIMCDSER	CHAR(4)	Controller serial number
08C		MIMCDDAT	CHAR(12)	Controller object data
08C		MIMCDSAD	CHAR(2)	Direct select address
08C	0	MIMCDBS#	BIT(8)	IOP bus number
08D	0	MIMCCDBD	BIT(8)	IOP card, board structure
08D	0	MIMCDCRD	BIT(4)	IOP card number
08D	4	MIMCDBRD	BIT(4)	IOP board number
08E		MIMCDLBA	CHAR(1)	Logical bus address
08F		MIMCDIUA	CHAR(2)	IOP unit address
091		MIMCDRID	CHAR(4)	Resource identifier
095			CHAR(3)	Reserved
098		MIMLUDAT	CHAR(12)	Work station object data
098		MIMLUDSA	CHAR(2)	Direct select address
098	0	MIMLUBS#	BIT(8)	IOP bus number
099	0	MIMLUCBD	BIT(8)	IOP card, board
099	0	MIMLUCRD	BIT(4)	IOP card number
099	4	MIMLUBRD	BIT(4)	IOP board number
09A		MIMLULBA	CHAR(1)	Logical bus address
09B		MIMLUDUA	CHAR(2)	Device unit address
09B		MIMLUDPT	CHAR(1)	Port
09C		MIMLUDSW	CHAR(1)	Switch setting
09D			CHAR(7)	Reserved
0A4		MIMLUTYP	CHAR(4)	Device type
0A8		MIMLUMOD	CHAR(4)	Device model
0AC			CHAR(1)	
0AC	0	MIMMSFEV	BIT(1)	Console information valid in this entry
0AC	1		BIT(7)	Reserved
0AD		MIMKEYTY	CHAR(1)	Console keyboard type
0AD		MIMKEYEX	CHAR(1)	Extended keyboard type
0AE			CHAR(1)	Reserved

The first element in the array is the console attributes for the device that used the preceding attended IPL. OS/400 sets this element. DST does not. When its values are zero, then this is either the first system IPL or the MISR is damaged and its contents are reset to the defaults. When OS/400 sets this element, OS/400 turns the bit MIMMSFEV on to indicate to OS/400 that information has been put in this element.

The second element in the array is the console attributes of the device that DST used as a console. DST sets this element. OS/400 does not.

DST indicates, through the following MISR fields, what device DST is using for the console:

MIMPRICN BIT(1)	Using system console.
MIMSECCN BIT(1)	Using alternative console.

For more information about the ZZMISR include, see the *AS/400 System Support: Diagnostic Aids Addendum*.

Note: The *AS/400 System Support: Diagnostic Aids Addendum* is an Object Code Only (OCO)—IBM Confidential Restricted. manual.

Implications of Starting DST during IPL

Selecting function 21 and pressing the Enter key on the operator panel starts DST. If DST was left in the debug mode, then DST suspends the SCPF process using the console until DST is exited.

If DST was completely signed off before beginning OS/400 IPL, then when function 21 is used to start DST, the OS/400 process using the console is ended. Therefore, if function 21 is used during an attended IPL, the IPL is not continued after DST is exited since the SCPF process used to IPL the system has ended. The machine appears dead after exiting DST. The system must be powered off to begin an IPL again. Because cleanup processing was not done by OS/400 before OS/400 stopped, the subsequent IPL is longer as it may have to run recovery, and so on.

Unpredictable results can occur when VLIC stops the SCPF process, rather than OS/400 stopping itself when it runs into trouble. Therefore, it is strongly recommended that DST should not be started during an attended IPL if DST is not in debug mode.

Alternative Console Support

DST switches to an alternative console when the system console does not work. This does not occur automatically. An SRC appears on the control panel indicating when intervention is needed. To access the alternative console, select function 21 on the control panel and press the Enter function.

DST is the only tool that uses the alternative console. OS/400 checks to see if DST used an alternative console. If DST used an alternative console, the system console is not usable. OS/400 then sees if it can switch to doing an unattended IPL. OS/400 does not use the alternative console.

DST does not allow an install to be performed from an alternative console since an install requires an attended IPL.

For more information, see the system value QSCPFCONS on page 19-7.

Device Configuration

For more information about device configuration, see page 7-4.

Interface during IPL

The device configuration vary code uses the MISR console data to vary the controller on. This is because the hardware resource manager database is not available for the vary code to obtain the controller resource name.

Outside of IPL

To reserve QCONSOLE for the system to use, device configuration prevents a description named QCONSOLE from being created.

Also, to make sure that no other description could be attached to controller QCTL, QCONSOLE is the only device description that is created with this controller.

When the console description is varied on, device configuration updates the QCONSOLE system value with the name of the description.

Kanji double byte character devices are supported as the console.

Device configuration forces the following rules on their commands:

- A local workstation controller named QCTL can be created only by the SCPF process.
- The RSRCNAME, ONLINE, and AUTOCFG parameters cannot be changed on the QCTL description.
- No controller other than QCTL can attach the device QCONSOLE.
- A display device named QCONSOLE can be created only by the SCPF process.
- The PORT, SWTSET, ONLINE, INACTTMR, LINESPEED, WORDLEN, PARITY, and STOPBITS, parameters cannot be changed on the QCONSOLE description.
- No device other than QCONSOLE can attach to controller QCTL.

System Values

You can display or change system values either after an IPL or during an IPL. System values are control information that affect the operation of certain parts of the system.

To change system values, set the Define or change system at IPL option to Y (yes) on the IPL Options display. Then, select the *System value commands* option from the Define or Change the System at IPL menu.

For more procedures on how to display or change system values, and for other system values not listed here, see the *Operator's Guide*. The following is a list of system values. Note that some can affect an IPL:

System Value	Description
QABNORMSW	Abnoraml end switch: 0 = Normal (initial value) 1 = Abnormal
QACGLVL	Accounting level Initial value is *NONE.
QACTJOB	Initial number WCB's created at SCPF Initial value is 20.
QADLACTJ	Number of WCB's created when all assigned Initial value is 10.
QADLSPLA	SCB extension size in bytes Initial value is 2048.
QADLTOTJ	Number of WCBTE's to create at WCBT extend Initial value is 10.
QAUTOCFG	This system value controls auto-configuration. The system values are: 0 = Automatic configuration off 1 = Automatic configuration on (initial value) For more information about this system value and auto-configuration, see "Controlling Auto-Configuration" on page 7-5.
QBASACTLVL	*BASE pool maximum activity level Initial value is 6.
QBASPOOL	Minimum size of *BASE pool in K-bytes Initial value is 500.
QCHRID	Graphic character set global ID Initial value for character set is 101 and code page is 37.
QCMNRCYLMT	Communication recovery limit

Console Usage

QCONSOLE	CHAR(10) system value for displaying the system console name. This system value can only be displayed or retrieved. It cannot be changed. The shipped value is QCONSOLE or DSP01.
QCTLSBSD	Controlling subsystem description Initial values are QBASE and QGPL.
QCURSYM	System currency sybmol (edit MSK) *Initial* value is **$**. **Note:** This value cannot be a '-', '*', '&', '0', or ' '.
QDATE	Date (ISF) QYEAR Year (subvalue) QMONTH Month (subvalue) QDAY Day (subvalue)
QDATFMT	Date format in chararacter and fixed (YMD, MDY, DMY, or JUL) Initial value is MDY or 2.
QDATSEP	Date separator (/, -, ., or ,) Initial value is a slash (/).
QDBRCVYWT	Database recovery wait indicator: 0 = Do not wait (initial value) 1 = Wait
QDECFMT	Decimal format (' ', 'J', or 'I') Initial value is a space or ' '.
QDEVNAMING	Device naming convention Initial value is *NORMAL.
QHSTLOGSIZ	History log size Initial value is 5000.
QIGC	IGC support: 0 = No IGC support (intial value) 1 = IGC support
QIPLDATTIM	Auto IPL date and time Initial value is hex 00.
QIPLSTS	IPL status: 0 = Operator (intial value) 1 = Power fail 2 = Restart 3 = Timed 4 = Remote
QIPLTYPE	CHAR(1) system value to indicate the type of IPL. This value is valid only when the Keylock switch is in the Normal position or the Keylock switch is in the Manual position and QIPLTYPE is 2. The following values may be specified: **Value Meaning** 0 No DST menus are displayed. Perform an IPL in unattended mode. This is the shipped default value. 1 DST menus are displayed. Perform an IPL in attended mode. 2 DST menus are displayed. Perform an IPL in attended mode. QCONSOLE is not varied off. The type of IPL that is performed when the system is powered up with the Keylock switch in the Normal position can be controlled with the system value QIPLTYPE. This affects the IPLs that are initiated by the: • Power on switch • Function 3 (Start IPL) on the control panel • PWRDWNSYS command with restart This system value is stored below the MI in the MISR for DST to access. The system value can only be changed through OS/400, not DST. If an IPL is performed with the Keylock switch in the Manual position, an attended IPL takes place. If QIPLTYPE is 2, then an attended IPL in debug mode takes place. When QIPLTYPE is 2, QCONSOLE is not varied off during the IPL to allow a user console to vary on. A QIPLTYPE value of 2 can be used when the initial Sign On display appears during IPL and when no console is usable after the IPL is complete. A QIPLTYPE value of 2 should only be used for debugging because it leaves the controller QCTL varied on and prevents devices other than QCONSOLE on the QCTL controller from varying on. If an IPL is automatic (either remote power on, timed power on, or an IPL after restoration of utility power), the IPL is always unattended regardless of the QIPLTYPE system value.
QJOBMSGQSZ	Initial size for a job message queue in K-bytes Initial value is 16.
QJOBMSGQTL	Truncation level for a job message queue in K-bytes Initial value is 24.
QJOBSPLA	Initial SCB size in bytes Initial value is 1536.

QKBDTYPE	Keyboard language Initial value is USB.
QLEAPADJ	Leap year adjustment Initial value is zero (0).
QMAXACTLVL	Machine maximum activity level Initial value is 100.
QMAXSIGN	Maximum signon attempts Initial value is 15.
QMCHPOOL	Minimum size of machine pool in K-bytes Initial value is 1500.
QPFRADJ	IPL tuning: 0 = Do not tune 1 = Tune (initial value)
QPRTDEV	System printer Initial value is PRT01.
QPRTTXT	Print text to be printed on output Initial value for text is ' ' and for indicator is hex 00.
QPWRDWNLMT	Maximum time limit in seconds for PWRDWNSYS *IMMED Initial value is 300.
QPWRRSTIPL	Auto IPL Initial value is zero (0).
QRMTIPL	Remote IPL 0 = Do not allow a remote IPL (initial value) 1 = Allow a remote IPL
QSCPFCONS	Contains a value that indicates whether or not to switch to an unattended IPL when trouble occurs. OS/400 checks this system value to see if it is allowed to continue an unattended IPL. OS/400 stops the system with an SRC when trouble occurs if it is not allowed to continue an unattended IPL. The shipped default of this system value is to continue an unattended IPL.
QSECURITY	System security level: 10 = No PW/NO RSRC (initial value) 20 = PW/NO RSRC 30 = PW/RSRC
QSPCENV	Special environment Initial value is *NONE.
QSRLNBR	System serial number
QSRVDMP	Service dump control: (*DMPUSRJOB, *DMPSYSJOB, *DMPALLJOB, *None) Initial value is *DMPUSRJOB.
QSTRPRTWTR	Start print writers in controlling subsystem: 0 = No start 1 = Start (initial value)
QSTRUPPGM	Set up program to run in controlling subsystem Initial value is QSTRUP QSYS.
QSYSLIBL	System portion of library list Initial values are QSYS, QHLPSYS, and QUSRSYS.
QTIME	Time (from clock): QHOUR HOUR QMINUTE MIN QSECOND SEC
QTOTJOB	Initial number of WCBTE's created at SCPF Initial value is 30.
QUPSDLYTIM	Initial value is *CALC.
QUPSMSGQ	MSG queue where uninterruptible power supply messages are to be sent Initial value is QSYSOPR *LIBL.
QUSRLIBL	User portion of library list Initial values are QGPL and QTEMP.

Note: Use the CHGSYSVAL command to change system values if command entry is available.

The MI object that contains all of the system values is QWMSYSVAL. This MI object, located in QSYS, is a space object. It has an object type of 19 and subtyte of D2. This object is mapped by the WWSVAL include. The WWNETA include maps information specific to network attributes.

The EPA header is hex 100 in length and starts at offset hex 00. The object specific header is hex 0F60 in length. This area contains a list of the system values. It starts at offset hex 100 from the start of the object.

The data portion, which contains the values to which each system value is set, begins at offset hex 0F60 after the EPA header (hex 1060 from the beginning of the object).

To patch an individual system value, locate the system value you want to alter. At offset hex 0A, on the line where the system value name resides, for a length of 2 bytes is the offset into the data portion of the object (offset hex 1060 from the start of the object). Resolve to this offset to find the current value of the system value in question.

The offset to each individual value can also be found by using the include. The offsets specified in the include are from the start of the data portion. This hex offset must be added to hex 1060 to locate the value using display/alter/dump.

| The WWSVAL include is shown in the *AS/400 System*
| *Support: Diagnostic Aids Addendum*[1].

IPL Restrictions and Limitations

The following restrictions and limitations must be considered when performing an IPL:

- The console is a local work station at bus 0 and port 0 on the first work station controller.
- OS/400 uses only the system console. The alternative console is not used by OS/400.
- Device configuration prevents certain parameters for the system console from being changed by the user. See "Outside of IPL" on page 19-5 for other device configuration restrictions.
- If auto-configuration (QAUTOCFG) is turned off on the initial installation. The controller and device descriptions that are to be used by the console after the IPL is complete must be created again.
- There must be a work station entry in the controlling subsystem for the console.

Console Usage

Example of Messages that Occur during an IPL

Figure 19-1 shows examples of messages that occurred during an IPL. These message are stored in the history log (QHST). For more information about history logs, see page 15-8.

```
                          History Log
MSGID
CPF0905  Attended IPL in progress.
CPC2609  Vary Configuration (VRYCFG) command completed for controller QCTL.
CPC2605  Vary Configuration (VRYCFG) command completed for device QCONSOLE.
CPF0965  IPL options used.
CPF3120  No interrupted data base object level operations found.
CPF3121  No data base files open at system end.
CPF1805  System value QMCHPOOL changed from 11897 to 11897.
CPF1805  System value QBASACTLVL changed from 7 to 7.
CPC1602  Subsystem description QSPL in library QGPL changed.
CPC1602  Subsystem description QBASE in library QGPL changed.
CPI0986  Performance values were adjusted.
CPC2621  Warning. Device QCONSOLE varied off while in session.
CPC2610  Controller QCTL varied off.
CPI0C04  IPL from machine area ##MACH#A.
CPC2609  Vary Configuration (VRYCFG) command completed for controller CTL01.
CPF5908  Controller CTL01 contacted on line *N.
CPC2609  Vary Configuration (VRYCFG) command completed for controller CTL07.
CPF5908  Controller CTL07 contacted on line *N.
CPD27D1  Controller QCTL vary on failed.
CPD2723  Device QCONSOLE not varied on.
CPD27EF  Vary Configuration error occurred during IPL.
CPF0993  Start of controlling subsystem in progress during IPL.
CPF1804  Subsystem QBASE in library QGPL starting.
CPF0934  IPL completed.
CPF1124  Job 002806/QSYS/QBASE started on 03/17/89 at 22:42:13 in subsystem QBA
CPF1187  Subsystem QBASE cannot allocate work station QCONSOLE.
CPF1103  Subsystem QBASE started.
CPF1124  Job 002805/QSECOFR/DSP010000 started on 03/17/89 at 22:42:19 in subsystem
```

Figure 19-1. An Example of a History Log Containing IPL Messages

| [1] Object Code Only (OCO) — IBM Confidential Restricted.

Chapter 20. Install Communications Object

This object is used to communicate with the various modules of install. Figure 18-1 on page 18-2 shows where the install communication object is created.

Table 20-1 shows the format of the install communication object. This object may contain additional data that may help to determine the cause of the error encountered during an install.

The pointer to QICO1 (the install communication object) is part of the data passed to the machine for the terminate machine processing instructions. This data is usually displayed as part of the SRC data.

Sometimes, you can simply find the ICO by name. If so, the information you need is:

Object	**Description**
QICO1	Object name
19	Object type
C6	Object subtype
QSYS	Context name
01	Context subtype

Note: Finding the ICO by name can be done only after the licensed internal code completes the context rebuild phase of IPL. This happens during the re-IPL after an install terminates with an SRC. For more information about the context rebuild phase, see "How to Debug an IPL or Install Using Step Mode" on page 13-20.

If the SRC indicates problems with the console, the message index number (offset 2A0) and the display input/output parameters and return codes in the ICO may be helpful.

If the SRC and error message indicate an unexpected exception, the exception data can be found beginning at offset AB0 in the ICO. If the SRC indicates a tape problem, the feedback area can be found at offset AB0 in the ICO.

Offsets 0 to hex FF are the EPA header. If possible, see the include YYEPAHDR in the *AS/400 System Support: Diagnostic Aids Addendum*.[1]

Displaying or Printing the ICO

There are many cases when an install fails and an SRC appears indicating a need to display or print the install communications object (ICO). The ICO can be used for problem analysis.

Do the following to print or display the ICO:

1. Record the pointer to the ICO from the SRC data in functions 17 and 18).
2. Start the IPL process.
3. During the IPL process, select the *Work with dedicated service tools* option from the IPL/Install the System display.
4. Enter the DST password. For more information about DST passwords, see page 13-1.
5. Select the *Work with service tools* option from the Dedicated Service Tools menu. For more information about this menu, see page 13-21.
6. Display or print the ICO using the *Display/alter/dump* option. To print or display the ICO select the *Starting address* option from the Select Data menu under display/alter/dump. The starting address is the last 6 bytes of the pointer to the ICO. These 6 bytes are recorded in the SRC. For more information about the Select Data menu, see page 12-29.

ICO Debug Fields

The following is a list of debug fields that are useful for solving problems.

Table 20-1 (Page 1 of 2). Format of the Install Communications Object

Offset (Hex)	**Size in Bytes (Decimal)**	**Description**
0100	8	ICO level ID
0108	4	Phase, function, and subfunction
0190	16	System pointer to SSR space
0280	1	Short (S) or full (F) install flag
0285	1	System values restored? (Y or N)
0286	1	Call language exit program? (Y or N)
028C	1 byte, bit 0	Bit 0, loading MRI objects? (1 or 0)
028F	1 byte, bit 0	Bit 0, automatic install? (1 or 0)
028F	1 byte, bit 1	Bit 1, automatic recovery? (1 or 0)
02A0	8	Message ID
02D7	4	Count of objects loaded for this library
02DB	4	Language feature ID being installed
02E9	50	(Array of five 10 character names) User profiles whose storage limit was exceeded
0325	1	Recovery point

1 Object Code Only (OCO)—IBM Confidential Restricted.

Table 20-1 (Page 2 of 2). Format of the Install Communications Object

Offset (Hex)	Size in Bytes (Decimal)	Description
0327	40	(Array of four recovery point data) Tape volume ID, volume sequence number, file sequence number
0480	128	Program name invocation stack
06C7	2	Service function completion code
06C9	8	Service function completion code qualifier
06F3	228	Display or message replacement values
0922	32	SRC data
0A5C	2	Volume number of current file
0A5E	2	Sequence number of current file
0A68	32	Installation profile data
0A88	2	Return code from read/open of installation profile
0AB0	596	Exception data or I/O feedback record

ICO

Install Phase/Function/Subfunction Codes

Phase, function, and subfunction codes are in the install communications object. These are similar in intent to those stored by Start OS/400 in the start OS/400 data object (QWCSCPF). That is, they are used when debugging install problems to indicate where in the install processing the problem occurred. Error recovery needs to be determined by the SRC.

The **phase** is a 1-byte field showing the general phase of install processing being performed:

```
01 = Part 1 Processing (before OS/400 initiated)
02 = Part 2 Processing (after OS/400 initiated)
```

The **function** code is a 1-byte field showing the general section of install processing being performed within that phase.

The **subfunction** is a 2-byte field which narrows down the error to a specific section of code.

The following are the install function and subfunction codes in hex:

Phase 01 (Part 1)

00 Initial set up

- 0000 Create or recreate the QINSTALL library
- 0010 Create the process access group (PAG)
- 0020 Create the feedback queue
- 0030 Initialize for display I/O
- 0040 Get system date and time into ICO

10 Setting up the install device

- 0000 Invoke the initialize device processing and route call
- 0010 Get addressability to MISR and materialize XMISR
- 0020 Create the CD (if necessary)
- 0030 Create the LUD
- 0050 Vary on the CD (if necessary)
- 0060 Vary on the LUD
- 0070 Create and initialize the space for device support soure/sink requests (SSRs)

20 Setting up the install type 1 environment

- 0000 Materialize MISR and check if QSYS user profile was damaged
- 0010 Get language feature ID from MISR into ICO
- 0020 Access old ICO (if any) and get fields from it
- 0030 Get old language from Q5728SS1 if not already set
- 0040 Resolve to QSYS user profile
- 0050 Advance to next file on media
- 0060 Set up for loading install type 1 (INT1) programs
- 0070 Create or load install type 1 (INT1) programs from the media
- 0080 Build, resolve to each install type 1 (INT1) program
- 0090 Resolve to install type 1 (INT1) programs and update local entry point table (EPT)
- 0095 Create the alternate process definition template (PDT)
- 00A0 Set up the process default exception handler

30 Setting up for any type install

- 0000 Call to the general set up routine (QINSETUP)
- 0010 Check if the QSYS user profile was previously damaged
- 0020 Ensure default owner user profile exists and is not damaged
- 0030 Check all libraries for damage and correct format
- 0040 Ensure QSYS library exists and is set up properly
- 0050 Create or recreate the QWCSCPF and put it into the QSYS context
- 0060 Create all required user profiles and authorize user table (AUT)
- 0080 Create all required libraries

40 Display install option display or displays

- 0000 Call to display option displays routine (QINOPTS)
- 0010 Materialize count of objects in QSYS context
- 0020 Initialize for displaying option display or displays
- 0030 Display or validate the Install the Operating System display
- 0040 Set the system clock if the operator modified the date or time
- 0050 Set the install default options (operator took defaults)

0060	Display or validate the Installing Options display
0070	Display or validate the Restore Options display
0080	Set option flags in the ICO
1010	Check the MISR for defaulted date or time
1020	Display CPA2001 for date or time
1030	Change system date or time
1040	Open the installation profile
1050	Read the installation profile
1060	Close the installation profile
1070	Validate the installing options read from the installation profile
1080	Default the restore options
1090	Validate the restore options read from the installation profile

50 Set up to perform selected type of install

0000	Call to perform selected type of install (QININST)
0010	Transfer ownership of objects in transfer table
0020	Clear job or output queues: check the required libraries or user profiles for damage
0030	Clear job or output queues: destroy the objects in the cold start table
0040	Not restoring the operating system: check for previously detected damage
0050	Not restoring the operating system: ensure OS/400 is currently installed

60 Restoring program objects (full install)

0000	Begin to load OS/400 objects
0005	Build, call to build OS/400 (BLDP1)
0010	Materialize auxiliary storage space available to see if suspends are necessary
0020	Delete the Q5728IGC data area if it exists
0030	Delete the program QINDUMMY if it exists
0040	Load the LIB*ALL descriptor
0050	Find the file containing OS/400 programs (QSYS)
0060	Load the save/restore descriptor for the current library
0070	Call to load all the objects for the library (QINLDALO)
1010	Remove the library PC index if it exists
1020	Load the new PC index from media
1030	Grant authority to the library objct information repositorys (OIRs)
1040	Load or create/load all objects for the library
0080	Build the OIR data for the library and the objects again

70 Restoring MRI objects (full install)

0000	Find the MRI file on the media
0010	Call to load the MRI data (QINLDMRI)
2010	Set up to load MRI data
2020	Load the save/restore descriptor for the library
2030	Call to load all the objects for the library (QINLDALO)
1010	Remove the library PC index if it exists
1020	Load the new PC index from media
1030	Grant authority to the library OIRs
1040	Load or create/load all objects for the library
2040	Build the OIR data for the library and the objects again
2050	Link/load the VLIC MRI data

80 Restoring MRI objects only

0000	Load the LIB*ALL descriptor
0010	Find the MRI file on the install media
0020	Call to load the MRI objects (QINLDMRI)
2010	Set up to load the MRI data
2020	Load the save/restore descriptor for the library
2030	Call to load all the objects for the library (QINLDALO)
1010	Remove the library PC index if it exists
1020	Load the new PC index from media
1030	Grant authority to the library OIRs
1040	Load or create/load all objects for the library
2040	Build the OIR data for the library and the objects again
2050	Link/load the VLIC data

90 Creating system-wide entry point table

0000	Call to create the system-wide entry point table (QLIINT1)
0010	Resolve to QSRV user profile
0020	Resolve to QLINMTBL
0030	Create temporary space for the resolved library pointers
0040	Resolve to each library in QLINMTBL and store the pointer
0050	Create (or locate and create again) space for the system entry point table (SEPT)
0060	Grant public authorities to SEPT
0070	Resolve to program QINDUMMY
0080	Materialize pointers to programs in QSYS before SEPT is built
0090	Resolve to each program in QLINMTBL and update SEPT
00A0	Destroy temporary space for the resolved library pointers

A0 Initiating the start OS/400 process

0000	Prepare the start OS/400 process
0010	End part 1 device processing
0020	End screen I/O processing
0030	Wait for the console available event
0040	Initiate the start OS/400 process
0050	Clean up the install type 1 (INT1) environment
0060	Check if start OS/400 process initiated OK and end

ICO

Phase 02 (Part 2)

10 Set up for restore part 2 objects

0010	Retrieve the install LUD name
0020	Extract the display console name
0030	Open the QDSTRCPF display file
0040	Handle invalid CRCs encountered during part 1 install

20 Restoring part 2 objects

0000	Access the LIB*ALL descriptor
0010	Set up for the correct language ID
0020	Display the in-progress message
0030	Destroy objects in the destroy objects table
0040	Restore part 2 objects for the library (?RSTOBJ)
0050	Call the language exit program if needed

30 Fix-up functions

0000	Call to fix-up subroutine (QINFIXUP)
0010	Create the required system job queues
0020	Create the required system output queues
0030	Call to assign the system private authorities (QSYINT2)
1010	Resolve to authority object
1020	Grant all the system private authorities
1025	Resolve to user profiles to get private authorities
1030	Grant special program authorities for QSMCSMSU
1040	Grant special program authorities for QARDRIVE
1050	Grant special program authorities for QPGMMENU
1060	Grant special program authorities to QSNADS and QGATE
1070	Grant special program authorities for QDXDDOER
1080	Grant special program authorities for QSPRDR
1090	Grant special program authorities for QSPWTRM1
10A0	Grant public *USE authority to program QCMD
10B0	Grant public authority for objects in QCPUATBL
10xx	Reserved for install part 2 authority fix up
0040	Put OIR information into the QSYS OIR for objects in the OIR table
0050	Set up attribute entries for the libraries created

40 Clean up installation

0000	Build the service OIR records for objects created during an install
0010	Update the language ID in code of the product definition area (PDA) if needed
0020	Destroy save/restore descriptors for LIB*ALL and last library
0030	Vary off and delete the install CD and LUD
0040	Destroy the noncontext addressable copy of QINITT
0050	Destroy the QINSTALL library and all install type 1 (INT1) programs in it
0055	Destroy the MISR materialization space
0060	Store the installation complete message in QHST
0065	Modify the spread or no-spread bit in MISR (if needed)
0070	Destroy the ICO
0080	Close the QDSTRCPF display file

Chapter 21. Start OS/400 Data Object (QWCSCPF)

This start data object is also the process communication object (PCO) for the initial OS/400 process. QWCSCPF (start OS/400 object) retains the data obtained by the QWCIINSR module during the initial OS/400 process and passes the data to the start OS/400 process. Also, for debugging purposes, options selected on the IPL Options and the Set Major System Option displays, exception data, and the phase, function, and subfunction counters (as they are set throughout the IPL and system termination phases) are stored in QWCSCPF. OS/400 uses the data stored in the QWCSCPF to determine the location of error conditions encountered during the previous system termination.

Figure 18-1 on page 18-2 shows where the start OS/400 data object is created. Figure 21-1 on page 21-2 shows the format of the start OS/400 data object.

The pointer to QWCSCPF is passed to the machine as the second parameter of the terminate machine processing (TERMMPR) instruction. The first parameter of the TERMMPR instruction contains the reference code that is displayed on the control panel. The machine status information is contained in 28 bytes. Table C-1 on page C-57 shows the 28 bytes of data associated with reference codes 3100 through 3FFF. The reference codes and data can be viewed by displaying functions 12 through 18 on the control panel. For more information about these reference codes, see page C-57.

The start OS/400 data object contains the termination data until the OS/400 process is initialized by VLIC on the next IPL. The object and the termination data should be accessible on the next IPL *after* storage management recovery has run and *before* the operating system is initiated. From DST, select the manual mode of IPL to stop the IPL at the proper point.

Locating and Dumping QWCSCPF: You can locate the QWCSCPF (start OS/400 data object) only in the full paging environment. To locate and dump QWCSCPF, do the following:

1. Select the *Work with dedicated service tools* option from the IPL/Install the System display.
2. Enter your DST password. For more information about passwords, see page 13-1. After the correct password is entered, the Dedicated Service Tools main menu appears.
3. Select the *Select DST console mode* option from the Dedicated Service Tools main menu.
4. Select the *Start DST debug mode on IPL* option from the Select DST Console Mode menu. The Dedicated Service Tools main menu appears again.
5. Select the *Perform an IPL* option from the Dedicated Service Tools main menu.
6. Select the *Step-mode IPL* option from the Select IPL menu to get to DST.
7. Press the Enter key to continue the IPL.

   Continue pressing the Enter key until the storage management function of the IPL has run.
8. Press the F16 key to get to DST after the storage management function has run.
9. Select the *Start a Service Tool* from the DST main menu.
10. Select the *Display/alter/dump* option from the Start a Service Tool menu.
11. Select the *Dump to printer* option.
12. Select the *machine interface (MI) object* option.
13. Select the *Space* option from the Machine Interface (MI) Object menu.
14. Select the *Name and context name* option.

Object	Description
QWCSCPF	Object name
19	Object type
DE	Object subtype
QSYS	Context name
01	Context subtype
2048	Length (in bytes) of the start OS/400 data object.

   The following areas of the system may also contain valuable debugging information:

Area	Description
QWCBT	Work control block table
QWMSYSCB	System control block
QWMSYSVAL	System values object
QWCRMCB	Resource management control block

   Pointers to these can be found in QWCSCPF; use Figure 21-1 on page 21-2 to find the offsets of the pointers. The pointers are system pointers, so replace the last 2 bytes of the addresses with zeros.
15. To resume the IPL:
    a. Select the *Work with DST Environment* option from the DST main menu.
    b. Select the *Work with active service tools* option from the Work with DST Environment menu.
    c. Enter a 1 in the field to the left of the *IPL service function* option and press the Enter key.

For more information about using DST to do an IPL or install, see "How to Start DST Debug Mode" on page 13-20. For more information about the displays that appear during an attended IPL, see "Work Control Displays" on page 18-19.

QWCSCPF

8 Bytes

Offset	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0100	Space pointer to system entry point table							
0110	Phase number	Function number	Subfunction number		System reference code		QWCIDSPR return code	
	QDSTRCPF missing or damaged	QDSTRCPF open fail	Reserved (6 bytes)					
0120	Retrieve exception data area (160 bytes = hex A0). Used by QWCIINSR, QWCIPDEH, QWCISCFR, QWCIDIOR, QWCICLSR, QWCITRSE, QWCAINAR, and QWCASCUE to store (save) exception data when the exception leads to system termination. (See parts 6, 7, and 8.)							
01C0	Object name (10 bytes): The name of the system object or object type for which a resolve has most recently been attempted.							
			Resolve object type/subtype		Resolve index		Reserved (1 byte)	Release level
01D0	QICO exists	Cold start	QICO transfer	*ABBRV install	Auto install	Slip install	New WCBT	SYSARB complete
	Reserved (2 bytes)		Restricted state (storage)	Restricted state (QCSM)	Restricted state (from the display)	*KEEP jobqs	*KEEP outqs	*KEEP joblogs
01E0	Start print writer	Run #STRTUP1	Run #STRTUP2	Set M options	Define system IPL	Reserved (2 bytes)		Enable autoconfiguration
	Default configuration naming: (10 bytes)							
01F0			Default special environment: (10 bytes)					

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Figure 21-1 (Part 1 of 8). QWCSCPF Start OS/400 Data Object

8 Bytes

Offset	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
	Default special environment (continued)				Reserved (2 bytes)		Number of rebuilt objects	
0200								
	Number of job structures created		Number of job structures to extend		Temporary job structure size in binary format (4 bytes)			
	Reserved (8 bytes)							
0210								
	System control block data from the previous IPL. (16 bytes)							
0220								
	Reserved (144 bytes - hex 90)							
02B0								
	QWCBT system pointer (work control block table)							
02C0								
	QWMSYSCB system pointer (system control block)							
02D0								
	QWMSYSVAL system pointer (system value object)							
02E0								
	QJMQSCB system pointer (WCBT recovery object)							
02F0								

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Figure 21-1 (Part 2 of 8). QWCSCPF Start OS/400 Data Object

QWCSCPF

8 Bytes

Offset	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
02F0	QWCRMCB space pointer (resource management control block)							
0300	QARBCLS system pointer (system arbiter class)							
0310	QSYS system pointer (QSYS user profile)							
0320	MISR space pointer (points to MISR data at offset hex 0330 below)							
0330	Number of MISR bytes provided				Number of MISR bytes available			
0338	MISR materialized data (88 bytes): MISR status and pointers. This is the MISR data that was materialized by initial CPF process. (Content of this field is mapped by include ZZMISR.)							
0390								

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Figure 21-1 (Part 3 of 8). QWCSCPF Start OS/400 Data Object

Part 4 shows fields mapped by include ZZMISR. The content of these fields is also shown in Table 19-1 on page 19-4. The fields are used by OS/400 to communicate console information. Also see the ZZMISR include in the *AS/400 System Support: Diagnostic Aids Addendum* (Object Code Only—IBM Confidential Restricted).

8 Bytes

Offset	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0390	MISR materialized data (80 bytes): OS/400 console information. This is data that is materialized by initial OS/400 process. (Content of this field is mapped by include ZZMISR.)							
03E0	MISR materialized data (80 bytes): Console DST used. This is data that is materialized under the start OS/400 process. (Content of this field is mapped by include ZZMISR.)							
0430	Reserved (48 bytes = hex 30)							
0460	Number of NRL entries (1)		Reserved (14 bytes). 0460 and 0470 represent the NRL for the initial OS/400 (and first part of start OS/400) process.					
0470	QSYS system pointer (QSYS system library)							
0480	Reserved (48 bytes = hex 30)							
04B0								

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Figure 21-1 (Part 4 of 8). QWCSCPF Start OS/400 Data Object

QWCSCPF

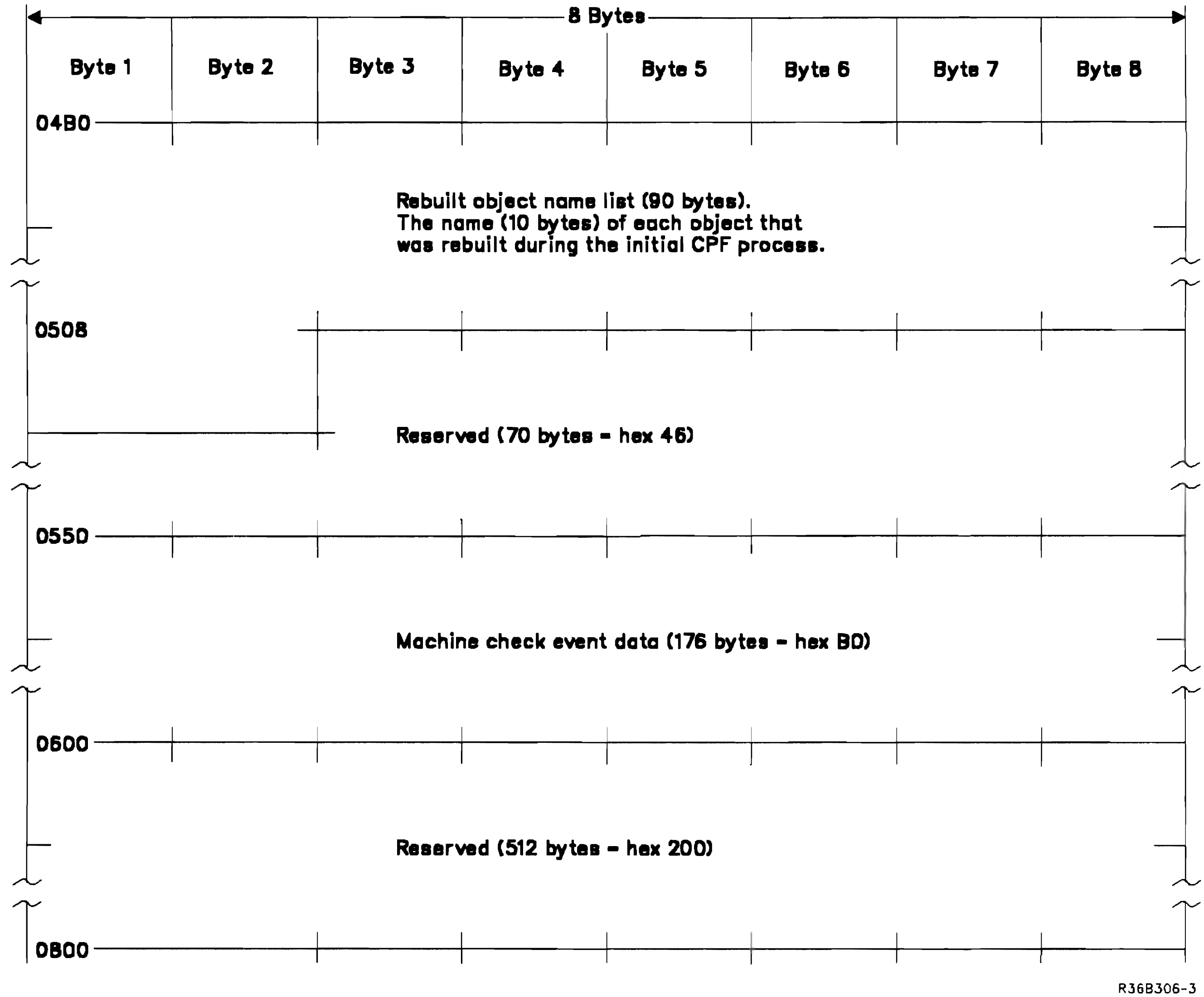

Figure 21-1 (Part 5 of 8). QWCSCPF Start OS/400 Data Object

Part 6 shows the retrieve exception data area when system termination is initiated in the start OS/400 (20) phase, console and controller creation and verification (24) phase, system arbiter (30) phase, or system or subsystem termination (40) phase. Byte 1, hex 0110 (phase number) in the start OS/400 message or data object identifies the phase. During the start OS/400 phase, until function 18 and subfunction 0010 are executed, this area does not contain exception data as the message handler is needed to retrieve the exception data.

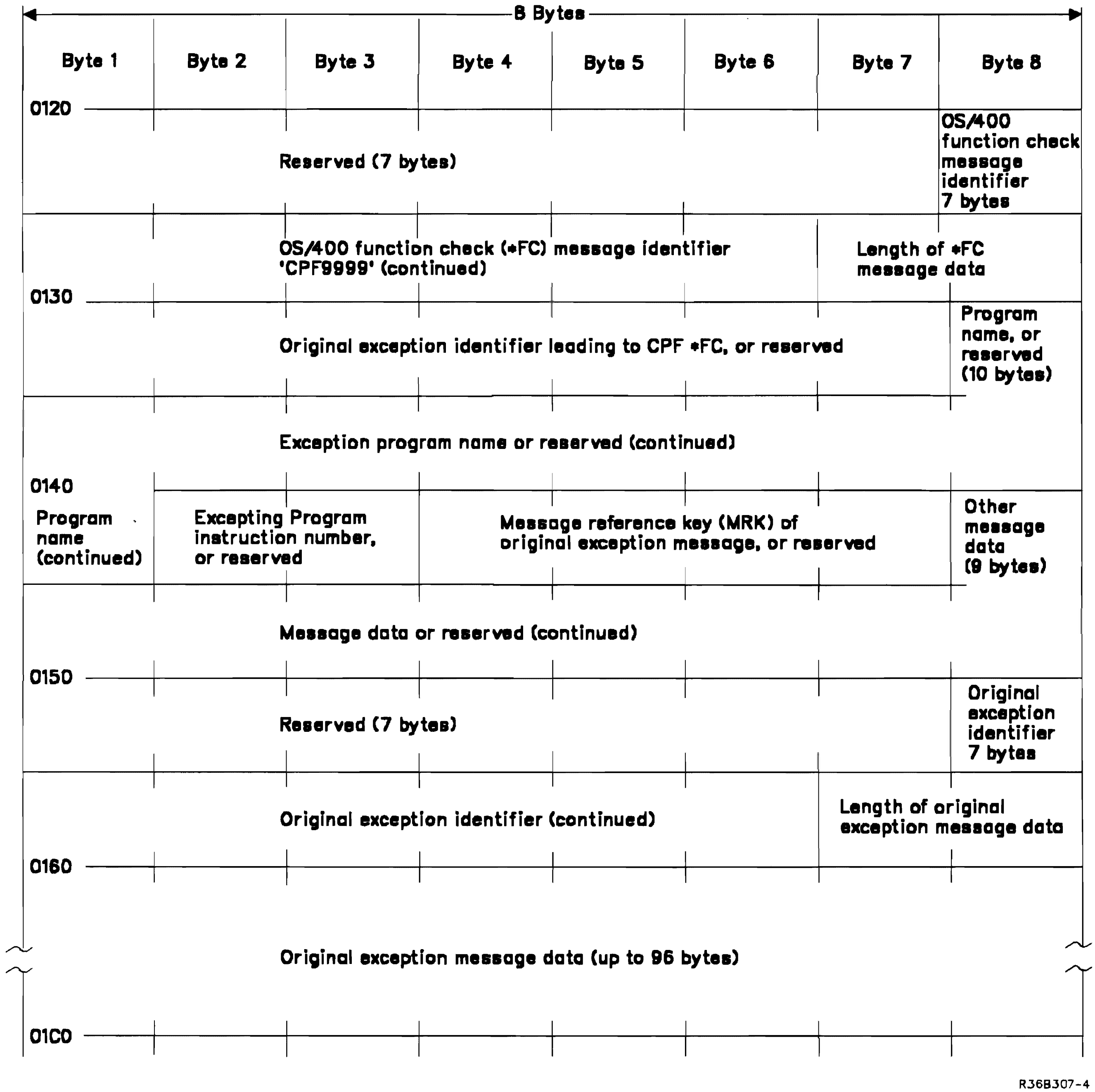

Figure 21-1 (Part 6 of 8). QWCSCPF Start OS/400 Data Object

Parts 7 and 8 show the retrieve exception data when system termination is initiated in the initial OS/400 phase. Byte 1, hex 0100 (phase number) in the OS/400 object identifies the initial OS/400 phase when it equals 10.

8 Bytes

Offset	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0120	Number of bytes provided for exception data retrieval				Number of bytes available for exception data retrieval (for example, the number of bytes retrieved)			
	Exception identifier (rr if OS/400 function check *FC)		Compare value length (4 if machine exception, 3 if OS/400 signaled (CPF or MCH) exception)		OS/400-inserted, compare value (CPF or MCH) or first 3 bytes of machine compare value (hex 000000) Note: When this is CPF, the exception can be CPF or MCH.			Last byte of machine compare value or first byte of original machine exception identifier if OS/400 *FC
0130	Second byte of original machine exception identifier if OS/400 *FC	Reserved (31 bytes)						
	Reserved (continued)							
0150	If exception-specific data exists, it begins at offset hex 0130 and continues for a variable length (denoted by N). The end of the exception-specific data can be recognized by the location of the next two space pointers. For example, if no exception data exists, the following pointer is found at offset hex 0130.							
0150 + N								

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Figure 21-1 (Part 7 of 8). QWCSCPF Start OS/400 Data Object

QWCSCPF

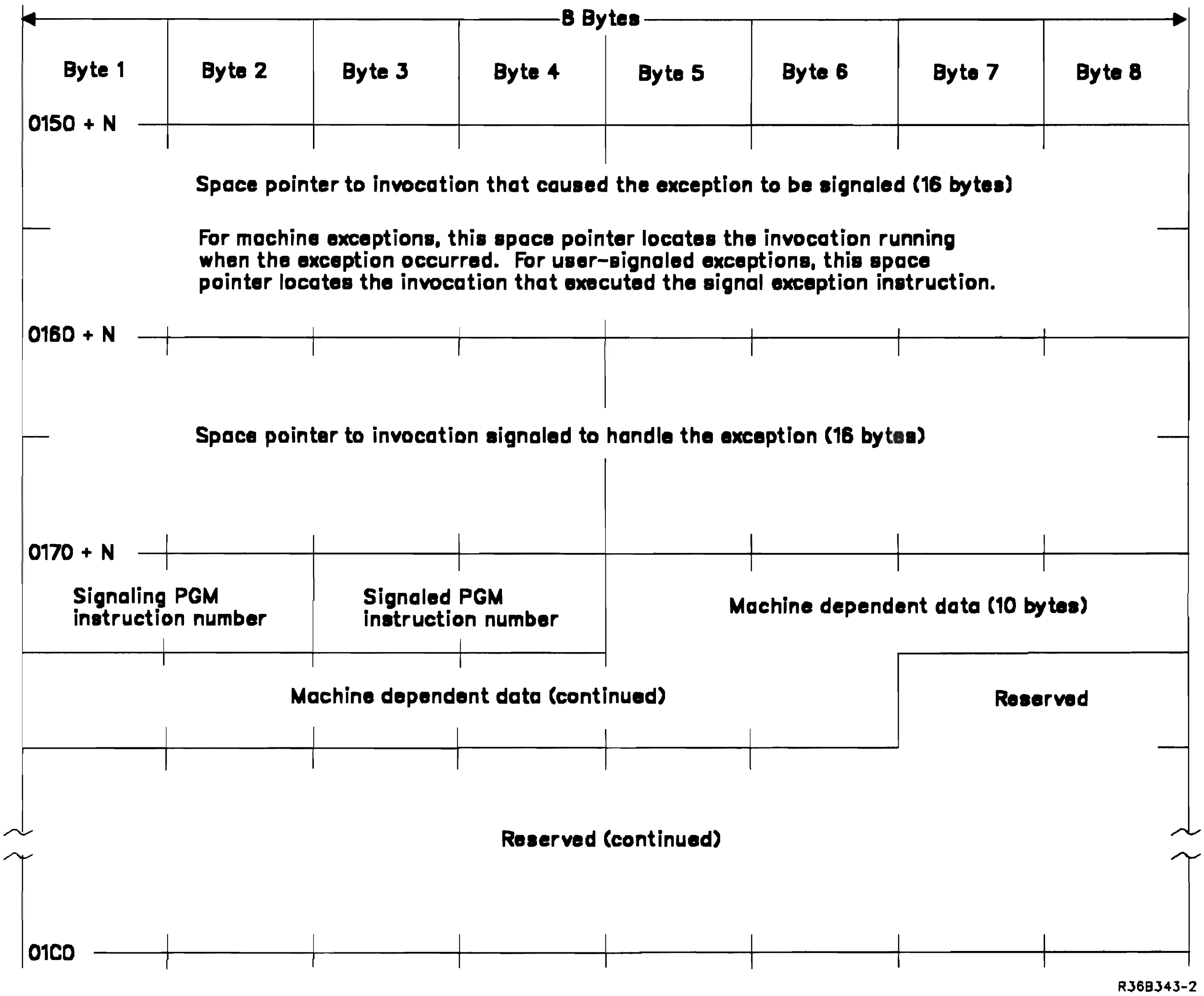

Figure 21-1 (Part 8 of 8). QWCSCPF Start OS/400 Data Object

Codes for When IPL Ends

The codes that end IPL are sometimes referred to as IPL terminator codes. To aid in debugging problems that occur during the IPL of the operating system or when the system stops, codes are *set* in the start OS/400 data object to indicate where in the OS/400 IPL code the system ended.

The codes that are set indicate the following numbers:

- Phase
- Function
- Subfunction

The phase, function, subfunction numbers are the first 4 bytes (or word 1) of the SRC of function 12. Error recovery needs to be determined by the SRC. For more information about OS/400 reference codes, see page C-57. The following information describes each of the phase, function, and subfunction numbers:

Phase Number: This number appears in QWCSCPF as a 1-byte binary number (two hexadecimal digits) at offset hex 0110. The phase numbers are:

Phase Description

10 Initial OS/400 phase, see page 21-10.

- QWCIINSR is the problem phase program.

20 Start OS/400 phase, see page 21-12.

- QWCISCFR is the problem phase program.
- QWCIDIOR manages the display I/O part of the IPL.

24 Console and controller creation or verification phase, see page 21-17.

- QWCIDSPR manages the creation and verification of the console and controller descriptions.

30 System arbiter OS/400 phase, see page 21-18.

- QWCAINAR is the initiation phase program.
- QWCAMNAR is the problem phase program.

40 System and subsystem termination OS/400 phase, see page 21-21.

- QWCASCUE is the process termination event handler in the system arbiter process.
- QWCASDSM is the termination system message processor.
- QWCAT2TE is the system termination timer event handler.
- QWCITRSE is the system termination event handler.

***Function and Subfunction Numbers*:** These numbers appear in QWCSCPF at hex offsets 0111 and 0112, respectively, and indicate the function being performed at any particular time within each phase.

Initial OS/400 Phase (Hex 10)

The function and subfunction numbers for when the initial OS/400 phase number is hex 10 are:

(10,X) Executable code before the QWCSCPF (start OS/400) data object is created.

(10,0010) Modify process PCO pointer.

(10,0020) Materialize enough of MISR to get information about whether to run reclaim function.

(10,0030) Run reclaim machine context.

(10,0040) Resolve QSYS library.

(10,0050) Turn off the exception monitors for `MCH1602: Machine Context damaged.`

(10,0060) Resolve to install communications object QICO.

(10,0070) Resolve to QWCSCPF.

(10,0080) Destroy and create QWCSCPF data object again for the new release.

(10,0090) Materialize the initial PDT and modify the PCO pointer to point to the QWCSCPF object.

(20,X) This function modifies the process attributes necessary for the initial OS/400 process.

(20,0010) Modify initial OS/400 process attributes to set up the initial OS/400 PCO and set flags (if any) from install into the start OS/400 data object.

(20,0020) Modify process attributes to set up process NRL which is QSYS context.

(30,X) This function resolves to *touch* the major objects necessary to the initial OS/400 process.

(30,0010) Resolve to system entry point table (QINSEPT) and check for damage.

(30,0020) Resolve to system user profile (QSYS) and check for damage.

(30,0030) Resolve to system arbiter class object (QARBCLS) and check for damage.

(30,0040) Resolve to system control block (QWMSYSCB) and check for damage.

(30,0050) Resolve to system value object (QWMSYSVAL) and check for damage.

(38,X) Call QWCSCRLR to create the system value object again if it was damaged or cannot be found.

(38,0010) Call QWCSCRLR to recreate system value object if it was damaged or could not be found. Materialize network attributes.

(38,0018) Materialize MISR.

(38,0020) Materialize serial number. Check pending system name.

(38,0030) Convert system value object.

(38,0034) Materialize save storage information.

(38,0036) Fill in modify template for network attributes.

(38,0040) Create new system value object. WCESVAL include.

(38,0048) Set keyboard type from MISR.

(38,0050) Modify network attributes.

(38,0051) Try modify network attributes again.

(38,0060) Set IGC feature. Serial number.

(38,0070) UPS delay time. Modify UPS connection type.

(38,0080) Process QIPLDATTIM system value.

(38,0082) Disable timed power on machine value.

(38,0084) Set timed power on machine value.

(38,0086) Disable timed power on value. Set QIPLDATTIM to *NONE because time was out of range.

(38,0090) Process QRMTIPL system value. Modify remote IPL attribute.

(38,0098) Process QPWRRSTIPL system value. Modify auto IPL after power failure attribute.

(38,00A0) Process QDATSEP system value. Modify date separator attribute.

(38,00A8) Process QDATFMT system value. Modify date format attribute.

(38,00AA) Process QLEAPADJ system value. Modify leap year adjustment attribute.

(38,00AC) Process QMODEL system value. Materialize VPD to get model number.

(38,00B0) Process QSECURITY system value.

(38,00C0) Process QIPLTYPE system value.

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(38,00D0) Set QKBDTYPE system value if the language changed.

(38,00E0) Ensure system value object.

(38,00F0) Returned to QWCIINSR from QWCSCRLR.

(3A,X) Call QWCSCRLR to convert the system value object to the current release level if the previous function did not create it again.

(3A,0010) Materialize network attribute.

(3A,0018) Materialize MISR.

(3A,0020) Materialize serial number. Check pending system name.

(3A,0030) Convert system value object.

(3A,0034) Materialize save storage information.

(3A,0036) Fill in modify template for network attributes.

(3A,0040) Create new system value object. WCESVAL include.

(3A,0048) Set keyboard type from MISR.

(3A,0050) Modify network attributes.

(3A,0051) Try modify network attributes again.

(3A,0060) Set IGC feature. Serial number.

(3A,0070) UPS delay time. Modify UPS connection type.

(3A,0080) Process QIPLDATTIM system value.

(3A,0082) Disable timed power on machine value.

(3A,0084) Set timed power on machine value.

(3A,0086) Disable timed power on value. Set QIPLDATTIM to *NONE because time was out of range.

(3A,0090) Process QRMTIPL system value. Modify remote IPL attribute.

(3A,0098) Process QPWRRSTIPL system value. Modify auto IPL after power failure attribute.

(3A,00A0) Process QSECURITY system value.

(3A,00A8) Process QDATFMT system value. Modify date format attribute.

(3A,00AA) Process QLEAPADJ system value. Modify leap year adjustment attribute.

(3A,00AC) Process QMODEL sytem value. Materialize VPD to get model number.

(3A,00B0) Process QSECURITY system value.

(3A,00C0) Process QIPLTYPE system value.

(3A,00D0) Set QKBDTYPE system value if language has changed.

(3A,00E0) Ensure system value object.

(3A,00F0) Returned to QWCIINSR from QWCSCRLR.

(40,X) Performs the resolves to objects related to the WCBT and RMCB.

40,0010) Resolve to work control block table (QWCBT) and check for damage.

40,0020) Resolve to WCBT recovery object (QJMQSCB) and check for damage.

40,0030) Create the work control block table (QWCBT) again if it is damaged or cannot be found, or if the WCBT recovery object (QJMQSCB) exists.

40,0050) Resolve to resource management control block (QWCRMCB) and check for damage.

(50,X) Machine initialization status record (MISR) input for OS/400 .

(50,0010) Materialize MISR into the start OS/400 data object.

(50,0020) Resolve to database library and MISR chain object. Create or recreate MISR chain object if not found.

(50,0030) Create the database MISR data object if there are any machine detected damaged objects.

(50,0040) Materialize MISR data into the database MISR object, and place it in the QRECOVERY library if there are any machine detected damaged objects.

(50,0050) Set the MISR data (MODMATR) in the VLIC again.

(50,0060) Modify the MISR to turn off the power down bit indicators.

(60,X) System control block initialization.

(60,0010) Initialize the normal or abnormal and auto or manual indicators from the MISR and system control block carryover data.

(60,0020) Set (null) the first and last SBSD chain pointers in the system control block (QWMSYSCB) again.

(70,X) Make sure that the authorized user table exits.

(70,0010) Invoke the security macro CHGSYSSY to make sure that the authorized user table (AUT) exists.

(80,X) Resource management (storage pool/MPL) initialization.

(80,0010) Create the resource management control block if it cannot be found.

(80,0020) Destroy and create the resource management control block again if it is not large enough (number of pools or MPL classes has increased).

(80,0030) Materialize the resource management data into the control block.

(80,0040) Initialize the OS/400 resource management control parameters.

(80,0050) Initialize the storage pools and the MPL classes for the machine.

(A0,X) Initialize OS/400 job structure queue.

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(A0,0010) Create the MI queue for use with the OS/400 temporary job structures.

(A0,0020) Create and initialize the OS/400 prototype NRL.

(B0,X) Work control block table (WCBT) initialization.

(B0,0010) Initialize WCBT header pointers and values.

(B0,0020) Create the job message queue for the start OS/400 process if the WCBT was rebuilt or the job message queue is damaged.

(B0,0030) Create the spool control block for the start OS/400 process if the WCBT was rebuilt.

(B0,0040) Change the spool control block for the start OS/400 process (if the WCBT was not rebuilt).

(B0,0050) Initialize the X entry (the start OS/400 process entry in the WCBT) and ensure the WCBT object.

(D0,X) Create one OS/400 job structure.

(D0,0010) Call QWTAMCJS to create the objects, which make up the OS/400 temporary job structure, for the start OS/400 process.

(F0,X) Start the start OS/400 process.

(F0,0010) Allocate an OS/400 job structure.

(F0,0020) Initialize the WCBT entry and the PDT for the start OS/400 process.

(F0,0030) Monitor the MI process event.

(F0,0040) Remove last message from the job structure queue.

(F0,0050) Initiate the start OS/400 process.

(F0,0060) Wait on the MI process event for the success or failure of the start OS/400 process initiation.

Start OS/400 Phase (Hex 20)

The QSYS library and the QWCSCPF object must be resolved to before QWCSCPF can be used to track the status of the IPL.

The function and subfunction numbers for when the phase number is hex 20 are:

(08,X) Verify the start OS/400 job message queue.

(08,0010) Invoke QMHVSCPF module to verify the start OS/400 job message queue. If found to be damaged the queue is created again.

(10,X) Start OS/400 process initialization.

(10,0010) Base the system value object and the work control block table.

(10,0020) Resolve to the process control event handler program (QWTPECTL) in the QSYS library.

(10,0030) Monitor the process control event, hex 81001000.

(10,0040) Resolve to the unsolicited data event handler program (QWTAESRQ) in the QSYS library.

(10,0050) Monitor the unsolicited data (type 1) event, hex 000B0501 and the unsolicited data (type 2) event, hex 000B0502.

(10,0060) Monitor the start OS/400 process error event.

(18,X) System logging initialization.

(18,0010) Call QMHLINIT to set up the system logging in the start OS/400 process and check for the required system logging objects.

(18,0020) If message queue was found to be damaged in QMHVSCPF module, send CPF2467 to QSYSOPR: `Message queue logically damaged.`

(18,0030) Send message to QSYSOPR (and QHST) indicating start OS/400 is in progress.

(20,X) Change the security officer password.

(20,0010) Invoke CHGSECPW macro to change the security officer password.

(28,X) Cleanup libraries and related objects.

(28,0010) Call QLICLNUP to clean up libraries and OIR objects.

(30,X) Database and journal function.

(30,0010) Establish event monitors for data space index invalidated, data space compression threshold, entry not journaled, journal receiver unusable, and journal threshold reached.

(30,0020) Call QDBXFIXQ module to check and fix cross-reference queues used by database.

(34,X) QWCIDIOR.

(34,0010) Call QWCIDIOR to handle display part of IPL.

(38,X) Attended IPL, handle console and controller descriptions.

(38,0010) Establish event monitors for device configuration events used to create and delete configuration objects.

(38,0020) Call QWCIDSPR module to handle console and controller.

(38,0030) A QWCIDSPR problem. The QSCPFCONS system value allows the switch to the unattended IPL mode. Send CPF0955 message, change the QSYSOPR message queue to default mode, and switch to unattended mode to continue the IPL.

(40,X) Perform display tests and start OS/400 display functions.

(40,0010) Change the QSYSOPR message queue to break mode so that messages can be displayed on the console.

(40,0020) Resolve to start OS/400 display file, QDSTRCPF, in QSYS library.

(40,0030) Test if the start OS/400 display file, QDSTRCPF, is damaged.

(40,0040) The start OS/400 device file, QDSTRCPF, is missing or damaged and the QSCPFCONS system value indicates to continue the IPL in the unattended mode. The CPF9054 message is sent, a test is made as to whether this is an install (the system is stopped if it is an install because the install cannot continue in the unattended mode), and the QSYSOPR message queue is changed to default mode.

(40,0050) The start OS/400 device file, QDSTRCPF, is missing or damaged and the QSCPFCONS system value indicates NOT to continue the IPL in the unattended mode. The system is terminated.

(40,0060) Call QINCPF (part 2 of install) when the QICO object exists.

(40,0070) Enable and disable the event monitors for the data base index invalidated and the compression threshold events.

(48,X) Sign On display processing.

(48,0010) Open the system console for the start OS/400 displays.

(48,0020) Setup output buffer for the Sign On display.

(48,0030) PUTGET for the Sign On display.

(48,0034) PUTGET failed, close the display file.

(48,0036) PUTGET failed, switch to unattended IPL.

(48,0038) PUTGET failed, cannot switch to unattended IPL.

(48,0040) Set the FM save area and initialize the output buffer again.

(48,0050) Check to see if the program name entered is a valid name.

(48,0060) Check to see if the menu name entered is a valid name.

(48,0070) Check to see if the current library name entered is a valid name.

(48,0080) Verify the user password (security verify macro).

(48,0090) When the password, initial program, menu, and current library are valid and the current library is not QTEMP, extract special authorizations from the user profile and check for proper user and use of system console.

(48,00A0) When the sign on attempts exceeds the limit, close the console device file.

(48,00B0) Open failed, attempt to close the console device file.

(48,00B8) The open of the system console device file failed. The QSCPFCONS system value indicates to continue in the unattended mode. The QSYSOPR message queue is changed to default mode.

(48,00C0) The open of the system console device file failed. The QSCPFCONS system value indicates NOT to continue in the unattended mode. Terminate the system.

(48,00D0) Clear the Sign On display.

(50,X) ATTENDED IPL, handle PTFs and initialize the IPL Options display defaults.

(50,0010) Test for service component PTF installation and maintenance.

(50,0020) Read the MI established system time and set up the OS/400 estimated time.

(50,0030) Initialize IPL Options display defaults.

(50,0040) Invoke 36EE macro WWEXSPFG to determine if startup procedures exist in #library.

(51,X) Unattended IPL, handle PTFs and initialize the IPL Options display defaults.

(51,0010) Test for service component PTF installation and maintenance during an unattended IPL.

(51,0020) Read the MI established system time and set up the OS/400 estimated time.

(51,0030) Initialize IPL Options display defaults.

(56,X) Attended IPL, log data to the history log (QHST) and send messages to the system operator's message queue (QSYSOPR), before the IPL Options display, for conditions found during the IPL.

(56,0010) Log system objects which were built again during the start OS/400 to the history log (QHST), and send a message to the system operator's message queue (QSYSOPR).

(56,0020) Log system name network attributes restored and/or not restored messages to the history log (QHST), and also send them to the system operator's message queue (QSYSOPR).

(56,0030) Log message CPI0919, `Auto IPL may not have occurred`, sent to the system operator's message queues (QSYSOPR). The MISR was damaged or the service processor lost the IPL options.

(56,0040) Log reason why the system powered down to the history log (QHST), and also send it to the system operator's message queue (QSYSOPR).

(56,0050) Log message CPI0990, `Previous termination abnormal because CNLJOBABN used`, sent to the history log (QHST), and also sent to the system operator's message queue (QSYSOPR).

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(56,0060) Log CPF1096 or CPF1221. The service processor sent a failed message to the history log (QHST), and also send it to the system operator's message queue (QSYSOPR).

(57,X) Unattended IPL, log data to the QHST and send messages to the system operator's message queue (QSYSOPR), before the start OS/400 prompt, for conditions found during IPL.

(57,0010) Log system objects which were built again during the start OS/400 to the QHST, and send a message to the system operator's message queue (QSYSOPR).

(57,0020) Log default local location network attributes restored and/or not restored messages to the QHST, and also send them to the system operator's message queue (QSYSOPR).

(57,0030) Log message CPI0919, `Auto IPL may not have occurred`, sent to the system operator's message queues (QSYSOPR). The MISR was damaged or the service processor lost the IPL options.

(57,0040) Log message CPI0990, `Previous termination abnormal because CNLJOBABN used`, sent to the history log (QHST), and also to the system operator's message queue (QSYSOPR).

(5B,X) IPL Options display processing.

(5B,0010) PUTGET for IPL Options display.

(5B,0020) Copy user input from display to output data area.

(5B,0030) Verify the time input from the display.

(5B,0040) Verify the date input from the display.

(5B,0050) Read the system time of day (TOD) clock.

(5B,0060) Clear the IPL Options display.

(60,X) After IPL Options display processing.

(60,0010) Convert user input system time (actual or default) from display.

(60,0020) Set the system TOD clock.

(60,0030) Convert the input date and store in the system value object.

(60,0040) Extract the output file bit from the system control block. If the WCBTE was built again and there are no spool files for the start OS/400 job, then update the *job entered system* time-of-day and the *job started* time-of-day in the start OS/400 WCBTE and system control block, respectively, to reflect the value entered on the IPL Options display.

(68,X) Log data to history log.

(68,0010) Log to the history log (QHST) the IPL Options display input from the user or default.

(70,X) Perform Set Major System Options display processing if requested from the IPL Options display.

(70,0010) Set up the record name for the Set Major System Options display.

| (70,0011) Open the installation profile during automatic install

| (70,0012) Get the Set Major System Options from the installation profile during automatic install

| (70,0013) Close the installation profile during automatic install

(70,0020) PUTGET for the Set Major System Options display.

(70,0030) Copy user input from screen to output data area. Update system values according to user input.

(70,0030) Copy user input from screen to output data area. Update system values according to user input.

(70,0040) End of Set Major System Options display processing; screen is cleared.

(78,X) Processing the *Define or change system at IPL* option if requested from the IPL Options display.

(78,0010) Add library QHLPSYS to the NRL.

(78,0018) Resolve to the QSYS38 and QUSER38 libraries.

(78,0020) Turn on the full CSM indicator, adopt the signed on user profile and mark the start OS/400 job interactive type.

(78,0030) Call QMNCONFG to provide the Define or Change System at IPL menu. Then return to normal mode (turn off full CSM indicator).

(78,0040) Cancel the event monitors established for device configuration.

(80,X) Perform damage notification, database (part 1), journal, and commit recovery.

(80,0010) Call QRCIMPLN which performs damage notification and invokes QDBRCIPS. If there are database files that need recovery, QDBRCIPS presents a display to allow the operator to indicate when recovery should be performed. QDBRCIPS then performs the initial database recovery and locks any database objects to be recovered later by QDBRCDYN. QDBRCIPS also invokes journal and commit recovery, if needed.

(88,X) Check the storage requirements for the job structure allocation system values and compare them against the amount of auxiliary storage available on the system.

(88,0010) *Materialize resource management data* option and determine the amount of auxiliary storage available.

(88,0020) Determine the amount of additional auxiliary storage required for creation of permanent and temporary job structures, based on the allocation system values.

(88,0030) If the available storage is insufficient, change the allocation system values to the minimum values required to bring up the system, and send CPF0915 to QSYSOPR.

(88,0040) Determine if the amount of main storage (usable and not usable) is less than what the recommended engineering needs are for the system, and send CPI0901 to QSYSOPR.

(90,X) Create the command analyzer (CA) space queue.

(90,0010) Invoke CRTCASQ macro to create the CA space queue.

(96,X) Call QWCITUNR to calculate and set performance tuning values.

(96,0010) Call QWCITUNR from QWCISCFR.

(96,0020) Start of QWCITUNR.

(96,0100) List device description objects (LSTOBJ macro).

(96,0110) Work with results of list object.

(96,0115) Count types of device descriptions.

(96,0120) List line description objects (LSTOBJ macro).

(96,0130) Work with results of list object.

(96,0135) Count types of line descriptions.

(96,0140) List controller description objects (LSTOBJ macro).

(96,0150) Work with results of list object.

(96,0155) Count types of controller descriptions.

(96,0160) Materialize resource management data for main storage.

(96,0170) Materialize machine attributes for model.

(96,0180) Materialize resource management data for checksum usage.

(96,0190) Resolve to QSSP for System/36 environment.

(96,01A0) Resolve to QOFC for office.

(96,0300) Search tables for performance tuning values.

(96,0400) Calculate machine pool size.

(96,0410) Calculate interactive pool size and activity level.

(96,0500) Create command analyzer object.

| (96,0505) Retrieve text message CPX8407.

(96,0510) Change machine pool system value.

(96,0520) Change base activity level system value.

| (96,0524) Change spool shared pool.

| (96,0526) Change interactive shared pool.

(96,0530) Change the spool subsystem description.

(96,0540) Change the interactive subsystem description.

(96,0550) Call CA to change the interactive subsystem description.

(96,0560) Send CPI0985 subsystem description (SBSD) not changed.

(96,0570) Destroy CA object.

(96,0800) Send CPI0986 completion message.

(98,X) Finish the initialization of the system control block and use of the system values.

(98,0010) Initialize the machine and *BASE storage pools based on the system values QMCHPOOL and QBASPOOL.

(98,0020) Destroy and create the job structure queue again if the size is too small (user may have changed system values).

(98,0030) Set up the final prototype NRL from the system and user library names in the system values QSYSLIBL and QUSRLIBL.

(98,0040) Locate the subsystem description for the controlling subsystem.

(98,0050) Use the backup subsystem description QSYSSBSD in the QSYS library to stop the system if it is not found.

(98,0060) Resolve to and clear message queue specified in system value QUPSMSGQ. Send CPF1822 if not found.

(98,0070) Resolve to and clear message queue specified in the system value QINACTMSGQ.

(96,0190) Resolve to QSSP for System/36 environment.

(96,01A0) Resolve to QOFC for office.

(A0,X) Initialize the WCBT.

(A0,0010) Call QSPFFACB to initialize the necessary system level spool objects.

(A0,0020) Initialize fields in the WCBT header and create the WCBT entry queue and the job number queue.

(A0,0030) Call QWCICLSR to clean up the WCBT.

(A4,X) Change security level.

(A4,0010) Invoke CHGSYSSY macro. This macro will change the security level if the security level system value, QSECURITY, is different from the current security level in effect.

(A8,X) Create OS/400 temporary job structures.

(A8,0010) Call QWTAMCJS to create the number of temporary job structures specified in the system values.

(B0,X) Invoke the storage functions.

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(B0,0010) Invoke the storage recovery include WCESTREC to either send the CPF0996 message or create the storage buffer space.

(B0,0200) Materialize save storage MISR information.

(B0,0210) Set up interface to QSRIPLXT.

(B0,0220) Call module QSRIPLXT for save storage IPL functions.

(B0,0230) Reset save storage MISR information.

(B0,0240) Modify save storage MISR information.

(B4,X) Call alert module QALSYSEH.

(B4,0010) Call alert module QALSYSEH to set up alert control block.

(B8,X) If the ideographic feature is installed, clean up the double-byte character set tables and dictionaries.

(B8,0010) Invoke KJFIXUP macro to clean up double-byte character set tables and dictionaries.

(C0,X) Start the system arbiter process.

(C0,0010) Assign a WCBT entry for the system arbiter process.

(C0,0020) Allocate an OS/400 job structure for the system arbiter process.

(C0,0030) Initialize the PDT for the system arbiter process.

(C0,0040) Establish event monitor for the MI process event, specifying QWCITRSE as the event handler.

(C0,0050) Establish event monitor for the system arbiter synchronization event.

(C0,0060) Initiate the system arbiter process.

The system arbiter initiation phase program (QWCAINAR) executes at this point (phase number hex 30).

Set up a wait on the system arbiter synchronization event, hex 81001402.

Wait for the system arbiter synchronization event, hex 81001402.

The system arbiter problem phase program (QWCAMNAR) executes at this point (phase number hex 30).

(C0,0090) Cancel the event monitors for the unsolicited data events under the start OS/400 process. The event IDs are hex 000B0501 and 000B0502.

(C0,00A0) If it was in break mode, change the system operator message queue to hold mode.

(C8,X) Set up a WCBT entry to be used for writing the start OS/400 process job log. For options 0020 to 0090, the user specified keep on the IPL Options display for incomplete job logs, or the start OS/400 job has spooled output files.

(C8,0010) Extract the output file bit from the start OS/400 job.

(C8,0020) Assign an alternate WCBTE for the start OS/400 job.

(C8,0030) Swap the job message queue pointers of the two WCBTEs.

(C8,0040) Update the changed WCBTE offsets of the job message queues.

(C8,0050) Invoke message handler macro to update start OS/400 job message queue.

(C8,0060) Update the changed WCBTE offsets in the spool control blocks.

(C8,0070) Update the time-of-day field in the new WCBTE to match its spool control block, and invoke spool end-of-job processing to clean up the spool control block of the new WCBTE.

(C8,0080) A machine check or OS/400 exception occurred. Create and initialize the old and new start OS/400 WCBTE's job message queue again and clean up the spool control block of the new WCBTEs.

(C8,0090) Update the time-of-day value and print text in the WCBTE and spool control block for the ongoing start OS/400 job.

(D0,X) Set up user session, if attended.

(D0,0100) Check user console.

(98,0070) Resolve to and clear message queue specified in the system value QINACTMSGQ.

(D0,0200) Assign a WCBT entry for the user session process, to be initiated by the controlling subsystem monitor.

(D0,0300) Allocate an OS/400 job structure for the user session process.

(D0,0400) Initialize user session PDT and WCB.

(D8,X) Perform DIA recovery and SNADS recovery.

(D8,0010) Invoke OSIPLR macro to perform DIA recovery.

(D8,0020) Invoke ZDIPLR macro to perform SNA distribution services (SNADS) recovery.

(D8,0400) Clear informational SRCs.

(D8,0800) Display no user console SRC if necessary.

(E0,X) Start the controlling subsystem.

(E0,0010) Establish event monitor for the subsystem message event (SBME).

(E0,0020) Check damage on SBSD.

(E0,0030) Verify that the user is authorized to the subsystem description for the controlling subsystem.

(E0,0040) Lock the controlling subsystem description for both LEAR and LENR.

(E0,0050) Perform SBSD recovery (?RCRSBSD).

(E0,0060) Pack the SBSD (?PCKSBSD).

(E0,0070) Set the object used information for SBSD (?OBJUSED).

(E0,0080) Unlock all locks held against the console.

(E0,0090) Send message to system operator message queue to record the start of controlling subsystem and signal system arbiter input event (SAIE).

(E0,00A0) Wait for SBME and then test for successful result.

(E0,00B0) Send message to system operator message queue to record completion of start OS/400 .

(E0,00C0) Notify the machine that OS/400 is able to handle uninterruptible power supply related events.

(E4,X) Perform asynchronous functions.

(E4,0100) Invoke LICLRLIB macro to clear the QRPLOBJ library and test for damage. The library is created again if found to be damaged.

(E8,X) Perform asynchronous recovery.

(E8,0010) Invoke OSIPLR macro to perform asynchronous DIA recovery.

(E8,0020) Call QDBRCDYN to perform the second phase of database recovery.

(F0,X) Create command analyzer (CA) spaces and enqueue them to the CA space queue, if storage is available.

(F0,0010) Enable the event monitors for the compression threshold and index invalidated events.

(F0,0020) Invoke CRTCASQ macro to fill the CA space queue.

(F4,X) Determine OS/400 observability.

(F4,0010) Determine OS/400 observability and send a message to QSYSOPR if OS/400 is nonobservable.

(FF,X) Write the job logs of the jobs that were active or transferring at the previous system termination, and then enter a wait on an event that never is signaled.

(FF,0010) Replace the generic process event monitor established in (C0,0040) with a specific process termination event monitor.

(FF,0020) Write the job logs of jobs that were active or transferring at the previous system termination.

(FF,0030) Establish an event monitor for resource manager recovery.

(FF,0040) Call QURINZCL for initialize system.

(FF,0050) Send function check message to QHST.

(FF,0200) Establish an event monitor for the system arbiter never event.

(FF,0210) Unable to monitor for the system arbiter neve event. End machine processing.

(FF,0220) Wait on the system arbiter never event.

Note: With the start of the controlling subsystem (function E0), the IPL is in effect complete. The system has changed from synchronous activity to asynchronous. The start OS/400 process performs further activity (as evidenced by the remaining functions listed above), but these functions run concurrently with user sessions and activities.

Console and Controller Creation or Verification Phase (Hex 24)

The function and subfunction numbers for when the phase number is hex 24 are:

(10,X) Mainline module code.

(10,0010) Initial module setup.

(10,0020) Materialize the MISR to get the console information from DST.

(30,X) Console information from the MISR matches the console information used by the last IPL.

(30,0110) Resolve to the controller description, QCTL.

(30,0118) Check the controller to see if it was used on the previous IPL.

(30,0120) Check the controller description. If damaged, delete and create again.

(30,0128) Delete and create the controller again if not the same one used on the previous IPL.

(30,0130) Controller description not found. Create a new description.

(30,0210) Resolve to the console description.

(30,0220) Controller description was NOT created again earlier. Check the console description.

(30,0230) Controller description was created again earlier. Create a new console description.

(30,0400) Console description not found. Create a new console description named QCONSOLE.

(30,0800) Create a new console description.

(50,X) Console information from the MISR does NOT match the console information used in the last IPL.

Subfunctions 0110 to 0130 are where the controller attributes have NOT changed.

(50,0110) Resolve to the controller description, CTL01.

(50,0118) Check the controller to see if it was used on the previous IPL.

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(50,0120) Check the controller description. If damaged, delete and create again.

(50,0128) Delete and create the controller again if not the same one used on the previous IPL.

(50,0130) Controller description not found. Create a new description.

Subfunctions 0500 to 0530 are where the controller attributes have changed.

(50,0500) Send CPI0968 message to QSYSOPR and QHST message queues to indicate controller attributes have changed.

(50,0510) Resolve to the controller description, QCTL.

(50,0520) Delete found controller description and create a new description using the new attributes.

(50,0530) Controller description not found. Create a new description using the new attributes.

Subfunctions 0600 to 0800 are where the console attributes have changed.

(50,0600) Send CPI0968 message to QSYSOPR and QHST message queues to indicate console attributes have changed.

(50,0610) Resolve to the console description.

(50,0620) Delete found console description and create a new console description.

(50,0800) Create a new console description.

(55,X) Console attributes have NOT changed even though some of the console information in the MISR has.

(55,0210) Resolve to the console description.

(55,0220) Controller description was NOT created again earlier. Check the console description. If damaged, delete and create again.

(55,0230) Controller description was created again earlier. Create a new console description.

(55,0400) Create a new console description.

(55,0800) Create a new console description.

(60,X) Update the MISR with the console and controller information that changed since the last IPL. The OS/400 section is updated.

(60,0010) Modify the MISR.

(70,X) The first IPL, no existing console information exists from a previous IPL.

(70,0510) Resolve to the controller description, QCTL.

(70,0520) Delete found controller description and create a new description using the new attributes.

(70,0530) Controller description not found. Create a new description using the new attributes.

(70,0610) Resolve to the console description.

(70,0620) Delete found console description and create a new console description.

(70,0800) Create a new console description.

(80,X) MISR damaged and initialized again to defaults.

(80,0510) Resolve to the controller description, QCTL.

(80,0520) Delete found controller description and create a new description using the new attributes.

(80,0530) Controller description not found. Create a new description using the new attributes.

(80,0610) Resolve to the console description.

(80,0620) Delete found console description and create a new console description.

(80,0800) Create a new console description.

(80,0900) Send CPI0969 message to QSYSOPR and QHST message queues to inform the user about the damaged MISR.

(B0,X) Vary-on the console and controller.

Subfunctions 0010 to 0040 are where the DST function has not informed CPF that DST has finished using the console.

(B0,0010) Monitor for the console available event, hex 000C 0801, from DST.

(B0,0020) Materialize the MISR to get console information from DST.

(B0,0030) Wait on the console available event.

(B0,0040) Cancel the console available event monitor.

(B0,0050) Vary on the console and controller.

(F0,X) Wait-time-out exception handler.

(F0,0010) Send CPI0971 message to QSYSOPR and QHST message queues to indicate that DST still has control of the console.

(F0,0020) Cancel the console available event monitor.

OS/400 System Arbiter Phase (Hex 30)

The function and subfunction numbers for when the phase number is hex 30 are:

(10,X) QWCAINAR, system arbiter initiation phase.

(10,0100) Resolves to system control block.

(10,0120) Establish event monitor, invocation reference event handler, QWTAESRQ. Event hex D0160301. Event handler QMHIREH.

(10,0140) Establish event monitor, system arbiter event, ENDSYS. Event hex 81001601. Event handler QWCAHNAE.

(10,0160) Establish event monitor, system arbiter event, ENDSBS. Event hex 81001602. Event handler QWCAHNAE.

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(10,0180) Establish event monitor, system arbiter event, CHGSYSVAL. Event hex 81001603. Event handler QWCAHNAE.

(10,0200) Establish event monitor, system arbiter event, STRSBS. Event hex 81001604. Event handler QWCAHNAE.

(10,0220) Establish event monitor, system arbiter event, create job structures. Event hex 81001605. Event handler QWCAHNAE.

(10,0240) Establish event monitor, system arbiter event, request resources. Event hex 81001606. Event handler QWCAHNAE.

(10,0260) Establish event monitor, system arbiter event, Extend job number queue. Event hex 81001607. Event handler QWCAHNAE.

(10,0280) Establish event monitor, system arbiter event, handle work control block table (WCBT) entries. Event hex 81001000. Event handler QWCAHNAE.

(10,0320) Establish event monitor, reserved storage released event. Event hex 000B0805. Event handler QWCARSRE.

(10,0340) Call QSWINTQ to set up the switched line handling of its message queue.

(10,0360) Establish event monitor, system request event. Event hex 000D0200. Event handler QWTAESRQ.

(10,0380) Establish event monitor, test request event. Event hex 00100701. Event handler QWTAESRQ.

(10,0400) Establish event monitor, unsolicited data event. Event hex 81001100. Event handler QWTAESRQ.

(10,0420) Establish event monitor, unsolicited data event. Event hex 00190201. Event handler QWTAESRQ.

(10,0440) Establish event monitor, controlling subsystem terminate Event hex 81001403. Event handler QWCASCUE.

(10,0460) Establish event monitor, subsystem termination event. Event hex 00100202. Event handler QWCASCUE.

(10,0520) Establish event monitor, LUD contact event. Event hex 000B0600. Event handler QSWLUDEV.

(10,0540) Establish event monitor, LUD contact failure event. Event hex 000B0800. Event handler QSWLDFR.

(10,0560) Establish event monitor, controller description contact event. Event hex 00040400. Event handler QSWCUDEV.

(10,0580) Establish event monitor, controller description failure event. Event hex 00040500. Event handler QSWCUDEV.

(10,0600) Establish event monitor, controller description manual intervention event. Event hex 00040600. Event handler QSWCUDEV.

(10,0620) Establish event monitor, network unit description exchange ID failure event. Event hex 000E0400. Event handler QSWNDEV.

(10,0640) Establish event monitor, network unit description failure event. Event hex 000E0500. Event handler QSWNDEV.

(10,0660) Establish event monitor, partial damage event. Event hex 00170801. Event handler QSWNDEV.

(10,0680) Establish event monitor, object locked event. Event hex 000A0101. Event handler QSWCPFEV.

(10,0700) Establish event monitor, pending lock event. Event hex 000A0401. Event handler QSWCPFEV.

(10,0720) Establish event monitor, obtain event. Event hex 8100330D. Event handler QSWCPFEV.

(10,0740) Establish event monitor, switched line request event. Event hex 81003502. Event handler QSWCPFEV.

(10,0760) Establish event monitor, delete LUD event. Event hex 81003301. Event handler QDCDLDEH.

(10,0780) Establish event monitor, delete controller description option. Event hex 81003303. Event handler QDCDLCEH.

(10,0800) Establish event monitor, vary LUD event. Event hex 81003305. Event handler QDCVRDEH.

(10,0840) Establish event monitor, change LUD event. Event hex 81003309. Event handler QDCCGLUD.

(10,0860) Establish event monitor, create network description event. Event hex 81003311. Event handler QDCCRCEH.

(10,0880) Establish event monitor, authorization violation event. Event hex 00020000. Event handler QSYAUTEV.

(10,0900) Establish event monitor, process control event. Event hex 81001000. Event handler QWTPECTL.

(10,0920) Establish event monitor, 24-hour rollover timer event. Event hex 00140101. Event handler QWCAROTE.

(10,0940) Establish event monitor, system arbiter never event. Event hex 810014FF. No event handler.

(10,0960) Establish event monitor, SST or DST offline device event. Event hex 8100330B. Event handler QSMOODE.

(10,0980) Establish event monitor, system object damage event. Event hex 00170401. Event handler QRCDMGLG.

(10,0A00) Establish event monitor, tape, magnetic media SRC event. Event hex 000B0805. Event handler QTAEVMON.

(10,0A20) Establish event monitor, machine check event. Event hex 000D0101. Event handler QWCAMCKE.

(10,0A40) Establish event monitor, power event. Event hex 000D0200. Event handler QWCAMCKE.

(10,0A60) Establish event monitor, 3320 DASD service request event. Event hex 000D0401. Event handler QWCAMCKE.

(10,0B00) Establish event monitor, machine resource event. Event hex 000C0000. Event handler QWCAMCKE.

(10,0B10) Materialize and modify ASP information.

(10,0B14) Call QWCATARE to handle overflowed ASP.

| (10,0B18) Materialize machine address data.

| (10,0B1A) Modify machine address threshold.

(10,0B20) Establish event monitor, maximum CPU time exceeded. Event hex 00100701. Event handler QWCAMCKE.

(10,0B40) Establish event monitor, maximum temporary storage exceeded. Event hex 00100801. Event handler QWCAMCKE.

(10,0B60) Establish event monitor, command analyzer space allocation and maintenance. Event hex 81001100. Event handler QCASPCRT.

(10,0B80) Establish event monitor, grant/revoke for devices not varied on. Event hex 81007001. Event handler QSYEVAUT.

(10,0BC0) Establish event monitor in disabled state, control event for 36EE configuration. Event hex 8100160C. Event handler QCICNFIG.

(10,0BD0) Establish event monitor in disabled state, update 36EE alias table upon create or delete of devices. Event hex 81003317. Event handler QCICNFIG.

(10,0BE0) Establish event monitor in disabled state, automatic configuration. New local device attached. Event hex 81003316. Event handler QDCACFE4.

(10,0C00) Establish event monitor in disabled state, system resource code (SRC) event. Event hex 00190201. Event handler QRURASEV.

(10,0C20) Establish event monitor in disabled state, hardware resource manager, update error log record with resource name. Event hex 000D0801. Event handler QRZHRMRN.

(10,0C40) Establish event monitor in disabled state, hardware resource manager alter. Event hex 000D0501. Event handler QRZHRMEH.

(10,0C50) Call QWCADSVR to vary off the system console, and change the operator's queue to hold mode.

(10,0C60) Call QRZHRMIN to build or update the software resource manager database.

(10,0C80) Enable the following event monitors:

- Hardware resource manager alter. Event hex 000D0501.
- Hardware resource manager update error log record with resource name. Event hex 000D0801.
- System resource code SRC event. Event hex 00190201.
- Automatic configuration, new local device attached. Event hex 81003316.
- Control event for 36EE configuration. Event hex 8100160C.
- Update 36EE alias table when devices are created or deleted. Event hex 81003317.

(10,0D40) Establish event monitor, VLIC request I/O complete. Event hex 000B0901. Event handler QT1AVAIL.

(10,0D60) Establish event monitor, close SRM database files. Event hex 81008101. Event handler QRZSRMEH.

(10,0D70) Establish event monitor, network system not available. Event hex 00000903. Event handler QSWNEV.

| (10,0D80) Establish event monitor, console available from DST. Event hex 000C0801. Event handler QWTAEVRY.

| (10,0D90) Establish event monitor, open SIOM LUD failure. Event hex 000B0B0A. Event handler QSWLUDEV.

| (10,0D91) Establish event monitor, open SIOM LUD failure. Event hex 000B0B0B. Event handler QSWLUDEV.

| (10,0D92) Establish event monitor, ND switched intervention. Event hex 000E0305. Event handler QSWNDEV.

| (10,0D93) Establish event monitor, ND manual intervention. Event hex 000E0306. Event handler QSWNDEV.

| (10,0D95) Establish event monitor, ND connection events. Event hex 000E0700. Event handler QSWNDEV.

| (10,0D96) Establish event monitor, object domain event. Event hex 00160401. Event handler QSYAUTEV.

(10,0DA0) Lock prototype NRL.

(10,0DA8) Lock system part of prototype NRL.

(10,0DC0) Assign a WCBT entry for the LU services process.

(10,0DE0) Allocate temporary job structure for the LU services process.

(10,0E00) Resolves to initiation phase, problem phase, and termination phase programs for initialization of the LUS process definition template.

(10,0E20) Establish event monitor, process events. Event hex 00100000. No event handler.

(10,0E40) Establish event monitor, LUs synchronization event. Event hex 81001303. No event handler.

(10,0E60) Initiate the LU services process.

(10,0E80) Wait for the MI process event.

(10,0EA0) Enable the process termination event monitor. Event hex 00100202. Event handler QWCASCUE.

(10,0EC0) Cancel the generic process event monitor. Event hex 00100000.

(10,0EE0) Test for successful initiation of the LUS process.

(10,0F00) Wait for the LUs synchronization event. Event hex 81001303.

(10,0F20) Cancel the LUs synchronization event monitor. Event hex 81001303.

(10,0F40) Test for successful LUs process initialization, and send CPF1827 (LUs job initiation failed), if not successful, to QSYSOPR.

(10,0FFF) End of QWCAINAR module.

(20,X) QWCAMNAR, system arbiter mainline (problem phase program).

(20,0200) Turn off exception monitor for resolves to QSYS and QWCSCPF.

(20,0400) Call QDCSTF module to initialize the system devices.

(20,0600) Signal the system arbiter synchronization event, hex 81001402.

Call QDBXREF module to open cross-reference queues that were created or if already existing, verified as good earlier in this IPL.

Wait on the system arbiter never event.

OS/400 System and Subsystem Termination Phase (Hex 40)

The function and subfunction numbers for when the phase number is hex 40 are:

Note: Function numbers 10, 20, and 30 are used by the subsystem termination event handler, QWCASCUE, operating in the system arbiter during the system termination phase (phase number: hex 40). The start OS/400 data object is used in exactly the same way as during the start OS/400 process.

(10,X) Subsystem monitor process termination event handler, QWCASCUE.

(10,0100) Retrieve process terminate event related data.

(10,0200) Cancel the T1 timer event for the terminated subsystem (if one exists).

(10,0300) Test for abnormal termination of a subsystem monitor and call QWTAMABT.

(10,0400) Process unexpected termination of a noncontrolling subsystem monitor.

(10,0480) Process expected termination of a noncontrolling subsystem monitor.

(10,0500) Perform tests on the termination conditions of the controlling subsystem.

(10,0600) Termination to on state event signaled by the monitor of the controlling subsystem (normal condition).

(10,0700) Normal process termination event for the controlling subsystem monitor process.

(10,0780) Unexpected process termination event for the controlling subsystem monitor process.

(10,0800) Call QWCASDSM module to initiate the system termination because of unexpected termination of the controlling subsystem monitor.

(10,0900) Processing for final system termination when the subsystem count has gone to zero.

(10,0A00) When the subsystem count has gone to zero and the power down of the system is controlled, call QDCTRF to vary off devices.

(10,0A10) Continue processing for final system termination after the return from the call to QDCTRF.

(10,0B00) If the LUS process is active, terminate the process and indicate a normal termination.

(10,0C00) Cancel the T2 or T3 timer event.

(10,0D00) Call QDBXCLOS module to close any open database cross-reference queues.

(10,0E00) Terminate the arbiter process.

(10,0F00) Test for system termination to one of the *on* states (ENDSYS to the system console or ENDSBS *ALL to the requester's session).

(20,X) Unchain SBSD from *active* SBSD chain in system control block.

(20,0100) Search active SBSD chain for terminating SBSD and remove it from the chain.

(20,0200) Clean up SBSD, monitor's PASA and PSSA fields.

(20,0300) Deallocate monitor's job structure.

(20,0400) Return storage resources held by SBSD.

(20,0500) Release monitor's WCBT entry.

(20,0600) Unlock SBSD.

(30,X) Send error message.

(30,0X00) Send message to system operator message queue (subfunction numbers are from the function 10 operation).

(60,X) Termination system message processor, QWCASDSM.

(60,0100) If PWRDWNSYS *IMMED command issued while on auxiliary power, shut down the machine at once.

(60,0300) Test for system termination in progress and set indicator for current type of system termination.

(60,0330) If the power down command cannot be performed (system termination already in effect), then signal a subsystem monitor event (SBME) to the appropriate command processing program.

(60,0360) If the controlling subsystem is in the *restricted* state and the new termination device does not match the old termination device, then signal a subsystem monitor event (SBME) to the appropriate command processing program. The event is controlling subsystem currently terminated to a single job.

(60,0390) Cancel the T2 event timer if it exists.

(60,03B0) Setup system termination data in the system control block.

(60,0400) System not currently in termination mode. Test if controlling subsystem is in termination.

(60,0410) Resolve to the system console.

(60,0430) Materialize the system console description to obtain its current status.

(60,0460) If ENDCPF command was issued and the console is inoperative then signal a subsystem monitor event (SBME) to the appropriate command processing program. The event is ENDCPF not allowed when console powered or varied off.

(60,0490) If the subsystem is in the *restricted* state and the new termination device does not match the old termination device, then signal a subsystem monitor event (SBME) to the appropriate command processing program. The event is controlling subsystem resolves to a single job.

(60,04B0) Set the stopped system data in the system control block.

(60,0600) Create a timer event for a controlled power down.

(60,0800) If there are no active subsystems, then signal a subsystem monitor event (SBME) to the appropriate command processing program.

(60,0900) Step through the chained active subsystems.

(60,0A00) Create a timer event for immediate power down.

(60,0C00) Signal a subsystem control event (SBCE) that a immediate power down was initiated.

(60,0E00) Send one of the messages: CPF0930, CPF0931, or CPF0994.

(60,0F00) Function check occurred. If neither the subsystem control event (SBCE) nor the subsystem monitor event (SBME) was signaled, try to signal a subsystem monitor event that a function check occurred in the system arbiter.

(60,0F10) Function check occurred. If the subsystem control event (SBCE) was signaled, but the subsystem monitor event (SBME) was not signaled, try to signal a SBME that the subsystem control event (SBCE) was signaled.

(60,0FFF) Exit from QWCASDSM module.

(90,X) System termination timer event handler, QWCAT2TE.

(90,0100) Cancel the timer event monitor.

(90,0200) Test if T3 timer exists, immediate power down in progress. If it does, terminate machine processing.

(90,0400) If any subsystems are still active, step through the chain of active subsystems and signal the subsystem control event (SBCE) to each active subsystem.

(90,0600) Handle situation where a controlled power down timer has expired during a PWRDWNSYS command execution.

(90,0800) Resolve to the timer event handler when power down timer has expired during a PWRDWNSYS command execution.

(90,0F00) Send the message: `CPF0928, function check during terminate system timeout processing.`

(90,0FFF) Exit from QWCAT2TE module.

(F0,X) System termination event handler, QWCITRSE. (This function is performed by the event handler, QWCITRSE, executing in the start OS/400 process.)

(F0,0010) When the system arbiter process terminates, terminate machine processing. (This function and subfunction is set on an abnormal termination.)

(F0,0020) If the module, QWCIINSR, does NOT exist, call QLIDLCPF to power down the system. All OS/400 objects except QLIDLCPF itself are deleted before the system is powered down.

Chapter 22. OS/400 Job, Process, and Task Structure Overview

The purpose of this information is to assist in problem analysis when the available information is either a main storage dump or main storage contents when you have control of the system. The intent is to enable the service representative to analyze the state of the system by determining the state of all active processes and tasks. Information is provided about the structure of jobs, processes, tasks, and procedures to determine the status of each of them. This information is divided into two parts:

- The structure of jobs and the relationship of a job structure to a process
- The structure of processes, tasks, and procedures to determine their status

  For more information about the last item, see Chapter 27 on page 27-1.

OS/400 Job Structure

The following text describes the objects that make up the OS/400 job structure and the information needed to identify jobs in the system and to determine their status. To identify jobs, see "Identifying Jobs in the System" on page 22-8. To determine the jobs status, see "Status of Jobs" on page 22-8.

Job Structure Objects

Each job in the system uses a OS/400 job structure. The objects that make up the job structure are in one of three categories:

- Permanent job structure objects, see page 22-3
- Job structure control objects, see page 22-4
- Temporary job structure objects, see page 22-6

Figure 22-1 on page 22-2 and Figure 22-2 on page 22-5 identify the objects that make up the job structure and the addressing structure used to locate and refer to these objects. The following text describes the OS/400 job structure objects.

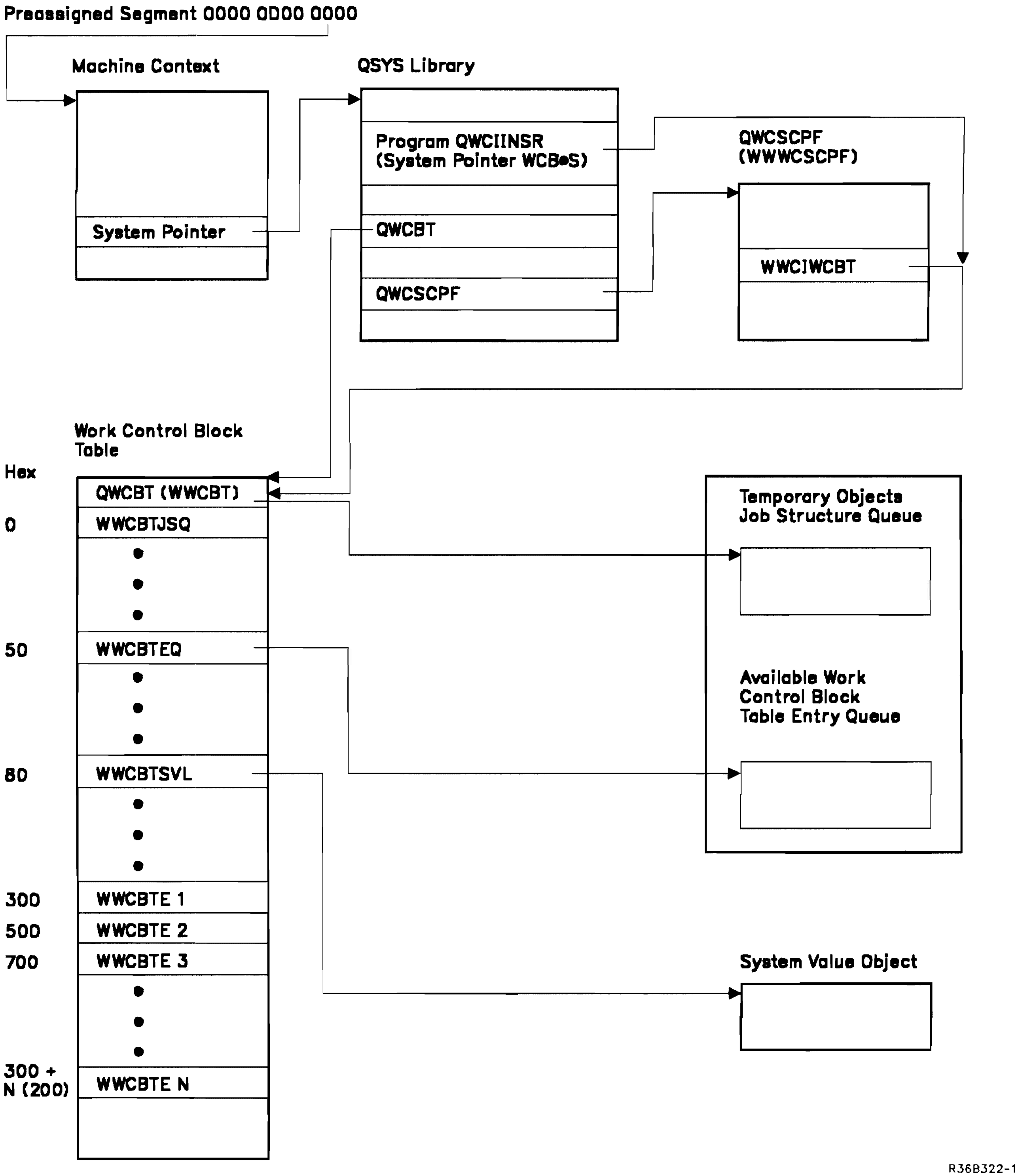


Figure 22-1. Permanent Job Structure Objects

Permanent Job Structure Objects: The permanent job structure is made up of objects that contain related information that must exist across initial microprogramming loads (IPLs). The objects that make up the permanent job structure are:

WCBT Work control block table (WCBT)

- The WCBT is created during the IPL when it does not exist or is damaged.
- The WCBT is a permanent extendable space object.
- The address of the WCBT is stored in the QSYS library.
- The WCBT contains:
  - Header used to manage the job structures
  - Work control block table entries (WCBTEs)
- The initial number of WCBTEs created in the WCBT is controlled by QTOTJOB (a system value).
- The WCBT is extended when all previously created WCBTEs are assigned. The number of WCBTEs added to the WCBT when it is extended is controlled by QADLTOTJ (a system value).
- WCBTE
  - Entries in the WCBT that are created when the WCBT is created or extended.
  - Serves as the focal point for the job while the job is in the system.
  - A WCBTE contains:
    - A work number assigned to uniquely identify when the job is entered on the system.
    - Permanent job-related information.
    - A system pointer to the spool control block (SCB) for this job structure.
    - A system pointer to the job message queue (JMQ) for this job structure.
    - A system pointer to the local data area for this job structure.
- A WCBTE is assigned to a job when the job enters the system. The types of jobs are as follows:
  - System jobs (system arbiter, SCPF process, LU services process, and subsystem monitors). WCBTEs are assigned before the process that they call is initiated.
  - Queued (batch) jobs. WCBTEs are assigned when the job is placed on a job queue.
  - Autostarted jobs. WCBTEs are assigned before the process is initiated for the job.
  - Interactive jobs. WCBTEs are assigned when a valid sign-on request is received.
- The WCBTE assigned to a job is released when the job leaves the system. If the job has spooled output, the entry is released after all output has been produced or deleted; or if the job has no spooled output, the entry is released at the end of the job.
- The WCBTE for a job can be located:
  - When the job is active or inactive, by searching the WCBT for a job's entry.
  - When the job is active, by using the WCBT offset contained in the job's work control block (WCB).

SCB Spooling control block (SCB)

- The SCB is created when the WCBTE is initialized. One SCB is associated with each WCBTE.
- The SCB is a permanent extendable object.
- The SCB address can be located by using the SCB system pointer that is stored in the WCBTE. The address is not stored in a context.
- The SCB contains information about spooled input and output files for the job.
- The SCB is logically allocated to a job when its associated WCBTE is assigned to a job.
- The SCB has its size controlled by QJOBSPLA and QADLSPLA (system values).

JMQ Job message queue (JMQ)

- The JMQ is created when the WCBTE is initialized. One JMQ is associated with each WCBTE.
- The JMQ is a permanent extendable space object.
- The JMQ address can be located by using the JMQ system pointer that is stored in the WCBTE. The address is not stored in a context.
- The JMQ contains the job log used for the job.
- The JMQ is logically allocated to a job when its associated WCBTE is assigned to a job.
- The JMQ has its size controlled by QJOBMSGQSZ and QJOBMSGQTL (system values).

LDA Local data area (LDA)

- The LDA is created when the WCBTE is initialized. One LDA is associated with each WCBTE.
- The LDA is a permanent extendable space object.
- The LDA address can be located by using the LDA system pointer that is stored in the

WCBTE. The address is not stored in a context.

- The LDA is logically allocated to a job when its associated WCBTE is assigned to a job.
- A job cannot access another job's LDA.
- The LDA is initialized with the contents of the submitting job's LDA, if a job is a submitted job.
- The LDA contains 1024 bytes of data.

Job Structure Control Objects: The job structure control objects control the allocation of job structures. These are temporary objects that are created and primed with information during each IPL and are updated each time a job structure is created, allocated, or deallocated. The job structure control objects are:

WCBTEQ Work control block table entry queue (WCBTEQ)

- The WCBTEQ is created during each IPL.
- The WCBTEQ is a temporary extendable queue.
- The WCBTEQ address can be located by using a system pointer to it from the WCBT header.
- The WCBTEQ contains, for each entry on the queue, the displacement into the WCBT of an unallocated WCBTE.

JSQ Job structure queue (JSQ)

- The JSQ is created during each IPL.
- The JSQ is a temporary extendable queue.
- The JSQ address can be located by using the system pointer to it from the WCBT header. The address is not stored in a context.
- The JSQ contains, for each entry on the queue, the address of an unallocated temporary job structure (a system pointer to the process control space of the unallocated temporary job structure).

WCBJNQ Job number assigned queue (WCBJNQ)

- The WCBJNQ is created during each IPL.
- The WCBJNQ is a temporary extendable queue.
- The WCBJNQ address can be located by using a system pointer to it from the WCBT header.
- The WCBJNQ contains, for each entry on the queue, a new job number.

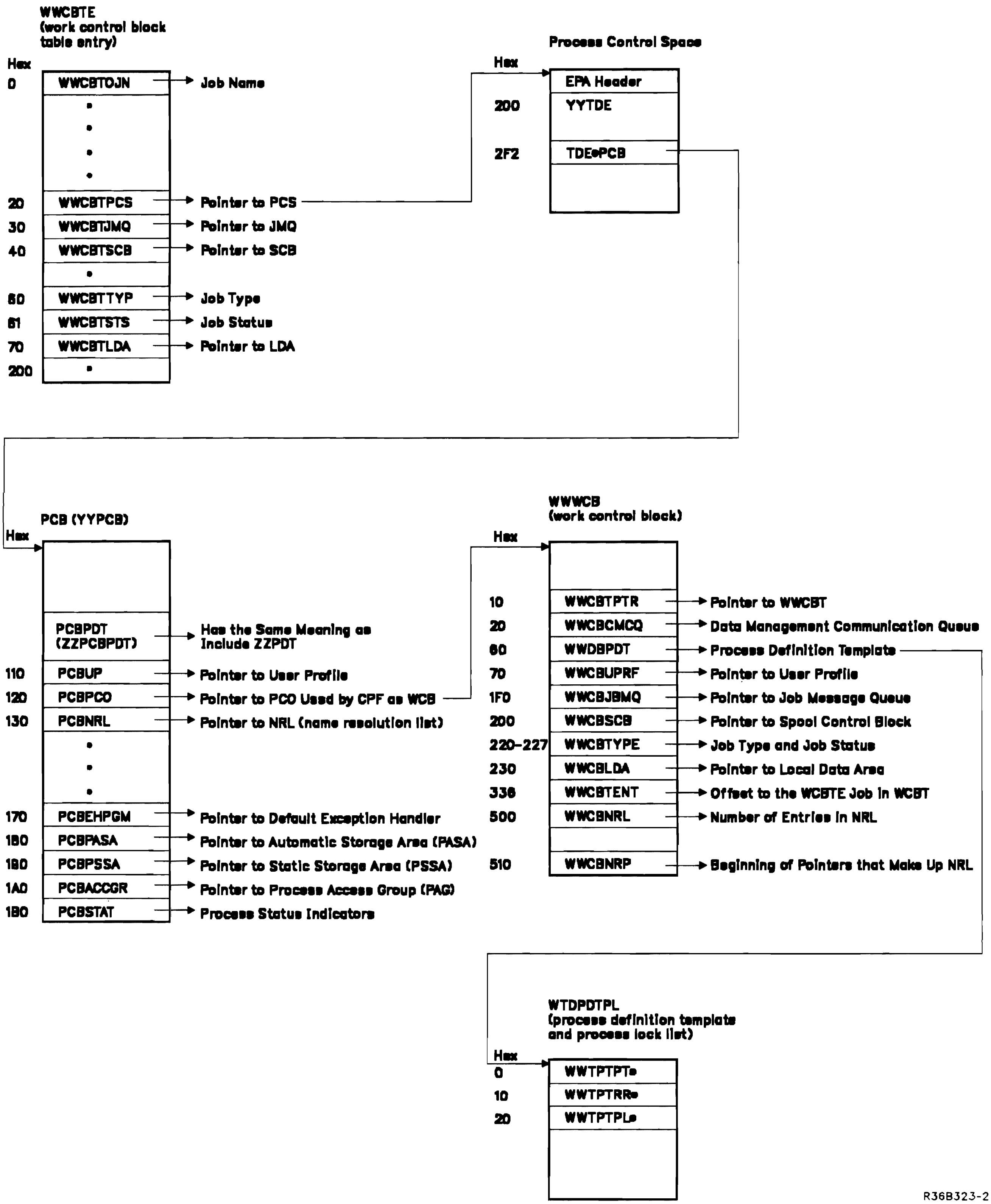


Figure 22-2. Temporary Job Structure Objects

Temporary Job Structure Objects: The temporary job structure consists of temporary objects that only last from IPL to IPL. The number of temporary job structures created is controlled by system value QACTJOB. Additional temporary job structures are created when all of the existing ones are allocated. The number of additional temporary job structures that are created is controlled by system value QADLACTJ. A temporary job structure is allocated to a job when the job is selected for execution.

Jobs *selected* for processing are:

- System jobs (system arbiter and subsystem monitors) before the process they call is created
- Queued jobs (batch) when the job is selected from a job queue
- Autostarted jobs before the process is initiated for the job
- Interactive jobs when a valid sign-on request is received

A job's temporary job structure is deallocated when the job reaches end of job. Jobs that reach end of job are:

- System jobs (system arbiter, SCPF process, and subsystem monitors) when the system or subsystem stops
- Queued jobs (batch) when the job completes processing or the job is canceled
- Autostarted jobs when the process they call is canceled or stopped
- Interactive jobs when the user signs off or the job is canceled

The objects that make up the temporary job structure are:

PAG Process access group (PAG)

- The PAG is a temporary access group.
- The PAG address can be located by a system pointer to the PAG that was placed in the process definition template (PDT). The address is not stored in context.
- The PAG contains other temporary objects that make up part of the temporary job structure.
- The PAG is used by the machine to swap processes in and out of main storage when either the instruction-wait or the time-slice end-of-access bits are on for the process.

PCS Process control space (PCS)

- The PCS is a temporary process control space created in the PAG.
- The PCS address can be located by using the system pointer to the PCS that was placed in the WCBTE. The pointer in the WCBTE only addresses the PCS when the job is active. When the job is inactive, the pointer is null. The address is not stored in a context.
- The PCS is used by the machine as a process work area.
- The PCS is named PCSnnnnnn where *nnnnnn* is the job number in the WCBTE in the WCBT.

PCSAS Process control space associated space (PCSAS)

- The PCSAS is the associated space of the process control space.
- The PCSAS address can be located by setting a space pointer from the system pointer to the PCS.
- The PCSAS serves as the process communications object (PCO).
- The PCO is used by OS/400 to serve as the WCB (may be found at include WWWCB).
- The PCSAS has a space pointer to the PDT in the PCO (located at label PCBPCO, include YYPCO).
- The PCSAS has the first pointer in the PCO pointing to the OS/400 entry point table.
- The PCSAS contains the following:
  - Work control block (WCB)
    - The WCB is a fixed-length area at offset 0 of the PCO.
    - The WCB address can be located by using the space pointer (PCBPCO in the PCB) to the PCO.
    - The WCB contains temporary job-related information and pointers to the other objects that make up the temporary job structure.
    - The WCB serves as the starting point to locate other objects in the temporary job structure.
  - Process name resolution list (PNRL)
    - The PNRL is a variable-length area that follows the WCB in the PCO.
    - The PNRL contains the job's name resolution list (number of libraries in the list and up to 40 system pointers to the libraries that make up the library search list).
  - L/U work area
    - The L/U work area contains the L/U defined job values.

- The L/U work area contains the job switches.

PSSA Process static storage area (PSSA)

- The PSSA is a temporary extendable space created in the PAG.
- The address of the PSSA can be located by using the space pointer that was placed in the PDT. The address is not stored in a context.
- A space pointer in the PDT addresses the PSSA base entry that contains the following four space pointers:
  - The current activation entry that is initialized to the address of the PSSA base entry.
  - The first activation entry that is not initialized.
  - The next available storage location that is initialized to the address of the first byte following the header.
  - The maximum addressable location in the PSSA that is initialized to the end of the PSSA space.
- A space in the PSSA is allocated and extended by the machine as program invocations are created in the process.
- A space in the PSSA is deallocated but not truncated by the machine as process invocations are destroyed in the process.

PASA Process automatic storage area (PASA)

- The PASA is a temporary extendable space created in the PAG.
- The address of the PASA can be located by using a space pointer that points to it from the PDT. The address is not stored in a context.
- A space pointer in the PDT addresses the PASA base entry that contains the following three space pointers:
  - The current invocation entry that is initialized to the address of the PASA base entry
  - The first invocation entry that is not initialized
  - The next available storage location (initialized to the address of the first byte following the header)
- A space in the PASA is allocated and extended by the machine as program invocations are created in the process.
- A space in the PASA is deallocated but not truncated by the machine as program invocations are destroyed in the process.

DMCQ Data management communications queue (DMCQ)

- The DMCQ is a temporary extendable space created in the PAG.
- The address of the DMCQ can be located by using a system pointer that is in the WCB. The address is not stored in a context.
- The DMCQ is used by data management to keep track of devices that have been passed to the process, files opened in the process, file overrides for the process, and temporary closes performed in the process.

PDPLLSP Process definition template/process lock list space (PDPLLSP)

- A temporary nonextendable space created outside the PAG.
- The address of the PDTPLLSP is stored in the WCB for the job (located at label WWCBPDT, include WWWCB).
- The PDTPLLSP contains a:
  - Header
    - Base pointer for the PDT
    - Base pointer for the RTGREQ data save area
    - Base pointer for the process lock list (PLL)
  - PDT

    The PDT contains information used by OS/400 and the machine to initiate processes for the job. Information in the PDT defines the process attributes.
- Routing data save area (RTGDTA)

  The RTGDTA contains the original routing data for the job (up to 80 bytes).
- Request data save area (RQSDTA)

  The RQSDTA contains the original request data for the job (up to 256 bytes).
- Process lock list (PLL)

  The address of the PLL is stored in the PDTPLLSP header. For interactive jobs, the PLL is initialized to contain the address of the work station associated with the job. The PLL is then used to transfer the locks on the device held by the monitor process to the subprocess being initiated.

MIRQ Machine interface response queue (MIRQ)

- The temporary extendable machine interface queue that is created outside the PAG.

- The address of the MIRQ can be located by using a system pointer that is contained in the WCB. The address of the MIRQ is not stored in a context.
- The MIRQ is used by data management to receive completion status for device I/O operations.

QTEMP Job temporary library (QTEMP)

- A temporary context created outside the PAG.
- The address of QTEMP can be located by using a system pointer that is contained in the WCB. The address of QTEMP is not stored in a context.
- The job temporary library is used to contain addressability to user objects that are created in QTEMP.
- A system pointer to QTEMP is placed on the job's process name resolution list, if specified.
- The objects created in QTEMP are destroyed at the end of the job and the addressability to these objects is deleted from the context.

Note: None of the temporary job structure objects are addressable through QTEMP.

Identifying Jobs in the System

All jobs in the system have their associated WCBTEs reference data structure WWCBTE in include WWWCBT. Jobs are identified by name and type:

- The job's 26-byte qualified job name is located in field WWCBTQJN in the WCBTE.
  - The entry is an available WCBTE (no job is assigned to it), if the first byte of field WWCBTQJN (WWCBTAEF) is a blank (hex 40).
  - The first 10 bytes are the simple job name that is assigned to the job when it enters the system if the first byte of WWCBTQJN is not a blank.
  - The next 10 bytes of the qualified job name are the name of the user profile associated with the job.
  - The last 6 bytes of the qualified job name (reference field WWCBTNBR) is the job number assigned to the job. This number is used as part of the name for the PCS assigned to an active job.
- Field WWCBTTYP of WWCBTE is a 1-byte field that defines the type of job associated with a given WCBTE. The valid values of this field are:

WWCBTTYP	Job Type
B	Batch
I	Interactive job
A	Autostart (batch)
R	Spooling reader
W	Spooling writer
M	Subsystem monitor
X	Start OS/400 process
S	System

Status of Jobs

Jobs exist in the system in one of the following states:

- Jobs being read in by the spooling reader
- Jobs on the job queue
- Active jobs
- Jobs on the output queue (complete)
- Held jobs
- Jobs leaving the system

Jobs Being Read by the Spooling Reader: A job in this state cannot be displayed, held, released, or canceled. Any system command, which can be performed on a job, cannot find a job in this state.

Jobs on the Job Queue: There can be two kinds of jobs on the job queue, a simple batch job or a job that is transferring to a different subsystem. For both types, field WWCBTJIQ (located in include WWWCBT) is set to a binary 1. For the transferring job, the field WWCBTJTR (located in include WWWCBT) is also on. The field WWCBTJLC (located in include WWWCBT) contains a system pointer to the job queue where the job resides. The SCB, pointed to by field WWCBTSCB (located in include WWCBT), is the qualified name of the job queue (WSPCHJBQ). WSPCHJBQ is a field in the SPSCB include. The inline files for the job are described in the spooling control block (SCB). Field WSPCINOF (located in include SPSCB) gives the offset to the first inline file control block. Field WSPIN#F (located in include SPSCB) gives the total number of inline files. A detailed description of the file is found in field WSPCINFC (located in include SPSCB). The priority of a transferring job on the job queue is in field WSPCHJPY (located in include SPSCB). The priority of a transferring interactive job on a job queue is always 0. The priority of a transferring batch job on a job queue is the same as the job's priority.

Active Job: An active job has field WWCBTJAC (located in include WWWCBT) on, a permanent job structure (WCBTE) and a temporary job structure (such as PCS, PAG, WCB, and PSSA) allocated to it. For an active job, field WWCBTJLC (located in include WWWCBT) contains a system pointer to the subsystem description (SBSD) of the subsystem that the job executes. The field WWCBTPCS (located in include WWWCBT) contains a system pointer to the PCS that is contained in the job's temporary job structure. The associated space of this PCS is the job's WCB, also known as the PCO, which contains other job status information. A job that is active can have files on one or more output queues; therefore, it can be on an output queue, but it is not complete.

Job on the Output Queue (Complete): You must be able to differentiate between a job that has files on an output queue but is not complete and a job that is complete. A job is marked complete when it is finished executing and has spooled files on one or more output queues. Fields WWCBTJLC and WWCBTPCS are set to null.

When a job has completed processing, the bit WWCBTJCM is set on. A job structure having this bit set on is retained until all of its spooled output files have been completed or canceled. Each one of the output files has an entry on an output queue until the job has been completed or canceled. The job also has an entry, OFCB (output file control block), in the SCB. Each one of these OFCBs has the name (field WSPCOOTQ) and a pointer (field WSPCOQPT) to the output queue for that file. These fields may be empty or reset.

Field WSPCHOTQ (located in include SPSCB) is the name for the default output queue for the job. This field is used only when a printer file is opened and the output queue (OUTQ) specified in the file and its override is OUTQ (*Job). The OUTQ that the file is put on is an attribute of the file, but it can be specified in more than one place. It could be specified in the file, in any override on the file, in the job, or in the Change Job (CHGJOB) command.

Held Jobs: A job can be held in any of three states. These three states are:

- Jobs on the job queue
- Jobs active
- Jobs on the output queue (complete)

When the job is held, field WWCBTJHL is set on. If the job is held on a job queue, it cannot be selected for execution by a subsystem monitor until it is released.

If the job is held active, the MI process that it executes is suspended (execution is stopped at an AS/400 instruction boundary). The execution is resumed at the next sequential AS/400 instruction when the job is released.

If the job is held while complete, none of the spooling files for the job will be printed by the spooling writer. If field WSPCHHLF (located in include SPSCB) is on, then all files for that job are held. If field WSPCOHLJ or field WSPCOHLF (located in include SPSCB) is on, only that particular file is held. The job stays in the system until all of its files have been released and printed or canceled.

Jobs Leaving the System: When a job has finished execution and all of its files have been removed from the system, the job's permanent job structure (WCBTE) is released. The field WWCBTAEF is set to blank, WWCBTPCS is null, WWCBTJLC is null, all status fields are 0's (no bits in WWCBTSTS are on, and the offset of the WCBTE is enqueued to the WCBT entry queue [WWCBTEQ]).

Chapter 23. OS/400 Program Debug Function

This is not to be confused with the *Program debug* option under DST.

How to Debug

One advantage of the program debug function is that no program changes or recompilations are required to use it. This greatly simplifies and speeds up the debugging process. It is primarily an interactive tool where the main interface is a group of CL commands. This makes most of the operating system ease-of-use features, such as command prompting, available to the programmer while debugging.

Some other features of this debug function are:

- Up to ten programs can be debugged at the same time in the same job.
- Debugging a program in one job (for example, a terminal session) has no effect on other jobs using the same program. This means any number of people can debug code concurrently in contrast to some tools which require specific devices or dedicated system test time for each person.
- Programs in one job can be debugged from another job. This allows an interactive job to debug a batch job. A batch program can be debugged interactively as easily as an interactive program.
- Program variables can be modified at breakpoints to temporarily fix a bug and continue testing to find more bugs. These variables may represent local program storage or storage in other system objects or control blocks.
- Breakpoints or traces can be defined or removed dynamically at any time during the debug session, even at a breakpoint.
- Programs can be placed into, or removed from, the list of programs being debugged dynamically at any time during the debug session, even at a breakpoint.
- A breakpoint automatically occurs whenever an unmonitored exception condition is detected while debugging programs.

Table 23-1 shows a grouping of commands used by this function.

Table 23-1. OS/400 Program Debug CL Commands

Function	Primary Commands	Related Commands
Debug mode	STRDBG ENDDBG	CHGDBG DSPDBG ADDPGM RMVPGM
Breakpoints	ADDBKP RMVBKP	DSPBKP RSMBKP CHGHLLPTR CHGPTR DSPPGMVAR CHGPGMVAR
Traces	ADDTRC RMVTRC	DSPTRCDTA CLRTRCDTA DSPTRC

To debug a program you must first place the interactive job (terminal session) in debug or TEST mode versus the default PROD mode. This is done using the Start Debug (STRDBG) command. TEST mode remains in effect until the ENDDBG command is entered or until the job ends using the SIGNOFF command.

While in debug mode, you will want to specify one or more programs that you wish to debug. This can be done using the PGM parameter on the STRDBG command or by using the Add Program (ADDPGM) command. You can designate one of these programs to be the default program using the DFTPGM parameter on the Start Debug (STRDBG), Add Program (ADDPGM), or Change Debug (CHGDBG) commands. This feature is provided so that you do not always have to specify which program that you mean (PGM parameter) on commands like Add Breakpoint (ADDBKP) and Display Program Variable (DSPPGMVAR) when debugging more than one program. If you specify programs using the STRDBG command PGM parameter (this is the most common method), the first (or only) program is taken as the default program unless you specify the DFTPGM parameter. You can change the default program using the Change Debug (CHGDBG) or Add Program (ADDPGM) commands.

To remove programs from debug mode, use the Remove Program (RMVPGM) command.

Note: If a program that is in debug mode is deleted, created again, or saved with storage freed, references made to that program may result in a function check. You must either remove the program (RMVPGM) or end debug (ENDDBG) mode. If you want to change the program and then debug it, you must remove it from debug mode and after it is created again, add it to debug mode (ADDPGM).

Production database files are not updated in debug mode unless UPDPROD(*YES) has been specified on the STRDBG command.

Another useful command is the Display Debug (DSPDBG) command. It displays the current program stack and the following debug information:

- The programs that are currently being debugged

- The instruction number of the calling instruction or the instruction number of each breakpoint at which the programs are stopped
- The program call level
- The names of programs that are in debug mode but have not been called

Adding Breakpoints to Programs

When testing a program, it is often helpful to suspend or stop the executing program at certain points. By doing so you can verify if a certain statement is executed.

The point at which you want to suspend the program is called a breakpoint and you define a breakpoint using the ADDBKP command. You can define up to ten breakpoints in a program that you are debugging. If you do not specify the name of the program that you want the breakpoint added to, the breakpoint is added to the default program specified on the STRDBG, CHGDBG or ADDPGM commands.

Note: You can specify up to ten breakpoints on a single ADDBKP command, all of which apply to the same program.

All breakpoints remain active until you issue a RMVBKP command, a RMVPGM command, or exit debug mode (for example, ENDDBG). When an executing program reaches a statement which has a breakpoint defined, the program is suspended before the statement is executed and a breakpoint display appears. You have three different options available when a breakpoint is reached. They are:

- Resume program execution (as if breakpoint never occurred) by pressing the Enter key.
- Press F10 to get to a new Command Entry display and enter CL commands such as Display Program Variable (DSPPGMVAR), Change Program Variable (CHGPGMVAR), Remove Breakpoint (RMVBKP). Press F3 to return to the breakpoint.
- Cancel any further execution of the program by pressing F3.

You may want to see the value of certain variables in a program every time a breakpoint in that program is encountered. This can be done by using the PGMVAR parameter on the ADDBKP command. The variables specified are then shown as part of the breakpoint display. Variables can be displayed in character or hexadecimal format.

You may add a **conditional breakpoint**, which is a breakpoint that only stops a program when a certain condition is true. A skip value may be specified, which specifies the number of times the statement or statements must be executed before the program is to stop. The SKIP parameter of the ADDBKP command is used to specify a skip value. A relational expression can also be specified, in which the program does not stop at the statement or statements until that condition is true. The relational expression compares one variable to another variable, or a variable to a constant. The BKPEXPR parameter of the ADDBKP command is used to specify a relational expression for the breakpoint. Both the SKIP and BKPEXPR parameters may be used together; however, SKIP is performed first.

For more information, see the *CL Programmer's Guide* as described in the *Information Directory*.

When To Use Program Debug

Debugging Asynchronous Jobs

The debug function is an interactive test tool; therefore, all debugging is done in an interactive job. However, the job being debugged does not have to be an interactive job. The debug function supports debugging one job from another job. Any job that can be serviced, using the Start Service Job (STRSRVJOB) command, can be debugged.

If a batch job on a job queue is to be debugged, it should first be held on the queue. From the interactive job doing the debugging, enter the STRSRVJOB command and specify the batch job name. Then enter the STRDBG command. The job can now be released from the job queue. An initial breakpoint screen appears on the display indicating that the job is about to start. From here, breakpoints or tracepoints can be added, like in a normal breakpoint display.

A batch job that is already running may be debugged. Since the job is running, the code with the problem may have already run. This technique works well when the code is looping in a known place, or if a pause is inserted in the program at a known location.

To debug a running job, enter a STRSRVJOB command for that job and then enter the STRDBG command. The job does not stop until a breakpoint is entered. Therefore, enter a breakpoint at a point where the batch job is expected to run. When the breakpoint is reached, a normal breakpoint display appears.

Although all debug commands are entered on the interactive display, they apply only to the job being serviced. It does not matter if the interactive job runs programs that are being debugged in the batch job.

The program debug function may be used for debugging many background jobs such as subsystem monitors or spool readers. However, if the job appears and disappears quickly, debugging may be difficult. If the job does not originate from a job queue, it cannot be stopped by the program debug function before it runs, and probably cannot be serviced in time to add a breakpoint. For this job, you can rename the program in question and substitute a CL program that contains a pause. The CL program calls the renamed module.

The Masking Problem

The debug function support relies heavily on MI events to perform functions like breakpoints; therefore, if the module that you want to test has sections of code in which the process is masked from events, you may want to consider using other test tools for debugging. Results from defined breakpoints, and so on, may be unpredictable or confusing when attempting to debug such a module. You can use trace on a module where code is masked to show the order that the statements are executed, but there is no data shown for variables (PGMVAR parameters) for the masked code. At a minimum you should be aware of code sections the process masked. You may be able to comment out the code that masks the process temporarily to use the debug function for initial unit tests and enable the code when done.

Testing Other System Components

The debug function has dependencies on several system components, such as common data management (DM), message handler (MH), and work station (WS) to produce breakpoint and trace displays. You may suspect that it would be impossible to test some modules in such components because of these dependencies. Usually this is *not* true because special hooks have been designed into the debug function to allow testing of other system components. Note that it is difficult to destroy anything outside of your interactive job using the debug function.

How to Handle Exceptions

To determine what your exceptions are, press F10 from the Command Entry display. This display shows all messages associated with the failing command or commands. From there you can move the cursor down to a message and press the Help key to get more information. This tells you which modules were used and at what offset they failed, the time and date, and the second level message text. You may need to call IBM to determine who owns that module.

Also, check the QSYSARB job log. Two ways of looking at this job log are:

- Enter the Work with Active Jobs (WRKACTJOB) command and press the Enter key. Next, enter a 5 in front of the QSYSARB, which does a WRKJOB command, and press the Enter key. Select the option to display the job log for QSYSARB. Scroll through this log and look for messages such as a pointer at a particular location that does not contain a pointer, a function check, and so on.
- Enter the command WRKJOB QSYSARB. If multiple jobs exist, take the job that has the larger job number. Then select the option to display the job log for QSYSARB. Scroll through this log and look for messages such as a pointer at a particular location that does not contain a pointer, a function check, and so on.

How to Trace a Program

Sometimes a specific problem in a program cannot be found. For example, a problem may not be found if the program is looping indefinitely or the loop is in an exception loop and you have no idea where the loop condition is occurring. In these situations, the trace function may be more useful than using breakpoints, or you may want to use traces with breakpoints. The STRDBG and ADDTRC combination of commands lets you use traces with breakpoints.

The trace function produces a chronological log of statements that were executed when the program was run. You can trace all executable statements (STMT(*ALL)) in a program or any subset (called a statement range) of statements by using the Add Trace (ADDTRC) command. If desired, up to five statement ranges can be specified. All MI instructions, STMT(*ALLINST), or instruction ranges can be traced, also.

Note: You can specify more than one trace statement range on a single ADDTRC command, all of which applies to the same program. Use the ADDTRC to verify how many times a statement is started, or verify what order the different statements are processed.

You can view this log, called trace data, when a breakpoint is encountered or when the programs is done executing (ended normally or abnormally) by using the Display Trace Data (DSPTRCDTA) command. The Display Trace (DSPTRC) command shows all trace ranges currently defined using the ADDTRC command (analogous to Display Breakpoints (DSPBKP) command); however, do not confuse this with Display Trace Data (DSPTRCDTA), the command most often used. The trace data keeps accumulating in a holding space managed by the debug function. This space is cleared by the Clear Trace Data (CLRTRCDTA) command or the CLEAR parameter on the Display Trace Data (DSPTRCDTA) command and is destroyed when debug mode is exited, when the job is ended, or when you sign off.

As with breakpoints, traces can be added and removed whenever a CL command is entered during the debug session. You can also display values of program in the trace log along with the statements executed by using the PGMVAR parameter on the Add Trace (ADDTRC) command.

Miscellaneous Trace Commands

- CHGJOB LOGCLPGM(*YES)

  This change job trace command logs CL commands. For more information about this command, see the *CL Reference*.

- TRCINT

  This trace internal command is used primarily for problem analysis. It traces the internal events associated with the current job that is below the machine interface (MI). For more information about this command, see page 17-12.

Chapter 24. Events

The following is a list of events that are signaled and/or handled by OS/400. Events are listed by class, type, subtype; the list also includes a brief description of each event. The events are:

Class	Event
8100	OS/400 events, see 24-1
8200	Utility events, see 24-3
8300	System/36 environment events, see 24-3

OS/400 Events

For the most part, the OS/400 event types are grouped as follows:

Type	Description
01-0F	Reserved
10-1F	Work management
20-2F	Data management
30-3F	Device support
40-4F	Message handler
50-5F	Spool
60-6F	Librarian
70-7F	Security
80-8F	Service or install
90-9F	Reserved
A0-AF	Office
B0	OS/400 Program Debug

Table 24-1 (Page 1 of 3). OS/400 Events

Class	Type	Subtype	Component	Description
Work Management Events (10 through 1F)				
Process Control Events				
8100	10	00	WT	Generic monitor for process control events
8100	10	01	SC	Service request event
8100	10	02	WT	End job
8100	10	03	WT	Subsystem end
8100	10	04	MH	Deliver message
8100	10	05	WT	System request
8100	10	06	WT	Work station test request
8100	10	07	WT	Unsolicited data
8100	10	09	WC	Display job
8100	10	0A	WT	Change job process control event
8100	10	0B	WT	System/36 environment unlock object
8100	10	0D	WT	Disconnect by another job
Command Analyzer Space Handling Events				
8100	11	01	WC	Space queue empty
8100	11	02	WC	Space queue operation failed
Subsystem Control Events				
8100	12	00	WT	Generic monitor for subsystem control events
8100	12	03	WT	End subsystem
8100	12	04	WT	Change job
8100	12	05	WT	Hold job
8100	12	06	WT	Release job
8100	12	07	WT	End job
8100	12	08	WT	End group job
8100	12	09	WT	Change group attributes
8100	12	0A	WT	Retrieve group attributes
8100	12	0B	WT	Monitor startup
8100	12	0C	WT	Change subsystem description
8100	12	0D	WT	Mode allocation response
8100	12	0E	WT	Change a JOBQ entry
8100	12	0F	WT	Change a prestarted job entry
8100	12	10	WT	Start prestarted job (STRPJ) and end prestarted job (ENDPJ)
8100	12	11	WT	Prestarted job ready
8100	12	12	WT	Find jobs for the ENDJOB command
8100	12	13	WT	Reset statistics for DSPACTPJ
8100	12	14	WT	Disconnect job event
8100	12	15	WT	Disconnect another job
Subsystem Message Events				
8100	13	01	WT	Subsystem CPP response
8100	13	02	WT	APPC device request
8100	13	03	WT	APPC LUs process synchronization
8100	13	04	WT	LUD contacted
8100	13	05	WT	Procedure start request data available
8100	13	06	WT	Trigger invite
8100	13	07	WT	Vary off communication device
8100	13	08	WT	Attach prestarted job
8100	13	09	WT	Reconnect job event
8100	13	0A	WT	Disconnect interval update
8100	14	02	WC	System arbiter synchronization
8100	14	03	WC	Controlling subsystem termination
8100	14	04	WC	Start OS/400 error
8100	14	FF	WC	System arbiter wait
Spooling Events				
8100	15	01	WT	New entry on job queue
8100	15	02	WT	Job queue available
Request To Arbiter Events (system arbiter input events)				
8100	16	01	WC	End system
8100	16	02	WC	End subsystem
8100	16	03	WC	Update clock rollover
8100	16	04	WC	Start subsystem
8100	16	05	WC	Create job structures
8100	16	06	WC	Request resources
8100	16	07	WC	Handle work control block table job number queue
8100	16	08	WC	Handle work control block table entry queue
8100	16	09	WC	Start system job event
8100	16	0A	WC	End system job event
8100	16	0C	WC	Control event for System/36 configuration
8100	16	0D	WC	Response event for System/36 configuration
Storage Resources Events				
8100	17	01	WT	Storage allocated
8100	17	02	WT	Storage available
8100	17	03	WT	Allocate storage
Display Job Event				
8100	18	01	WC	Display job completion
Control Job End Events				
8100	19	01	WT	Controlled job end in progress

Events

Table 24-1 (Page 2 of 3). OS/400 Events

Class	Type	Subtype	Com-ponent	Description
8100	19	02	WT	Controlled job end to SST or DST
SNADS Events				
8100	1B	01	ZD	Check send conditions
8100	1B	02	ZD	Hold queue entry
8100	1B	03	ZD	Start sending
8100	1B	04	ZD	Something was queued
8100	1C	01	OS	Add indirect user to directory
8100	1D	01	PM	Performance monitor stop
8100	1D	02	PM	Performance monitor job end
8100	1D	03	PM	Performance monitor complete
8100	1D	04	PM	Performance monitor end scheduler
8100	1D	05	PM	Performance monitor check the schedule
8100	1E	03	WT	QINACTITV system value changed
Terminate Accept Input Events (20 through 2E)				
8100	20	01	DM	End accept input
8100	20	02	DM	User end accept input
8100	21	01	CN	DDM change job reclaim
8100	21	02	CN	Data available
Device Available Events (30 through 3F)				
8100	30	01	WS	Device available
8100	31	01	WS	Get-no-wait data available
8100	31	02	WS	Put-no-wait complete
8100	31	03	WT	Routing data available
8100	31	04	WT	Sign-on data available
Get or Put Data Available Events				
8100	31	05	SL	Unsolicited data available (normal flow)
8100	31	06	SL	Unsolicited data available (expedited flow)
8100	31	07	BS	Translate complete
8100	31	08	WS	Get extended function complete
8100	31	0A	A1	Intrasystem-evoke request
8100	31	0B	A1	Intrasystem-data available
8100	31	0C	A1	Intrasystem-vary off
Work Station Attention Event				
8100	32	01	WS	Work station Attention key
Device Configuration Events				
8100	33	01	DC	Delete device description
8100	33	02	DC	Device description deleted
8100	33	03	DC	Delete control unit description
8100	33	04	DC	Control unit description deleted
8100	33	05	DC	Vary device online
8100	33	06	DC	Device varied online
8100	33	07	DC	Power device on or off
8100	33	08	DC	Power device on or off complete
8100	33	09	DC	Change device description
8100	33	0A	DC	Device description changed
8100	33	0B	SM	Obtain offline device
8100	33	0C	SM	Offline device granted
8100	33	0D	WT	Obtain device not signed on
8100	33	0F	DM	Obtain device event acknowledgment
8100	33	11	DC	Create control unit
8100	33	12	DC	Control unit created
8100	33	13	DC	APPC LUD creation reply
8100	33	14	DC	APPC LUD deletion reply
8100	33	15	DC	APPC LUD vary complete
8100	33	16	DC	New display device configured

Table 24-1 (Page 2 of 3). OS/400 Events

Class	Type	Subtype	Com-ponent	Description
8100	33	17	DC	Create or delete of display, printer, tape, or diskette
8100	33	18	DC	Automatic configuration of new local device or controller
8100	33	19	DC	GAIJI table updated
Device Passed Event				
8100	34	01	DM	Device passed
Switched Line Events				
8100	35	01	SW	OS/400 LUD contact
8100	35	02	SW	OS/400 switched lines request
APPC Session Negotiation Events				
8100	36	01	SW	APPC CHGNBRSSN command or negotiation
8100	36	02	SW	APPC CHGNBRSSN command completion
APPC Configuration/Vary Events				
8100	37	01	SW	APPC vary: on, off LUD contact
8100	37	02	SW	APPC LUD create, delete
8100	37	03	SW	APPC pass conversation
8100	38	01	T1	Twinaxial DLC data available
Message Handler Events (40 through 4F)				
8100	40	01	MH	Message arrived
8100	41	01	MH	System log queue is full
8100	41	02	MH	Logging completed
Alert Events				
8100	42	01	AL	Alert notification
8100	42	02	AL	Alert deferred
8100	42	03	AL	Change focal point event
8100	43	01	MH	Function check in debug mode
8100	44	01	MH	Message arrived with BRKMSG(*HOLD|NOTIFY)
Spooling Signaled Events (50 through 5F)				
8100	50	01	SP	Spooled output available
8100	50	02	SP	Stop writing current output
8100	50	03	SP	Release writer
8100	50	04	SP	Reset or delete spool database members
Advanced Function Printing Events				
8100	51	01	PQ	Print request status
8100	51	02	PQ	Log writer message
8100	52	01	PQ	Print driver manager status update
8100	52	02	PQ	Print service facility manager work enqueued
Security Events (70 through 7F)				
8100	70	01	SY	Device authority change to arbiter
8100	70	02	SY	Report device authority change from arbiter
Service and Installation Events (80 through 8F)				
8100	80	01	IE	CICS Network pass complete
8100	80	02	SM	SST or DST data available
System Resource Manager Event				
8100	81	01	RZ	SRM database control (disable or enable)
Reserved (90 through 9F)				
Office Event (A0 through AF)				
8100	A0	01	OH	Status list
OS/400 Program Debug (B0)				
8100	B0	01	TE	Serviced job breakpoint
8100	B0	02	TE	Serviced job function check
8100	B0	03	TE	Serviced job information returned
8100	B0	04	TE	Serviced job released from job queue

Table 24-1 (Page 3 of 3). OS/400 Events

Class	Type	Subtype	Component	Description
8100	B0	05	TE	Released serviced job from breakpoint
8100	B0	06	TE	Serviced job breakpoint canceled

Utility Events

Table 24-2. Utility Events

Class	Type	Subtype	Component	Description
8200	10	00	EM	3270 device emulation
8200	10	02	EM	3270 end
8200	10	03	EM	Work station data available
8200	10	04	EM	3270 host contact established
8200	10	05	EM	3270 host data available
8200	20	03	HR	Work station data available

System/36 Environment Events

Table 24-3. System/36 Environment Events

Class	Type	Subtype	Component	Description
8300	01	01	EX	System/36 environment device passed
8300	50	01	EX	Environment read under format (RUF) data available
8300	50	02	EX	System/36 environment general information signalled
8300	50	03	EX	System/36 environment general information signalled again
8300	50	04	EX	System/36 environment NRT

Events

Chapter 25. OS/400 Object Types and Subtypes

Table 25-1 lists the objects used by OS/400. The objects are listed by type and then by subtype within a type. Also included is the mnemonic, object class, OS/400 object type, and the names of creation template, materialization template, and object content mapping where applicable.

The creation template specifies the template macros used to create the object. The materialization template specifies the template macros that map the system object dump header (DMPSYSOBJ command or DMPOBJ command) for the object. Object content mapping specifies the OS/400 include or template macros. Object content mapping also maps the OS/400 contents of the object or the entries in the object, for example, an index.

When mapping an object, use the templates and includes in the order they are listed.

You can dump 01 subtypes using DMPSYSOBJ and specifying QSYS as the context. Subtypes 00 are VLIC objects and are not used in OS/400. For more information about working with objects, see page 16-6. To dump an object, see "Display/Alter/Dump" on page 12-27.

List of OS/400 Object Types and Subtypes

The object types are grouped as follows:

Type	Name
01	Access group
02	Program
04	Permanent context
04	Temporary context
06	Byte string space
07	Journal space
08	User profile
09	Journal port
0A	Queue
0B	Data space
0C	Space index
0D	Cursor
0E	Index
0F	Commit block
10	Logical unit description
11	Network unit description
12	Controller unit description
13	Dump space
14	Class of service
15	Mode
19	Space
1A	Process control space
1B	Authorization list
1C	Dictionary
81	Machine context

Table 25-1 lists the OS/400 objects by type and subtype. Table 25-2 on page 25-10 lists the OS/400 objects by object description.

Table 25-1 (Page 1 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
01	00	Access group (AG)	Machine interface	YYCAG1	YYMAG1		
01	90	Composite piece, access group (QDAG)	Design	YYCAG1	YYMAG1		
01	EF	Temporary access group (QTAG)	Internal	YYCAG1	YYMAG1	General usage	
02	00	Program (PROG)	Machine interface	YYS02, YYCRTP1	YYS02, YYCRTP1		
02	01	Program (PGM)	External	YYS02, YYCRTP1	YYS02, YYCRPT1		
04	00	Context (CTX)	Machine interface	YYS02	YYS02	YYMCTX1, YYMCTX2	
04	01	Library (LIB)	External	YYS02	YYS02		
06	C1	Document byte string space	Internal	YYS02	YYS02		
07	00	Journal space (JS)	Machine interface	YYS02, YYCRTJS	YYS02, YYMJSA		

Table 25-1 (Page 2 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
07	01	Journal receiver (JRNRCV)	External	YYS02, YYCRTJS	YYS02, YYMJSA		
08	00	User profile (USRPRF)	Machine interface	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
08	01	User profile (USRPRF)	External	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
09	00	Journal port (JP)	Machine interface	YYS02, YYCRPTJP	YYS02, YYMJPA		
09	01	Journal (JRN)	External	YYS02, YYCRPTJP	YYS02, YYMJPA		
0A	00	Queue (Q)	Machine interface	YYS02, YYQTM1	YYS02, YYQTM1		
0A	01	Data queue (DTAQ)	External	YYS02, YYQTM1	YYS02, YYQTM1		
0A	02	User queue (USRQ)	External	YYS02, YYQTM1	YYS02, YYQTM1		
0A	90	Composite piece, queue (QDQ)	Design	YYS02, YYQTM1	YYS02, YYQTM1		
0A	C1	Measurement message queue (JTMMQ)	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
0A	C2	FM queue (SIQ)	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
0A	C3	Distribution recipient queue (DRQ)	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
0A	C4	Data dictionary queue (DCTQ)	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
0A	C6	Office host print queue, queue (HPQ)	Internal				
0A	C7	TCP/IP internal queue	Internal				
0A	EF	Temporary queue (QTQ)	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
0B	00	Data space (DS)	Machine interface	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2		
0B	90	Composite piece, data space (QDDS)	Design	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2	DBASP (associated space only)	
0B	EF	Temporary data space (QTDS)	Internal	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDSA1, YYDSA2	General usage	
0C	00	Data space index (DSI)	Machine interface	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYCMP21	YYS02		

Table 25-1 (Page 3 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
0C	90	Composite piece, data space index (QDDSI)	Design	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYINA1, YYINA2		
0C	EF	Temporary, data space index (QTDSI)	Internal	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYINA1, YYINA2	General usage	
0D	00	Cursor (CUR)	Machine interface	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
0D	50	Database file member (MEM)	Design	YYS02, YYCAT1, YYCAT2, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21	Various templates including WWODPROT and WWDBODP (associated space)	
0D	EF	Database operational cursor (OCUR)	Internal	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
0E	00	Index (IDX)	Machine interface	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	01	Job queue (JOBQ)	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
0E	02	Output queue (OUTQ)	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
0E	03	Message file (MSGF)	External	YYS02, YYIXDT1	YYS02, YYIXDT1	WWMHVMF (index entry)	
0E	04	Forms control table (FCT)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	05	Session description (SSND)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	06	Ideographic dictionary (IGCDCT)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	07	Information search index (SCHIDX)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	08	Reference code translate table (RCT)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	09	Alert table, index (ALRTBL)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	0A	User index (USRINX)	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	90	Composite piece, index (QDIDX)	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If the object is a part of an object information repository (OIR), it is a part of a library composite object and contains offsets into an object information repository space (OIRS). See include WWLIOIR for mapping of the index entries.	

Table 25-1 (Page 4 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
0E	91	Master service index (MSRVI)	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If object name is QSERVICE, this is a master service index and does not have an associated space. It is part of a library composite object. SCMPCI (include in OS/400 data areas) maps the associated space and the index records. SCPCCR (include in OS/400 data areas) maps PCCRs in the associated space. For master PC index, see module QPZARPC.	
0E	C1	Menu index (MNINX)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	C2	SNADS distribution queue (SDQ)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	C4	Interactive profile	Internal	YYS02, YYIXDT1			
0E	C5	Authorized user table (AUT)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SYAUTENT (index entry)	
0E	C6	File available control block (FACB)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SPFACB (index entry)	
0E	C7	Print queue (PRTQ)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	C8	System resource manager index (SRMIDX)	Internal				
0E	C9	Secondary logic unit index (SLFSMS)	Internal				
0E	CB	Operand description table (PRODT)	Internal	YYS02, YYIXDT1			
0E	CC	S/36 index, index (S36IDX)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	CD	System wide folder list (SWFL)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	CE	System/36 help object (S36HLP)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0E	EF	Temporary, index (QTIDX)	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
0F	00	Commit block (CB)	Machine interface	YYS02	YYS02, YYMCBA		
0F	C1	Commit block (CBLK)	Internal	YYS02	YYS02, YYMCBA		
10	00	Logical unit description (LUD)	Machine interface		YYS02, ZZILUST		
10	01	Device description (DEVD)	External	YYS02, ZZSILUST	YYS02, ZZSILUST, ZZSILDSA	WWDCDASP (associated space)	
11	00	Network unit description (NUD)	Machine interface	YYS02, ZZSINDST	YYS02, ZZSINDST		

Table 25-1 (Page 5 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
11	01	Line description (LIND)	External	YYS02, ZZSINDST	YYS02, ZZSINDST	WWDCLASP (associated space)	
12	00	Controller unit description (CUD)	Machine interface	YYS02, ZZSICDST	YYS02, ZZSICDST		
12	01	Control unit description (CUD)	External	YYS02, ZZSICDST	YYS02, ZZSICDST	WWDCCASP (associated space)	
13	00	Dump space (DMPSP)	Machine interface				
13	90	Dump space (DMPSP)	Design				
14	00	Class of service (CS)	Machine interface	YYS02, ZZSICSST	YYS02, ZZSICSST		
14	01	Class of service description (COSD)	External	YYS02, ZZSICSST	YYS02, ZZSICSST		
15	00	Mode (MD)	Machine interface	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
15	01	Mode description (MODD)	External	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
19	00	Space (SO)	Machine Interface	YYS02	YYS02	WWDBFDT	
19	01	Database file description (SO)	External	YYS02	YYS02	WWDBFDT	
19	01	Spool file description (FILE)	External	YYS02	YYS02	WWODPRODT	
19	01	Printer file (FILE)	External	YYS02	YYS02	WWODPRODT	
19	01	Diskette device file description (FILE)	External	YYS02	YYS02	WWODPRODT	
19	01	Tape device file description (FILE)	External	YYS02	YYS02	WWODPRODT	
19	02	Message queue (MSGQ)	External	YYS02	YYS02	WWODPRODT	
19	03	Job description (JOBD)	External	YYS02	YYS02	WDJOBD	
19	04	Class (CLS)	External	YYS02	YYS02	WWCLS	
19	05	Command (CMD)	External	YYS02	YYS02	WWCDOBJ	
19	06	Table (TBL)	External	YYS02	YYS02		
19	07	Print image (PRTIMG)	External	YYS02	YYS02		
19	08	Edit description (EDTD)	External	YYS02	YYS02	DCEDITU	
19	09	Subsystem description (SBSD)	External	YYS02	YYS02	WDSBSD, WDSDATR, WDVATR, WDVRTG, WDVJOB, WTWCSBSD	
19	0A	Data area (DTAARA)	External	YYS02	YYS02	WWSYSVAR	
19	0B	C locale description, space (CLD)	External				
19	0C	Graphics symbol set (GSS)	External	YYS02	YYS02		
19	0D	Chart format (CHTFMT)	External	YYS02	YYS02		
19	0E	Document (DOC)	External	YYS02	YYS02		

Table 25-1 (Page 6 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
19	0F	Document list (DOCL)	External	YYS02	YYS02		
19	10	DBCS font character table (IGCTBL)	External	YYS02	YYS02		
19	11	Query definition (QRYDFN)	External	YYS02	YYS02		
19	12	Folder (FLR)	External	YYS02	YYS02		
19	15	Panel group definition (PNLGRP)	External	YYS02	YYS02		
19	16	Menu definition (MENU)	External	YYS02	YYS02		
19	18	Configuration list (CFGL)	External	YYS02	YYS02		
19	19	System/36 machine description (S36)	External	YYS02	YYS02		
19	1A	Ideographic sort table (IGCSRT)	External	YYS02	YYS02		
19	1B	Product definition (PRDDFN)	External	YYS02	YYS02		
19	1C	Product function (PRDFUN)	External	YYS02	YYS02		
19	1D	Product load (PRDLOD)	External	YYS02	YYS02		
19	20	Data dictionary (DTADCT)	External	YYS02	YYS02		
19	22	Cross system product map (CSPMAP)	External	YYS02	YYS02		
19	23	Cross system product table, space (CSPTBL)	External	YYS02	YYS02		
19	26	Font resource, space (FNTRSC)	External	YYS02	YYS02		
19	27	Page segment, space (PAGSEG)	External	YYS02	YYS02		
19	28	Form definition, space (FORMDF)	External	YYS02	YYS02		
19	29	Overlay, space (OVL)	External	YYS02	YYS02		
19	34	User space (USRSPC)	External	YYS02	YYS02		
19	50	Database dictionary (DIR)	Design	YYS02	YYS02	DBDIRADD	
19	51	File format (FMT)	Design	YYS02	YYS02	WWDDFMTD	
19	52	Composite piece (OIRS)	Design	YYS02	YYS02	WWLIOIR	
19	90	Composite piece, space (QDSP)	Design	YYS02	YYS02	WDJOBE, WDRTGE or WDNMTBL	
19	CO	Measurement collection object (MCO)	Internal	YYS02	YYS02		

Table 25-1 (Page 7 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
19	C1	Install initial template space (INITSP)	Internal	YYS02	YYS02	YYPDT11, YYPDT31, YYPDT41, YYPDT21, YYS02, YYUP11 Each of these templates is preceded by a header. Each header must be on a 16-byte boundary. Each of these templates is in the OS/400 data areas. The program name is QINIT. The program template is in this space.	
19	C2	Spool control block (SPLCB)	Internal	YYS02	YYS02	SPSCB	
19	C3	System entry point (SEPT)	Internal	YYS02	YYS02	(List of pointers) This space object consists entirely of pointers (each pointer is 16 bytes long). Each entry in the table maps to a corresponding entry in QLINMTBL (librarian space object).	
19	C4	System program name table (SNMTBL)	Internal	YYS02	YYS02	YYS02 contains names of most OS/400 modules and the library names where the modules reside.	
19	C5	Read/write control block (ICO)	Internal	YYS02	YYS02	SPRWCB	
19	C6	Install communication object (ICO)	Internal	YYS02	YYS02	WWINICO	
19	C7	Process definition template (PDT)	Internal	YYS02	YYS02	WTDPDTPL	
19	C8	Measurement collection object table (MCOTBL)	Internal	YYS02	YYS02		
19	C9	Measurement descriptor object (MDO)	Internal	YYS02	YYS02		
19	CA	Job APAR repository (JAR)	Internal	YYS02	YYS02	QAPARSPACE	
19	CB	Menu text (MNTXT)	Internal	YYS02	YYS02	WWMNTXT	
19	CC	Program change control record (PCCR)	Internal	YYS02	YYS02	SCPCCR, structure PCCR	
19	CD	Group data area (GDA)	Internal	YYS02	YYS02		
19	CE	Local data area (LDA)	Internal	YYS02	YYS02		
19	CF	Save/restore authorizations table (SRAUTH)	Internal	YYS02	YYS02	STAUTBL	WSRAUTBL
19	D0	Work control block table (WCBT)	Internal	YYS02	YYS02	WWWCBT	
19	D1	Library recovery object (LIBRCVR)	Internal	YYS02	YYS02	Temporary space created by librarian for library recovery	
19	D2	System value (SVAL)	Internal	YYS02	YYS02	WWSVAL, WCVALUES, WWSYSVAL	QWMSYSVAL

Table 25-1 (Page 8 of 9). Object Types and Subtypes

Type	Subtype	Object Description	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
19	D3	System control block (SYSBC)	Internal	YYS02	YYS02	WWCSYSB	QWMSYSCB
19	D4	Database recovery object (DBRCVR)	Internal	YYS02	YYS02	WWDBRCOB, WWWCMISR, WWDBRBLD	
19	D5	Install authority object (INAUT)	Internal	YYS02	YYS02	WWSYAUTH	
19	D6	System print image part numbers (SYSPRTI)	Internal	YYS02	YYS02		
19	D7	Data management entry point table (EPTAB)	Internal	YYS02	YYS02	WWUFCB	
19	D8	System reply list (SYSRPYL)	Internal	YYS02	YYS02		
19	D9	User file control block (UFCB)	Internal	YYS02	YYS02	WWFUCB	
19	DA	Operation code table (PROCT)	Internal	YYS02	YYS02	PRTMPL	
19	DB	Save/restore descriptor space (SRDS)	Internal	YYS02	YYS02	WWSRDS	
19	DC	Service communication object (SCO)	Internal	YYS02	YYS02	SCSCO	QSCO concatenated with fully qualified job name (without periods)
19	DD	Work control block table recovery object (WCBTRO)	Internal	YYS02	YYS02	YYMAUO1 (used once), YYMAUO2 (multiple use)	QJMQSCB
19	DE	SCPF space (SCPFSP)	Internal	YYS02	YYS02	WWWSCSCPF	QWCSCPF
19	DF	Message queue locking protocol (MQLOCK)	Internal	YYS02	YYS02		
19	E0	Asynchronous distribution object (ADO)	Internal	YYS02	YYS02		
19	E1	Ideographic character table (IGCTBL)	Internal	YYS02	YYS02		
19	E2	Distribution tracking object (DTO)	Internal	YYS02	YYS02		
19	E3	Document unit object (DUO)	Internal	YYS02	YYS02		
19	E4	Session control block (OSSCB)	Internal	YYS02	YYS02		
19	E5	Network facility space (NFSP)	Internal	YYS02	YYS02		
19	E6	Mail document (MDOC)	Internal	YYS02	YYS02		
19	E7	Unfiled folder object (UFO)	Internal	YYS02	YYS02		

Table 25-1 (Page 9 of 9). Object Types and Subtypes

Type	**Subtype**	**Object Description**	**Object Class**	**Creation Template**	**Materialization Template**	**Object Content Mapping**	**Object Name**
19	E8	FMS system object (FSO)	Internal	YYS02	YYS02		
19	E9	DSNX system object (DSNXO)	Internal	YYS02	YYS02		
19	EA	System/36 entry point table (S36EPT)	Internal	YYS02	YYS02		
19	EB	Internal data dictionary (IDDEDT)	Internal	YYS02	YYS02		
19	EC	System/36 history object (S36HST)	Internal	YYS02	YYS02		
19	ED	VLIC LSF holder (VLICLSF)	Internal	YYS02	YYS02		
19	EE	Permanent miscellaneous space (MSCSP)	Internal	YYS02	YYS02	General usage	
19	EF	Temporary, space (QTSP)	Internal	YYS02	YYS02	General usage	
19	F0	Automatic configuration names (ACNAME)	Internal	YYS02	YYS02		
19	F1	System/36 batch object (S36BCH)	Internal	YYS02	YYS02		
19	F2	Library REC object for rename (LIRCVR)	Internal	YYS02	YYS02		
19	F3	System resource manager space (SRMSPC)	Internal				
1A	00	Process control space (PCS)	Machine interface	YYS02	YYS02		
1A	90	Complete piece PCS (QDPCS)	Design	YYS02	YYS02	WWWCB (associated space)	
1A	EF	Temporary, process control space (QTPCS)	Internal	YYS02	YYS02	General usage	
1B	00	Authorization list (AUTLST)	Machine interface	YYS02	YYS02		
1B	01	Authorization list (AUTL)	External	YYS02	YYS02		
1B	C1	Authority holder (AUTHLR)	Internal	YYS02	YYS02		
1C	00	Spelling aid dictionary (SPDCT)	Machine interface	YYS02	YYS02		
1C	01	Spelling aid dictionary (SPADCT)	External	YYS02	YYS02		
81	00	Machine context (MCTX)	Machine interface	Not applicable	YYS02, YYIXDT1		

List of OS/400 Object Types and Subtypes in Order by Object Description

Table 25-2 (Page 1 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Access group (AG)	01	00	Machine interface	YYCAG1	YYMAG1		
ACNAME (automatic configuration names)	19	F0	Internal	YYS02	YYS02		
ADO (asynchronous distribution object)	19	E0	Internal	YYS02	YYS02		
AG (access group)	01	00	Machine interface	YYCAG1	YYMAG1		
Alert table, index (ALRTBL)	0E	09	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
ALRTBL (alert table, index)	0E	09	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
Asynchronous distribution object (ADO)	19	E0	Internal	YYS02	YYS02		
AUT (authorized user table)	0E	C5	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SYAUTENT (index entry)	
AUTHLR (authority holder)	1B	C1	Internal	YYS02	YYS02		
Authority holder (AUTHLR)	1B	C1	Internal	YYS02	YYS02		
Authorization list (AUTLST)	1B	00	Machine interface	YYS02	YYS02		
Authorization list (AUTL)	1B	01	External	YYS02	YYS02		
Authorized user table (AUT)	0E	C5	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SYAUTENT (index entry)	
AUTL (authorization list)	1B	01	External	YYS02	YYS02		
AUTLST (authorization list)	1B	00	Machine interface	YYS02	YYS02		
Automatic configuration names (ACNAME)	19	F0	Internal	YYS02	YYS02		
BS (document byte string space)	06	C1	Internal	YYS02	YYS02		
C locale description, space (CLD)	19	0B	External				
CB (commit block)	0F	00	Machine interface	YYS02	YYS02, YYMCBA		
CBLK (commit block)	0F	C1	Internal	YYS02	YYS02, YYMCBA		
CFGL (configuration list)	19	18	External	YYS02	YYS02		
Chart format (CHTFMT)	19	0D	External	YYS02	YYS02		
CHTFMT (chart format)	19	0D	External	YYS02	YYS02		
Class (CLS)	19	04	External	YYS02	YYS02	WWCLS	

Table 25-2 (Page 2 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Class of service (CS)	14	00	Machine interface	YYS02, ZZSICSST	YYS02, ZZSICSST		
Class of service description (COSD)	14	01	External	YYS02, ZZSICSST	YYS02, ZZSICSST		
CLD (C locale description, space)	19	0B	External				
CLS (class)	19	04	External	YYS02	YYS02	WWCLS	
CMD (command)	19	05	External	YYS02	YYS02	WWCDOBJ	
Command (CMD)	19	05	External	YYS02	YYS02	WWCDOBJ	
Commit block (CB)	0F	00	Machine interface	YYS02	YYS02, YYMCBA		
Commit block (CBLK)	0F	C1	Internal	YYS02	YYS02, YYMCBA		
Complete piece PCS (QDPCS)	1A	90	Design	YYS02	YYS02	WWWCB (associated space)	
Composite piece (OIRS)	19	52	Design	YYS02	YYS02	WWLIOIR	
Composite piece, access group (QDAG)	01	90	Design	YYCAG1	YYMAG1		
Composite piece, queue (QDQ)	0A	90	Design	YYS02, YYQTM1	YYS02, YYQTM1		
Composite piece, data space (QDDS)	0B	90	Design	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2	DBASP (associated space only)	
Composite piece, data space index (QDDSI)	0C	90	Design	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYINA1, YYINA2		
Composite piece, index (QDIDX)	0E	90	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If the object is a part of an object information repository (OIR), it is a part of a library composite object and contains offsets into an object information repository space (OIRS). If available, see the include WWLIOIR for mapping of the index entries.	
Composite piece, space (QDSP)	19	90	Design	YYS02	YYS02	WDJOBE, WDRTGE or WDNMTBL	
Configuration list (CFGL)	19	18	External	YYS02	YYS02		
Context (CTX)	04	00	Machine interface	YYS02	YYS02	YYMCTX1, YYMCTX2	
Control unit description (CUD)	12	01	External	YYS02, ZZSICDST	YYS02, ZZSICDST	WWDCCASP (associated space)	
Controller unit description (CUD)	12	00	Machine interface	YYS02, ZZSICDST	YYS02, ZZSICDST		
COSD (class of service description)	14	01	External	YYS02, ZZSICSST	YYS02, ZZSICSST		
Cross system product map (CSPMAP)	19	22	External	YYS02	YYS02		

Table 25-2 (Page 3 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Cross system product table, space (CSPTBL)	19	23	External	YYS02	YYS02		
CS (class of service)	14	00	Machine interface	YYS02, ZZSICSST	YYS02, ZZSICSST		
CSPMAP (cross system product map)	19	22	External	YYS02	YYS02		
CSPTBL (cross system product table, space)	19	23	External	YYS02	YYS02		
CTX (context)	04	00	Machine interface	YYS02	YYS02	YYMCTX1, YYMCTX2	
CUD (control unit description)	12	01	External	YYS02, ZZSICDST	YYS02, ZZSICDST	WWDCCASP (associated space)	
CUD (controller unit description)	12	00	Machine interface	YYS02, ZZSICDST	YYS02, ZZSICDST		
CUR (cursor)	0D	00	Machine interface	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
Cursor (CUR)	0D	00	Machine interface	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
Data area (DTAARA)	19	0A	External	YYS02	YYS02	WWSYSVAR	
Data dictionary (DTADCT)	19	20	External	YYS02	YYS02		
Data dictionary queue (DCTQ)	0A	C4	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
Data management entry point table (EPTAB)	19	D7	Internal	YYS02	YYS02	WWUFCB	
Data queue (DTAQ)	0A	01	External	YYS02, YYQTM1	YYS02, YYQTM1		
Data space (DS)	0B	00	Machine interface	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2		
Data space index (DSI)	0C	00	Machine interface	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYCMP21	YYS02		
Database dictionary (DIR)	19	50	Design	YYS02	YYS02	DBDIRADD	
Database file description (SO)	19	01	External	YYS02	YYS02	WWDBFDT	
Database file member (MEM)	0D	50	Design	YYS02, YYCAT1, YYCAT2, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21	Various templates including WWODPROT and WWDBODP (associated space)	
Database operational cursor (OCUR)	0D	EF	Internal	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
Database recovery object (DBRCVR)	19	D4	Internal	YYS02	YYS02	WWDBRCOB, WWWCMISR, WWDBRBLD	

Table 25-2 (Page 4 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
DBCS font character table (IGCTBL)	19	10	External	YYS02	YYS02		
DBRCVR (database recovery object)	19	D4	Internal	YYS02	YYS02	WWDBRCOB, WWWCMISR, WWDBRBLD	
DCTQ (data dictionary queue)	0A	C4	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
Device description (DEVD)	10	01	External	YYS02, ZZSILUST	YYS02, ZZSILUST, ZZSILDSA	WWDCDASP (associated space)	
DEVD (device description)	10	01	External	YYS02, ZZSILUST	YYS02, ZZSILUST, ZZSILDSA	WWDCDASP (associated space)	
DIR (database dictionary)	19	50	Design	YYS02	YYS02	DBDIRADD	
Diskette device file description (FILE)	19	01	External	YYS02	YYS02	WWODPRODT	
Distribution recipient queue (DRQ)	0A	C3	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
Distribution tracking object (DTO)	19	E2	Internal	YYS02	YYS02		
Document unit object (DUO)	19	E3	Internal	YYS02	YYS02		
DUO (document unit object)	19	E3	Internal	YYS02	YYS02		
DMPSP (dump space)	13	00	Machine interface				
DMPSP (dump space)	13	90	Design				
DOC (document)	19	0E	External	YYS02	YYS02		
DOCL (document list)	19	0F	External	YYS02	YYS02		
Document (DOC)	19	0E	External	YYS02	YYS02		
Document byte string space (BS)	06	C1	Internal	YYS02	YYS02		
Document list (DOCL)	19	0F	External	YYS02	YYS02		
DRQ (distribution recipient queue)	0A	C3	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
DS (data space)	0B	00	Machine interface	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2		
DSI (data space index)	0C	00	Machine interface	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYCMP21	YYS02		
DSNX system object (DSNXO)	19	E9	Internal	YYS02	YYS02		
DSNXO (DSNX system object)	19	E9	Internal	YYS02	YYS02		
DTAARA (data area)	19	0A	External	YYS02	YYS02	WWSYSVAR	
DTADCT (data dictionary)	19	20	External	YYS02	YYS02		
DTAQ (data queue)	0A	01	External	YYS02, YYQTM1	YYS02, YYQTM1		

Table 25-2 (Page 5 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
DTO (distribution tracking object)	19	E2	Internal	YYS02	YYS02		
Dump space (DMPSP)	13	00	Machine interface				
Dump space (DMPSP)	13	90	Design				
Edit description (EDTD)	19	08	External	YYS02	YYS02	DCEDITU	
EDTD (edit description)	19	08	External	YYS02	YYS02	DCEDITU	
EPTAB (data management entry point table)	19	D7	Internal	YYS02	YYS02	WWUFCB	
FACB (file available control block)	0E	C6	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SPFACB (index entry)	
FCT (forms control table)	0E	04	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
File available control block (FACB)	0E	C6	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1	SPFACB (index entry)	
File format (FMT)	19	51	Design	YYS02	YYS02	WWDDFMTD	
FILE (diskette device file description)	19	01	External	YYS02	YYS02	WWODPRODT	
FILE (printer file)	19	01	External	YYS02	YYS02	WWODPRODT	
FILE (spool file description)	19	01	External	YYS02	YYS02	WWODPRODT	
FILE (tape device file description)	19	01	External	YYS02	YYS02	WWODPRODT	
FLR (folder)	19	12	External	YYS02	YYS02		
FM queue (SIQ)	0A	C2	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
FMS system object (FSO)	19	E8	Internal	YYS02	YYS02		
FMT (file format)	19	51	Design	YYS02	YYS02	WWDDFMTD	
FNTRSC (font resource, space)	19	26	External	YYS02	YYS02		
Folder (FLR)	19	12	External	YYS02	YYS02		
Font resource, space (FNTRSC)	19	26	External	YYS02	YYS02		
Form definition, space (FORMDF)	19	28	External	YYS02	YYS02		
FORMDF (form definition, space)	19	28	External	YYS02	YYS02		
Forms control table (FCT)	0E	04	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
FSO (FMS system object)	19	E8	Internal	YYS02	YYS02		
GDA (group data area)	19	CD	Internal	YYS02	YYS02		
Graphics symbol set (GSS)	19	0C	External	YYS02	YYS02		
Group data area (GDA)	19	CD	Internal	YYS02	YYS02		

Table 25-2 (Page 6 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
GSS (graphics symbol set)	19	0C	External	YYS02	YYS02		
HPQ (office host print queue, queue)	0A	C6	Internal				
ICO (install communication object)	19	C6	Internal	YYS02	YYS02	WWINICO	
ICO (read/write control block)	19	C5	Internal	YYS02	YYS02	SPRWCB	
IGCSRT (ideographic sort table)	19	1A	External	YYS02	YYS02		
Ideographic character table (IGCTBL)	19	E1	Internal	YYS02	YYS02		
Ideographic dictionary (IGCDCT)	0E	06	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
Ideographic sort table (IGCSRT)	19	1A	External	YYS02	YYS02		
IDDEDT (internal data dictionary)	19	EB	Internal	YYS02	YYS02		
IDX (index)	0E	00	Machine interface	YYS02, YYIXDT1	YYS02, YYIXDT1		
IGCDCT (ideographic dictionary)	0E	06	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
IGCTBL (DBCS font character table)	19	10	External	YYS02	YYS02		
IGCTBL (ideographic character table)	19	E1	Internal	YYS02	YYS02		
INAUT (install authority object)	19	D5	Internal	YYS02	YYS02	WWSYAUTH	
Index (IDX)	0E	00	Machine interface	YYS02, YYIXDT1	YYS02, YYIXDT1		
Information search index (SCHIDX)	0E	07	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
INITSP (install initial template space)	19	C1	Internal	YYS02	YYS02	YYPDT11, YYPDT31, YYPDT41, YYPDT21, YYS02, YYUP11 Each of these templates is preceded by a header. Each header must be on a 16-byte boundary. Each of these templates is in the OS/400 data areas. The program name is QINIT. The program template is in this space.	
Install authority object (INAUT)	19	D5	Internal	YYS02	YYS02	WWSYAUTH	
Install communication object (ICO)	19	C6	Internal	YYS02	YYS02	WWINICO	

Table 25-2 (Page 7 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Install initial template space (INITSP)	19	C1	Internal	YYS02	YYS02	YYPDT11, YYPDT31, YYPDT41, YYPDT21, YYS02, YYUP11 Each of these templates is preceded by a header. Each header must be on a 16-byte boundary. Each of these templates is in the OS/400 data areas. The program name is QINIT. The program template is in this space.	
Interactive profile	0E	C4	Internal	YYS02, YYIXDT1			
Internal data dictionary (IDDEDT)	19	EB	Internal	YYS02	YYS02		
JAR (job APAR repository)	19	CA	Internal	YYS02	YYS02	QAPARSPACE	
Job APAR repository (JAR)	19	CA	Internal	YYS02	YYS02	QAPARSPACE	
Job description (JOBD)	19	03	External	YYS02	YYS02	WDJOBD	
Job queue (JOBQ)	0E	01	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
JOBD (job description)	19	03	External	YYS02	YYS02	WDJOBD	
JOBQ (job queue)	0E	01	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
Journal (JRN)	09	01	External	YYS02, YYCRPTJP	YYS02, YYMJPA		
Journal port (JP)	09	00	Machine interface	YYS02, YYCRPTJP	YYS02, YYMJPA		
Journal receiver (JRNRCV)	07	01	External	YYS02, YYCRTJS	YYS02, YYMJSA		
Journal space (JS)	07	00	Machine interface	YYS02, YYCRTJS	YYS02, YYMJSA		
JP (journal port)	09	00	Machine interface	YYS02, YYCRPTJP	YYS02, YYMJPA		
JRN (journal)	09	01	External	YYS02, YYCRPTJP	YYS02, YYMJPA		
JRNRCV (journal receiver)	07	01	External	YYS02, YYCRTJS	YYS02, YYMJSA		
JS (journal space)	07	00	Machine interface	YYS02, YYCRTJS	YYS02, YYMJSA		
JTMMQ (measurement message queue)	0A	C1	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
Measurement message queue (JTMMQ)	0A	C1	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
LDA (local data area)	19	CE	Internal	YYS02	YYS02		
LIB (library)	04	01	External	YYS02	YYS02		
Library (LIB)	04	01	External	YYS02	YYS02		
Library REC object for rename (LIRCVR)	19	F2	Internal	YYS02	YYS02		

Table 25-2 (Page 8 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Library recovery object (LIBRCVR)	19	D1	Internal	YYS02	YYS02	Temporary space created by librarian for library recovery	
LIBRCVR (library recovery object)	19	D1	Internal	YYS02	YYS02	Temporary space created by librarian for library recovery	
LIND (line description)	11	01	External	YYS02, ZZSINDST	YYS02, ZZSINDST	WWDCLASP (associated space)	
Line description (LIND)	11	01	External	YYS02, ZZSINDST	YYS02, ZZSINDST	WWDCLASP (associated space)	
LIRCVR (library REC object for rename)	19	F2	Internal	YYS02	YYS02		
Local data area (LDA)	19	CE	Internal	YYS02	YYS02		
Logical unit description (LUD)	10	00	Machine interface		YYS02, ZZILUST		
LUD (logical unit description)	10	00	Machine interface		YYS02, ZZILUST		
Machine context (MCTX)	81	00	Machine interface	Not applicable	YYS02, YYIXDT1		
Mail document (MDOC)	19	E6	Internal	YYS02	YYS02		
Master service index (MSRVI)	0E	91	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If object name is QSERVICE, this is a master service index and does not have an associated space. It is part of a library composite object. SCMPCI (include in OS/400 data areas) maps the associated space and the index records. SCPCCR (include in OS/400 data areas) maps PCCRs in the associated space. For master PC index, see module QPZARPC.	
MCO (measurement collection object)	19	CO	Internal	YYS02	YYS02		
MCTX (machine context)	81	00	Machine interface	Not applicable	YYS02, YYIXDT1		
MD (mode)	15	00	Machine interface	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
MDOC (mail document)	19	E6	Internal	YYS02	YYS02		
Measurement collection object (MCO)	19	CO	Internal	YYS02	YYS02		
Measurement collection object table (MCOTBL)	19	C8	Internal	YYS02	YYS02		
Measurement descriptor object (MDO)	19	C9	Internal	YYS02	YYS02		
MCOTBL (measurement collection object table)	19	C8	Internal	YYS02	YYS02		

Table 25-2 (Page 9 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
MDO (measurement descriptor object)	19	C9	Internal	YYS02	YYS02		
MEM (database file member)	0D	50	Design	YYS02, YYCAT1, YYCAT2, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21	Various templates including WWODPROT and WWDBODP (associated space)	
Menu definition (MENU)	19	16	External	YYS02	YYS02		
MENU (menu definition)	19	16	External	YYS02	YYS02		
Menu index (MNINX)	0E	C1	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
Menu text (MNTXT)	19	CB	Internal	YYS02	YYS02	WWMNTXT	
Message file (MSGF)	0E	03	External	YYS02, YYIXDT1	YYS02, YYIXDT1	WWMHVMF (index entry)	
Message queue (MSGQ)	19	02	External	YYS02	YYS02	WWODPRODT	
Message queue locking protocol (MQLOCK)	19	DF	Internal	YYS02	YYS02		
MNINX (menu index)	0E	C1	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
MNTXT (menu text)	19	CB	Internal	YYS02	YYS02	WWMNTXT	
Mode (MD)	15	00	Machine interface	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
MODD (mode description)	15	01	External	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
Mode description (MODD)	15	01	External	YYS02, ZZSIMDST	YYS02, ZZSIMDST		
MQLOCK (message queue locking protocol)	19	DF	Internal	YYS02	YYS02		
MSCSP (permanent miscellaneous space)	19	EE	Internal	YYS02	YYS02	General usage	
MSGF (message file)	0E	03	External	YYS02, YYIXDT1	YYS02, YYIXDT1	WWMHVMF (index entry)	
MSGQ (message queue)	19	02	External	YYS02	YYS02	WWODPRODT	
MSRVI (master service index)	0E	91	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If object name is QSERVICE, this is a master service index and does not have an associated space. It is part of a library composite object. SCMPCI (include in OS/400 data areas) maps the associated space and the index records. SCPCCR (include in OS/400 data areas) maps PCCRs in the associated space. For master PC index, see module QPZARPC.	
Network facility space (NFSP)	19	E5	Internal	YYS02	YYS02		

Table 25-2 (Page 10 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Network unit description (NUD)	11	00	Machine interface	YYS02, ZZSINDST	YYS02, ZZSINDST		
NFSP (network facility space)	19	E5	Internal	YYS02	YYS02		
NUD (network unit description)	11	00	Machine interface	YYS02, ZZSINDST	YYS02, ZZSINDST		
OCUR (database operational cursor)	0D	EF	Internal	YYS02, YYCMP11, YYCMP21	YYS02, YYCMP11, YYCMP21		
Office host print queue, queue (HPQ)	0A	C6	Internal				
OIRS (composite piece)	19	52	Design	YYS02	YYS02	WWLIOIR	
Operand description table (PRODT)	0E	CB	Internal	YYS02, YYIXDT1			
Operation code table (PROCT)	19	DA	Internal	YYS02	YYS02	PRTMPL	
OSSCB (session control block)	19	E4	Internal	YYS02	YYS02		
Output queue (OUTQ)	0E	02	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
OUTQ (output queue)	0E	02	External	YYS02, YYIXDT1	YYS02, YYIXDT1	SPSLKEY (index entry)	
Overlay, space (OVL)	19	29	External	YYS02	YYS02		
OVL (overlay, space)	19	29	External	YYS02	YYS02		
Page segment, space (PAGSEG)	19	27	External	YYS02	YYS02		
PAGSEG (page segment, space)	19	27	External	YYS02	YYS02		
Panel group definition (PNLGRP)	19	15	External	YYS02	YYS02		
PCCR (program change control record)	19	CC	Internal	YYS02	YYS02	SCPCCR, structure PCCR	
PCS (process control space)	1A	00	Machine interface	YYS02	YYS02		
PDT (process definition template)	19	C7	Internal	YYS02	YYS02	WTDPDTPL	
Permanent miscellaneous space (MSCSP)	19	EE	Internal	YYS02	YYS02	General usage	
PGM (program)	02	01	External	YYS02, YYCRTP1	YYS02, YYCRPT1		
PNLGRP (panel group definition)	19	15	External	YYS02	YYS02		
PRDDFN (product definition)	19	1B	External	YYS02	YYS02		
PRDFUN (product function)	19	1C	External	YYS02	YYS02		
PRDLOD (product load)	19	1D	External	YYS02	YYS02		
Print image (PRTIMG)	19	07	External	YYS02	YYS02		

Table 25-2 (Page 11 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Print queue (PRTQ)	0E	C7	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
Printer file (FILE)	19	01	External	YYS02	YYS02	WWODPRODT	
Process control space (PCS)	1A	00	Machine interface	YYS02	YYS02		
Process definition template (PDT)	19	C7	Internal	YYS02	YYS02	WTDPDTPL	
PROCT (operation code table)	19	DA	Internal	YYS02	YYS02	PRTMPL	
PRODT (operand description table)	0E	CB	Internal	YYS02, YYIXDT1			
Product definition (PRDDFN)	19	1B	External	YYS02	YYS02		
Product function (PRDFUN)	19	1C	External	YYS02	YYS02		
Product load (PRDLOD)	19	1D	External	YYS02	YYS02		
PRTIMG (print image)	19	07	External	YYS02	YYS02		
PRTQ (print queue)	0E	C7	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
PROG (program)	02	00	Machine interface	YYS02, YYCRTP1	YYS02, YYCRTP1		
Program (PGM)	02	01	External	YYS02, YYCRTP1	YYS02, YYCRPT1		
Program (PROG)	02	00	Machine interface	YYS02, YYCRTP1	YYS02, YYCRTP1		
Program change control record (PCCR)	19	CC	Internal	YYS02	YYS02	SCPCCR, structure PCCR	
Q (queue)	0A	00	Machine interface	YYS02, YYQTM1	YYS02, YYQTM1		
QDAG (composite piece, access group)	01	90	Design	YYCAG1	YYMAG1		
QDDS (composite piece, data space)	0B	90	Design	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDPT1, YYDSA1, YYDSA2	DBASP (associated space only)	
QDDSI (composite piece, data space index)	0C	90	Design	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYINA1, YYINA2		
QDIDX (composite piece, index)	0E	90	Design	YYS02, YYIXDT1	YYS02, YYIXDT1	If the object is a part of an object information repository (OIR), it is a part of a library composite object and contains offsets into an object information repository space (OIRS). If available, see the include WWLIOIR for mapping of the index entries.	
QDPCS (complete piece PCS)	1A	90	Design	YYS02	YYS02	WWWCB (associated space)	

Table 25-2 (Page 12 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
QDQ (composite piece, queue)	0A	90	Design	YYS02, YYQTM1	YYS02, YYQTM1		
QDSP (composite piece, space)	19	90	Design	YYS02	YYS02	WDJOBE, WDRTGE or WDNMTBL	
QRYDFN (query definition)	19	11	External	YYS02	YYS02		
QTAG (temporary access group)	01	EF	Internal	YYCAG1	YYMAG1	General usage	
QTDS (temporary data space)	0B	EF	Internal	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDSA1, YYDSA2	General usage	
QTDSI (temporary data space index)	0C	EF	Internal	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYINA1, YYINA2	General usage	
QTIDX (temporary, index)	0E	EF	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
QTPCS (temporary, process control space)	1A	EF	Internal	YYS02	YYS02	General usage	
QTQ (temporary queue)	0A	EF	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
QTSP (temporary, space)	19	EF	Internal	YYS02	YYS02	General usage	
Queue (Q)	0A	00	Machine interface	YYS02, YYQTM1	YYS02, YYQTM1		
Query definition (QRYDFN)	19	11	External	YYS02	YYS02		
RCT (reference code translate table)	0E	08	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
Read/write control block (ICO)	19	C5	Internal	YYS02	YYS02	SPRWCB	
Reference code translate table (RCT)	0E	08	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
Save/restore authorizations table (SRAUTH)	19	CF	Internal	YYS02	YYS02	STAUTBL	WSRAUTBL
Save/restore descriptor space (SRDS)	19	DB	Internal	YYS02	YYS02	WWSRDS	
SCO (service communication object)	19	DC	Internal	YYS02	YYS02	SCSCO	QSCO concatenated with fully qualified job name (without periods)
SBSD (subsystem description)	19	09	External	YYS02	YYS02	WDSBSD, WDSDATR, WDVATR, WDVRTG, WDVJOB, WTWCSBSD	
SCHIDX (information search index)	0E	07	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
SCPF space (SCPFSP)	19	DE	Internal	YYS02	YYS02	WWWSCSCPF	QWCSCPF

Table 25-2 (Page 13 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
SCPFSP (SCPF space)	19	DE	Internal	YYS02	YYS02	WWWSCSCPF	QWCSCPF
SDQ (SNADS distribution queue)	0E	C2	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
Secondary logic unit index (SLFSMS)	0E	C9	Internal				
SEPT (system entry point)	19	C3	Internal	YYS02	YYS02	(List of pointers) This space object consists entirely of pointers (each pointer is 16 bytes long). Each entry in the table maps to a corresponding entry in QLINMTBL (librarian space object).	
Service communication object (SCO)	19	DC	Internal	YYS02	YYS02	SCSCO	QSCO concatenated with fully qualified job name (without periods)
Session control block (OSSCB)	19	E4	Internal	YYS02	YYS02		
Session description (SSND)	0E	05	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
SIQ (FM queue)	0A	C2	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
SLFSMS (secondary logic unit index)	0E	C9	Internal				
SNADS distribution queue (SDQ)	0E	C2	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
SO (database file description)	19	01	External	YYS02	YYS02	WWDBFDT	
SO (space)	19	00	Machine interface	YYS02	YYS02	WWDBFDT	
SPADCT (spelling aid dictionary)	1C	01	External	YYS02	YYS02		
Space (SO)	19	00	Machine interface	YYS02	YYS02	WWDBFDT	
SPDCT (spelling aid dictionary)	1C	00	Machine interface	YYS02	YYS02		
Spelling aid dictionary (SPADCT)	1C	01	External	YYS02	YYS02		
Spelling aid dictionary (SPDCT)	1C	00	Machine interface	YYS02	YYS02		
SPLCB (spool control block)	19	C2	Internal	YYS02	YYS02	SPSCB	
Spool control block (SPLCB)	19	C2	Internal	YYS02	YYS02	SPSCB	
Spool file description (FILE)	19	01	External	YYS02	YYS02	WWODPRODT	
SNMTBL (system program name table)	19	C4	Internal	YYS02	YYS02	YYS02 contains names of most OS/400 modules and the library names where the modules reside.	

Table 25-2 (Page 14 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
SRAUTH (save/restore authorizations table)	19	CF	Internal	YYS02	YYS02	STAUTBL	WSRAUTBL
SRDS (save/restore descriptor space)	19	DB	Internal	YYS02	YYS02	WWSRDS	
SRMIDX (system resource manager index)	0E	C8	Internal				
SRMSPC (system resource manager space)	19	F3	Internal				
SSND (session description)	0E	05	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
Subsystem description (SBSD)	19	09	External	YYS02	YYS02	WDSBSD, WDSDATR, WDVATR, WDVRTG, WDVJOB, WTWCSBSD	
SYSBC (system control block)	19	D3	Internal	YYS02	YYS02	WWCSYSB	QWMSYSCB
SVAL (system value)	19	D2	Internal	YYS02	YYS02	WWSVAL, WCVALUES, WWSYSVAL	QWMSYSVAL
SWFL (system wide folder list)	0E	CD	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
SYSRPYL (system reply list)	19	D8	Internal	YYS02	YYS02		
SYSPRTI (system print image part numbers)	19	D6	Internal	YYS02	YYS02		
System/36 batch object (S36BCH)	19	F1	Internal	YYS02	YYS02		
System control block (SYSBC)	19	D3	Internal	YYS02	YYS02	WWCSYSB	QWMSYSCB
System entry point (SEPT)	19	C3	Internal	YYS02	YYS02	(List of pointers) This space object consists entirely of pointers (each pointer is 16 bytes long). Each entry in the table maps to a corresponding entry in QLINMTBL (librarian space object).	
System reply list (SYSRPYL)	19	D8	Internal	YYS02	YYS02		
System resource manager space (SRMSPC)	19	F3	Internal				
System print image part numbers (SYSPRTI)	19	D6	Internal	YYS02	YYS02		
System program name table (SNMTBL)	19	C4	Internal	YYS02	YYS02	YYS02 contains names of most OS/400 modules and the library names where the modules reside.	
System resource manager index (SRMIDX)	0E	C8	Internal				
System value (SVAL)	19	D2	Internal	YYS02	YYS02	WWSVAL, WCVALUES, WWSYSVAL	QWMSYSVAL

Table 25-2 (Page 15 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
System wide folder list (SWFL)	0E	CD	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
System/36 entry point table (S36EPT)	19	EA	Internal	YYS02	YYS02		
System/36 help object (S36HLP)	0E	CE	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
System/36 history object (S36HST)	19	EC	Internal	YYS02	YYS02		
System/36 index, index (S36IDX)	0E	CC	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
System/36 machine description (S36)	19	19	External	YYS02	YYS02		
S36 (System/36 machine description)	19	19	External	YYS02	YYS02		
S36BCH (System/36 batch object)	19	F1	Internal	YYS02	YYS02		
S36EPT (System/36 entry point table)	19	EA	Internal	YYS02	YYS02		
S36HLP (System/36 help object)	0E	CE	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
S36HST (System/36 history object)	19	EC	Internal	YYS02	YYS02		
S36IDX (System/36 index, index)	0E	CC	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
Table (TBL)	19	06	External	YYS02	YYS02		
Tape device file description (FILE)	19	01	External	YYS02	YYS02	WWODPRODT	
TBL (table)	19	06	External	YYS02	YYS02		
TCP/IP internal queue	0A	C7	Internal				
Temporary access group (QTAG)	01	EF	Internal	YYCAG1	YYMAG1	General usage	
Temporary data space (QTDS)	0B	EF	Internal	YYS02, YYDFT1, YYDPT1	YYS02, YYDFT1, YYDSA1, YYDSA2	General usage	
Temporary data space index (QTDSI)	0C	EF	Internal	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSLT11, YYCMP21	YYS02, YYSIT11, YYSIT21, YYSIT31, YYSIT11, YYINA1, YYINA2	General usage	
Temporary index (QTIDX)	0E	EF	Internal	YYS02, YYIXDT1	YYS02, YYIXDT1		
Temporary process control space (QTPCS)	1A	EF	Internal	YYS02	YYS02	General usage	
Temporary queue (QTQ)	0A	EF	Internal	YYS02, YYQTM1	YYS02, YYQTM1		
Temporary space (QTSP)	19	EF	Internal	YYS02	YYS02	General usage	
UFCB (user file control block)	19	D9	Internal	YYS02	YYS02	WWFUCB	
UFO (unfiled folder object)	19	E7	Internal	YYS02	YYS02		

Table 25-2 (Page 16 of 16). Object Types and Subtypes in Order by Object Description

Object Description	Type	Subtype	Object Class	Creation Template	Materialization Template	Object Content Mapping	Object Name
Unfiled folder object (UFO)	19	E7	Internal	YYS02	YYS02		
User file control block (UFCB)	19	D9	Internal	YYS02	YYS02	WWFUCB	
User index (USRINX)	0E	0A	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
User queue (USRQ)	0A	02	External	YYS02, YYQTM1	YYS02, YYQTM1		
User profile (USRPRF)	08	00	Machine interface	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
User profile (USRPRF)	08	01	External	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
User space (USRSPC)	19	34	External	YYS02	YYS02		
USRINX (user index)	0E	0A	External	YYS02, YYIXDT1	YYS02, YYIXDT1		
USRQ (user queue)	0A	02	External	YYS02, YYQTM1	YYS02, YYQTM1		
USRPRF (user profile)	08	00	Machine interface	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
USRPRF (user profile)	08	01	External	YYS02, YYUP11	YYS02, YYUP11	YYMAUO1, YYMAUO2, YYMAUO3, YYAUU1, YYAUU2, YYAUU3	
USRSPC (user space)	19	34	External	YYS02	YYS02		
VLIC LSF holder (VLICLSF)	19	ED	Internal	YYS02	YYS02		
VLICLSF (VLIC LSF holder)	19	ED	Internal	YYS02	YYS02		
WCBT (work control block table)	19	DO	Internal	YYS02	YYS02	WWWCBT	
WCBTRO (work control block table recovery object)	19	DD	Internal	YYS02	YYS02	YYMAUO1 (used once), YYMAUO2 (multiple use)	QJMQSCB
Work control block table (WCBT)	19	DO	Internal	YYS02	YYS02	WWWCBT	
Work control block table recovery object (WCBTRO)	19	DD	Internal	YYS02	YYS02	YYMAUO1 (used once), YYMAUO2 (multiple use)	QJMQSCB

T1 and T3

Chapter 26. OS/400 Trace Points and Descriptions

This appendix describes the trace information provided by the OS/400 T1 and T3 components. You can interface with these components using the TRCJOB, STRSRVJOB, and ENDSRVJOB commands. For more information about these commands, see "Trace Job Information" on page 17-7.

Trace Information for the T1 Component

Figure 26-1 shows an overview of the trace information for the T1 component. These trace points appear at 16 in Figure 17-5 on page 17-10.

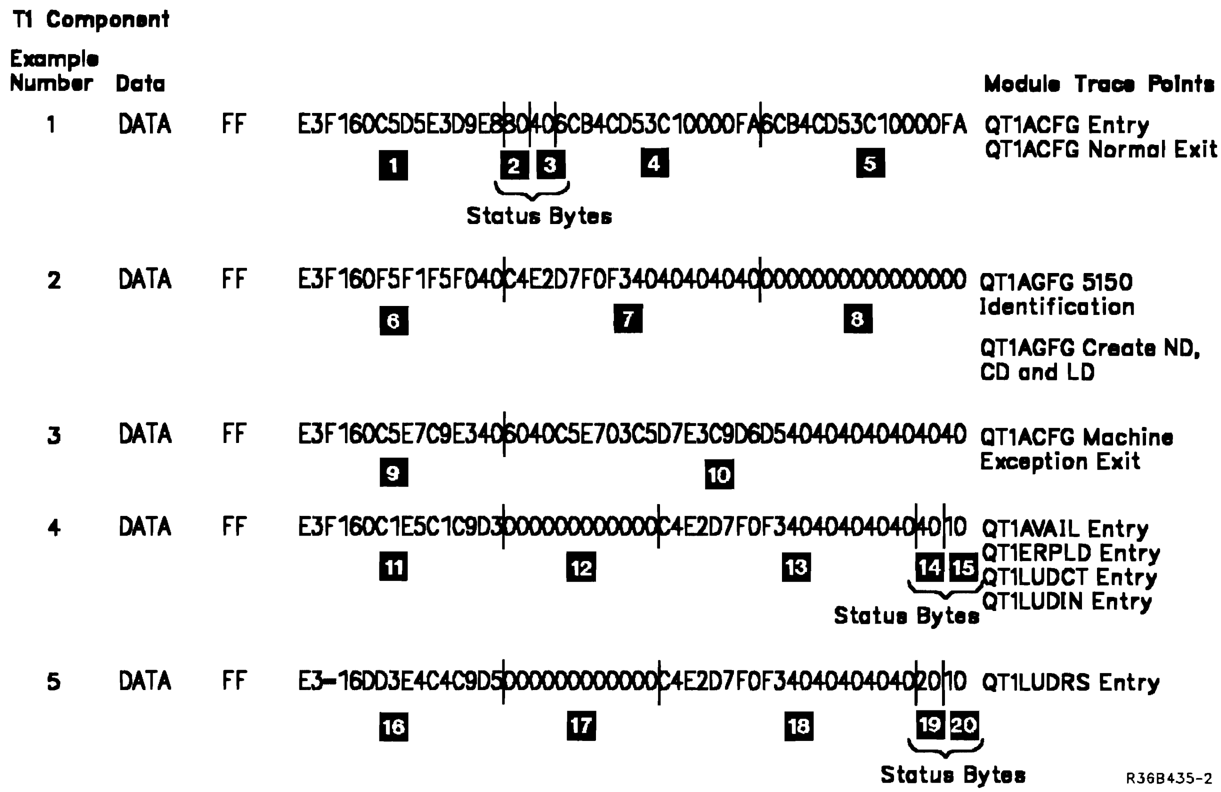


Figure 26-1. T1 Component Trace Examples

In general, each T1 trace entry contains two sections. The first section contains the trace point identifier and occupies the first 8 bytes of trace data. The second section contains the entry dependent data. The following list describes the T1 trace information.

QT1ACFG—Entry Trace Point: Upon entry to the module QT1ACFG, which runs in the QLUS process, trace data is taken which describes the current status of the automatic configuration processing. The information is taken from the LUD-ASP of the current 5150 device and event specific data from the T1 request auto- configuration event: 8100-38-01.

Example 1 in Figure E-1	Bytes	Description
1	1-8	Trace point ID: T1-ENTRY
2	9	Session status, see page 26-3
3	10	Configuration status, see page 26-3
4	11-18	Time stamp
5	19-26	Event specific data

QT1ACFG—5150 Identification Trace Point: After completing its initial checking, QT1ACFG makes a trace entry to indicate the name of the 5150 device that automatic configuration is taking place for. The information is presented in the following positions of the trace data.

Example 2 in Figure E-1 on page E-1	Bytes	Description
6	1-8	Trace point ID: T1-5150
7	9-18	5150 Device name
8	19-26	Reserved

QT1ACFG—Create ND Trace Point: If a TDLC ND is created by QT1ACFG, a trace point is taken to identify the name of the ND. The information is presented in the following positions of the trace data.

Example 2 in Figure E-1 on page E-1	Bytes	Description
6	1-8	Trace point ID: T1-CRTND
7	9-18	TDLC ND name
8	19-26	Reserved

QT1ACFG—Create CD Trace Point: If an APPC CD is created by QT1ACFG, a trace point is taken to identify the name of the CD. The information is presented in the following positions of the trace data.

Example 2 in Figure E-1 on page E-1	Bytes	Description
6	1-8	Trace point ID: T1-CRTCD
7	9-18	APPC CD name
8	19-26	Reserved

QT1ACFG—Normal Exit Trace Point: When exiting the module QT1ACFG normally, trace data is taken which describes the status of the automatic configuration processing. The information is taken from the LUD-ASP of the current 5150 device and the event specific data originally received.

Example 1 in Figure E-1 on page E-1	Bytes	Description
1	1-8	Trace point ID: T1-EXIT
2	9	Session status, see page 26-3
3	10	Configuration status, see page 26-3
4	11-18	Time stamp
5	19-26	Event specific data

QT1ACFG—Machine Exception Exit Trace Point: If any machine check exceptions occur during the execution of QT1ACFG, a branch point exception handler is invoked. The trace data taken in the exception handler is as follows.

Example 3 in Figure E-1 on page E-1	Bytes	Description
9	1-8	Trace point ID: T1-EXIT
10	9-26	Exception

QT1AVAIL—Entry Trace Point: When the module QT1AVAIL has established the addressibility to the LUD associated space for the current LU7 device, the following information is taken:

Example 4 in Figure E-1 on page E-1	Bytes	Description
11	1-8	Trace point ID: T1-AVAIL
12	9-14	Reserved
13	15-24	LU7 device name
14	25	Session status, see page 26-3
15	26	Configuration status, see page 26-3

QT1ERPLD—Entry Trace Point: When the module QT1ERPLD has established the addressibility to the LUD associated space for the current 5150 device, the following information is taken.

Example 5 in Figure E-1 on page E-1	Bytes	Description
16	1-8	Trace point ID: T1-ERPLD
17	9-14	Reserved
18	15-24	5150 device name
19	25	Session status, see page 26-3
20	26	Configuration status, see page 26-3

QT1LUDCT—Entry Trace Point: When the module QT1LUDCT has established the addressibility to the LUD associated space for the current 5150 device, the following information is taken.

Example 4 in Figure E-1 on page E-1	Bytes	Description
11	1-8	Trace point ID: T1-LUDCT
12	9-14	Reserved
13	15-24	5150 device name
14	25	Session status, see page 26-3
15	26	Configuration status, see page 26-3

QT1LUDIN—Entry Trace Point: When the module QT1LUDIN has established the addressibility to the LUD associated space for the current 5150 device, the following information is taken.

Example 4 in Figure E-1 on page E-1	Bytes	Description
11	1-8	Trace point ID: T1-LUDIN
12	9-14	Reserved
13	15-24	5150 device name
14	25	Session status, see page 26-3
15	26	Configuration status, see page 26-3

QT1LUDRS — Entry Trace Point: When the module QT1LUDRS has established the addressibility to the LUD associated space for the current 5150 device, the following information is taken.

Example 5 in Figure E-1 on page E-1	Bytes	Description
16	1-8	Trace point ID: T1-LUDRS
17	9-14	Reserved
18	15-24	5150 device name
19	25	Session status, see page 26-3
20	26	Configuration status, see page 26-3

T1 Session Statuses

The following list defines valid values for the T1 session status used in several T1 trace points.

Status	Meaning
80	Active session status
40	Activate resource pending
20	Varied on, no contact made
10	Error recovery pending
01	Contact pending

T1 Configuration Statuses

The following list defines valid values for the T1 configuration status used in several T1 trace points.

Status	Meaning
80	Configuration complete
40	Configuration pending
20	Initialization pending
10	Not configured
01	Configuration failed

Trace Information for the T3 Component

Figure 26-2 on page 26-4 shows an overview of the trace information for the T3 component. These trace points appear at 16 in Figure 17-5 on page 17-10.

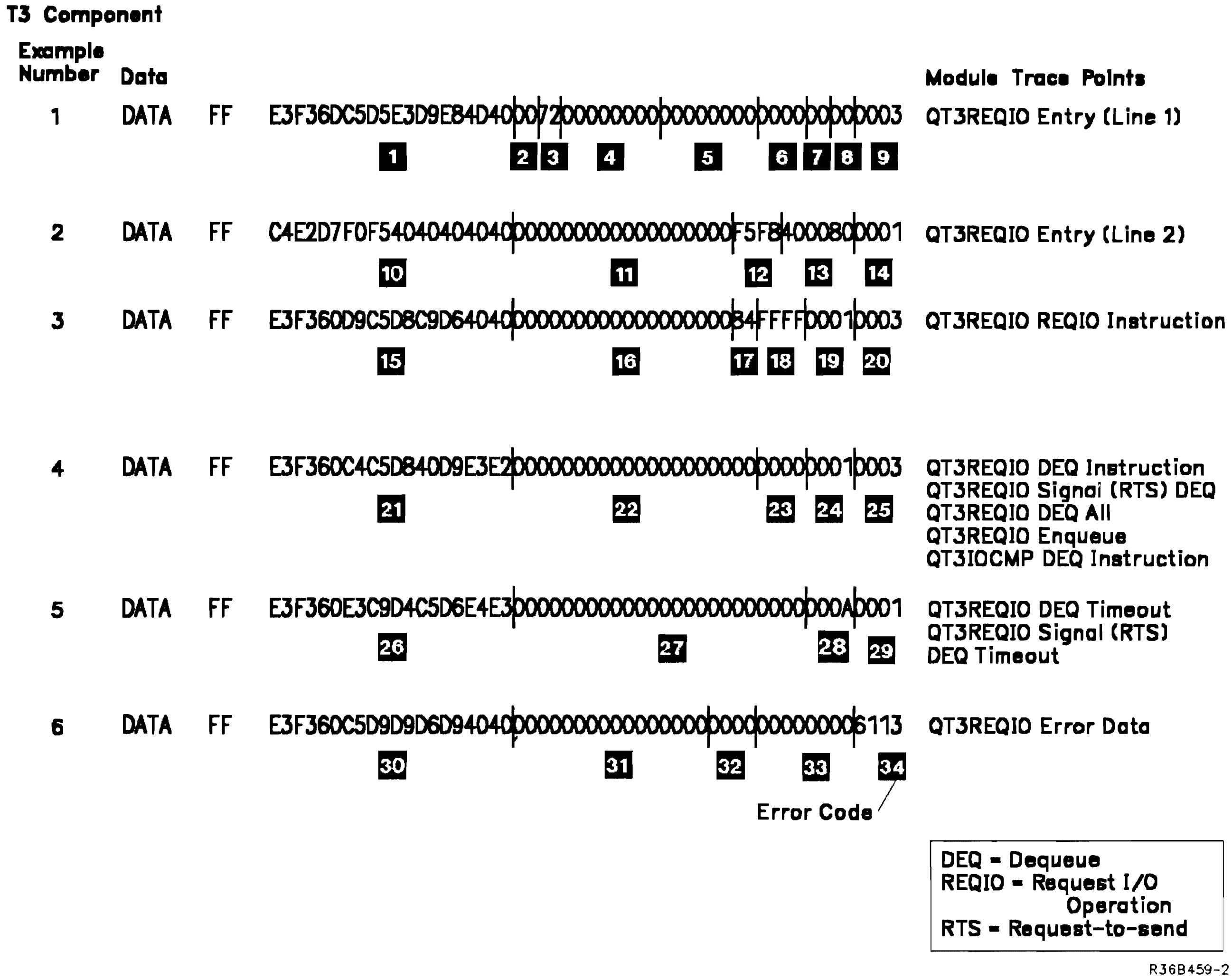


Figure 26-2. T3 Component Trace Examples

The following list describes the T3 trace information. In general, each T3 trace entry contains two sections. The first section contains the trace point identifier and contains the first 10 bytes of the trace data. The second section contains the entry dependent data.

QT3REQIO — Entry Trace Point (Line 1): Upon entry to the module QT3REQIO, trace data is taken describing the current request. This trace point produces two lines of trace information. The information for the first line is taken from the request block and is in the following positions in the trace data.

Example 1 in Figure E-2	Bytes	Description
1	1-10	Trace point ID: T3-ENTRY
2	11	Reserved
3	12	T3 function code, see page 26-6
4	13-16	Transmit data length in hex
5	17-20	Requested receive data length in hex
6	21-22	Function option indicators
7	23	Request descriptor subcommand
8	24	DBCS indicators
9	25-26	Request block number

QT3REQIO — Entry Trace Point (Line 2): The information for the second line of data for this trace point is taken from the LUD associated space. The format of the second line is as follows:

Example 2 in Figure E-2 on page E-4	Bytes	Description
10	1-10	Device name
11	11-19	Reserved
12	20-21	QT3REQIO revision code
13	22-24	Current T3 status table
14	25-26	Number of outstanding requests

QT3REQIO — REQIO Instruction Trace Point: Immediately before the REQIO MI instruction, trace point information is taken showing portions of the VLIC structures built for this request. This information is presented in the following positions in the trace data.

Example 3 in Figure E-2 on page E-4	Bytes	Description
15	1-10	Trace point ID: T3-REQIO
16	11-19	Reserved
17	20	SSR function code
18	21-22	Number of transmit request descriptors built
19	23-24	Total number of request descriptors built
20	25-26	Request block number

QT3REQIO — DEQ Instruction Trace Point: After the DEQ MI instruction, trace point information is taken showing portions of the VLIC feedback information for this request. The information is presented in the following positions in the trace data.

Example 4 in Figure E-2 on page E-4	Bytes	Description
21	1-10	Trace point ID: T3-DEQUEUE
22	11-20	Reserved
23	21-22	VLIC error summary feedback code
24	23-24	Number of request descriptors processed
25	25-26	Request block number

QT3REQIO — Signal (Request-to-Send) Dequeue Trace Point: As part of the processing for the quiesce, interrupt, and retract functions, QT3REQIO issues a Signal (Request-to-Send) command. When the response to this command is dequeued from the MI response queue, trace point information is taken showing portions of the VLIC feedback data for this request. The information is presented in the following positions in the trace data.

Example 4 in Figure E-2 on page E-4	Bytes	Description
21	1-10	Trace point ID: T3-DEQ RTS
22	11-20	Reserved
23	21-22	VLIC error summary feedback code
24	23-24	Number of request descriptors processed.
25	25-26	Request block number.

QT3REQIO — Dequeue All Trace Point: As part of the processing for the quiesce, interrupt, and retract functions, QT3REQIO attempts to dequeue all outstanding requests. If a request is dequeued during this processing, trace point information is taken showing portions of the VLIC feedback data for this request. The information is presented in the following positions in the trace data.

Example 4 in Figure E-2 on page E-4	Bytes	Description
21	1-10	Trace point ID: T3-DEQ ALL
22	11-20	Reserved
23	21-22	VLIC error summary feedback code
24	23-24	Number of request descriptors processed.
25	25-26	Request block number.

QT3REQIO — Enqueue Trace Point: As part of the processing for the resume function, QT3REQIO may enqueue a completed request back on to the MIRQ. This request is dequeued by the interrupted call. Trace point information is taken showing portions of the VLIC feedback data that was received for this request. The information is presented in the following positions in the trace data.

Example 4 in Figure E-2 on page E-4	Bytes	Description
21	1-10	Trace point ID: T3-ENQUEUE
22	11-20	Reserved
23	21-22	VLIC error summary feedback code
24	23-24	Number of request descriptors processed.
25	25-26	Request block number.

QT3REQIO — Dequeue Timeout Trace Point: When a dequeue operation exceeds its timeout value, trace point information is taken showing the current timeout value and the current request block. The information is presented in the following positions in the trace data.

T1 and T3

Example 5 in Figure E-2 on page E-4	Bytes	Description
26	1-10	Trace point ID: T3-TIMEOUT
27	11-22	Reserved
28	23-24	Dequeue time out value in seconds.
29	25-26	Request block number.

QT3REQIO — Signal (Request-to-Send) Dequeue Timeout Trace Point: When a dequeue operation for a signal-request-to-send operation exceeds its time out value, trace point information is taken showing the current timeout value and the current request block. The information is presented in the following positions in the trace data.

Example 5 in Figure E-2 on page E-4	Bytes	Description
26	1-10	Trace point ID: T3-SG FAIL
27	11-22	Reserved
28	23-24	Dequeue time out value in seconds.
29	25-26	Request block number.

QT3REQIO — Error Data Trace Point: When an error condition has been detected by QT3REQIO, trace point information is taken showing the error code being returned in the current request block. The information is presented in the following positions in the trace data.

Example 6 in Figure E-2 on page E-4	Bytes	Description
30	1-10	Trace point ID: T3-ERROR
31	11-18	Reserved
32	19-20	VLIC error summary feedback code
33	21-24	Device detected error code
34	25-26	T3 detected error code, see page 26-7

QT3IOCMP — DEQ Instruction Trace Point: When processing asynchronous input, QT3IOCMP dequeues the completed request. Before calling QT3REQIO to process this data, trace point data is taken to show portions of the VLIC feedback information for this request. The information is presented in the following positions in the trace data.

Example 4 in Figure E-2 on page E-4	Bytes	Description
21	1-10	Trace point ID: T3-IO CMPL
22	11-20	Reserved
23	21-22	VLIC error summary feedback code
24	23-24	Number of request descriptors processed
25	25-26	Request block number

T3 Function Codes

The following list defines the T3 function codes used in the QT3REQIO entry trace point.

Code
Description

71 Transmit data

Send user data to the device and either synchronously or asynchronously wait for an acknowledgement that the data was received.

72 Quiesce

Interrupts an outstanding active request and returns it to the FM. The request is eligible to be reinstated using the Resume function. When the request is reinstated, a Read command is sent to the device.

73 Transmit or receive data

Send user data to the device and either synchronously or asynchronously receive response data from the device.

74 Retract

Interrupts an outstanding active request and returns it to the FM. The request is not eligible to be reinstated.

75 Interrupt

Interrupts an outstanding active request and returns it to the FM. The request is eligible to be reinstated using the resume function. When the request is reinstated, a write-to-display (unlock keyboard) and Read command is sent to the device.

76 Process dequeued data

This function is used by QT3IOCMP when calling QT3REQIO after it has dequeued the request block. It is also used as an internal routing code with the QT3REQIO module.

77 Resume

The complimentary function to quiesce and interrupt functions. The request that was interrupted is resumed at the point of interruption.

78 Receive unsolicited data

This function code is used by QT3UNSOL when calling QT3REQIO to retrieve unsolicited data. QT3UNSOL is called from QWTPECTL to handle the unsolicited data available events 000B-05-01 and 000B-05-02.

79 Allocate device

Establishes a bound active session with the target work station device. The allocate may be performed either synchronously or asynchronously.

80 Deallocate device

End the bound active session with the target work station device. The deallocate function is performed synchronously.

81 Process error summary feedback code 402D or 400D

This function is used for internal routing within QT3REQIO.

C9 Signal

Send a Signal Command to the device on the expedited flow. This function can be utilized to turn the message waiting indicator on or off.

T3 Error Codes

The following list defines the T3 error codes which may be found in the QT3REQIO error data trace point.

Code
Description

0000 Normal completion

This indicates that no T3 errors were detected. VLIC and device-detected errors may still be returned.

6100 Unsupported function code

A function code was passed to T3 that is not defined.

6101 Invalid signal command

A signal command was passed to T3 that could not be interpreted.

6102 Device allocation already requested

An allocate was received while a previous allocate command request was still outstanding.

6103 Device not allocated

A request was issued while there was not a bound active session with the device.

6104 Session not in send state

A transmit or transmit or receive could not be issued because the change direction indicator was outstanding.

6105 Device currently allocated

An allocate was received while a bound active session already existed with the device.

6106 Auto-configuration in progress

An allocate was issued while auto-configuration was in process.

6107 Read command not found

A Read command was not found in the original quiesced or interrupted data stream so the request could not be resumed.

6108 Previous error pending

A previous invocation of QT3REQIO had detected an error.

6109 Too much data received

More data was returned from a transmit or a receive operation than the FM was willing to receive.

6110 Device currently deallocated

A deallocate was received while a bound active session did not exist and an allocate request was not outstanding.

6111 Expedited flow request outstanding

A signal command was received while another signal command was still outstanding.

6113 Retrieve too late

A quiesce, interrupt, or retract request was received after the previously outstanding request had completed.

6114 Parameter error in LUSTAT

Unregonized parameters were received with a LUSTAT.

6115 Invalid number of RDS built

The proper number of send, receive, and response RDs could not be built to accomodate the requested function.

6130 Recoverable SNA error received

A message has been received from the device which indicates that a recoverable error has been detected by the remote device.

6132 MODLUD failed

A MODLUD MI instruction failed because of a machine check exception.

6136 Extraneous response received

A response was received from the device while there was no outstanding normal flow requests.

6138 Send state not achieved

The change direction indicator could not be recovered during an attempt to quiesce, interrupt, or retract an outstanding request.

T1 and T3

6139 Too many request blocks quiesced

More than one outstanding request was found during a quiesce, interrupt, or retract.

6140 Request shutdown received

A request shutdown was received from the device.

6141 Wait not allowed for chain-and-a-half

A synchronous request using chain-and-a-half support was received but chain-and-a-half support may only be used asynchronously.

6142 Partial chains not allowed

A request to use chain-and-a-half support was received from a non-printer device.

6145 Normal flow request outstanding

A normal flow request was received while another normal flow request was still outstanding.

6150 Partial chain received

A partial chain was received from the device when the FM indicated that partial chains were not supported.

6151 FM function check enqueued

A previous quiesce or resume operation had enqueued a 200F error summary feedback code on the MI response queue.

6155 Dequeue instruction timed out

A DEQ MI instruction failed to complete within the specified time.

6156 Device failed or in recovery

The device has been marked as having failed or is in the process of recovery.

Part 7. General Licensed Internal Code Information

Chapter 27. Structure of VLIC Tasks and Processes

For an overview of tasks and processes, see Chapter 22 on page 22-1.

At any one time, several dispatchable units, called tasks, compete for the resources of the machine. Competition for the CPU is managed at the lowest level by functions built into IMP. The status of a task is described by a task dispatching element (TDE). A TDE is 512 bytes long and is resident in main storage throughout its use. The first 168 bytes contain IMP fields used by the HLIC for task control. The next 344 bytes contain VLIC fields needed for all TDEs.

There are two types of tasks in the machine:

- VLIC tasks
- System processes

VLIC Tasks

A VLIC task is created to perform work asynchronous to AS/400 instructions. Examples are storage management tasks and I/O managers (IOMs). These tasks may or may not require a task invocation work area (IWA). If a VLIC task requires the use of an IWA, the IWA segment contains, besides the standard segment header, a task control block (TCB) that contains work areas required by the VLIC routines. Figure 27-1 illustrates the building blocks of the various types of tasks in the AS/400 system.

For a list of VLIC tasks, see "List of Licensed Internal Code Tasks" on page 27-10.

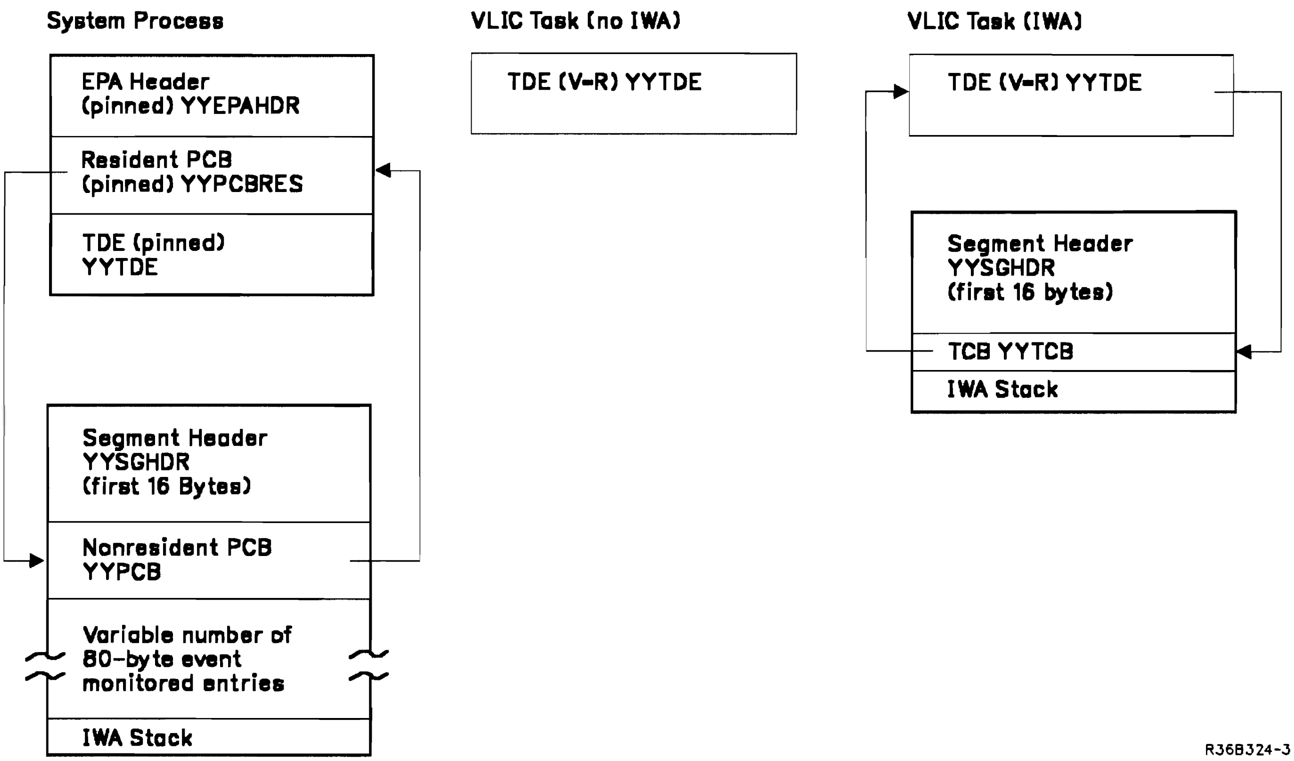


Figure 27-1. Structure of Processes and Tasks

System Processes

The system process is built from an initiate process instruction and is the only type of task that is visible to the system machine interface. A system process is assembled from information contained in the process definition template (PDT). The *create* process control space instruction builds a PCS. It creates a 2-page segment containing the encapsulated program architecture (EPA) header. It also builds a second segment, which may reside in an access group and is pointed to from the first segment.

When the process is initiated, a TDE is built in the second page of the 2-page PCS segment. A PCB, which completely describes the process, is then built in two sections. The resident PCB is built in the second 256 bytes of the first page of the 2-page PCS segment. Both pages of the 2-page segment are pinned. The resident PCB contains fields that may have to be referred to asynchronously by other processes. The remainder of the PCB, termed the nonresident PCB, follows the 16-byte segment header in the second segment of the PCS. The PCB is followed by a variable number of 80-byte event entries (0 to 256). Following these 80-byte entries is the IWA. The IWA is a block of storage that is managed by VLIC as a stack. IWA is used for automatic storage needed by VLIC routines for all current encapsulated program invocations under the process that is running.

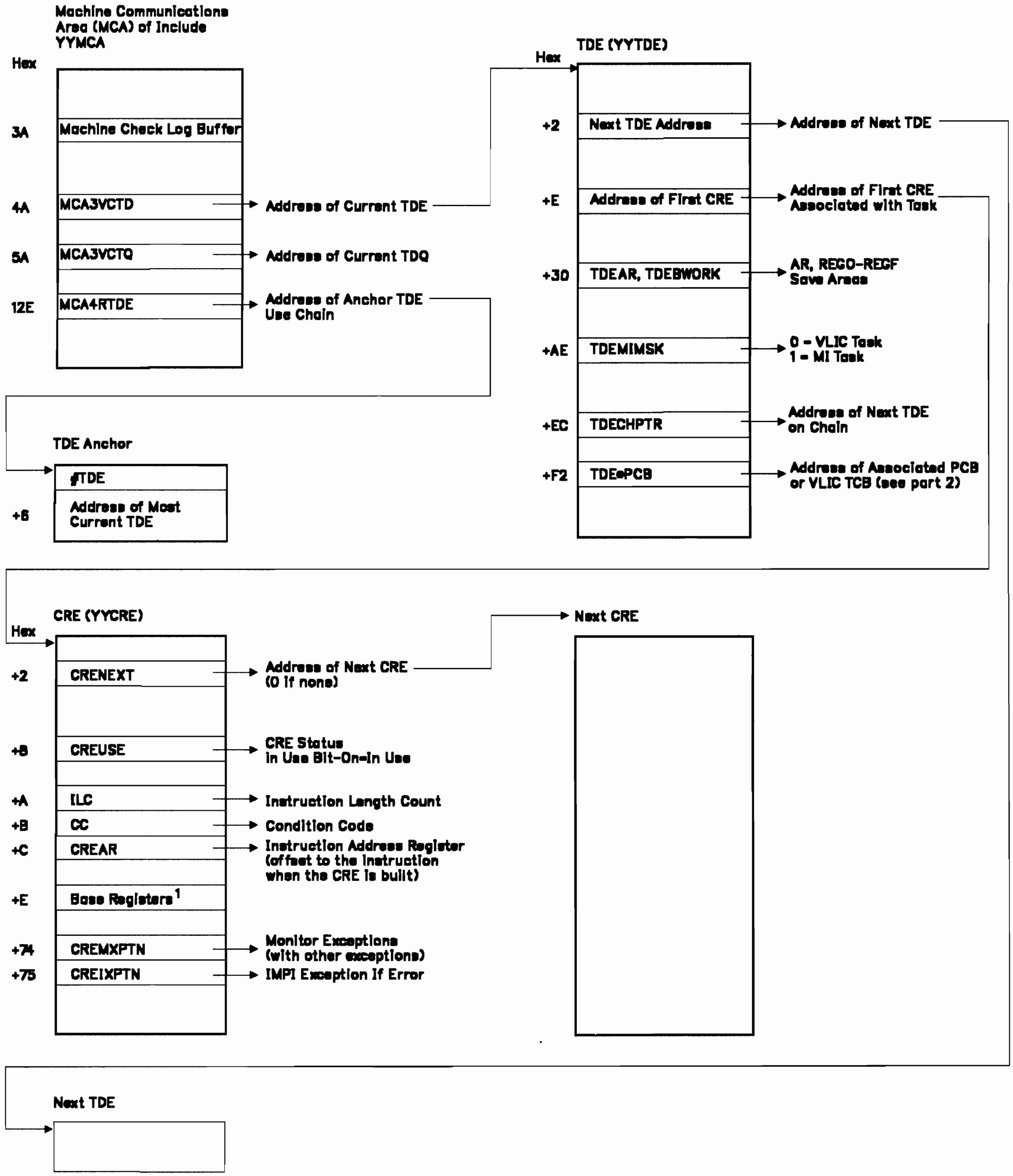
A system process runs translator-generated system programs and VLIC routines linked to these programs.

Finding a Task

The task dispatching element (TDE) of a task, as they appear in a dump, is formatted and is easy to locate. Figure 27-2 on page 27-3 shows the structure of a task and Figure 32-2 on page 32-4 shows the format of a TDE. Tasks may be located in the following ways:

- Using display/alter/dump under DST or SST
- Main storage dump
- Stand-alone main storage dump (function 22 on the control panel), if an IPL is needed again.
- Stand-alone CPU stop and CPU display (functions 50 and 51 on the control panel)
- Print stand-alone dump service function using DST

  It is possible to find all active tasks by locating the active task dispatching element (TDE) chain. The active TDE chain is pointed to by MCA4RTDE that is in the machine communications area.
- The chain header consists of the number of active tasks (2 bytes) and a pointer to the most recently created task (or initiated process). The remaining tasks are chained by field TDECHPTR that is in the TDE.



[1] R0 Base Address of the program running when the CRE was built
R1 Parameter pointer
ACB pointer
R2 PSSA/PASA
R3 Address of ICB of the program running when the CRE was built

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Figure 27-2 (Part 1 of 6). Task Structure Overview

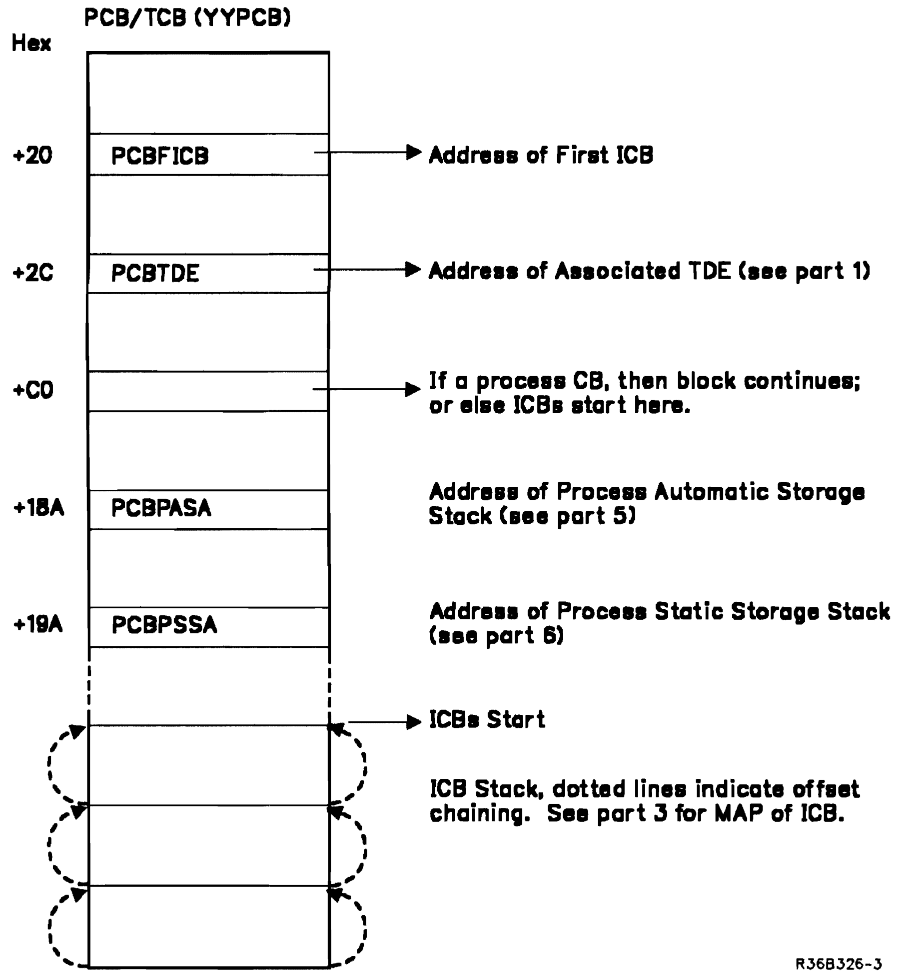

Figure 27-2 (Part 2 of 6). Task Structure Overview

ICB(YYAIICB)

Hex	Field	Description
+0	AIIFWD	Offset to next ICB space
+4	AIIBKWD	Offset to previous ICB
+6	AIITYPE	1 = ICB for MI Program; 0 = ICB for VLIC Program (Bit 7)
+18	AIIREGSV	Save area for registers 1 through 15, end of block if a VLIC ICB
+72	AIIPCB	Address of PCB if MI ICB (see part 2)
+78	AIIIAR, AIIBREGO	IAR, REGO value (used for return) if MI ICB
+86	AIIACB	Address of activation information in program if MI ICB
+8C	AIIPSSA	Address of PSSA entry containing the state of the data for the program (0 if none) if MI ICB
+92	AIIPASA	Address of PASA entry containing the automatic data for program if MI ICB (see part 5)
+C6	AIIPASAN	Address of next PASA entry or the next available PASA entry location if MI ICB
+CE	AIIIVMK	Invocation mark count if MI ICB
+D2	AIIINVN	Invocation number if MI ICB
+D5	AIIINVT	Invocation type if MI ICB

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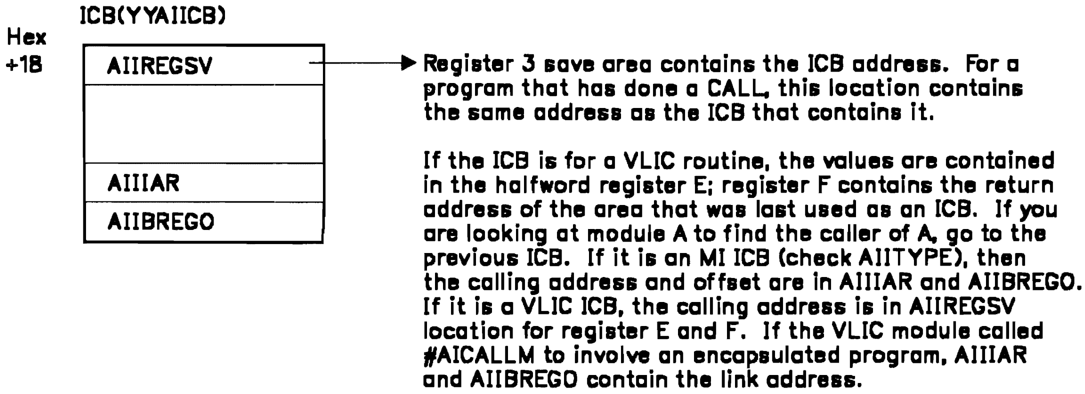
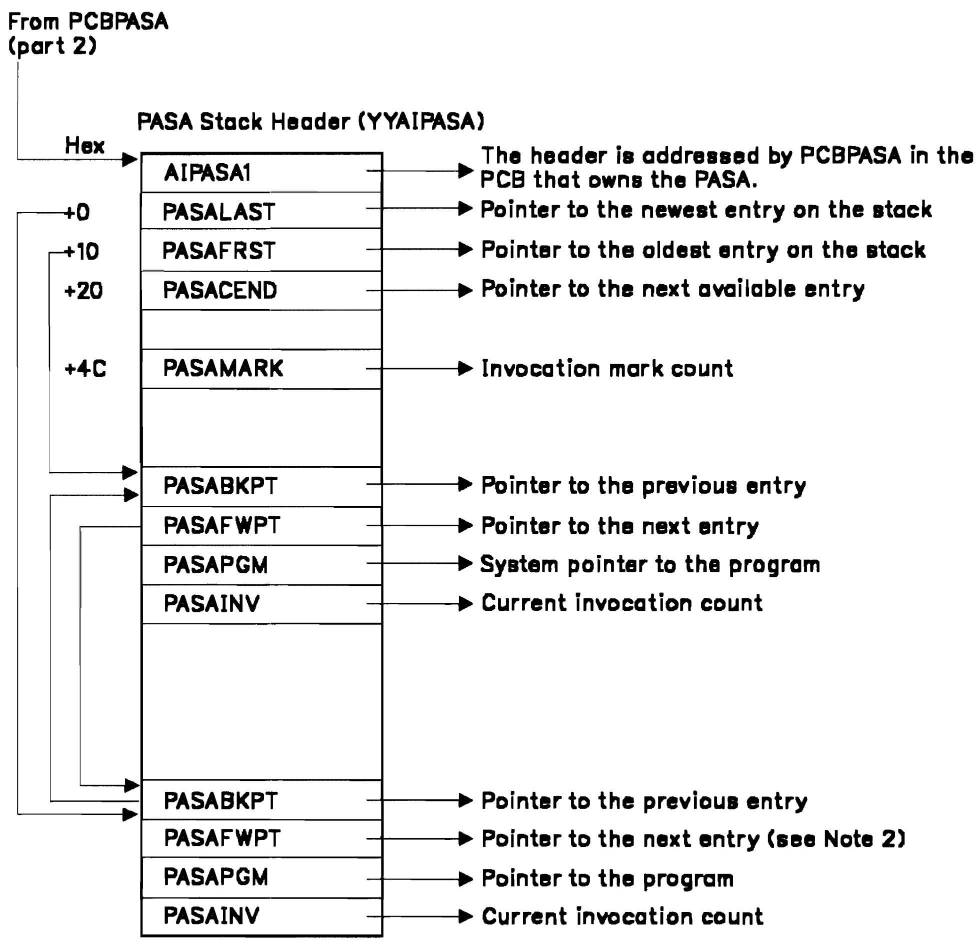
Figure 27-2 (Part 3 of 6). Task Structure Overview



R36B328-2

Figure 27-2 (Part 4 of 6). Task Structure Overview



Notes:

1. PASA entry is addressed by AIIPASA out of ICB for the program using the space.
2. Value may not be set in last PASA on chain.
3. The information in the above fields is up-to-date when the AIIPASAU = 1 in the associated MI ICB.

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Figure 27-2 (Part 5 of 6). Task Structure Overview

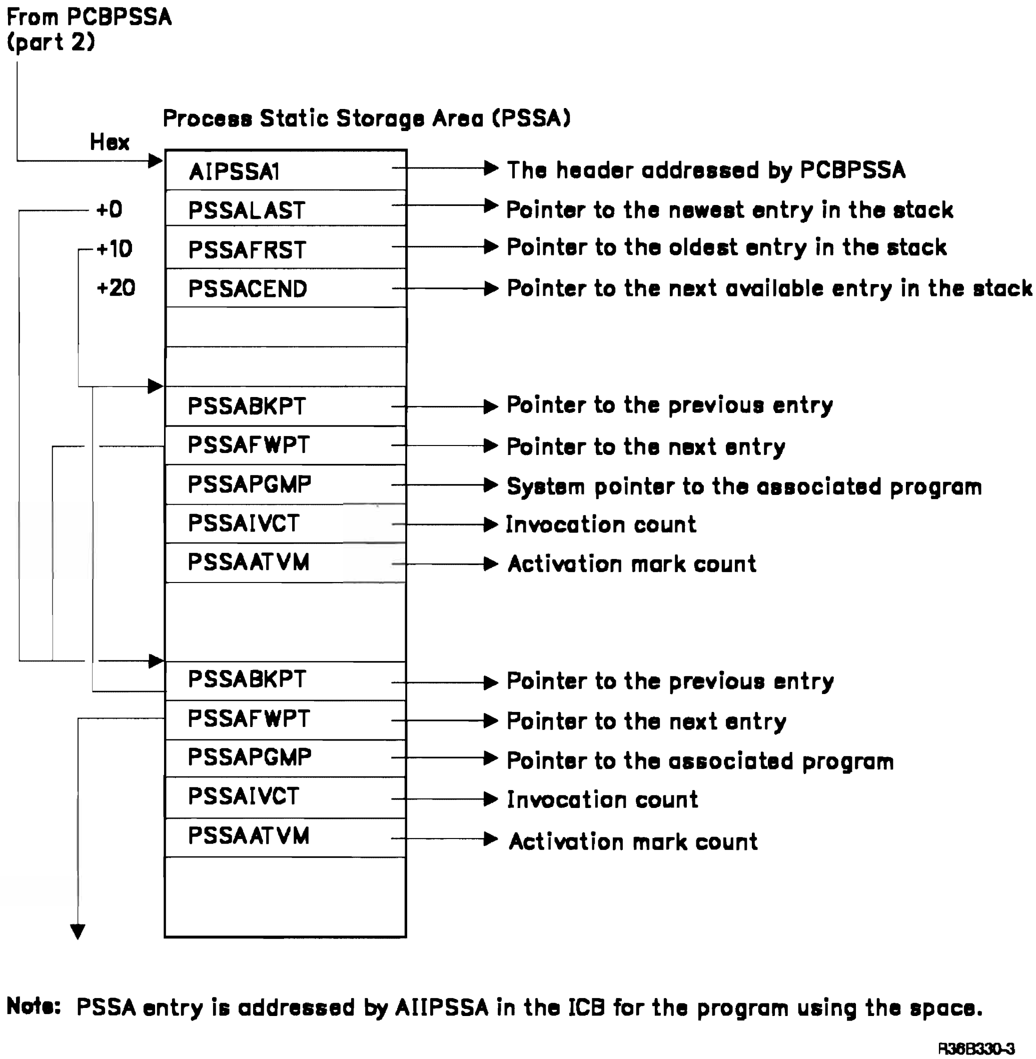

Figure 27-2 (Part 6 of 6). Task Structure Overview

Identifying Tasks

Processes are identified by TDEMIMSK being on. They are easily recognized because their TDEs have addresses of the form XXXXXX000200. VLIC task TDEs have V=R addresses of the form 8000XXXXXX00. The way AS/400 jobs are associated with a process TDE is defined under active jobs on page 22-8.

VLIC tasks contain a 6-byte task name either at TDE@PCB if the task has no IWA or at TCBNAME, where the TCB structure is located by TDE@PCB. For an explanation of VLIC tasks names, see "List of Licensed Internal Code Tasks" on page 27-10.

Current Task Status

The TDE for any task or process is always in one of the following states:

1. On the prime task dispatching queue (TDQ)

   The address of the prime TDQ is in MCA3VCTQ in YYMCA.

   a. Executing or the last to execute (TDE address in MCA3VCTD).
   b. Waiting for the processor in priority sequence (on the prime TDQ). TDEs on a TDQ are chained using TDE@NEXT. TDE@NEXT can be found in the YYTDE include.
   c. Just having signaled (or was executing or was last to execute when hardware or HLIC signaled) a machine check, placing the processor in the check stop state.

   Note: MCA3VCTD locates this task.

2. On an send/receive queue (SRQ) or send/receive counter (SRC)

   SRQs and SRCs are used for communication and synchronization within the system. When TDEs are waiting on an SRQ or an SRC, the first TDE is located at the SRQ or SRC offset plus 2 bytes. The next TDE can be found by looking at the TDEs offset plus 2 bytes.

3. On a TDQ, other than the prime TDQ, MI processes that are in the ineligible state are placed on a queue (enqueued) located in the field name MPLMINEQ of structure RMMPLM. The RMMPLM structure is contained in the VLIC #RMMPLM module.
4. The TDE could be waiting for I/O to be completed and not be waiting on a queue

   These TDEs *are located* by using the address at offset hex 12 in the I/O request message (IORM) waiting for service on an HLIC managed I/O queue. The TDE status is stored in the TDE and is enqueued to the prime TDQ when the current I/O is completed. This state is call storage management I/O wait and is indicated when bit TDESNDMW equals 1. That is:

I/O wait	011XXX1X binary
Not I/O wait	011XXX0X binary

Statuses or States	Description

1a If the current task status is waiting for the processor in priority sequence (on the prime TDQ), the current status of the task (registers, IAR) is in the CPU if bit TDEUSE is off.

It is important to remember that if the TDEUSE bit is off, the task status in the TDE is not accurate. The existing status represents the condition that existed the last time the TDE gave control of the CPU to another task. Since that time, the TDE could have performed many operations such as SVL, SVX, or it could have gone in and out of a wait state if no other task had gained control.

1a, 1b, 2 If TDEUSE is on, the status is in the dispatcher call/return element (CRE) located in the TDE (bytes hex 2C-91). Register B0 (base register) contains the identity of the module that is executing.

Note: The dispatcher CRE is part of the TDE, not part of the CREs that are chained to the TDE by the TDE@CRE.

If executing in a VLIC module (B0 = hex 8000 XXXX XXXX, 0000 04XX XXXX, 0000 0BXX XXXX, or 00000FXXXXXX), the module can be determined by:

- Looking for the address in a VLIC link map.
- Looking at the module in main storage. Within 10 or 20 bytes of the front of the module there is an EBCDIC module name.
- Using the find VLIC module function of display/alter/dump (D/A/D), enter the address of the module and then the name of the module is displayed.

If executing an encapsulated program, the program might be identified by using a MAP or the program name can be taken from the field name EPAHNAME, where the include YYEPAHDR is based on B0. This module determination procedure applies to any control block (for example CRE, ICB), which identifies module B0 values. In state 2, the B0 IAR value in the CRE locates the receive message (RECM) or receive count (RECC) IMP instruction, which placed the process in a wait state.

1c If the status of the executing task immediately preceding the placing of the processor in the checkstop state is contained in the machine check log buffer (MCLB) (include MCLB, located by MCA2RMLB) see Chapter 34 on page 34-1 to extract information from the MCLB and see Appendix C for information about the codes shown on the control panel.

2 Determination of the SRQ or SRC waited on, might be important in analyzing a problem. The most likely places for TDEs to be waiting are:

- VLIC tasks: Each VLIC task has at least one normal place to be waiting. Also, a VLIC task could be waiting on any of the internal queues and counters described later.
  - Storage management tasks
    - Asynchronous I/O task waits on queue SMAIOINQ in SMVTN for new work from a user task
    - Page-out tasks wait on the counter SMTHL in SMVTN (module #SMSMVTN) for sufficient work to trigger activation
  - Resource management tasks
    - Service task waits on an SRQ in module #RMMPLM (EP #RMSVQ) for messages representing work
    - Clock comparator task waits on an SRC for clock comparator (located by MCA2VSCC)
    - Busy task waits on an SRC for interval timer (located by MCA2VSIT)
  - Source/sink tasks
    - I/O manager (IOM) task waits on its input queue.
    - Load dump task waits on its input queue
    - Error log task waits on an SRQ in module #ITTASKS (located by MCA4VELQ)
    - Machine services control point (MSCP) task waits on the SRQ in source/sink device list (SSADL) (address hex 0000 0800 0000)
  - Miscellaneous VLIC tasks
    - VLIC log task waits on the SRQ in segment hex 0000 2F00 0000 if waiting for work

- AS/400 processes: Processes can be in one of four states:
  - Active state
    - Task dispatching queue (TDQ)
    - Waiting on internal VLIC queue or counter, or in storage management I/O wait; see "Internal VLIC Queues and Counters."
  - Ineligible state
    - Enforcement of resource management rules on the multiprogramming level has placed the process in the ineligible state pending a wait or timeslice end of some other process. The process is enqueued on a TDQ located in module #RMMPLM.
  - Wait state

    The process has issued an instruction which places it in a wait state:
    - Wait on event. The process is on an SRQ in a 128-byte block of machine-wide storage (MWS). This includes waiting on a timer event and also the WAITTIME MI instruction.
    - Dequeue. The process is waiting on an SRQ (QCBSRQ in the ZZPMQCB include) in an AS/400 queue object
    - Lock. SRQ in #RMLKD
    - Set cursor. SRQ in #RMLKD (for update)
  - Suspended state

    A suspend process instruction has been issued against the process. The process is waiting on an SRQ in #PMDPROF, with the external name #PMSVQ.

Internal VLIC Queues and Counters

The following is a list of internal VLIC queues and counters:

- Seize wait counter (offset hex D4 in TDE)

  A TDE is waiting for a seize (internal locking protocol) request to be granted.
- Storage management lock

  A set of SRCs in module #SMSMVTN at offsets hex 0 through 90.
- Process interrupt SRC

  Synchronization during process interrupt processing. (PCBITSRC is an the serialization send/recevie queue found in the YYPCBRES include).
- Machine-wide storage counter

  Synchronize access to machine-wide storage tables during allocation/deallocation.
- Busy exception handling

  The SRC in #RMBSYX is waiting for a send from a busy task to trigger a retry of the instruction against the busy queue or the hash table.
- ACQ (available CRE queue)

  ACQ (located in #ITTASKS by MCA2RACQ) waiting for CREs to be placed on the ACQ for exception/SVL processing.
- Clock comparator lock

  An SRC in the #RMCCDX.
- Event index SRC

  An SRC in the #RTVCA (VLIC communication area) to serialize accesses to the event.
- Process management SRC

  An SRC in the #RTVCA to serialize access to subprocess linkages in a process control block (PCB) located in VCAPMSRC.
- Active TDE chain SRC

  An SRC used to serialize chaining operations to the active TDE chain (external name RMTDESRC in #ITTASKS).
- AS/400 queue available message queue

  An SRQ embedded in an AS/400 queue that contains available messages to be enqueued to the response queue.
- Lock wait processing

  A set of SRCs and SRQs in module #RMLKDX.
- IWA counter

  Synchronize access to IWA extension work area (an SRC in #CFIWATB).

Execution Sequence Leading to Current State

The chain of active CREs (bit CREUSE on) anchored from the TDE (TDE@CRE and chained to CRENEXT) indicates the sequence of SVLs and exceptions leading to the current state. The first active CRE encountered on the chain is the most recent, followed by the next most recent, and so forth. (It is possible to have no chain or no active CREs on the chain.) To determine the sequence of each active CRE:

- If field CREXCEPT (offset hex 74) equals hex 0000, the CRE represents an SVL. Using B0 plus the IAR in the CRE, minus CREILC (the instruction length), find the operation code.
  - If the operation code is hex 3F, 5D, or DF, the instruction is an explicit SVL. The I-byte (following the operation code) indicates the SVL number.

Tasks and Processes

Use this number to index into the SVL router table (#SVTABLE) to determine the function.

- If the I-byte is hex 5D, see the SVL5D interface.
- If the operation code is hex 1F, a maskable SVL has been enabled to service a process interrupt (for example, event scheduling).
- If the operation code is hex 5B, it is a call trace SVL.
- For any other operation code, the instruction is an implicit SVL. See the Chapter 33 on page 33-1 for more information on how to use the operation code as an index.

- If field CREXCEPT does not equal hex 0000, see Chapter 29 for a description of the meaning of each of the codes.

The address of the last encapsulated program to execute (and the offset within that program) for any AS/400 process is almost always contained in either the TDE CRE or the first active CRE encountered with a non-VLIC address in register B0. This is true because all linkages from encapsulated programs to VLIC code involve an SVL. The exception to this is the linkage through the instruction FNC2 to the module #SV78CLL which supports external calls. The TDE and CRE chain normally are identified if a task is failing. Often, one or more CREs have suspicious exceptions in CREXCEPT. When there are multiple exceptions, the start of the problem is usually found in the least recent or second least recent exception CRE. Many problems, especially those where the failure is in one module, can be debugged from the last exception CRE.

However, there is generally a more involved program linkage than is visible in the CREs. When it is necessary to determine the full linkage of calls leading to the current state, the invocation control block (ICB) chain should be examined as described below. In this way, both the sequence of calls in encapsulated programs and the sequence of calls in VLIC modules involved from the last encapsulated program can be observed for a process, and inter-VLIC sequences may be examined for all tasks.

Invocation Work Area (IWA) Stack Linkages

The invocation stack can be examined by beginning at the first invocation (located by PCBFICB) and successively examining the forward chain pointer until the most recent invocation is encountered. Generally, the end-of-stack condition is only recognized by encountering an invalid stack control block.

The invocation stack can also be examined by obtaining the intermediate value from base register 3 in an in-use CRE or CPU register display and following the forward or backward stack pointers.

The forward and backward pointers, AIIFWD and AIIBKWD, respectively, are 2-byte segment offsets that are concatenated with the segment ID to form the virtual address of the ICB. The first ICB (oldest) backward pointer (AIIBKWD) points to itself.

The invocation entries are defined by the include YYAI ICB. These entries are called ICBs. The contents of the ICB can be used to determine the current module invocation (calling) sequence, both encapsulated programs and VLIC modules. To associate an ICB with a program, use the information from one of two fields in the ICB:

- If the first ICB is associated with an encapsulated program (AIITYPE is on), and if it has directly invoked another encapsulated program, AIIIAR and AIIBREG0 contain the IAR and B0 of the instruction that invoked the external call.
- If the encapsulated program invoked a VLIC routine, using an SVL router, AIIIAR and AIIGREG0 are not valid. The SVL router registers 0 through F are stored in AIIREGSV. Register E and F of AIIREGSV contain the IAR and B0 of the instruction that invoked the VLIC routine.

It is also possible to get the address of the associated program from an encapsulated program's ICB (AIITYPE is on) by using the pointer at AIIPSSA or AIIPASA that locates the program static storage area (PSSA) or program automatic storage area (PASA) entry for that program. The third 16-byte pointer, which is a system pointer, contains the virtual address of the encapsulated program.

If the ICB is associated with a VLIC module (AIITYPE is off), halfword registers E and F in AIIREGSV contain the IAR and B0 of the last external call made by that module. An exception to this is if a VLIC module uses #AICMACH to invoke an encapsulated program, for instance, an event handler or external exception handler. The registers (E and F) that the module to #AICMACH are not saved in AIIREGSV but are saved in AIIIAR and AIIBREG0.

It must be remembered while examining program linkage (AIIIAR and AIIBREG0 or AIIREGSV) in successive ICBs, that holes appear in the linkages. This abnormality might be attributed to an SVL exception or to a VLIC module not creating an ICB. However, if you use both the CRE and ICB information together, along with the properties of VLIC modules such as seize/release (#CFSZREL) and get machine-wide storage (#CFGTMWS), the calling sequence can be determined.

List of Licensed Internal Code Tasks

Table 27-1 on page 27-11 describes VLIC tasks. The task name, number of tasks created, type of task, how the task is created, and the priority of the task are shown.

Table 27-1 (Page 1 of 2). VLIC Tasks

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
VLIC initialization	VMCIPL	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB). Also VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Prebuilt in nucleus module #ITTASKS	0000 0005
Nonchecksummed DASD directory recovery control	DRCNTL	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0008
Checksummed DASD validation and directory recovery control	XVAL	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0008
Directory recovery and checksum processing	DIRXSP	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0007
Checksum set manager ss = set number	XSETss	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0006
Checksum member manager ss = set number nn = member number	XTssnn	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
Storage management page-out task nn = task number	SMPOnn	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
Storage management asynchronous I/O task nn = task number	SMAInn	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD connection manager	SMCNMG	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD connection recovery manager	SMCRMG	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD ERP task nn = task number	SMERnn	1 or more	VLIC task (with no IWA) top name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
ASP manager nn = task number	SMAPnn	1 or more	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD time-out task	SMTIME	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD IOP manager	SMIPMG	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
DASD not operational task	SMNOOP	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMTKMGR at IPL	0000 0005
Busy exception handler	BUSYTD	1	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	D000 0000
Resource management services	RMTSK1 RMTSK2 RMTSK3 RMHTK1 RMHTK2	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the #RMINIT at IPL	0000 8040 0000 8080 0000 80C0 007F 0000 00EF 0000

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Table 27-1 (Page 2 of 2). VLIC Tasks

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
Clock comparator	RCCINT	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the #RMINIT at IPL	0000 8080
Error log task	ERRLOG	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the #SSINIT at IPL	0042 8080
Machine services control point	MSCP	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the #SSINIT at IPL	0078 8080
Timed forced statistical data recording update	FORSDR	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the #MSERRLG to gather communication statistics	0080 8080
Inter-process communication facility open manager task	OPNMGR	1	VLIC task (with IWA). Name is in the task control block (TCB)	Built by the #SSINIT at IPL	0040 8080
3270 data stream pass-through	#P00xx (xx is the LU address)	1 per 3270 work station using pass-through	VLIC task (with IWA). Name is in the task control block (TCB), offset hex C0 (TCBNAME)	Built by the the REQPO instruction	0080 8080
Inter-process communication facility router task	ROUT## (see note)	1 per I/O processor	VLIC task (with IWA). Name is in the task control block (TCB)	Built by the #IPOMGR at IPL	0030 8080
	Note: ## is the hexadecimal representation of the 1 byte logical bus address of the IOP: **Bits** — **Represent** 0-2 — Bus number (bits 000 through 010 are valid) 3-7 — Position of the IOP on the bus (bits 00001 through 11111 are valid)				
Work station pass-through intermediate	#IXXXX (XXXX is incremented for each session)	1 per pass-through session	Same as diskette IOM	Built by the REQPO instruction	0080 8080
Work station pass-through source	#S00pp (pp is the LU address)	1 per pass-through session	Same as diskette IOM	Built by the REQPO instruction	0080 8080
Work station pass-through target	#T00pp (pp is the LU address)	1 per pass-through session	Same as diskette IOM	Built by the REQPO instruction	0080 8080
Virtual terminal manager	VTMTSK	1 per system	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the REQPO instruction	0078 8080
Service function driver (See Table 27-2 on page 27-13.)	SFD	1	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built when first start service session REQIO instruction is issued	0000 8080

Tasks Created by the Service Function Driver

Table 27-2. VLIC Tasks Created by the Service Function Driver

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
Communications utility	SFCU	1 or more	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the service function driver	0080 8080
Environmental recording, editing, and printing	SFER	1 or more	Same as communications utility	Built by the service function driver	0080 8080
Work with licensed internal code	SFLL	1	Same as communications utility	Built by the service function driver	0002 8080
Synchronous data link control (SDLC) link test	SFLT	1 or more	Same as communications utility	Built by the service function driver	0080 8080
VLIC log	SFVL	1	Same as communications utility	Built by the service function driver	0002 8080
Display/alter/dump	SFDA	1 or more	Same as communications utility	Built by the service function driver	0002 8080
VLIC trace	SFTR	1	Same as communications utility	Built by the service function driver	0002 8080
Print stand-alone dump	SFDP	1	Same as communications utility	Built by the service function driver	0040 8080
Retrieve internal data	SFRI	1 or more	Same as communications utility	Built by the service function driver	0040 8080
MI boundary recovery task	RMIBDY	1	Same as communications utility	Built by the #RMINIT at IPL	0000 0005
Basic UPS task	ITBUPS	1 if the system value QUPSOLYnn is *BASIC	VLIC task (with no IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by the #SMINIT or #ITBUPSI	0080 8080
DST main task	MSF	1	Same as communications utility	Built by the #CMCCIOM	0080 8080
DST display controller	MSFCON	1	Same as communications utility	Built by the DST	0000 8080
DST display service function	SFS3	1	Same as communications utility	Built by the service function driver	0001 8080
DST printer controller	MSFPRT	1	Same as communications utility	Built by the DST	0080 8080
DST tape controller	MSFTAP	1	Same as communications utility	Built by the DST	0080 8080
DST diskette controller	MSFDKT	1	Same as communications utility	Built by the DST	0080 8080
DST signal PAR event	S3EVT	1	Same as communications utility	Built by the DST	0080 8080

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IOM Tasks

Table 27-3. VLIC Tasks Created by IOM (or IOM Tasks)

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
Service processor IOM (pageable)	#-0100	1	VLIC task (with IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0005
Service processor IOM (resident)	NPSPIO	1	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0005
Bus manager kernel	BMKRNL	1	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0007
Bus manager common function	BMCFBM	1	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 00010
Bus manager common function router	BMCFRT	1	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0007
Bus interface managers n = bus number	BMINFn	3	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0005
Bus manager timer	BMTIME	1	VLIC task (without IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Prebuilt in nucleus module #ITTASKS	0000 0007
Load/dump task	LDMAIN	1 per LD session	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by #LDCREAT during MODLUD (active) instruction	The normal priority is 0080 xx20; where, xx is the priority from the MI process which is doing the save or restore. The priority for restricted state is 0078 8080.
Load/dump pipeline tasks	LDXXXX	var	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the LDMAIN task.	var

Tasks Created by MSCP during MODLUD, MODCD, or MODND

Table 27-4 (Page 1 of 3). VLIC Tasks Created by MSCP during MODLUD, MODCD, and MODND

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
Diskette IOM	#0XXXX	1 per diskette device	VLIC task (with IWA). Name is in the TCB, offset hex C0 (TCBNAME)	Built by the MSCP at MODLUD (vary on) instruction	0070 8080
Asynchronous station IOM	#1XXXX	1 per station (controller)	Same as diskette IOM	Built by the MSCP at MODCD (vary on) instruction	0078 8080

Table 27-4 (Page 2 of 3). VLIC Tasks Created by MSCP during MODLUD, MODCD, and MODND

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
Asynchronous line IOM	#2XXXX	1 per IOP	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080
Token ring line IOM	#3XXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080
Tape IOM	#4XXXX	1 per tape device	Same as diskette IOM	Built by the MSCP at MODLUD (vary on) instruction	0070 8080
Work station station IOM	#5XXXX	1 per station (controller)	Same as diskette IOM	Built by the MSCP at MODCD (vary on) instruction	0078 8080
Twinaxial line IOM	#6XXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080
SDLC line IOM	#7XXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080
BSC station and line IOM	#8XXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0060 8080
MTAM station and line IOM	#9XXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0060 8080
Work station line IOM	#AXXXX	1 per controller	Same as diskette IOM	Built by the MSCP at MODCD (vary on) instruction	0070 8080
PU type 2 station IOM	#BXXXX	1 per station (controller)	Same as diskette IOM	Built by the MSCP at MODCD (vary on) instruction	0078 8080
Open station IOM	#CXXXX	1 per station (controller)	Same as diskette IOM	Built by the MSCP at MODCD (vary on) instruction	0078 8080
Ethernet LAN line IOM	#DXXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080
BSC 3270 emulation station and line IOM	#EXXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0060 8080
File server nnnn = internal, table, index, entry, or number	FSnnnn	1 per PC using shared folders support	VLIC task (with IWA). Name is in the TDE, offset hex F2 (TDE@PCB)	Built by OS/400 server on allocate of PC session	0078 8080

Table 27-4 (Page 3 of 3). VLIC Tasks Created by MSCP during MODLUD, MODCD, and MODND

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
X.25 line IOM	#GXXXX	1 per line	Same as diskette IOM	Built by the MSCP at MODND (vary on) instruction	0070 8080

Tasks Created by MSCP during IPL

Table 27-5. VLIC Tasks Created by MSCP during IPL

Task Description	Task Name	Number of Tasks	Task Type	Task Creation	Priority
APPN control point manager	CPMGR	1	VLIC task (with IWA). Name is in task control block (TCIS).	Built by the MSCP at IPL	0078 8080
APPN topology and rack selection services	TRS	1	VLIC task (with IWA). Name is in task control block (TCIS).	Built by the MSCP at IPL	0078 8080
APPN directory services	DS	1	VLIC task (with IWA). Name is in task control block (TCIS).	Built by the MSCP at IPL	0078 8080
APPN control point presentation services	CPPS	1	VLIC task (with IWA). Name is in task control block (TCIS).	Built by the MSCP at IPL	0078 8080
Location manager	LOCMGR	1	VLIC task (with IWA). Name is in task control block (TCIS).	Built by the MSCP at IPL	0078 8080

The following convention is used for naming tasks created by the modify instructions (MODLUD, MODCD, MODND). The name is six EBCDIC characters:

```
ABXXXX
```

where:

A The task type is #. # indicates an I/O manager (IOM) task of VLIC.

B The IOM associated with the task:

- 0 Diskette IOM
- 1 Asynchronous station IOM
- 2 Asynchronous line IOM
- 3 Token-ring line IOM
- 4 Tape IOM
- 5 Work station station IOM
- 6 Twinaxial line IOM
- 7 SDLC line IOM
- 8 BSC station and line IOM
- 9 MTAM station and line IOM
- A Work station line IOM
- B PU type 2 station IOM
- C Open station IOM
- D Ethernet LAN IOM
- E BSC 3270 emulation station and line IOM
- G X.25 line IOM
- I Intermediate
- S Source
- T Target

XXXX This is the printable representation of the MSCP assigned VLIC ID or send identifier which is unique for each active IOM task.

Tasks and Processes

Chapter 28. Introduction to Source/Sink

Overview

An asynchronous task to provide VLIC source/sink support may be created when a logical unit descriptor (LUD), a controller descriptor (CD), or a network descriptor (ND) is modified to the varied on state. Depending on the kind of LUD, CD, or LD a new task may not be created. "I/O, IOM, and Source/Sink Module" on page 28-2 gives the name of the VLIC module for the created I/O manager (IOM) task for each device and the object (LUD, CD, or ND) that is being varied on when the task is created. For example, a modify LUD command to vary on the tape device results in the creation of the tape IOM task. The tape IOM task then starts from module #TA00IOM.

The request I/O (REQIO) instruction starts the asynchronous transfer of data to and from a device. The REQIO instruction processor verifies the input parameters and pointers, builds a request message, and sends the request to the IOM queue associated with the device. The request message contains a standard VLIC message header (SSVMCHDR), a request I/O message structure (SIRQM1), and a copy of the source/sink request (SIRQS). Figure 28-1 shows the layout of the request message and identifies the include structure that MAPs the contents of the structure's various sections.

The I/O structure in support of the REQIO instruction consists of an asynchronous task. The IOM task, implemented in the AS/400 internal microprogramming, supports a particular device type. Note that there is one or more separate tasks (unique task dispatching element) for each device, even though the instructions executed are common.

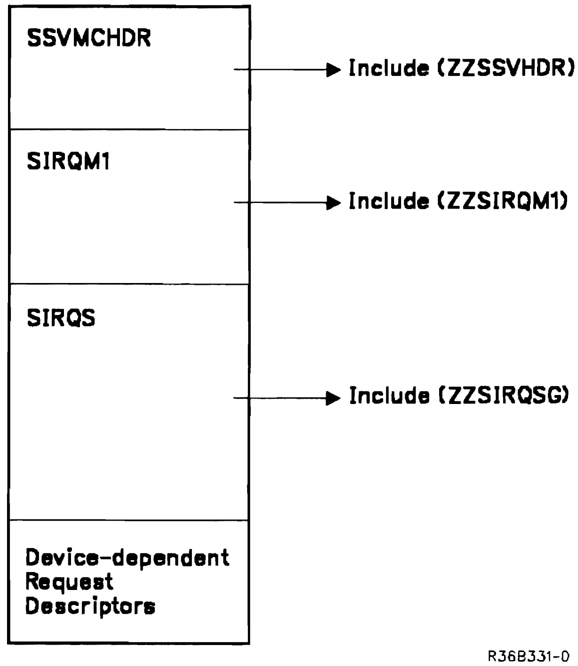

Figure 28-1. Request I/O Message Sent to the IOM

Associated with an IOM task is a single input send/receive queue (SRQ) that the IOM uses to receive all messages (both requests and responses). Thus, when the IOM does not have work to do, it waits on its input queue. The IOM can selectively wait for a certain class of message (a response or request) if it adjusts the key compare value associated with the Receive Message instruction. In this way, other messages can be stacked on the queue until the IOM is ready to process another request; the IOM then adjusts the receive key accordingly.

Diagnosing I/O Problems

The approach for diagnosing system I/O problems depends on the information available and the symptoms of the failure. In most situations, you should first use ANZPRB. If this is not successful, then display the information in the hardware error log (use the Work with error log option under DST or SST) and see if errors pertinent to the problem have been logged. This information often indicates a diagnostic procedure that can be used to identify the problem.

However, there are times when you must examine the system at intermediate steps because the standard error recovery procedures have not corrected the problem. Once the failure is isolated to a particular device, it is often helpful to observe the current state of the IOM task.

TDE is a primary source of information about the status of each task and the operation of the device.

I/O, IOM, and Source/Sink Module

Table 28-1 on page 28-2 shows the I/O devices, IOM module names, and associated source/sink object types.

Table 28-1. I/O Devices, IOM Modules, and Source/Sink Object Types

Device	Module	Object
BSC	#TPBBIOM	ND
BSC MTAM	#TMMMIOM	ND
Ethernet LAN line	#TULIOM	ND
Primary station	#TSWSIOM	CD
PU type 2 station	#TP2SECS	CD
SDLC line	#TULIOM	ND
TDLC line	#T1LIOM	ND
Token-ring LAN line	#TULIOM	ND
Open station	#OTSIOM	CD
X.25 line	#TULIOM	ND
2440 tape	#TA00IOM	LD
3270 BSC IOM	#TEBBIOM	ND
3270 BSC IOM	#TEBBIOM	ND
3422 tape	#TA00IOM	LD
3430 tape	#TA00IOM	LD
3480 tape	#TA00IOM	LD
3490 tape	#TA00IOM	LD
6040 WSC	#TSWSIOM	CD
6041 ASCII WSC	#TSWSIOM	CD
6140 WSC	#TSWSIOM	CD
6141 ASCII WSC	#TSWSIOM	CD
9331 diskette	#DK00IOM	LD
9332 diskette		
9346 tape	#TA00IOM	LD
9347 tape	#TA00IOM	LD

For more information about source/sink, see page 30-18.

Source/Sink

Chapter 29. VLIC Program Exceptions and Causes

Use Table 29-1 along with the VLIC log entries in Appendix A and "Main Storage Dump" on page 16-1 to isolate a problem.

Table 29-1 (Page 1 of 3). VLIC Program Exceptions and Causes

Hex Code	Exceptions	Causes	Instruction Is
00	No exception		
02	Invalid descriptor	Invalid field encountered during operation on IMP object.	Ended
04	Busy	1. Send/receive queue (SRQ) busy 2. Hold/free chain busy	Nullified
0A	Monitored descriptor SRQ	Send/receive queue (SRQ) access attempted when its byte 1 is nonzero.	Suspended
0C	Monitored descriptor SRM	Send/receive message (SRM) access attempted when its byte is nonzero.	Suspended
0E	Monitored descriptor TDE	Task dispatching element (TDE) access attempted when its byte 1 is nonzero.	Suspended
10	Send/receive counter overflow	A carry from the high-order position of the count field occurred during a send operation.	Ended
12	Address translation	Not able to translate a virtual to a real address by using VAT except for GHRF, GHR, FHRF, and FHR instructions. For these instructions, the instruction is completed and condition code 3 is set if exception occurs on hold record chain.	Nullified
14	Programming event	An instruction is executed in a defined address range. 1. If not masked (bit 8 of TDE exception mask field is set). 2. If masked (bit 8 of TDE exception mask field is reset).	Nullified Completed
16	Execute	Subject of EX instruction is another EX instruction.	Suppressed
18	Specification (All instructions are tested for this exception.)	1. Improper alignment 2. Other conditions	Suppressed
1A	Addressing	1. Invalid real instruction address. 2. Invalid real operand address.	Suppressed Ended
1C	Effective address	1. Offset overflow during effective address calculation. 2. Storage operand crossed segment boundary.	Suppressed
1E	Data	1. Invalid decimal sign code. 2. Invalid decimal digit code. 3. Insufficient left zeros in multiplicand (MP).	Suppressed Ended Ended
20	Binary overflow	1. Carry from sign bit and carry from high-order numeric bit disagree. 2. Result exceeds 31 bits (CVPB). 3. Significant bits are lost (SLA).	Completed
22	Binary divide	Quotient exceeds the size of the result field or an attempt to divide by zero.	Suppressed
24	Decimal overflow	Destination field is too small for the result.	Completed
26	Decimal zero divide	An attempt to divide by zero.	Suppressed
28	Floating-point overflow	Resultant exponent is too large.	Completed
2A	Floating-point underflow	Resultant exponent is too small.	Completed
2C	Floating-point inexact result	Rounded result is not exact.	Completed

Table 29-1 (Page 2 of 3). VLIC Program Exceptions and Causes

Hex Code	Exceptions	Causes	Instruction Is
2E	Floating-point zero divide	An attempt to divide by a number with a zero fraction.	Suppressed if not masked; completed if masked
30	Operation *(All instructions are tested for this exception.)*	Invalid operation code	Suppressed
32	Stack	1. Stack entry to be removed during unstack has flag bit 15 (first entry in segment) set. 2. Stack operation adds entry that extends beyond stack limit value.	Suppressed
34	Verify	A verify exception occurs when an LVT, AHSPOI, AHSPO, or AFSPO instruction detects an invalid operand.	Suppressed
36	Chain conflict	1. Conflict on an object hold operation. 2. Object free operation attempted to free a monitored hold.	Nullified
38	End-of-chain	1. Empty chain on free operation 2. End of available chain on hold operation. 3. No matching hold on free operation.	Nullified
3A	Edit digit count	1. End-of-source field was reached and there are more control characters corresponding to digits in edit-mask field than in source field. 2. End-of-edit-mask field was reached and there are more digit positions in the source field.	Ended
3C	Length conformance	1. More character positions in result than in edit-mask field (EDPD). 2. More character positions in edit-mask field than in result field (EDPD). 3. Incorrect number of hex B2's following a hex B1 (floating string) field in the edit mask (EDPD). 4. The converted form of the source record is larger than the result record length (CVTMC).	Ended
3E	Edit mask syntax	1. Invalid control characters in edit-mask field. 2. End-of-string character field termination missing.	Ended
40	Invalid segment group address	1. Leftmost 3 bytes of virtual address are invalid. 2. Address below lower boundary address. 3. Overflow generated in calculation of 3-byte address.	Suppressed
42	Floating-point invalid operand	An operand or operation is not valid.	Suppressed if not masked; completed if masked
46	Second chain search	A Grant Hold or Free Hold instruction has determined that a secondary chain must be searched.	Nullified
48	Conversion	1. Data length in string control byte is zero for CVTMC or CVTSC instruction. 2. The end of source is encountered before the end of a compression string. 3. A compression string describes a character string which would cross a record boundary in the receiver.	Ended
4A	Invalid floating-point conversion	When overflow, infinity, or not-a-number precludes accurate representation in binary format.	Suppressed
4C	SID extender	A LACE instruction could not validate a SID extender.	
4E	SID extender not found	A STSE instruction could not determine the correct SID extender.	
80	Invalid segment	Segment does not exist.	Suppressed
81	Invalid page	A page was referenced which was beyond the end of a virtual segment.	Suppressed
82	Page read error	Permanent I/O error while reading page from auxiliary storage.	Ended
83	Invalid pool state	Too many pages pinned to perform bring or clear with pin (PPR).	Suppressed
84	Invalid pin request	1. Attempted pin was 256th pin for same page. 2. Unpin attempted on unpinned page.	
85	Invalid write request	Write requested for a pinned page.	Suppressed

Table 29-1 (Page 3 of 3). VLIC Program Exceptions and Causes

Hex Code	Exceptions	Causes	Instruction Is
87	Bad main storage dump page	A page addressed in a main storage dump contains no data because the corresponding main storage frame was not usable at the time of the dump.	Suppressed
88	Invalid reference to access group data page	A page in an access group data segment was referenced directly rather than by using the virtual address of a page created into the access group.	Suppressed
8F	Segment not available	A page is not currently addressable. The requested segment cannot be addressed because the storage management directories are not usable.	Suppressed
FC	Page not found	A page is not found in the print stand-alone dump.	N/A
FD	Media error	A media error is found in the print stand-alone dump.	N/A
FE	Index damaged	An index is damaged in the print stand-alone dump.	N/A
FF	Page frame damaged	The page frame is damaged in the print stand-alone dump.	N/A

Chapter 30. VLIC Trace and Trace Point Descriptions

VLIC Functions and Their Components

Function	Component
Data	Database management Byte string management Commitment management Index management Journal management Queue management Space object management
Internal machine	Auxiliary storage management Main storage management Machine index management Bus management
Machine support	Dedicated Service Tools Machine check Machine initialization/ termination Machine observation Service and installation
Object	Authorization management Context management
Program control	Program execution management Program management
Source/sink	BASE BSC IOM BSC MRJE IOM Error log File server Instruction processor LAN IOM Load/dump Local IOM MSCP Service processor IOM SDLC IOM Station IOM TDLC line IOM Virtual terminal manager X.25 IOM 3270 BSC IOM 3270 translator
Supervisor and control	Event management Exception management Process management Resource management
Common	Authority checking Object checking

VLIC Module Names and IDs

For a complete list of module names and IDs, see Chapter 4. For trace points related to these components, see Chapter 30. For information used to solve problems and/or submit with APARs or LICTRs, see Chapter 4.

Note: VLIC includes can be found in the *AS/400 System Support: Diagnostic Aids Addendum*.[1]

VLIC Traces

VLIC traces are described on pages 12-10 and 17-12. VLIC traces are used to isolate problems in VLIC and other components of the system such as application programs, OS/400, and HLIC. The major kinds of VLIC traces are:

- VLIC module call trace

  Use this trace in conjunction with the VLIC logic listings (as provided and made available by IBM) to trace the flow of control within VLIC modules. This trace type can be used in a system process or in a VLIC task.

- VLIC component trace, see page 30-4

  Use this trace to trace the activity in the various VLIC components.

- Multiprogramming level, see the MP component on page 30-13

  Use this trace to observe the tasking activity in the machine. This trace records all entries and exits to the multiprogramming level of the machine.

- System instruction supervisor linkage (SVL), see the SV component on page 30-18

  Use this trace to trace the start or call of VLIC modules when system instructions translate to IMP SVLs through the VLIC SVL router module #SV5DMIR. This trace covers all processes in the machine.

- Internal microprogrammer instruction (IMPI) trace, see the IN component on page 30-12

  Use this trace to trace all IMPI executions in the following manner:

  – By task (task dispatching element address)
  – Within a module (module name)
  – Within a range of instruction addresses (high and low virtual addresses)

- Task switch trace

  Use this trace to trace the dispatching sequence of tasks in the machine.

[1] Object Code Only (OCO) — IBM Confidential Restricted.

Trace Points

Trace Points

Collected Data

Trace VLIC is used to collect trace point information. The data collected at a trace point can be any of the following:

- A data field in the program
- A data field in a data structure
- A data value in a register
- A data field pointed to by a register

Use the Trace Vertical Licensed Internal Code function to write the collected trace data to an output device and also to control activation and deactivation of the different traces.

Register values are the only trace data defined in this publication. The name of a data field in a program is furnished for the other trace data and you must use the VLIC program listings (as made available and provided by IBM) in conjunction with this appendix to define the contents of the trace data.

Identifiers or Qualifiers

The trace identifiers are used to pinpoint the collected data to a specific location (or point) in the system. Each trace point is assigned a unique identifier in the form of:

```
TT#QQQQQ
```

where:

TT	Is the trace identifier
#	Is a separator
QQQQQ	Is a five-digit qualifier that makes the identifier unique in the trace.

The range for the qualifier numbers is 00 001 through 65 535. Information about each trace point appears in this appendix.

Trace Output

Each entry in the trace table contains a standard VLIC trace *header* followed by variable-length *data fields.* The VLIC trace function formats the header portion of each trace entry; it also formats the data portion of each trace entry for MI SVL, call, and task switch types. For all other traces, the data portion of each entry is formatted to provide the field number, field length in decimal, and the contents of the field in a standard hexadecimal/EBCDIC dump for each field recorded.

All trace entries for all the traces appear as unformatted byte strings if a display/alter/dump or stand-alone dump is used to access the trace entries instead of the VLIC trace function. Therefore, you should know how to decipher trace entries as they appear in unformatted form.

Trace Header

For general trace tables (for all traces except the call and task switch traces) the standard header has the following format:

Offset	Length	Description
0	3	Identifier ('¬?1')
3	1	Trace type (internal form)
4	6	Time value
A	4	TDE number
E	2	Trace qualifier (hexadecimal)
10	2	Total trace entry size (maximum trace entry length is 512 bytes)

For general trace tables, the data field is variable-length and the data field has the following format:

Offset	Length	Description
0	12	Header (described above)
12	2	Length of all data fields
14	Var	Data fields **Note:** There can be multiple variable-length data fields.

More information about data fields can be found on page 30-3. For a call trace, the header is:

Offset	Length	Description
0	3	Identifier ('¬?2')
3	1	Trace type (internal form)
4	6	Time value
A	4	Task dispatching element (TDE) number

For a call trace, the data field is fixed-length and has this format:

Offset	Length	Description
0	E	Header (described above)
E	2	Instruction address register (IAR) of caller
10	6	Base register zero (B0) of caller
16	2	IAR of called program
18	6	B0 of called program
1E	1	Control field: 1 = BALL, 2 = BRL, 3 = SVL, 4 = SVX

Note: The VLIC trace function prints call trace entries as unformatted data if the name of either the called or calling program cannot be determined.

For a task switch trace, the header is:

Offset	Length	Description
0	1	Type (hex F0)
1	1	Flag and length
2	2	TDE identifier

Offset	Length	Description
4	4	Time value
8	2	Control storage address register (IAR) or (CSAR)
A	6	Base register zero (B0)

The task switch trace has no variable data.

Data Entry Numbers

Data entry numbers are shown under the **Entry** column. Be aware that more than one logical field of data may be described by one data length field. An entry number is shown by each data field to tell you how the trace entry is defined. The entry value is incremented by one each time a length field appears in the data. In the following example there are two entries (three 1's and a 2) and four fields (A, B, C, and D):

Entry	Name	Length	Description
1	A	4	—————————
1	B	6	—————————
1	C	3	—————————
2	D	6	—————————

where the data is:

`|length A+B+C|A|B|C|length D|D|`

In the preceding example, the first length entry describes the combined length of three data fields (length of 13), and the second length entry describes the length of only one data field (length of 6).

In the following example there are four entries (1, 2, 3, and 4) and four fields (A, B, C, and D). Each data field is described by a separate length entry:

Entry	Name	Length	Description
1	A	4	—————————
2	B	6	—————————
3	C	3	—————————
4	D	6	—————————

where the data is:

`|length A|A|length B|B|length C|C|length D|D|`

This appendix contains a description of each trace point in VLIC. Use the trace point descriptions in this appendix or the program listings on microfiche (if provided and made available by IBM) to determine the relationship between data length values and logical data fields.

Data Fields

Data fields are identified under the **Name** column. Each general trace entry contains at least one data length field followed by the data itself. Some trace entries contain multiple length fields and multiple data fields. The following example is an entry with one data field:

```
... header (hex 12) bytes ... 0006 1122 3344 5566
```

where 0006 is the length of the data field and 1122 3344 5566 is the data itself. The following example is an entry with two data fields:

```
... header (hex 12) bytes ... 0004 1122 3344 0006
1122 3344 5566
```

where 0004 is the length of the first data field and 1122 3344 is the data; 0006 is the length of the second data field and 1122 3344 5566 is the data.

Internal Trace Type Values

The trace entries are implemented in the VLIC code by means of a macro called ?GTRACE. Each macro has a label in the form of:

```
TT#QQQQQ
```

where:

TT — Is the external trace identifier (two alphabetic characters)

— Is a separator

QQQQQ — Is the numeric qualifier

Note that the macro name is the same name as the qualifier or identifier.

Table 30-1 shows the internal trace value, the formatted (or external) trace identifier, the description of the trace and the internal type used with call trace to produce the VLIC logic listings.

Table 30-1 (Page 1 of 2). Trace Values

Internal Trace Values (Hex)	External Trace Identi-fier	Description	Call Trace Values
44	AD	Auxiliary storage management detailed	—
4F	SN	Storage management invocation	—
50	SD	Storage management detailed	—
63	CO	Commitment management	62
64	IN	Instruction	—
65	SI	Source/sink instructions	52
66	LD	Load/dump	29
67	MS	Machine services control point (MSCP)	5A
68	RM	Resource management	BC
69	EX	Exception management	48
6A	SV	System supervisor linkage	—

Trace Points

Table 30-1 (Page 2 of 2). Trace Values

Internal Trace Values (Hex)	External Trace Identi-fier	Description	Call Trace Values
6B	PG	Program management	20
6C	DB	Database management	22
6D	PM	Process management	BA
6E	QM	Queue management	19
6F	EM	Event management	2A
70	MP	Multiprogramming level	—
71	SO	Space object management	BD
72	JO	Journal management	54
73	CN	Control	—
74	AU	Authorization management	21
75	MN	Context management	59
76	AS	Auxiliary storage management	—
79	CF	Common functions	1A
7A	DO	Machine observation	28
7B	II	Independent indexes	49
7C	MG	Source/sink messages	—
7D	LP	Source/sink protocol	—
7E	UD	Source/sink user data	—
7F	CB	Source/sink control blocks	—
—	—	Recovery	BB
—	—	Local I/O manager	53
—	—	Source/sink teleprocessing	53
—	AI	Program execution	20
—	XL	Translator	—
84	PS	5250 pass-through	—
86	LM	Location manager task	CD
CF	CM	Common class I/O manager (CCIOM)	18
D0	IP	Inter-process communications facility (IPCF)	C2
D1	BS	Byte string space manager	—
D6	LT	Link test service function	C8
D2	EL	Error log	C4
D3	EE	Work with error log (EREP)	C5
D4	CT	Communications trace service function	C6
D8	CP	Control point manager task	C9
D9	DT	Directory services task	CA
DA	TR	Topology and routing services task	CB
DF	CS	Control point presentation services task	CC

List of VLIC External Trace IDs

Table 30-2 lists the external trace IDs and their associated component or components. Table 30-3 lists the components and their associated external trace IDs. Chapter 4 lists all components and the information that is needed to submit with an APAR.

Table 30-2. External Trace IDs and Their Associated Components

External Trace ID	Components
AD	SM
AS	SM
AU	AU, CF
BS	BS, FS
CB	DK, NA, OT, PI, RA, SB, SS, TA, TE, TL, TM, TS, TT, TU, TX, T1, T2, YI
CF	CF
CM	CM
CN	RI, CF, PM
CO	CO
CP	LC
CS	LC
CT	CT
DB	DB
DO	DO
DT	LC
EE	EREP
EL	EL
EM	CF, EM
EX	CF, EX
II	IX
IN	RI
IP	IP
JO	JO
LD	LD, SM
LM	LM
LP	NA, OT, PI, SB, TE, TL, TM, TS, TT, TU, TX, T1, T2, YI
MG	DK, NA, OT, PI, SB, TA, TE, TL, TM, TS, TT, TU, TX, T1, T2, YI
MN	CF, MN
MP	CF, RM, SV
MS	MS, SS
PG	AI, PG, XE, XL, XT
PM	CF, PM
PS	PA, TG, T2
QM	PM
RM	CF, RM
SD	SV
SI	SI, SS, TE
SN	SV
SO	SO
SV	SV
TR	LC
UD	DK, NA, OT, PI, RA, SB, TA, TM, TS, T1, T2, YI

Table 30-3 (Page 1 of 2). Components and Their Associated External Trace IDs

Component	External Trace IDs
AU	AU
BS	BS
CF	CF, CN, EM, EX, MP
CM	CM
CF	AU, MN
CO	CO
CT	CT
DB	DB
DK	CB, MG
DO	DO
EREP	EE
EL	EL
EM	EM
EX	EX
FS	BS
IX	II
IP	IP
JO	JO
LC	CP, CS, DT, TR

Trace Points

Table 30-3 (Page 2 of 2). Components and Their Associated External Trace IDs

Component	External Trace IDs
LD	LD
LM	LM
MN	MN
MS	MS
NA	CB, LP, MG
OT	CB, LP, MG, UD
PA	PS
PG	PG
PI	CB, LP, MG, UD
PM	CN
RA	CB
RI	CN, IN
SB	CB, LP, MG
SI	SI
SM	AD, AS, LD, SD, SN
SO	SO
SS	CB, MS, SI
SV	MP
TA	CB, MG
TE	CB, LP, MG, SI
TG	PS
TL	CB, LP, MG
TM	CB, LP, MG
TP	CB, LP, MG, PS
TS	CB, LP, MG
TT	CB, LP, MG
TU	CB, LP, MG
TX	CB, LP, MG
T1	CB, LP, MG
T2	CB, LP, MG, PS
YI	CB, LP, MG

For more information about each external trace ID, see the following list.

External Trace ID	Description and Page
AD	Auxiliary storage management detailed described on page 30-6. See SM for other external trace IDs of storage management.
AS	Auxiliary storage management described on page 30-6. See SM for other external trace IDs of storage management.
AU	Authorization management described on page 30-8.
BS	Byte string space management described on page 30-8.
CB	Source/sink control blocks described on page 30-8. See SS for other external trace IDs of source/sink.
CF	Common functions described on page 30-8.
CM	Common class I/O manager described on page 30-8.
CN	Control described on page 30-9. PM includes some CN trace points. For more information about PM, see page 30-14.
CO	Commitment management described on page 30-9.
CP	Control point manager task described on page 30-9.
CS	Control point presentation services task described on page 30-9.
CT	Communications trace service function described on page 30-9.
DB	Database management described on page 30-10.
DO	Machine observation described on page 30-10.
DT	Directory services task described on page 30-10.
EE	EREP — work with error log described on page 30-11.
EL	Error log described on page 30-11.
EM	Event management described on page 30-11.
EX	Exception management described on page 30-11.
II	Independent indexes described on page 30-12.
IN	Instruction described on page 30-12.
IP	Inter-process communications facility described on page 30-12.
JO	Journal management described on page 30-12.
LD	Load/dump described on page 30-12. See SS for other external trace IDs of source/sink.
LM	Location manager task described on page 30-13.
LP	Source/sink protocols described on page 30-13. See SS for other external trace IDs of source/sink.
LT	Link test service function described on page 30-13.
MG	Source/sink messages described on page 30-13. See SS for other external trace IDS of source/sink.
MN	Context management described on page 30-13.
MP	Multiprogramming level described on page 30-13.
MS	Machine services control point (MSCP) described on page 30-13. See SS for other external trace IDS of source/sink.
PG	Program management described on page 30-14.
PM	Process management described on page 30-14. Process management includes some of the control (CN) trace points. CN is described on page 30-9.

PS — 5250 pass-through and virtual terminal manager are described on page 30-15. See SS for other external trace IDs of source/sink.

QM — Queue management described on page 30-15.

RM — Resource management described on page 30-15.

SD — Main storage management detail described on page 30-16. See SM for other external trace IDs of storage management.

SI — Source/sink instruction processing described on page 30-16.

SM — Storage management component includes the following specific external trace IDs:

- AD — Auxiliary storage management detailed described on page 30-6.
- AS — Auxiliary storage management described on page 30-6.
- SD — Main storage management detail described on page 30-16.
- SN — Main storage management invocation described on page 30-17.

SN — Main storage management invocation described on page 30-17. See SM for other external trace IDs of storage management.

SO — Space object management described on page 30-17.

SS — Source/sink management described on page 30-18. This component includes the following external trace IDs:

Note: SS is not an external trace ID; however, these trace points are activated by a source/sink management trace.

- LD — Load/dump described on page 30-12.
- MS — Machine services control point (MSCP) described on page 30-13.
- PS — 5250 pass-through and virtual terminal manager are described on page 30-15.

Source/sink includes system objects described on page 30-19. The following external trace IDs are activated by an object.

- CB — Source/sink control blocks described on page 30-8.
- LP — Source/sink protocols described on page 30-13.
- MG — Source/sink messages described on page 30-13.
- UD — Source/sink user data described on page 30-19.

SV — System supervisor linkage described on page 30-18.

TR — Topology and routing services task described on page 30-18.

UD — Source/sink user data described on page 30-19. See SS for other external trace IDs of source/sink.

System objects are described on page 30-19.

AD—Auxiliary Storage Management Detailed

VLIC trace points for the auxiliary storage management detailed (AD) external trace ID can be found in volume 2 of this manual.

In general, the trace points are subdivided according to the type of information to be recorded.

Qualifiers	Description
1	Segment ID created.
10	Segment ID destroyed.

Qualifier 1: This trace point is located at the beginning of a create segment. It traces the segment ID created, its size, and information about the creator.

Qualifier 10: This trace point is located at the end of a destroy segment. It traces the segment ID destroyed, its size, and type.

For other storage management external trace IDs, see:

- AS — Auxiliary store management described on page 30-6.
- SD — Main storage management detail described on page 30-16.
- SN — Main storage management invocation described on page 30-17.

AS—Auxiliary Storage Management

VLIC trace points for the auxiliary storage management (AS) external trace ID can be found in volume 2 of this manual.

In general, the trace points are subdivided according to the type of information to be recorded.

Qualifiers	Description
1-8	Auxiliary storage management parameter list (ASMPL)
21-25	Auxiliary storage directory entry (ASDE)

41-45	Access group member directory entry (AGMDE)
61-63	Extent descriptor (XD)
81	No data recorded
91-95	Get free space control block
101-103	Access group table of contents (AGTOC) entry
121	Header list element (HLE)
141-142	Primary directory entry (PDE)

Qualifiers 1-8: An auxiliary storage management parameter list (ASMPL) is recorded.

These trace points are located at the entries to create segment, extend segment, destroy segment, truncate segment, create segment into access group, extend segment in access group, destroy segment in access group, and truncate segment in access group. The ASMPL contains the user's input parameters to the desired function.

Qualifiers 21-25: An auxiliary storage directory entry (ASDE) is recorded.

Qualifiers 41-45: An access group member directory entry (AGMDE) is recorded.

Qualifiers 61-63: A extent descriptor (XD) is recorded.

These are the mainline nonaccess group processing trace points. They track the allocation of secondary storage. An extent descriptor is used to map a block of disk space and an auxiliary storage directory entry (ASDE) is used to map virtual addresses to their corresponding disk addresses. The ASDEs built for a nonaccess group segment are auxiliary storage management's record of the segment.

Qualifier 81: No data recorded.

This trace point is located at the entry to the code that extends an access group. No data is recorded here because enough information is available from other trace points.

Qualifiers 91-95: The control block used to obtain free space is recorded.

These trace points are located in the space allocation loop. When disk space is needed for a segment that is being created or extended, the free space directory is searched for the appropriate extents. The data recorded at these trace points is the search argument used on the current pass through the free space directory. These points are reached only when the first pass is not successful.

Qualifiers 101-103: An access group table of contents (AGTOC) entry is recorded.

These are the mainline access group processing trace points. They track the allocation and deallocation of space in an access group. The access group member directory entry for a segment in an access group and the segment's access group table of contents entries make up auxiliary storage management's record of the segment. The access group member directory entry provides the means to map the address of the segment to the address of its access group, and the access group table of contents entries provide the means to map a virtual address in the segment to its corresponding disk address.

Qualifier 121: A header list element (HLE) is recorded.

Qualifiers 141-142: A primary directory entry (PDE) is recorded.

These are miscellaneous trace points located in seldom used paths.

Storage management has an asynchronous interface to the VLIC trace routines. Three trace queues are located in the storage management vector table (SMVT). The first two queues are for storage management trace messages, and the third queue is the storage management trace task's queue.

When a trace point in a storage management module is reached, an SVL is made to a trace collection routine. This routine has a message dequeued from one of the trace message queues and fills in the trace data to be recorded. The message is then sent to the storage management trace task's queue and an SVX back to the storage management module is issued. The storage management trace task issues the SVL to the VLIC trace routine.

If a message is not available to one of the trace collection routines, the routine does not wait. Instead, the missing trace event count (a 2-byte field located in the SMVT) is incremented, and an SVX instruction back to the storage management module is issued. Each time a message is successfully dequeued from one of the trace message queues, the missing trace event count is recorded in the message and this field in the SMVT is reset to 0. For all storage management trace points (AS, SD, and SN), the first entry in the trace data record is the missing trace event count.

For other storage management external trace IDs, see:

AD	Main storage management detailed described on page 30-6.
SD	Main storage management detail described on page 30-16.
SN	Main storage management invocation described on page 30-17.

Trace Points

AU — Authorization Management

VLIC trace points for the authorization management (AU) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-39.

The trace points record input and output to and from system instructions and common function routines.

In addition, the #CFAUTH module contains three additional trace points to identify when damage-tolerant code is being executed (no data is recorded).

The high-order number in each qualifier is assigned to a module and the low-order three numbers are categorized as follows:

Numbers	Category
001-099	Input/output fields
100-199	Damage tolerance code
200-299	Exception code
300-399	Machine check code
900-999	Miscellaneous

BS — Byte String Space Management

VLIC trace points for the byte string space management (BS) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-39.

The BS external ID is also used by the file server (FS) component because two components depend on each other. The trace points are divided between the two components as follows:

Qualifiers	Description
17000-17500	Byte string space modules
35000-36000	File server module

CB — Source/Sink Control Blocks

VLIC trace points for the source/sink control blocks (CB) external trace ID can be found in volume 2 of this manual.

This external trace ID is used with all objects and IOMs to trace the internal control blocks and working variables. This option should be used when it is necessary to look at the detailed data.

For other source/sink external trace IDs, see "SS — Source/Sink Management" on page 30-18.

CF — Common Functions

VLIC trace points for the common functions (CF) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-39.

Trace points are implemented to show the use of, and display errors in, heavily used common functions such as the object checker, and get or free machine-wide storage.

CM — Common Class I/O Manager (CCIOM)

VLIC trace points for the common class I/O manager (CM) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-43.

The common class I/O manager (CCIOM) provides the following functions after establishing the RAS connection to the IOP:

- RAS focal point services provide management and synchronization of commands on the RAS path to the IOPs
- System hardware configuration at each system IPL and dynamically configured as the IOPs and their resources are powered off and on
- Gathering and logging of problems reported on the RAS connection from the IOPs
- Downloading code to the IOPs
- Activation and deactivation of IOP tasks
- Gathering of volume statistics for removable media such as tapes and diskettes which can be used to project when volumes are deteriorating
- Gathering of IOP, device, and line statistics to aid in tuning the system and finding performance related problems
- Setting of communication line thresholds

These are the modules in the common class I/O manager (CCIOM) component, and each are assigned a range of qualifiers as follows:

Qualifiers	Description
10000-10999	#CMCCIOM mainline module
12000-12999	CMCNFIG configuration services
13000-13999	CMACTIV activation services and CMDEACT deactivation services
14000-14999	CMVSTAT CCIOM volume statistics
15000-15999	CMDSTAT CCIOM device statistics
16000-16999	CMRASFP RAS focal point
17000-17999	CMERP CCIOM error recovery

The trace points are at the entry of every external entry point to the CCIOM modules. Every message sent and received by the modules are traced.

In addition to the entry point traces, there are trace points for some of the modified CCIOMs control blocks. Also, the request descriptors, data descriptors, resource configuration records (RCRs), and operation request blocks (ORBs) are also traced. For more information about RCRs, see page 10-1.

CN — Control

VLIC trace points for the control (CN) external trace ID can be found in volume 2 of this manual.

This trace is included in process management to note the creation and termination of micro tasks, VLIC tasks (I/O managers, and so on), and processes in the machine. This external trace ID is automatically activated when any other external trace ID is activated, and the entries for this external trace ID are always dumped regardless of the selection criteria specified for the *Dump trace table* option.

This external trace ID is part of the process management (PM) component. For more information about the PM component, see page 30-14.

CO — Commitment Management

VLIC trace points for the commitment management (CO) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-39.

There are two kinds of trace points in the commitment component:

1. Trace points that record the input and output from the commitment modules have the last three digits of the qualifier as 001 for input and as 002 for output.
2. Trace points that document rare or unusual events such as extending the attached commitment block table or invoking an exception handler have the last three digits of the qualifier begin at 003 and continue from there.

The high-order two digits of the qualifier are assigned to a module.

CP — Control Point Manager Task

VLIC trace points for the control point manager task (CP) external trace ID be found in volume 2 of this manual.

The trace points are subdivided as follows:

Qualifiers	Description
04000-04039	These trace points are in the main task module for the control point manager task (#LCCPTSK).
04040	This trace point is the main exception handling module for the control point manager task (#LCCPEXH).
04050-04449	These trace points are in the session services module (#LCSS).
04450-04499	These trace points are in the session connector module (#LCSCM).
04800-04899	These trace points are in the session manager module (#LCMMAIN).
04900-04999	These trace points are in the resource manager module (#LCRM).

CS — Control Point Presentation Services

VLIC trace points for the control point presentation services task (CS) external trace ID can be found in volume 2 of this manual.

The trace points are subdivided as follows:

Qualifiers	Description
08000-08099	Send or receive messages from other APPN tasks are traced. The APPN tasks traced are: directory services, control point manager, topology and routing services, and T2 station IOM. Associated control blocks and data are also traced.
08100-08200	Send or receive messages sent by control point presentation services to other APPN tasks and the error log task are traced. Associated control blocks and data are also traced.
08500	The call/return element that was generated when the control point presentation services task took an exception is traced.

CT — Communications Trace Service Function

VLIC trace points for the communications trace service function (CT) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-44.

Qualifier	Description
10000-19999	Control program
20000-29999	Exception handler
30000-39999	Protocol formatter
40000-49999	Build trace buffer directory

Trace Points

Qualifiers 10000-19999: These trace points log all the send or receive message activity for communications trace. The module name is #CTMAIN.

Qualifiers 20000-29999: These trace points log activity performed by the exception handler for communications trace. The module name is #CTEXCP.

Qualifiers 30000-39999: These trace points indicate the execution path through a particular protocol formatting routine. For example, X.25, SDLC, BSC, asynchronous, and SNA. The module names are #CTSNA, #CTBSC, #CTSDLC, #CTHDLC, and #CTECL.

Qualifiers 40000-49999: These trace points log activity as the trace buffer data is accessed. The module name is #CTBUILD.

DB — Database Management

VLIC trace points for the database management (DB) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-39.

There are two kinds of trace points in the database external trace ID:

- Trace points along normal paths that document input values received and paths executed.
- Trace points along infrequently executed paths that document unusual conditions.

Normal Path: These trace points are selected to capture input values that influence subsequent execution paths. Their purpose is to help isolate interface problems between VLIC modules. To make these trace points useful, attempt to determine which data space, data space index, or permanent cursor is associated with the problem, and then supply the appropriate object qualifier during database trace activation so that only trace data associated with the database object in question is recorded.

Abnormal Path: Trace points along abnormal paths are selected to capture and explain unusual side effects on database objects. In some instances, side effects may cause the operational characteristics of the object to change. In general, it is useful to enable these trace points individually or by module when a single database instruction suddenly responds in an unexpected manner. This suggests that one of the underlying database objects has experienced some boundary condition, which is influencing its operational characteristics.

DO — Machine Observation

VLIC trace points for the machine observation (DO) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

The trace points display the input and/or output for each of the machine observation instructions. The qualifiers are subdivided so that the first 2 digits indicate the module (and in most cases, the instruction) being traced. The last three digits are not significant. The following list applies:

Qualifiers	Description
01001-01004	Displays the MATINV input and output for the instruction and some of the internal invocation search data.
02001-02002	Displays the MATPTR instruction's output.
03001-03002	Displays the MATPTRL instruction's input and output.
04001-04002	Displays the MATSOB instruction's input and output.
05001-05004	Displays the TRINS input, output, program header and trace header.
06001	Display only the input to CANTRINS.
07001-07006	Both the TRINV and CANINVTR instructions are handled by the same module, and the input and output for each is displayed along with some call or start search data.
08001-08002	Displays the event data for the instruction reference event.

DT — Directory Services

VLIC trace points for the directory services task (DT) external trace ID can be found in volume 2 of this manual.

The trace points are subdivided as follows:

Qualifiers **Description**

05000-05499 These trace points are in module #LCDSTSK. They trace the following:

- Send or receive messages from other APPN tasks and the REQPO MI instruction processor. The APPN tasks traced are: control point presentation services and manager, topology and routing services, and location manager.
- Send or receive messages sent by directory services to other APPN tasks and feedback records sent to MI response queues.
- Associated control blocks.
- Results of machine index operations performed on the directory services machine indexes.

05900-05999	Same as for qualifiers 05000 through 05499.
05500-05999	These trace points record error recovery data.

EE—EREP—Work with Error Log

VLIC trace points for the work with error log (EREP) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-44.

Every message sent and received by component or external trace ID EE is traced. Also traced are abnormal returns from display and print macros.

The trace points display conditions that cause the work with error log function to set status or status qualifiers. Some trace points display the send or receive messages in work with error log function. The trace points are divided into qualifiers. The qualifiers are for the activities in the work with error log function are as follows:

Qualifiers	Description
50000-50199	Selection and search
50200-50299	Problem analysis
51000-51999	Selection and search
53000-53499	Summary and detail reports
53500-53999	Volume statistics
54000-54999	PRTERRLOG command and ERAP
55000-55099	Summary and detail reports
55100-55399	Volume statistics
56000-56399	Selection and search
56400-56799	Summary and detail reports
56800-56899	Selection and search
58000-58999	Selection and search

EL—Error Log

VLIC trace points for the error log (EL) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-44.

Every message sent and received by component or external trace ID EE is traced. Also traced is an exception in the error log. For more information about error log, see 15-1.

EM—Event Management

VLIC trace points for the event management (EM) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

The trace points record successful execution of a system instruction, or internal data used in an event management common function. There is no significance to qualifier numbers.

EX—Exception Management

VLIC trace points for the exception management (EX) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

The trace points are subdivided by qualifier as follows:

Qualifiers	Description
10-29	Third-level exception handler
30-49	Exception generator
50-69	Return from exception
70-89	Invocation cleanup
90-109	Damage exception handling

Qualifiers 10-29 (Third-Level Exception Handler): The trace points record exception information and module status at the time the exception is incurred. All IMP exceptions, machine checks, and VLIC-signaled exceptions are traced. Also, component-specific exception handler processing information is recorded with abnormal task or process ending information.

Qualifiers 30-49 (Exception Generator): The information pertinent to locating an exception monitor is recorded. Included is the system exception data and if the exception handler is a branch point, internal entry point or an external invocation. An indication is also made if the exception is ignored or deferred or if the process is ended abnormally.

Qualifiers 50-69 (Return From Exception): These trace points record the occurrence of a system exception handler returning to the current invocation or to a prior invocation.

Qualifiers 70-89 (Invocation Cleanup): Information regarding an instruction exit routine is recorded before purging an invocation. The interface to the special CRE (call/return element) exit routine is recorded with information from the CRE being released. This information identifies the activity that occurred leading up to the handling of an exception or ending of a process. After cleanup is performed, all clues to the cause of the collapse of the invocation control block and CRE chains disappear.

Qualifiers 90-109 (Damage Exception Handling): These trace points record the location of a cleanup entry point and/or a resume point. This information isolates specific exception handling activity performed by the component-specific exception handler for a VLIC module.

FS — File Server

VLIC trace points for the file server (FS) component or external trace ID can be found in volume 2 of this manual under the byte string space management (BS) component or external trace ID. For more information about this component, see page 4-40.

The BS external ID is also used by the file server (FS) component because two components depend on each other. The trace *points* are divided between the two components as follows:

Qualifiers	Description
17000-17500	Byte string space modules
35000-36000	File server module

II — Independent Indexes

VLIC trace points for the independent indexes (II) external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

The trace points are placed only on unusual paths to capture data that is normally lost when problems occur. There are only two trace points in this component. Both occur when machine index processing returns a bad return code.

IN — Instruction

VLIC trace points for the instruction (IN) external trace ID can be found in volume 2 of this manual.

IP — Inter-Process Communications Facility

VLIC trace points for the inter process communications facility (IP) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

Inter-process communication facility (IPCF) trace points record events that occur during error recovery from I/O processor failures. Also, normal paths during allocation and deallocation of IPCF resources are recorded. Normal data flowing between the IMPI processor and the I/O processors is not traced. In most cases that IPCF trace should be used in conjunction with the common class I/O manager trace (CCIOM), machine services control point (MSCP) trace, and source/sink trace. IPCF trace points are in the following categories:

Trace Points	Description
30XXX	IPCF open manager trace points. These include normal paths executed during allocation and deallocation of IPCF resources and error recovery functions handled in the IPCF open manager task.
31XXX	Trace points for error recovery paths executed in the IPCF verbs.
32XXX	Trace points for error recovery paths in the IPCF router task.
33XXX	Trace points for error recovery paths common to the IPCF verbs, the IPCF router task, and the IPCF open manager.

JO — Journal Management

VLIC trace points for the journal management (JO) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-40.

There are two types of journal management trace points:

- Trace at completion of a major function
- Trace at an abnormal occurrence in a function

LD — Load/Dump

VLIC trace points for the load/dump (LD) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-41.

The load/dump trace points fall into the following categories:

Qualifiers	Description
0-1899	Load/dump asynchronous object processing trace points These trace points trace the progress of a load/dump session and trace module entry and exit, internal messages, portions of the object being processed, objects being sized or released, the load/dump descriptor for an object, and information about database networks.
1900-1999	Load/dump synchronous dump space object processing These trace points trace dump space modification entry points and input and output parameter lists.
2000-7999	The description for these trace points is the same as for trace points 0 through 1899.
8000-8399	Load/dump synchronous request I/O error checking These trace points log the first 400 bytes of the request I/O message and indicate when each internal routine is entered.
8400-8999	The description for these trace points is the same as for trace points 0 through 1899.
9000-9099	Suspend object. The #SMSUSOB module suspends an object or truncates its segments down to the headers. These trace points obtain

	information about the object's segments that are being truncated. The header of the object, the address, the current size, the amount to be truncated, and the amount that was truncated are traced.
9100-9199	The description for these trace points is the same as for trace points 0 through 1899.
10100-10199	The description for these trace points is the same as for trace points 0 through 1899.
22000-22500	The description for these trace points is the same as for trace points 0 through 1899.

For other external trace qualifiers of source/sink, see "SS—Source/Sink Management" on page 30-18.

LM—Location Manager Task

VLIC trace points for the location manager task (LM) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-44.

These trace points record successful processing of internal system messages. They also help isolate interface problems between VLIC tasks. In general, it is useful to enable these trace points when an unexpected result occurs when using the location manager functions. For more information about the location manager functions, see the *Communications User's Guide* and the *APPC Programmer's Guide* as described in the *Information Directory*.

LP—Source/Sink Protocols

VLIC trace points for the source/sink protocols (LP) external trace ID can be found in volume 2 of this manual.

This external trace ID is used to trace the communications protocols. The synchronous network architecture (SNA) protocols are traced in conjunction with the logical unit description object for both the remote and work station controller attached devices. The data link control (SDLC, X.25, and Token Ring LAN) protocols are traced in conjunction with the network description object at the line I/O manager level. Protocol trace shows SNA and SDLC violations and, therefore, points out the failing component.

For other source/sink external trace IDs, see "SS—Source/Sink Management" on page 30-18.

LT—Link Test Service Function

There are no trace points for link test. Link test relies on other components to debug its code.

MG—Source/Sink Messages

VLIC trace points for the source/sink messages (MG) external trace ID can be found in volume 2 of this manual.

This external trace ID traces all send or receive VLIC messages that a communications I/O manager (IOM) receives or sends. The trace starts the highest level object that an IOM processes (that is, controller description) instead of logical unit description for both station and work station controller IOMs. It also starts a network unit description instead of a controller unit description for a line IOM. This trace shows the sequence of functions being performed by the IOM.

For other external trace IDs of source/sink see "SS—Source/Sink Management" on page 30-18.

MN—Context Management

VLIC trace points for the context management (MN) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-41.

The trace points are placed at the beginning of modules to collect input data in order to verify errors in context management and to locate errors in components that use context management functions. Certain functions (resolve system pointer, insert context entry, and delete context entry) do not dump all input for performance reasons. A context is basically a special use of indexes, and context management trace points are placed on all paths where index errors occur.

MP—Multiprogramming Level

VLIC trace points for the multiprogramming level (MP) external trace ID can be found in volume 2 of this manual.

The trace points are placed so that each time multiprogramming level processing is performed, a trace point is reached. Changes in state, such as a change from the wait state to the active state, are recorded. Potential changes are also recorded even though the transition does not take place because no other process has the required attributes to force the change.

MS—Machine Service Control Point

VLIC log trace point entries for machine service control point (MS) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-45.

Trace qualifiers for machine services control point (MSCP) are allocated, in groups of 100, to different MSCP modules. There are three types of modules in MSCP:

- Synchronous modules service requests from source/sink system instructions.

- Asynchronous modules service messages from VLIC.

Table 30-4 shows the grouping of trace points by qualifier, module type (A = asynchronous and S = synchronous), module name, and module description.

Table 30-4. Trace Qualifiers for Machine Services Control Point (MSCP)

Qualifier Range	Module Type	Module Name	Description
10XX	A	#LOSPIOM	Service processor I/O manager (IOM)
01XX	A	#MSAELRB	Build or send request I/O maintenance statistics
04XX	S	#MSCDIAL	Level dial operation for the controller unit description (CTLD)
06XX	A	#MSSWMGD	Physical unit services
07XX	A	#MSSWMGS	Physical unit services
08XX	A	#MSCPEH	Asynchronous MSCP exception handler
09XX	A	#MSSRQIO	REQIO processor
11XX	A	#MSND	Network unit description (NUD) functions
14XX	A	#MSCPTSK	Machine services control point (MSCP) task
15XX	A	#MSUTIL	MSCP utility routines
16XX	S/A	#MSFECHQ	MSCP queue management subroutine
17XX	S	#MSGCSEH	General exception handler
18XX	S/A	#MSGETID	Get ID
19XX	S/A	#MSEVTSG	Event signaller
20XX	S	#MSLSCRT	Activates session between logical unit description (LUD) and device
21XX	S	#MSLVONN	Vary on or off LUD
22XX	S	#MSCVONN	Controller unit description (CTLD) routines
23XX	S	#MSNVONN	Vary on or off network descriptor
24XX	S	#MSCMRTN	MSCP common routines
25XX	S	#MSRELID	Return ID
26XX	S/A	#MSREQB	Build request I/O interface structure
27XX	A	#MSNDIAL	Level dial operation for the network unit description (NUD)
28XX	A	#MSCNTCT	Contact routines
30XX	A	#MSACTIV	Activate routines
34XX	A	#MSBART #MSBERP	BSC automatic recovery BSC error recovery procedures
36XX	S	#SSSNDR	Source/sink, send or receive time-out
54XX	S	#MSSAPPN or #MSAPINT	MSCP APPN routines

For other external trace IDs of source/sink, see "SS—Source/Sink Management" on page 30-18.

PG—Program Management

VLIC trace points for the program management (PG) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-41.

The qualifiers of the trace points in program management are subdivided so that the first two digits indicate the module that is being traced, and the last three digits indicate the nature of the trace point. If the value of the last three digits is less than 100, the trace point is for a normal path. If the value is in the range 200 through 299, the trace point is for an exception path.

Program Execution (Activation or Invocation Only): Trace points in the activation or invocation portion of program management display the parameters for the activation or invocation type instructions. The first two digits of the qualifiers are subdivided to indicate the instruction (and module) being traced. The last three digits are not significant. The following table indicates the instruction being traced.

Trace Points	Description
01xxx	ACTPG
02xxx	DEACTPG
03xxx	MODASA
04xxx	CALL (external)
05xxx	CALL (SVL)

PM—Process Management

VLIC trace points for the process management (PM) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-41.

Process management trace points are subdivided by qualifier as follows:

Qualifiers	Description
1-199	Used by normal path processing
200-399	Used by exception path processing

400-599	Used for trace points immediately before machine checks

Qualifiers 1-99 (Normal Path): In general, these trace points record the input to, and output from modules.

Qualifiers 200-399 (Exception Path): These trace points are placed in the component-specific exception handler routines to note the occurrence of the exception and record the contents of the exception data and also the backout variables.

Qualifiers 400-599 (Machine Check Path): These trace points record the occurrence of unexpected conditions that cause a machine check. The unexpected condition could be the result of:

- An unexpected exception in a module
- The result of a return code indicating an invalid condition associated with process or task start and/or end

Process management also includes the control (CN) external trace ID. For information about the CN external trace ID, see page 30-9.

PS — 5250 Pass-Through

VLIC trace points for the 5250 pass-through (PS) external trace ID can be found in volume 2 of this manual.

For other source/sink external trace IDs, see "SS — Source/Sink Management" on page 30-18.

5250 pass-through has seven modules and each have the following range of qualifiers:

Qualifiers	Description
0001-0999	#T2VPASS source intercept task mainline program
0091-0109	#TPVPASD REQPO instruction processor for pass-through
1000-1999	#TPVPASI intermediate intercept task mainline program
2000-2899	#T2VPAST target intercept task mainline program
2900-2989	#TPVFUNC functional routines called by the other programs, event and exception handlers, conversion routines, and so on
2990-2995	#TPVEXCP intercept task exception handler
3000	Same as qualifiers 2000 through 2899
None	#TPVRQEH REQPO instruction exception handler
9000-9699	Virtual terminal manager trace points
9700-9899	Virtual terminal manager REQPO processor trace points
9900-9999	Virtual terminal manager exception handler trace points

Generally, the data messages between the 5250 work station and the OS/400 program and the communication messages between the pass-through source and pass-through target using the LU 6.2 link and MSCP are traced. Flags and status indicators, along with the message headers, SSRs, SSDs, and RDs are included in most of the trace points.

The following qualifiers are shared by the #T2VPASS and #T2PAST modules. Each of the qualifiers have a 4-character index to show where in the code the trace was called from. #T2VPASS starts its character index with a 1 and #T2VPAST starts its character index with a 2.

Qualifiers	Shows the:
0100	Message header
0200	Control block
0300	Control block and local flags
0400	Control block and local flags
0500	SSR associated with the message being processed
0600	RDs associated with the message being processed
0700	SSD data of the message
0800	Queue that a message is being enqueued or dequeued to or from
0900	Unique data that is pointed to by the register passed to the trace routine

QM — Queue Management

VLIC trace points for the queue management (QM) external trace ID can be found in volume 2 of this manual.

The trace points are placed to record successful operations. The trace data is probably more useful in troubleshooting problems in functions that use queue management than in troubleshooting problems in queue management itself. Among other things, the trace points record which processes destroy or extend queues.

RM — Resource Management

VLIC trace points for the resource management (RM) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-42.

The resource management trace points are subdivided by the trace qualifiers. They are as follows:

Qualifiers	Description
1-9	Assigned to the internal seize/release function
10-39	Assigned to the lock function

40-49	Assigned to the internal VLIC timer support functions

Qualifiers 1-9 (Seize/Release): These trace points are placed only in exception paths for performance reasons. A successful simple seize or release occurs too frequently to save a meaningful amount of data. Also, data about a successful seize or release is not likely to be useful. A seize is more significant when it is necessary to wait for the resource. It is also significant when a task dispatching element (TDE) waiting to seize a resource is restarted. If several TDEs are competing for a resource, the TDE with the lowest priority may be forced to repeat the seize-wait-restart loop many times before successfully obtaining the resource.

Qualifiers 10-39 (Lock): These trace points are placed throughout the supporting routines and the following applies:

- Input to the system instructions are recorded
- Some intermediate results are saved
- Infrequently used VLIC interfaces are logged

In addition, several trace points are devoted to exceptional conditions such as entering and leaving the wait state.

Qualifiers 40-49 (Timer): These trace points record which processes request timer services. The type of service requested is also recorded. The actual handling of the timer requests is not traced.

SD — Main Storage Management Detailed

VLIC trace points for the main storage management detail (SD) external trace ID can be found in volume 2 of this manual.

Qualifiers	Description
2	This trace point is located in the write sector and traces the number of pages written.
3	This trace point is located in the read sector and traces the number of pages read.
4-9	These trace points are located in the perform paging request (PPR) function of storage management. These trace points are located in seldom used paths. The starting virtual address and number of pages requested are traced.
10	This trace point is located in the PPR function of storage management. This trace point traces explicit paging requests for access groups. The starting virtual address, number of pages requested, and paging request code are traced.

The controlling module for these trace points is #SVE8PPR.

For other storage management external trace IDs, see:

AD	Auxiliary storage management detailed described on page 30-6.
AS	Auxiliary storage management described on page 30-6.
SN	Main storage management invocation described on page 30-17.

SI — Instruction Processing

VLIC trace points for the instruction processing (SI) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-42.

This external trace ID or component trace is automatically activated when any of CB, MG, LP, or UD generic traces are activated. This trace records system instruction requests associated with source/sink system objects:

- Creation (CRTLUD, CRTCD, CRTND)
- Materialization (MATLUD, MATCD, MATND)
- Modification (MODLUD, MODCD, MODND)
- Request I/O (REQIO) instruction

  Note: For 3270 Translate Request I/O instruction, any or all of the CB, MG, LP, or UD traces must be activated for the LUD along with the MSCP trace points to activate its (SI) trace type.
- Feedback record (FB)

The trace points are subdivided by qualifier into the following general categories. Each category supports a system instruction:

Range of Qualifiers	System Instruction	Source/Sink Module
0001-0010	CRTLUD	#SILUCR1
0011-0020	CRTCD	#SICDCRI
0021-0030	CRTND	#SINDCRI
0031-0040	DESLUD	#SILUDYI
0041-0050	DESCD	#SICDDYI
0051-0060	DESND	#SINDDYI
0061-0070	MATLUD	#SILUMT1
0071-0080	MATCD	#SICDMT1
0081-0090	MATND	#SINDMT1
0091-0100	REQIO	#SIRQIO1
0101-0110	MODLUD	#SILUMD1
0111-0120	MODCD	#SICDMD1
0121-0130	MODND	#SINDMD1
0131-0140	CRTMD	#SIMDCR1
0141-0150	DESMD	#SIMDDY1
0151-0160	MATMD	#SIMDMT1
0161-0170	MODMD	#SIMDMD1
0171-0180	CRTCS	#SICSCR1
0181-0190	DESCS	#SICSDY1
0191-0200	MATCS	#SICSMT1
0201-0210	MODCS	#SICSMD1
0211-0220	REQSO	#SIRQSO1

Qualifiers 0001-0030 (CRTXXx): These trace points record information to identify the object that is successfully created. The feedback trace points are used with the request I/O trace points and are included in these qualifiers.

Qualifiers 0031-0060 (DESXXx): These trace points identify the object that is successfully destroyed. These traces are conditioned by a check of the object's trace bit.

Qualifiers 0061-0090 (MATXXx): These trace points identify the object that is materialized and the options used to materialize the object. These traces are conditioned by a check of the object's trace bit.

Qualifiers 0091-0100 (REQIO): These trace points record information relative to the input and output of the request I/O processor.

Qualifiers 0101-0130 (MODXXx): These trace points identify the object that is modified and the particular options used to modify the object. Because object modification takes place in three steps (status down, nonstatus elements, and status up), additional information is recorded to indicate when each of these three steps has successfully completed. The traces are conditioned by a check of the object's trace bit.

Qualifiers 0131-0140 (CRTMD): These trace points record information to identify that the MODE object created successfully.

Qualifiers 0141-0150 (DESMD): These trace points identify that the mode object has been successfully destroyed.

Qualifiers 0151-0160 (MATMD): These trace points identify the mode object that is materialized.

Qualifiers 0161-0170 (MODMD): These trace points identify the mode object that is modified.

Qualifiers 0171-0180 (CRTCS): These trace points record information to identify that the class-of-service object created successfully.

Qualifiers 0181-0190 (DESCS): These trace points identify that the class-of-service object has been successfully destroyed.

Qualifiers 0191-0200 (MATCS): These trace points identify the class-of-service object that is materialized.

Qualifiers 0201-0210 (MODCS): These trace points identify the mode object that is modified.

Qualifiers 0211-0220 (REQSO): These trace points record information relative to the input of the request statistics processor.

SM — Storage Management

External trace IDs for the storage management component are:

AD Auxiliary storage management detailed described on page 30-6.

AS Auxiliary storage management described on page 30-6.

SD Main storage management detail described on page 30-16.

SN Main storage management invocation described on page 30-17.

For more information about this component, see page 4-42.

SN — Main Storage Management Invocation

VLIC trace points for the main storage management invocation (SN) external trace ID can be found in volume 2 of this manual.

Qualifiers	Description
1-3	These trace points are located at the perform paging request (PPR) function of storage management. The starting virtual address, number of pages requested, and paging request code are traced.

The controlling module for these trace points is #SVE8PPR.

For other storage management external trace IDs, see:

AD Auxiliary storage management detailed described on page 30-6.

AS Auxiliary storage management described on page 30-6.

SD Main storage management detail described on page 30-16.

SO — Space Object Management

VLIC trace points for the space object management (SO) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-43.

There are six trace points in space management modules. In the qualifiers, the first 2 digits identify the module that contains the trace point. The next 3 digits identify the nature of the trace point. When the value of the last 3 digits is less than 100, a normal path being traced. When the value of the last 3 digits is in the range 201 through 299, an exception path being traced. The trace points are:

Trace Points	Description
01001	#SOCRT create space
02201	#SOCRTEH create space exception handler
03001	#SODES destroy space
04001	#SOMAT materialize space
05001	#SOMOD modify space (input)
05002	#SOMOD modify space (output)

SS — Source/Sink Management

The VLIC source/sink trace is based on a combination of source/sink objects and generic traces. You select the objects and traces during trace activation. The source/sink objects involved are the network unit description (NUD), controller unit description (CTLD), and logical unit description (LUD). The trace can be invoked for any combination of these objects and, therefore, problems can be resolved that involve the entire network or any of its parts (controllers or devices). For more information about this component, see page 4-43.

The source/sink management trace points are subdivided by trace qualifiers. They are as follows:

Qualifiers	Description
1000-1999	Diskette IOM
7000-7999	Tape IOM
9500-9999	Common DLC IOM
10000-10999	LAN IOM (Ethernet and Token-Ring LAN)
11000-11999	Local or SDLC IOM
12000-12999	X.25 IOM
15000-15999	Open station IOM

Tracing is under control of the logical unit descriptions (LUDS).

Message tracing may be sufficient to isolate problems outside IOM; control block and protocol tracing are usually needed for problems in IOM.

Qualifiers 1000-1999 and 7000-7999 (Diskette and Tape IOM): These trace points indicate the execution path through the component. There are two types of trace points:

- Message: All messages received and sent by the I/O manager (IOM) are traced.
- Control blocks: Internal processing and control variables are traced.

Qualifiers 10000-12999 (Common DLC, LAN, Local, SDLC, X.25 IOM): These trace points indicate the execution path through the component. There are three types of trace points:

- Message: All messages received and sent by the I/O manager (IOM) are traced.
- Control blocks: Internal processing and control variables are traced.
- Line Protocol: Traces the data that goes out or comes in on the communications link.

Other source/sink external trace IDs are:

CB	Source/sink control blocks described on page 30-8.
MG	Source/sink messages described on page 30-13.
MS	Machine services control point (MSCP) described on page 30-13.
LD	Load/dump described on page 30-12.
LP	Source/sink protocols described on page 30-13.
PS	5250 pass-through and virtual terminal manager are described on page 30-15.
UD	Source/sink user data described on page 30-19.

System objects are described on page 30-19.

SV — System Supervisor Linkage

VLIC trace points for the system supervisor linkage (SV) component or external trace ID can be found in volume 2 of this manual. For more information about this component, see page 4-43.

There is a single trace point associated with supervisor linkage. This is placed in the VLIC SVL router module #SV5DMIR, so that each time the VLIC module is called or started by means of an implicit SVL the trace point is reached. This allows for MI instructions which are translated to implicit SVLs to be traced.

TR — Topology and Routing Services Task

VLIC trace points for the topology and routing services task (TR) external trace ID can be found in volume 2 of this manual.

The trace points are subdivided as follows:

Qualifiers	Description
07000-07049	Send or receive messages from other APPN tasks and REQPO MI instruction processor are traced. The APPN tasks traced are: directory services, control point manager, and machine services control point.
07050	Results of a machine index operation against the network topology machine index are traced.
07100-07499	Send or receive messages sent by topology and routing services to other APPN tasks are traced. Associated control blocks and data are also traced.
07500-07599	These trace points record error recovery data.

UD—Source/Sink User Data

VLIC trace points for the source/sink user data (UD) external trace ID can be found in volume 2 of this manual.

This trace type traces the user's data stream. The user data is traced with the logical unit description object. It shows any problems that occur as a result of misuse of the data stream commands (screen formatting) associated with a device. These problems are most likely to occur when a new application program is used.

Note: All data sent and received is traced and, therefore, large amounts of data may be dumped.

Any combination of the generic trace types can be invoked. When CB, LP, MG, or UD is activated, the instruction processing (SI) trace of source/sink is automatically invoked.

For other external trace IDs of source/sink, see "SS—Source/Sink Management" on page 30-18.

System Object

A generic trace type must be invoked before communications source/sink components make trace entries. The following generic external trace IDs are:

CB	Source/sink control blocks, see page 30-8
LP	Source/sink protocols, see page 30-13
MG	Source/sink message, see page 30-13
UD	Source/sink user data, see page 30-19

Chapter 31. VLIC Log (VLOG) Entry Descriptions

VLIC log (VLOG) entry descriptions are for VLIC code design errors. The VLIC log ID, sometimes referred to as the note ID, appears in some error messages. To work with the VLIC log, see page 12-46. The VLOG major and minor codes can be found in volume 2 of this manual.

VLIC Log Descriptions

The VLIC log provides online recording for several types of occurrences in the VLIC. Programs at the system instruction interface can also request that an entry be made in VLIC log (a process dump) by means of the Diagnose instruction. Information about the process dump can be found in the *AS/400 System Support: Diagnostic Aids Addendum*[1] manual.

Entries are written into the VLIC log during normal system operation. If an event or exception is to be generated for the occurrence being logged, a dump identifier is returned to the requester so that the VLIC log entry can be identified and retrieved later. The dump identifier consists of the following:

- The VLIC log identifier, or note ID (currently always hex 01)
- The dump wrap identifier
- The offset of the associated note (note index) into the note segment group.

Use the *Work with VLIC log* option under DST or SST, or use the Print Internal Data (PRTINTDTA) command to retrieve VLIC log entries.

The VLIC log consists of the following three preassigned segment groups:

- The VLIC log control
- The VLIC log notes
- The VLIC log dumps

Each VLIC log entry consists of the following:

- Note

  This is fixed-length (256 bytes).

- Dump (optional)

  This is variable-length and a logical extension of the note.

The note and the dump wrap when full, and they wrap independently of each other. This allows you to retain statistical information (notes) for long periods of time without having to also retain dumps and other voluminous data. The note header contains the displacement of the dump within the dump segment group.

Note Data

The note entry of the VLIC log has the following standard header:

Length	Description
2	Major entry type
2	Minor entry type
1	Wrap identifier (incremented by 1 each time the note segment group wraps)
3	Dump displacement (0 if no dump)
8	Time stamp
Var	Note data (maximum is 240 bytes)

Dump Data

The dump entry (if there is one) of the VLIC log has the following standard header:

Length	Description
1	Wrap identifier (incremented by one each time the dump segment group wraps)
3	Note offset
1	Control flags
3	Dump data length
Var	Dump data

Wrap IDs

Because both the note and dump segment groups wrap when full, the wrap identifier is used to assure that the note and dump portion of a VLIC log entry actually belong together. The dump segment group usually wraps first, and, therefore, you may receive a note with a nonzero dump displacement but no dump. When that happens, the associated dump has already been overlaid.

Entry Types

VLIC log entries are categorized according to the major type code as follows:

Major Type Code	Description
01XX	Machine check
02XX	Function check
03XX	Damage
0400	Tolerance
0401	VLIC log interface errors
0402	Enabled exception handler

1 Object Code Only (OCO) — IBM Confidential Restricted

0403	Tolerated exception
0404	Effective address overflow (EAO) threshold
0405	Recovered object list
0406	Locking exception
05XX	IPL
0501	End machine processing
0505	Object conversion at IPL
06XX	Database
07XX	Source/sink
08XX	AS/400 instruction request
09XX	Reserved
0AXX	Machine index
0BXX	Authority management
0CXX	Service function
0DXX	Journal management
0EXX	Unknown major ID
0FXX	Commitment management
10XX	Storage management
11XX	Translator
12XX	Program management

The VLOG major and minor codes can be found in volume 2 of this manual.

The second byte of the major type code may subdivide a major category. The minor type code provides a unique identity for each entry within the machine. The minor type code sometimes has special meaning within a particular major type code.

Machine and Function Check Exceptions

For machine and function check exceptions, the minor code in the VLIC log entry is the error code displayed in messages MCH3202 and MCH3203. Therefore, it is easy to relate an error code to a specific VLIC log entry.

Damage and Tolerance

For damage and tolerance entries, the type codes have the following meanings:

Minor Type Code	**Description**
XX01	Tolerance
XX02	Damage set
XX03	Damage encountered (not normally logged except for specific source/sink requests)

Major Type Code	**Description**
00XX	No damage, tolerance
01XX	Hard damage
02XX	Soft damage
XX00	No object type involved
XXtt	tt=object type

Using the preceding major and minor type codes, you can retrieve VLIC log entries based upon specific types of damage to specific types of objects.

Problem Analysis Information in VLIC IWAs

Problem determination information is often found in the invocation work area (IWA) of the executing process. The VLIC log formatted dump contains call or return elements (CREs) and invocation control blocks (ICBs) of the executing process when the error occurred. The CRE associated with the machine or function check exceptions is in the VLIC log with the same VLIC log ID as the process dump. Register 3 in the CRE (offset hex 20 through 25) points to the invocation control block (ICB).

For more information about a process storage dump or job structure dump, see the *AS/400 System Support: Diagnostic Aids Addendum*[2].

[2] Object Code Only (OCO)—IBM Confidential Restricted.

Part 8. General Internal Microprogramming Instructions (IMPI) Information

Chapter 32. IMPI Processor

Register Descriptions

When the processor starts executing the task, the task's TDE (on the prime TDQ) contains the values to be internalized to the processor registers. Figure 32-2 on page 32-4 shows the format of the TDE. The TDE contains the:

Instruction address register (IAR)
: This register of 2-bytes contains the address offset into the instruction steam segment to the next IMPI instruction to be executed.

Condition code register (CC)
: This register reflects the results of a majority of the arithmetic, logical, and other data manipulation and control IMPI instructions.

For more information about the status of a TDE, see page 27-7.

The hardware registers used with the processor can be used individually or can be combined to form larger registers. There are 16 segment identifier (SID) registers, 16 W (4-byte) and 16 R (2-byte) registers, and 16 r (1-byte) registers as shown in Figure 32-1 on page 32-2. R registers hex 8-F are divided to form 16 single-byte registers, r(0)-r(F). The S and R registers are combined to form the B or base registers. The 16 base registers can contain addresses during IMP instruction procedure execution. All instruction addressing and branching within a procedure relates to the address contained in base register 0 (B0). B0 points to the start of the instruction stream segment unless the program is larger than one segment. Then B0 points to the start of the segment containing the portion of the procedure that is currently executing.

There is also a set of 8 F (8-byte) registers used in the floating point operations.

IMPI View of Hardware (registers)

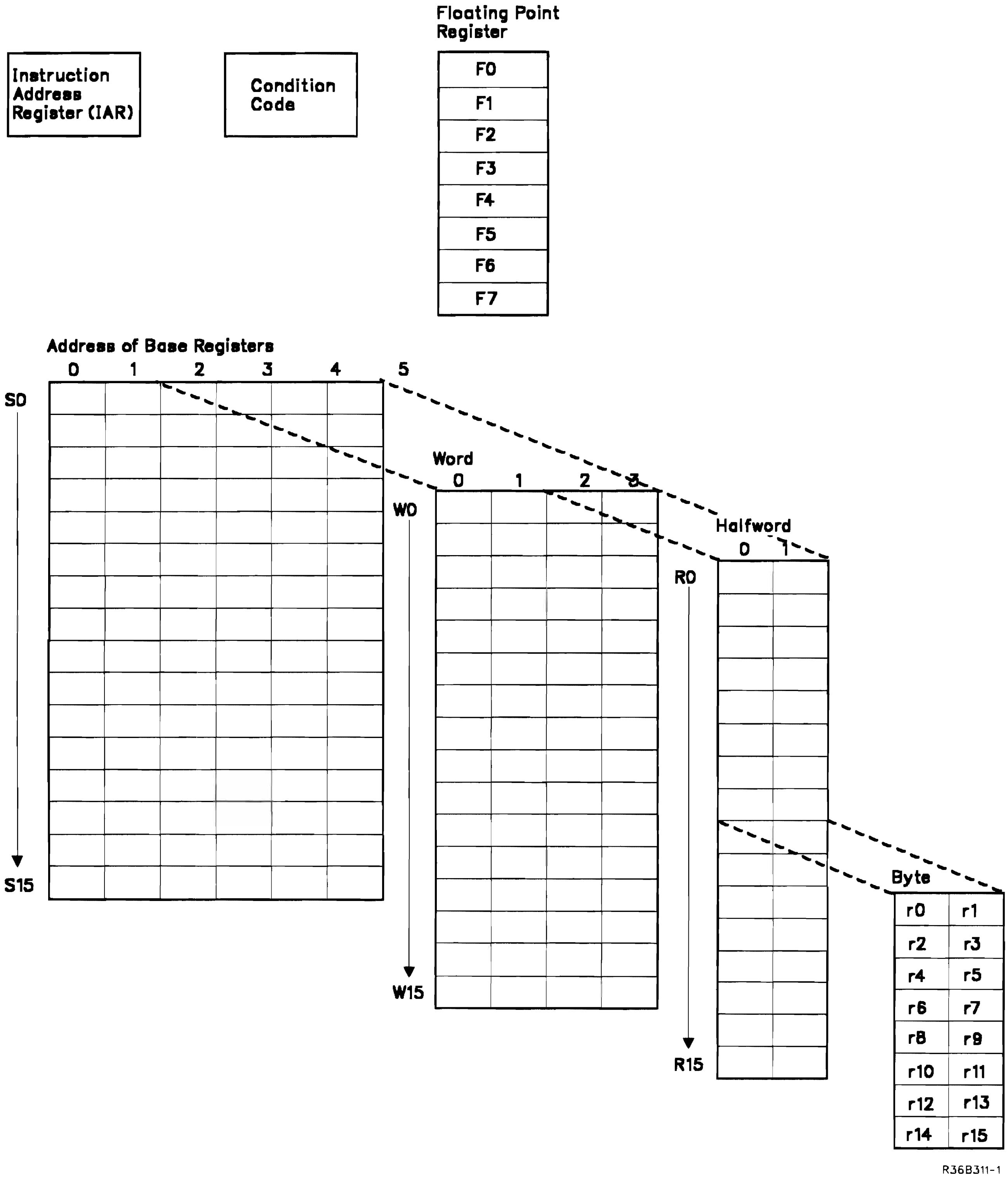

Figure 32-1. Register Sizes

Note: The number in parentheses indicates the number of the associated register (S, R, or r).

Supervisor Linkage Register Loading

IMPI

	Registers	Parameters Loaded
Implicit		
RR	r(e)	I-byte
RS, SI (4 bytes)	r(e)	I-byte
	B(1)	Operand 1 address or Operand 2 address
SS	r(e)	I-byte
	B(1)	Operand 1 address
	B(2)	Operand 2 address

Explicit

SVL0 — Registers: None

3F	I
0 Bits	8 15

SVL1 — Registers: B(1) — Operand 1 address

5D	I	B_1	D_1
0 Bits	8	16	20 31

SVL2 — Registers: B(1) — Operand 1 address; B(2) — Operand 2 address

DF	I	B_1	D_1	B_2	D_2
0 Bits	8	16	20	32	36 47

	Registers	Parameters Loaded
Address Translation Exception	B(1)	Faulting virtual address (SID and PID)
Cross Page Comment	R(12)	Page fault with page
All Other Exceptions	None	

Note: B(E) is loaded with the address of the CRE used to save status for all SVL types.

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IMPI

IMP Object Formats

Task Dispatching Queue (TDQ)

Descriptor	First TDE Address	
0	2 Bytes	8

Task Dispatching Element (TDE)

Descriptor	Next TDE Address	Priority	Control Mode	Address of CRE
0	2 Bytes	8	C	E

Exception Mask	Current Queue Address	Exception Occurrence	TDQ Address
14	16	1C	1E

Time Quantum	Status	Condition Code Register	Instruction Address Register	Base Registers	
24	2C	2F	30	31	91

Protection Domain	TDE Identifier	Hold Count	Exception Code	PEM Start Address	Computational Attributes	
92	94	96	98	9A	A0	A1

PEM Stop Address	Not Used	Reserved	Checkpoint Area	Not Used	
A2	A8	B0	C0	D0	FF

Floating Point Registers	Not Used	Reserved	Not Used	
100	140	180	190	1FF

Send/Receive, Available CRE, IOM (SRQ, ACQ, IOMQ)

Descriptor	First TDE Address	Re-served	Key Length-1	First Message Address
0	2 Bytes	8	9	A

Reserved	
10	20

Descriptor Type (byte 0)

Bit Assignments			
0	1	2	Mnemonic
0	0	0	TDQ
0	0	1	TDE
0	1	0	SRQ
0	1	1	SRM
1	0	0	SRC
0	1	1	CRE

Send/Receive Message (SRM)

Descriptor	Next Message Address	Key	Message	
0	2 Bytes	8	k+1	n

Send/Receive Counter (SRC)

Descriptor	First Waiting TDE Address	Count	Limit	
0	2 Bytes	8	A	C

Call/Return Element (CRE)

Descriptor	Next CRE Address	Status	Address Register	Base Registers
0	2 Bytes	8	C	E

ACQ Address	Exception	Not Used	
6E	74	76	80

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Figure 32-2 (Part 1 of 2). Formats of the IMP Objects

Primary Directory (PD) Entry

Flags	Hash Table Entry	Pin Count	Hash Chain	SID	PID	Status	SID Extender	
0	1	4	5	B	C	D	E	10

Flags	Hash Table Entry	Disk Unit	Disk Address	Flags	Pool Backward Chain Pointer	Pool	EXT Size	Pool Forward Chain Pointer	
10	11	14	15	18	19	1C		1D	20

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Figure 32-2 (Part 2 of 2). Formats of the IMP Objects

Chapter 33. Supervisor Linkage Router Table

Use Figure 33-1 to determine the supervisor linkage (VLIC SVL) router module that gains control as the result of an SVL.

The SVL number (hex 5D in this example) is used as an index into the following SVL table.

5D5D 3120   **SVL1 Hex 120 (ICB) Hex 5D**

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Figure 33-1. Hex 5D of the Supervisor Linkage Router Table

Table 33-1 (Page 1 of 2). Supervisor Linkage (SVL) Router Table

SVL Number (Hex)	Router Module	Router Description
00	#SV00EXC	First-level exception handler
01-05	#SVERROR	Error
06	#SV06SYN	Synchronize with AIO
07-0C	#SVERROR	Error
0D	#SV13DBC	Double-byte character exception router
0E-0F	#SVERROR	Error
10	#SV10CNN	Convert numeric to numeric
11	#SV11MEX	AS/400 exception signaling
12	#SV12NAS	Array index conversion
13	#SVERROR	Error
14	#SV14CKP	Pointer integrity check
15	#SV15SYP	Build system pointer
16-17	#SVERROR	Error
18-1A	#SV18CTR through #SV1ACTR	Call trace
1B	#SV1BCTR	Call trace
1C	#SVERROR	Error
1D	#SV1DEXC	Third-level error handler
1E	#SVERROR	Error
1F	#SV1FBDY	Monitored SVL instruction
20-22	#SV20CTR through #SV22CTR	Call trace
23-27	#SVERROR	Error
28-2A	#SV28CTR through #SV2ACTR	Call trace
2B-2C	#SVERROR	Error
2D	#SV2DCRT	Create segment CF
2E	#SV2EEXT	Extend segment CF
2F	#SV2FTRC	Truncate segment CF
30	#SV3ODES	Destroy segment CF
31	#SV31OVF	Three byte arithmetic overflow
32-35	#SVERROR	Error
36	#SV36FEX	Floating-point exception generator
37-43	#SVERROR	Error
44	#SV44ADR	Storage management— trace collection
45	#SVERROR	Error
46	#SV46SYN	Synchronize with AIO

Table 33-1 (Page 1 of 2). Supervisor Linkage (SVL) Router Table

SVL Number (Hex)	Router Module	Router Description
47	#SV47AIO	Granular synchronous I/O
48-4A	#SV48CTR through #SV4ACTR	Call trace
4B-4D	#SVERROR	Error
4E	#SV4EINX	EXCB indexing operand explicit SVL
4F	#SV4FSMT	Storage management trace
50	#SV50SMT	Storage management trace
51	#SVERROR	Error
52-54	#SV52CTR through #SV54CTR	Call trace
55-57	#SVERROR	Error
58-5A	#SV58CTR Call trace through	#SV5ACTR
5B	#SV5BSVL	SVLM1
5C	#SVERROR	Error
5D	#SV5DMIR	AS/400 instruction SVL router
Note: Table 33-2 on page 33-2 shows a list of modules that gain control when an SVL hex 5D is issued.		
5E-61	#SVERROR	Error
62	#SV62CTR	Call trace
63	#SV63GTR	General trace
64-75	#SV64GTR through #SV75GTR	General trace (II)
76	#SV76SMT	Storage management— trace collection
77	#SV77GTR	General trace (II)
78	#SVERROR	Error
79-7F	#SV79GTR through #SV7FGTR	General trace (II)
80-83	#SVERROR	Error
84	#SV84GTR	General trace (II)
85	#SV85GTR	General trace RM/MPL
86	#SV86GTR	General trace X.25 IOP
87-8C	#SVERROR	Error
8D	#SV8DTPS	Test page status extend
8E-93	#SVERROR	Error
94	#SV94EXC	EXC3801 macro
95	#SV95EXC	EXC3203 macro
96	#SV96EXC	EXCNODAT macro
97	#SV97EXC	EXCNODAT macro with system pointer
98	#SV98EXC	EXCNODAT macro with space pointer
99	#SV99EXC	EXCDATA macro
9A	#SV9AEXC	EXCDATA macro with system pointer
9B	#SV9BEXC	EXCDATA macro with space pointer
9C	#SV9CMCK	Machine-check macro
9D	#SV9DFLA	Program debug
9E	#SV9EMAP	Execution map
9F	#SV9FSVX	Storage management SVX
A0-AD	#SVERROR	Error
AE	#SVAE	Implicit extended operation code
AF-B9	#SVERROR	Error
BA-BD	#SVBACTR through #SVBDCTR	Call trace
BE	#SVBE	Implicit extended operation code
BF	#SVERROR	Error

Table 33-1 (Page 2 of 2). Supervisor Linkage (SVL) Router Table

SVL Number (Hex)	Router Module	Router Description
C0-C6	#SVC0CTR through #SVC6CTR	Call trace
C7	#SVERROR	Error
C8-CD	#SVC8CTR through #SVCDCTR	Call trace
CE	#SVCE	Implicit extended operation code
CF	#SVCFGTR	General trace
D0	#SVD0GTR	General trace
D1	#SVERROR	Error
D2-D4	#SVD2GTR through #SVD4GTR	General trace
D5	#SVERROR	Error
D6	#SVD6GTR	General Trace
D7	#SVERROR	Error
D8-DA	#SVD8GTR through #SVDAGTR	General Trace
DB-E7	#SVERROR	Error
E8	#SVE8PPR	Perform paging request (PPR) instruction implicit storage management SVL
E9-EA	#SVERROR	Error
EB	#SVEB	Move characters and tags long
EC-F3	#SVERROR	Error
F4	#SVF4	Extra long divide packed
F5-F8	#SVERROR	Error
F9	#SVF9	Multiply packed long implicit
FA	#SVFA	Divide packed long implicit
FB-FF	#SVERROR	Error

Supervisor Linkage 5D Interface

Use Table 33-2 to determine which VLIC module gains control as the result of a hex 5D SVL. Figure 33-2 shows both forms of usage. Halfword register 15 is loaded with a value that is used as an index into a table of VLIC labels. The labels are entry point labels in VLIC modules. Be aware that the entry point label and module name are sometimes different; when that is the case, use a VLIC linkmap to determine the correct module name.

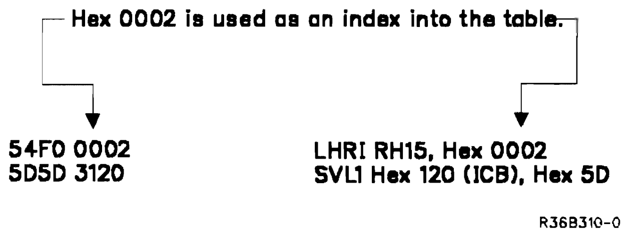

Figure 33-2. Hex 0002 Relationship with Hex 5D

Table 33-2 is also used by the Function Call Double instruction to transfer control to the function routine selected by the index in the instruction's immediate data field.

Table 33-2 (Page 1 of 5). Supervisor Linkage 5D Interface

SVLX R(15)	FNC2 I3	Index Entry Label	VLIC Module	Operation Description
1	0	CCCVTNN	#CCCVCN	Convert character to numeric or numeric to character
2	1	CVTEFN	#CCCVEN	Convert external form to numeric
3	2	CRTPG	#XLATOR	Create program
4	3	ACTPG	#AICRACT	Activate program
5	4	EDIT	#CCEDIT2	Edit
6	5	REQIO	#SIRQIO1	Request I/O
7	6	MODLUD	#SILUMD1	Modify logical unit description
8	7	MODND	#SINDMD1	Modify network unit description
9	8	MODCD	#SICDMD1	Modify controller unit description
A	9	MATLUD	#SILUMT1	Materialize logical unit description
B	A	MATND	#SINDMT1	Materialize network unit description
C	B	DELDSEN	#DBDELEN	Delete data space entry
D	C	DEACTCR	#DBDACR	Deactivate cursor
E	D	DESCR	#DBDCR	Destroy cursor
F	E	DESDS	#DBDDS	Destroy data space
10	F	DESDSINX	#DBDINX	Destroy data space index
11	10	ENSDSEN	#DBENDSE	Ensure data space entries
12	11	INSDSEN	#DBINSEN	Insert data space entry
13	12	MATCRAT	#DBMATCR	Materialize cursor attributes
14	13	SETCR	#DBSETCR	Set cursor
15	14	UPDSEN	#DBUPDEN	Update data space entry
16	15	FNDIXNEN	#IXFNDEN	Find index entry
17	16	INSINXEN	#IXINSEN	Insert index entry
18	17	CRTINX	#IXCRTIX	Create index
19	18	RMVINXEN	#IXRMVEN	Remove index entry
1A	19	GRANT	#AUGRAU	Grant authority
1B	1A	RETRACT	#AURCTAU	Retract authority

Table 33-2 (Page 2 of 5). Supervisor Linkage 5D Interface

SVLX R(15)	FNC2 I3	Index Entry Label	VLIC Module	Operation Description
1C	1B	MATAUOBJ	#AUMATOB	Materialize authorized objects
1D	1C	MATAUU	#AUMATUU	Materialize authorized users
1E	1D	CRTS	#SOCRT	Create space
1F	1E	MODS	#SOMOD	Modify space
20	1F	ACTCR	#DBACR	Activate cursor
21	20	CRTCR	#DBCCR	Create cursor
22	21	RLSDSEN	#DBRLSEN	Release data space entries
23	22	CRTCTX	#MNCRTC	Create context
24	23	DESCTX	#MNDSTC	Destroy context
25	24	RSLVSP	#MNRESSP	Resolve system pointer
26	25	TESTAUTH	#AUTSTAU	Test authority
27	26	SIGEVT	#EMSGEVT	Signal event
28	27	WAITEVT	#EMWOE	Wait on event
29	28	SIGEXCP	#EXSGEXP	Signal exception
2A	29	RETEXCPD	#EXRTEXD	Retrieve exception data
2B	2A	RTNEXCP	#EXRTEXP	Return from exception
2C	2B	CRTQ	#PMCRQUE	Create queue
2D	2C	ENQ	#PMEQMSG	Enqueue
2E	2D	DEQ	#PMDQMSG	Dequeue
2F	2E	MODPRATR	#PMMODF1	Modify process attributes
30	2F	INITPR	#PMINPR1	Initiate process
31	30	RESPR	#PMRSMPR	Resume process
32	31	SUSPR	#PMSUSPR	Suspend process
33	32	RTX	#AIRT	End and return external
34	33	CRTAG	#RMCACG	Create access group
35	34	UNLOCK	#RMUNLK	Unlock object
36	35	XFRLOCK	#RMMMXLK	Transfer object lock
37	36	DESPG	#PGDESPG	Destroy program
38	37	DESACTPG	#AIDACTV	Deactivate program
39	38	RSLVDP	#MNRSLVD	Resolve data pointer
3A	39	CRTUP	#AUCRTUP	Create user profile
3B	3A	DBMAINT	#DBMAINT	Database maintenance
3C	3B	DESS	#SODES	Destroy space
3D	3C	MATS	#SOMAT	Materialize space attributes
3E	3D	SUSOBJ	#SMSUSOB	Suspend object
3F	3E	CRTLUD	#SILUCR1	Create logical unit description
40	3F	TESTEXCP	#EXTSTEX	Test exception
41	40	TESTEVT	#EMTSTEVT	Test event
42	41	CANEVTMN	#EMCMEVT	Cancel event monitor
43	42	SETDPAT	#CCSTDT	Set data pointer attributes
44	43	DESUP	#AUDESUP	Destroy user profile
45	44	MATAU	#AUMATAU	Materialize authority
46	45	MATUP	#AUMATUP	Materialize user profile
47	46	MODUP	#AUMODUP	Modify user profile
48	47	XFRO	#AUXFRO	Transfer ownership
49	48	DELPGOBS	#PGDELPO	Delete program observability
4A	49	MATPG	#PGMATPG	Materialize program
4B	4A	MODASA	#AIMDASA	Modify automatic storage allocation
4C	4B	CRTCD	#SICDCR1	Create controller description
4D	4C	CRTND	#SINDCR1	Create network unit description
4E	4D	DESCD	#SICDDY1	Destroy controller description
4F	4E	DESLUD	#SILUDY1	Destroy logical unit description
50	4F	DESND	#SINDDY1	Destroy network unit description
51	50	MATCD	#SICDMT1	Materialize controller description
52	51	DIAG	#RIDIAGF	Diagnose
53	52	MATMATR	#RIMATMA	Materialize machine attributes
54	53	MODMATR	#RIMODMA	Modify machine attributes
55	54	TERMPR	#PMDTYPR	Terminate process
56	55	CRTDS	#DBCDS	Create data space
57	56	CRTDSINX	#DBCINX	Create data space index
58	57	MATDSAT	#DBMATDS	Materialize data space attributes
59	58	MATDSIAT	#DBMATIX	Materialize data space index attributes
5A	59	RETDSEN	#DBRETEN	Retrieve data space entry
5B	5A	DESINX	#IXDESIX	Destroy index
5C	5B	MATINXAT	#IXMATAT	Materialize index attributes
5D	5C	CANTRINV	#DOCTRNV	Cancel trace invocations
5E	5D	CANTRINS	#DOCTRIN	Cancel trace instructions

Table 33-2 (Page 3 of 5). Supervisor Linkage 5D Interface

SVLX R(15)	FNC2 I3	Index Entry Label	VLIC Module	Operation Description
5F	5E	MATPTRL	#DOMTPTL	Materialize pointer locations
60	5F	MATPTR	#DOMTPTR	Materialize pointer
61	60	MATSOBJ	#DOMTSOB	Materialize system object
62	61	TRINV	#DOTRINV	Trace invocations
63	62	TRINS	#DOTRINS	Trace instructions
64	63	MATCTX	#MNMATC	Materialize context
65	64	MODADR	#MNMODA	Modify addressability
66	65	RENAME	#MNRENAM	Rename object
67	66	CRTPCS	#PMCPCS	Create process control space
68	67	DESPCS	#PMDPCS	Destroy process control space
69	68	MATPRATR	#PMMATER	Materialize process attributes
6A	69	TERMMPR	#ITMPT1	Terminate machine processing
6B	6A	CRTDOBJ	#RMCDUPO	Create duplicate object
6C	6B	DESAG	#RMDACG	Destroy access group
6D	6C	ENSOBJ	#RMENOBJ	Ensure object
6E	6D	MATAGAT	#RMMACG	Materialize access group attributes
6F	6E	MATRMD	#RMMATD	Materialize resource management data
70	6F	MODRMC	#RMMODC	Modify resource management controls
71	70	SETACST	#RMSACS	Set access state
72	71	DBLEVTMN	#EMDBLED	Disable event monitor
73	72	EBLEVTMN	#EMEBLED	Enable event monitor
74	73	MNEVT	#EMMNEVT	Monitor event
75	74	RETEVTD	#EMREVTD	Retrieve event data
76	75	UNMASK	#EMUNMSK	Unmask
77	76	MATEXCPD	#EXMTEXD	Materialize exception description
78	77	MODEXCPD	#EXMDEXD	Modify exception description
79	78	DESQ	#PMDTYQU	Destroy queue
7A	79	MATQAT	#PMMTQAT	Materialize queue attributes
7B	7A	MATOBJLK	#RMMTOLK	Materialize object lock
7C	7B	MATPRLK	#RMMTPLK	Materialize process locks
7D	7C	LOCK	#RMLK	Lock object
7E	7D	MATINV	#DOMATIA	Materialize invocation
7F	7E	CALLE	#AICALLX	Call external without instruction definition list
80	7F	XCTL	#AICALLM	Transfer control
81	80	RECLAIM	#RCRCLM	Reclaim lost objects
82	81	CPYDSE	#DBUCOPY	Copy data space entry
83	82	INSSDSE	#DBINSEQ	Insert sequential data space entry
84	83	RETSDSE	#DBRESEQ	Retrieve sequential data space entry
85	84			Not used
86	85	LOCKSL	#RMLKS	Lock space address
87	86	UNLOCKSL	#RMUNLKS	Unlock space address
88	87	MATSELLK	#RMMTSLK	Materialize selected locks
89	88	SNSEXCPD	#EXSNEXD	Sense exception description
8A	89	CALLIDL	#AICIDL	Call external with instruction definition list
8B	8A	APYJCHG	#JOAPPLY	Apply journaled changes
8C	8B	CRTJP	#JOCRTJP	Create journal port
8D	8C	CRTJS	#JOCRTJS	Create journal space
8E	8D	DESJP	#JODESJP	Destroy journal port
8F	8E	DESJS	#JODESJS	Destroy journal space
90	8F	JRNLD	#JOURDAT	Journal data
91	90	JRNLOBJ	#JOJOBJ	Journal object
92	91	MATJPAT	#JOMATJP	Materialize journal port attributes
93	92	MATJSAT	#JOMATJS	Materialize journal space attributes
94	93	MATJOAT	#JOMATOA	Materialize journaled object attributes
95	94	MATJOBJ	#JOMATJO	Materialize journaled objects
96	95	MODJP	#JOMODJP	Modify journal port
97	96	RETJENT	#JORETEN	Retrieve journal entries
98	97	COMMIT	#COCOMIT	Commit
99	98	CRTCB	#COCRCOB	Create commitment block
9A	99	DECOMMIT	#CODCMIT	Decommit
9B	9A	DESCB	#CODSCOB	Destroy commitment block
9C	9B	MATCBATR	#COMACOB	Materialize commitment block attributes
9D	9C	MODCB	#COMOCOB	Modify commitment block
9E	9D	SETIEXIT	#EXSEXIT	Set invocation exit
9F	9E	CLRIEXIT	#EXCEXIT	Clear invocation exit
A0	9F	CVTCB	#CCCVCB	Convert character to BSC
A1	A0	CVTBC	#CCCVBC	Convert BSC to character

Table 33-2 (Page 4 of 5). Supervisor Linkage 5D Interface

SVLX R(15)	FNC2 I3	Index Entry Label	VLIC Module	Operation Description
A2	A1	MODINX	#IXMODII	Modify independent index
A3	A2	MODSOBJ	#DOMODSO	Modify system object
A4	A3	MATAOL	#RMMTALK	Materialize allocated object locks
A5	A4	MATINAT	#DOMTINS	Materialize instruction attributes
A6	A5	MODDSIA	#DBMODIX	Modify data space index attributes
A7	A6	GRNTLIKE	#AUGRLAU	Grant like authority
A8	A7	MATEVTMN	#EMMATMN	Materialize event monitors
A9	A8	WAITTIME	#RMWAIT	Wait on time
AA	A9	MATDRECL	#RMMTRLK	Materialize data space record locks
AB	AA	MATPRECL	#RMMPRLK	Materialize process record locks
AC	AB	MATQMSG	#PMMATQM	Materialize queue messages
AD	AC	RESAG	#RMRESAG	Reset access group
AE	AD	MATINVS	#DOMTSTK	Materialize invocation stack
AF	AE	RTX1	#AIRTX1	Return external special entry 1
B0	AF	RTX2	#AIRTX2	Return external special entry 2
B1	B0	RTX3	#AIRTX3	Return external special entry 3
B2	B1	CPYBTLLS	#SVCBLSH	Copy bits with left logical shift
B3	B2	CPYBTRLS	#SVCBRSH	Copy bits with right logical shift
B4	B3	REQPO	#TPVPASD	Request path operation
B5	B4	LOGICAL	#SVLOG	Logical common routine
B6	B5	MODDSAT	#DBMDSAT	Modify data space attributes
B7	B6	CIPHER	#CRCIPHR	Cipher (encrypt/decrypt)
B8	B7	ESTDSIKR	#DBIXGES	Estimate number keys/pages
B9	B8	CRTDMPS	#LDCRTDS	Create dump space
BA	B9	DESDMPS	#LDDESDS	Destroy dump space
BB	BA	INSDMPD	#LDINSDD	Insert dump data
BC	BB	MATDMPS	#LDMATDS	Materialize dump space
BD	BC	MODDMPS	#LDMODDS	Modify dump space
BE	BD	RETDMPD	#LDRETDD	Retrieve dump data
BF	BE	MODS2	#SOMOD2	Modify space attributes, character operand 2 entry
C0	BF	TERMINST	#PMTRMIN	Terminate instruction
C1	C0	CIPHERKY	#CRCPHKY	Cipher key
C2	C1	CRMD	#RMCRMD	Compute resource management data
C3	C2	CRTCSD	#SICSCR1	Create class of service description
C4	C3	CRTMD	#SIMDCR1	Create mode description
C5	C4	DESCSD	#SICSDY1	Destroy class of service description
C6	C5	DESMD	#SIMDDY1	Destroy mode description
C7	C6	MATCSD	#SICSMT1	Materialize class of service description
C8	C7	MATMD	#SIMDMT1	Materialize mode description
C9	C8	MODCSD	#SICSMD1	Modify class of service description
CA	C9	MODMD	#SIMDMD1	Modify mode description
CB	CA	REQSO	#SIRQSO1	Request statistics operation
CC	CB	MATMATR2	#RIMATM2	Materialize machine attributes 2
CD	CC	CRTAL	#AUCRTAL	Create authorization list
CE	CD	DESAL	#AUDESAL	Destroy authorization list
CF	CE	MATAL	#AUMATAL	Materialization authorization list
D0	CF	MODAL	#AUMODAL	Modify authorization list
D1	D0	CPYECLP1	#CCCLAP	Copy extended characters left adjusted with pad
D2	D1	CPYECLP2	#CCCLAP2	Copy extended characters left adjusted with pad (from data base mapping)
D3	D2	CRTDCT	#DSCRTD	Create dictionary
D4	D3	DESDCT	#OEDESDC	Destroy dictionary
D5	D4	CHKDCT	#DSLEXAM	Check dictionary
D6	D5	MATDCT	#OEMATDC	Materialize dictionary
D7	D6	GRNTLIKO	#AUGRLOB	Grant like object authority
D8-D9	D8-D9			Not used
DA	DA	CLSBSS	#BSSCLS	Close byte string space
DB	DB	CRTBSS	#BSSCRT	Create byte string space
DC	DC	DESBSS	#BSSDES	Destroy byte string space
DD	DD	MATBSS	#BSSMAT	Materialize byte string space
DE	DE	MODBSS	#BSSMOD	Modify byte string space
DF	DF	OPNBSS	#BSSOPN	Open byte string space
E0	E0	RETBS	#BSRETBS	Retrieve byte string
E1	E1	STBS	#BSSTBS	Store byte string
E2	E2	MODBSLS	#BSLOCK	Modify byte string lock state
E3	E3	CPYBTRAS	#SVCBRAC	Copy bits with right arithmetic shift
E4	E4	TESTEAU	#AUTSTPS	Test extended authority

Table 33-2 (Page 5 of 5). Supervisor Linkage 5D Interface

SVLX R(15)	FNC2 I3	Index Entry Label	VLIC Module	Operation Description
E5-FF	E5-FF			Not used

Chapter 34. Machine Check Log Buffer (MCLB)

To get the address of MCLB, select the following options from DST:

- *Work with service tools* on page 13-21
- *Display/alter/dump* on page 12-27

A pointer to the MCLB is located at offset hex 3A into the control address table or at virtual address that is real address hex 8000 0000 003A. MCLB can be displayed using main storage dump procedures as long as the machine check does not prevent proper operation.

When a machine check occurs, the data is logged in the machine check log buffer (MCLB). Machine checks are logged when:

- A hardware or HLIC malfunction is detected below the IMPI.
- An exception condition occurs and the task dispatcher is disabled.
- A Terminate Immediately instruction is issued and the machine is in machine check mode.
- An error exists for certain IMPI objects referred to by IMP instructions (for example, TDE or TDQ not aligned to a quadword).

Depending on the prior state of the MCLB, the processor status, the processor status and the task status, or neither may be logged. Figure 34-1 on page 34-2 shows the format of the MCLB template.

Problem Analysis or Error Recovery: For every machine check, there is a procedure that can be used to locate the point of failure. A point of failure is:

- A hardware malfunction that requires machine termination
- An IMP exception that is not handled by VLIC
- An explicit request to machine check by a VLIC component because an abnormal condition is detected

The primary means of problem analysis is the description of the code on the control panel and the primary MCLB or MCLB. The address of the primary MCLB is found at virtual address hex 8000 0000 003A and resides in V=R storage. See Figure 27-2 on page 27-3 to view hex offset 3A.

Location of the Machine Check CRE: Every machine check has a CRE associated with it. The machine check CRE is either the CRE created by the Terminate Immediate instruction or an exception that led to the signaling of a machine check.

The current TDE can either be located from the virtual address at hex 8000 0000 004A or is printed in the formatted dump of main storage dump. Offset hex E contains the virtual address of the first CRE. The first in-use CRE (byte 8, bit 0) contains the status of the module requesting machine termination. See Figure 27-2 on page 27-3 to view hex offset 4A and the hex offsets for the CRE status.

Area	Bytes (Hex)	0	1	2	3	
Processor Status	0	Error Type	VLIC Flags	MCHK Designation	MCHK Designation (secondary)	
	4	Hardware Code				
	8			Main Store Error Code		
	C	MSAR Main Store Address Failure Information				
	10	Reserved				
	14					
	18					
	1C					
	20			M Register		
	24					
	28					
	2C	MG Register		L Register		
	30	Reserved				
	34			EX Register		
	38					
	3C	Exception Code		Reserved		
	40					
	44					
	48	Page Fault Control Address		Reserved		
	4C					
	50					
	54	Page Fault IAR Save				
	58	Load Identifier				
	5C	Model				
	60	IS Register				Current CPU Register Values (HLIC Subroutine Mode)
	64			IL Register	CC Register	
	68	IAR Register				
	6C	B0 Register				
	70	IS Register				True IMPI Registers (VLIC)
	74			IL Register	CC Register	
	78	IAR Register				
	7C	Page Fault				
Task Status (CRE)	80	CRE Flags	Base Point Register Specification	IL Register	CC Register	
	84	IMPI/HLIC Address Register				
	88	Base Registers (0-15) (16 x 6 = 96 bytes)				
	E4					
	E8	Reserved				
	EC	Exception Code				
	F0	System Reference Code (34 bytes)				
	10C					
	111					

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Figure 34-1. The Machine Check Log Buffer (MCLB) Template

Processor Status (128 Bytes)

The processor status part of the MCLB contains the type and severity of the machine check. It also indicates the state of the HLIC at the time of the error.

Bytes (Hex) **Description**

00 This byte indicates the type of error being reported. A particular facility, such as main store or a machine check, is indicated.

Bits	**Meaning**
0	HLIC detected errors. See bytes 22, 23, 37 through 3B, and 60 through 65 for more information on specific errors.
1	Reserved for uncorrected main storage errors. Uncorrected hardware errors are logged in the MCLB.
2	A severe input or output error has been detected while in HLIC subroutine mode. See bytes 22 to 23 M register for additional information. This type of error will result in a check stop.
3-5	Reserved.
6	Successful recovery has been made from an initial error if this bit is set. The operation in process (IMPI instruction or built-in function) at the time of the error has completed normally. Only corrected main storage errors are recorded. See bytes 04 to 09 for additional information about the error.
7	Reserved.

01 This byte is reserved for vertical licensed internal code flags.

Note: HLIC initializes this byte to hex 00.

Bits **Meaning**

0 0 = Not VLIC machine check

Note: Bit 0 does not imply HLIC.

1 = VLIC machine check

1-7 Reserved for any value

02 The machine check number identifies the detecting facility and the state of the processor at the time the machine check was detected. Different processing techniques are used based on this number.

Hex 07 to hex 08 is for hardware facility.

Hex 1E to hex 25 is for licensed internal code facility.

Hex 28 is I/O.

Hex 2A to 2B is soft recovery.

Each number uniquely identifies the facility which detected the machine check, the state of the processor, the functions performed by the processor machine check handler (PMCH), and the exit from the PMCH.

03 If a machine check occurred and the processor status could not be logged because the MCLB is busy because of a previous machine check, this byte indicates the number of the most recent machine check.

04[1] CPU MCHK register.

05[1] CPU EASTAT register.

06[1] CPU ESSTAT register.

07[1] CPU ISTAT register.

08[1] TRAP (A program exception has been detected by hardware.)

Bits	**Meaning**
1	Program check (invalid decimal data)
2	Alignment check
3	Specification exception
4	Effective address overflow
5	Page fault
6-7	Reserved for any value

09[1] CPU SCUVTRAP register.

0A Information about main storage errors and main storage address compares are contained in this byte.

Bits **Meaning**

0-2 000 = No main storage error.

001 = Main storage single package single bit failure. Data has been corrected by the hardware and is good. (This is status only and does not cause a machine check.)

010 = Main storage single package multiple bit failure. Data has been corrected by the hardware and is good. (This is status only and does not cause a machine check).

011 = Main storage hard or soft multiple package failure. Data has been corrected in main storage and is good as presented.

MCLB

[1] These bytes are used to indicate a specific hardware error. The only hardware errors which are currently logged are the corrected and not corrected main storage errors. The main storage errors and main storage address compare are contained in bytes 0A and 0B.

The main storage location that incurred the error is defective.

Note: This error will be handled at IMPI instruction boundaries rather than by a machine check trap. The IMPI instruction which was executing when the error occurred will complete normally with correct results.

101 = Uncorrectable address parity error. This will cause an immediate machine check and will not be reported to VLIC.

110 = Uncorrectable multiple package error. This will cause an immediate machine check and will not be reported to VLIC.

111 = Main storage data bus parity error on store. This causes an immediate machine check and will not be reported to VLIC.

3 Invalid main storage address.

4 Address compare exception.

5 Address compare fetch/store latch.

6 Address compare on instruction fetch.

7 Address compare on data access.

0B Information about main storage errors and main store address compares are contained in this byte.

Bits	Meaning
0	Address compare on I/O access.
1-7	Reserved for any value.

0C-0F This information is needed to reconstruct the failing main storage address. The reconstruction varies depending on the type or types of main storage cards installed in the system.

10-21 Reserved.

22-23 This halfword is an HLIC work register. When an HLIC detected machine check occurs (MCLB byte 0, bit 0 = 1), a code indicating the cause is loaded into this register. For machine checks due to a TI instruction (MCLB byte 2 = hex 23 or 24), the contents of the IMPI halfword register specified by the TI instruction are copied to the M register and the meaning of this halfword is defined by VLIC. For all other HLIC detected machine checks, refer to the section on 90XX codes in the applicable *Unit Reference Code Guide*.

24-2B Reserved.

2C This byte contains the HLIC MG register.

2D Reserved.

2E This byte contains the HLIC L register.

2F-35 Reserved.

36 This byte contains the HLIC EX register.

37-3B Reserved.

3C-3D These exception code bytes contain the architected IMPI exception code.

3E-47 Reserved.

48-49 These bytes contain the page fault control address.

4A-53 Reserved.

54-55 PFIARSV contains the value of the IAR register at the time of the last page fault which occurred during HLIC subroutine mode.

56-57 Reserved for any value.

58-5B These bytes contain the HLIC load identification.

5C-5F A 4-byte alphanumeric field that identifies the model of the processor card.

Current IMPI Registers (HLIC Subroutine Mode)

Bytes	Description
60-65	These bytes contain the values in the HLIC IS register at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the values are the values loaded by the HLIC subroutine and not the values of the current IMPI procedure.
66	This byte contains a 3-bit value actually in the HLIC instruction length (IL) register at the time of the machine check, right justified. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value loaded by the HLIC subroutine and not the value of the current IMPI procedure.
67	This byte contains a value actually in the HLIC condition code CC register at the time of the machine check. This byte contains the architected IMPI condition code with bits 4 through 7 containing the 4-bit condition code and bits 0 through 3 containing hex 0. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value loaded by the HLIC subroutine and not the value of the current IMPI procedure.

True IMPI Registers (VLIC)

Bytes	Description
68-69	This byte contains the value actually in the HLIC instruction address register (IAR) at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

6A-6F This byte contains the value actually in the HLIC IMPI B0 (base zero) register at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

70-75 This byte contains the HLIC IS register value before entering HLIC subroutine mode. This byte contains the value logically in the instruction stream (IS) register at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

76 This byte contains the 3-bit value logically in the instruction length (IL) register, right justified, at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

77 This byte holds the architected IMPI condition code with bits 4 through 7 containing the 4-bit condition code and bits 0 through 3 containing hex 0. This byte contains the value logically in the condition code (CC) register at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

78-79 This byte contains the value actually in the HLIC instruction address register (IAR) at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

7A-7F This byte contains the virtual address which caused the most recent lookaside buffer (LB) miss at the time of the machine check. If the CPU was in HLIC subroutine mode (MCLB byte 2C, bit 1 is 1), the value is the value saved before entering subroutine mode and not the value loaded by the HLIC routine.

Task Status (CRE Data — 148 Bytes)

Bytes **Description**

80 This byte contains various CRE flags related to the state of the task that was running at the time of the machine check.

81 This byte contains the base point register specification related to the state of the task that was running at the time of the machine check.

- 0-3 This gives the number of the first base register to be logged.
- 4-7 This gives the number of base register to be logged -1.

82 This byte contains the 3-bit instruction length register, right justified, related to the state of the task that was running at the time of the machine check.

83 This byte contains the IMPI condition code (CC) related to the state of the task that was running at the time of the machine check.

84-85 These IMPI/HLIC address register bytes contain the IAR if you are using an IMPI procedure or the left justified CSAR if you are using an HLIC procedure related to the state of the task that was running at the time of the machine check.

86-E5 These bytes contain the 16 six-byte base registers beginning with BPR specified in bits 0 through 3 of byte 81 related to the state of the task that was running at the time of the machine check.

E6-EB Reserved for any value.

EC-ED These two bytes contain the architected IMPI (EXC) exception code related to the state of the task that was running at the time of the machine check.

EE-EF Reserved for any value.

F0-113 These 36 bytes contain an SRC when MCLB bytes 22 through 23 (M register) contain hex FFFF. These bytes are filled in by VLIC.

Part 9. Appendixes

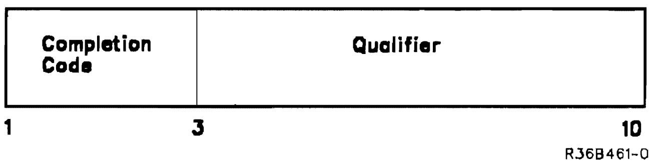
Completion Codes

Appendix A. Completion Codes

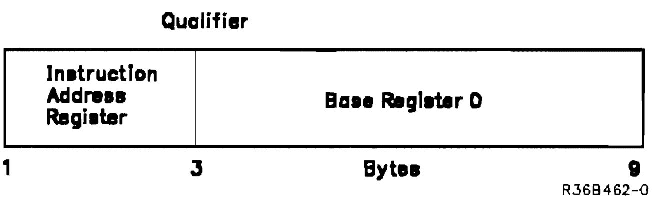
Completion codes may appear while running DST, SST, and OS/400. For example, a completion code appears when a PTF is applied to OS/400. The completion codes are shown in the VLOG as major code 0C00. For more information about VLOG entries, see Chapter 31.

When a service function ends, a 2-byte completion code and an 8-byte qualifier are passed to SST or DST and displayed. If the completion code is in the range hex 0000 through FFFE, the code was set by the service function driver. If the completion code is hex FFFF, the code identifies that the qualifier is from the service function and its meaning depends on the service function. For more information about the qualifiers for hex FFFF, see Table A-1 on page A-6.

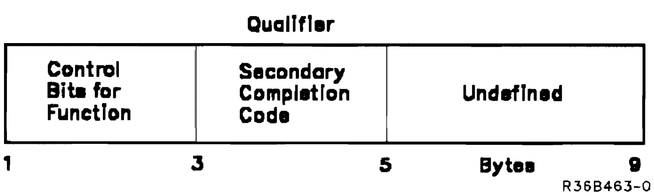
The following list describes the completion codes and qualifier codes in the range hex 0000 to FFFE.



If the first byte of the completion code equals hex 02 through 09, then the qualifier appears as:



If the first byte of the completion code equals hex 0A through FE, then the qualifier appears as:



Normal End

Completion Code and Qualifier	Description
0000	Always signifies normal end of task

Exception and Task Control

Completion Code and Qualifier	Description
02xx	IMPI exception (hard)
03xx	IMPI exception (monitored)

Note: For IMPI exceptions, the second byte of the completion code contains the exception code. Exception codes are listed in Chapter 29. For example, if the task ends because of a specification exception hex 18, the completion code is hex 0218.

Completion Code and Qualifier	Description
0400	HLIC machine check
0500	VLIC machine check
0600	AS/400 instruction exception
0700	Unknown exception
0800	Task ended with active subtasks
0900	Task destroy was not valid

Machine Interface Instruction Function Request

Completion Code and Qualifier	Description
0A0A	Terminate request
0A10	SSD error
0A11	Machine interface buffer error
0A12	General request queue error
0A13	Feedback record error

Machine Interface Instruction Response

Completion Code and Qualifier	Description
0B0A	Terminate request
0B10	SSD error
0B12	General request queue error

Create Task

Completion Code and Qualifier	Description
1001	Error return
1002	User (service function) error
1010	VLIC create task failed
1020	Not a valid parameter

Create Segment

Completion Code and Qualifier	Description
1101	No space available
1102	User (service function) error
1103	Tracking error

Get Real Page

Completion Code and Qualifier	Description
1202	User (service function) error
1203	Tracking error
1210	Create segment error

Create Queue

Completion Code and Qualifier	Description
1302	User error
1303	Tracking error
1310	Create segment error

Get Available Message

Completion Code and Qualifier	Description
1401	Error return
1402	User (service function) error

Data Conversion

Completion Code and Qualifier	Description
1510	Not a valid function
1511	Truncated
1512	Not a valid input
1513	No input data

Move Data

Completion Code and Qualifier	Description
1610	Error in the *to* address
1611	Error in the *from* address
1612	Bad boundary specified

Convert Time

Completion Code and Qualifier	Description
1701	Error return
1702	User (service function) error
1703	Conversion error
170A	Termination request

Julian Date Conversion

Completion Code and Qualifier	Description
1801	Error return
1802	User (service function) error
1803	Conversion error
1820	Month out of range
1821	Day out of range
1830	Month conversion error
1831	Day conversion error
1832	Year conversion error

Service Function Cleanup Routines

Completion Code and Qualifier	Description
1902	User error
1903	Tracking error

Find Source/Sink Object

Completion Code and Qualifier	Description
2001	Error return
2002	User (service function) error
2004	Object not found
2005	More than 10 objects found
2010	Index error

Retrieve Reference Code Translate Table Entry

Completion Code and Qualifier	Description
2901	Error return
2902	User (service function) error
290A	Terminate request
2911	The requested translate table was not found
2912	The reference code specified was not found
2913	Data truncated
2923	Buffer length too short

Display

Completion Code and Qualifier	Description
3001	Error return
3002	User (service function) error
3003	Input conversion error
300A	Terminate request
3010	Not a valid machine interface buffer pointer
3011	Not a valid machine interface buffer length
3012	Hex FFFF SSD status
3013	SSD status not open
3014	Not a valid SSD status
3015	Bad return code in machine interface input field
3016	Machine interface buffer to long
3017	Not a valid termination key from the machine interface
3023	Not a valid synchronous function key specified
3024	Logical screen definition line number invalid
3025	Screen not in the screen initialization table
3026	Message not found in the message initialization table
3027	Greater than 80 characters with out and end-of-line character
3028	Text replacement number not found in the text replacement search table
3029	Too many input fields
302A	Already open
302B	Not open
302C	Too many roll lines defined
302D	AFEUSECT=0 on close
302E	Not a valid roll logical screen definition
302F	Not a valid text replacement type
3030	No type 3 entry found for a type 2 text replacement label

Asynchronous Program Function Key Request

Completion Code and Qualifier	Description
3101	Error return
3102	User (service function) error
3103	Keys not active
310A	Terminate request

Common Display Facility

Completion Code and Qualifier	Description
3201	Error return
3202	User (service function) error
320A	Termination requested
3221	Not a valid screen mode
3222	Input text replacement label not found
3223	Message text replacement label not found
3224	Not a valid conversion for input text replacement label
3225	Not a valid conversion for message text replacement label
3226	Display control block not specified
3227	Input text replacement label not specified
3228	Message text replacement label not specified

Retrieve Message Text

Completion Code and Qualifier	Description
3301	Error return
3302	User (service function) error
3303	Input conversion error
330A	Terminate request
3321	Display or printer control block is not open
3322	User (service function) buffer length is too short

Print

Completion Code and Qualifier	Description
3401	Error return
3402	User (service function) error
3403	Printer not available
340A	Terminate request
3410	Not a valid machine interface buffer pointer
3411	Not a valid machine interface buffer length
3412	Hex FFFF SSD status
3413	SSD status, not open
3414	Not a valid SSD status
3420	Printer not open
3421	Printer already open
3422	Print after error
3423	Maximum lines not specified
3424	Number of lines is greater than maximum line count
3425	Logical screen definition line number is invalid
3426	Screen not found in screen initialization table
3427	Message not found in message initialization table
3428	Greater than 132 characters without an end-of-line character
3429	Text replacement label not in the text replacement search table
342A	Too many lines built
342B	Not a valid text replacement label type value found
342C	No type 3 for a type 2 text replacement label was found
342D	Roll buffer overflow

Completion Codes

Diskette

Completion Code and Qualifier	Description
3801	Error return
3802	User (service function) error
3803	No diskette available
3804	Bad volume name
3805	Duplicate file
3806	File not found
380A	Termination request
3810	Not a valid machine interface buffer pointer
3811	Not a valid machine interface buffer length
3812	Hex FFFF SSD status
3813	SSD status not open
3814	Not a valid SSD status
3815	Length of record does not equal the sector size
3816	Not a valid sector size
3817	Close, but not read or write
3820	Diskette not open
3821	Diskette already open
3822	Read or write request after an error
3823	Not a read, write, open, or close
3824	Open, but not read or write
3826	Write, but open for read
3827	Read, but open for write
3828	Diskette not cleared
3829	Diskette not renamed

Tape

Completion Code and Qualifier	Description
3901	Error return
3902	User (service function) error
3903	No tape available
3904	Bad volume name
3905	Duplicate file
3906	File not found
390A	Terminate request
3910	Not a valid machine interface buffer pointer
3911	Not a valid machine interface buffer length
3912	Hex FFFF SSD status
3913	SSD status is not open
3914	Not a valid SSD status
3917	Close but, not read or write
3920	Tape not open
3921	Tape already open
3922	Read or write after error
3923	Not a read, write, open, or close
3924	Open but, not read or write
3926	Write but, open read
3927	Read but, open write

Data Path

Completion Code and Qualifier	Description
3C01	Error return
3C02	User (service function) error
3C03	Path not available
3C0A	Termination request
3C10	Not a valid buffer pointer
3C11	Not a valid buffer length
3C12	Hex FFFF SSD status
3C13	Not open SSD status
3C14	Not a valid SSD status
3C15	Close, but not read or write
3C20	Path not opened
3C21	Path already open
3C22	Read or write after error
3C23	Not a read, write, open, or close request
3C24	Open, but not for read or write
3C25	Write, but open for read
3C26	Read, but open for write

Dump Entry String Interchange

Completion Code and Qualifier	Description
5001	Error return
5002	User (service function) error
5003	Source error
5004	Target error
5011	Not a valid dump entry string
5021	Buffer too small
5022	Not a valid source
5023	Not a valid target
5024	Target not open
5025	Source not open
5026	Not a valid dump entry string category
5027	Not a valid dump entry string sequence
5028	Not a valid data length
5029	Index error

Dump Entry String Print

Completion Code and Qualifier	Description
5101	Error return
5102	User (service function) error
5121	Not open or close

Dump Index Entries

Completion Code and Qualifier	Description
5201	Error return

Work Controller

Completion Code and Qualifier	Description
5901	Error return
5902	User (service function) error
5920	Request ID not found
5921	Not a valid request length
5922	Work session not open
5923	Work already open
5924	Not a valid request

Work Router

Completion Code and Qualifier	Description
5A01	Error return
5A02	User (service function) error
5A21	Not open
5A22	Already open
5A23	Not a valid request
5A24	Previous active
5A11	Active not found

Alter Log Inquiry

Completion Code and Qualifier	Description
6101	Error return
6102	User (service function) error
6104	Entry not found
6105	Alter log does not exist

Alter Log Insert

Completion Code and Qualifier	Description
6201	Error return
6202	User (service function) error

Find VLIC Module

Completion Code and Qualifier	Description
6301	Error return
6302	User (service function) error
6304	Object not found
630A	Termination request
6310	Index error
6311	External symbol directory name error
6312	Specification error

Find Machine Interface Object

Completion Code and Qualifier	Description
6401	Error return
6402	User (service function) error
6404	Object not found
6405	Object address not a segment group
6406	Context address not a segment group
6407	Object is not a system object
6408	Context is not a context
6409	Object address does not exist
640A	Terminate request
640B	Context address does not exist
640C	Index error
640D	Object found, but it is a dangler (not addressed by addressing context)

Task Selection

Completion Code and Qualifier	Description
6501	Error return
6502	User (service function) error
6504	TDE not found
650A	Terminate request
6510	Menu interface, but not selection
6511	No match found
6512	TDE chain error

Dump Entry String Interchange Move

Completion Code and Qualifier	Description
7201	Error return

Find Machine Interface Object from a Name Resolution List

Completion Code and Qualifier	Description
7401	Error return
7402	User (service function) error
7403	Object not found
7410	Damage encountered

Address Index Build

Completion Code and Qualifier	Description
9901	Error return
9902	User (service function) error
9910	Index error

9911	No space available
9912	Specification error
9913	Entry not in the external symbol directory

Hex FFFF Completion Code Qualifiers

These codes identify that the qualifier is from SST or DST and the meaning of these codes depends on DST and SST. Figure A-1 on page A-9 shows for a break down of this 8 byte qualifer.

Table A-1. Hex FFFF Completion Code Qualifiers for Work with Licensed Internal Code

Qualifier (Hex)	Meaning	Recovery
0000000000000001	Wrong side for requested operation	PTFs are applied and removed on the A side and made permanent on the B side. If the right side is not used, go to the other side.
0000000000000002	Hardware dependency failure	Find the dependency and see if it is on the machine.
0000000000000003	Prerequisite not temporarily applied	Apply prerequisite and try again.
0000000000000004	Prerequisite check failed	Apply prerequisite and try again.
0000000000000005	Prerequisite not permanently applied	Make the prerequisite permanent and try again.
0000000000000006	PTF is already applied	No action is needed.
0000000000000007	Wrong release or modification level	Get the correct level PTF and try again.
0000000000000008	PTF is already permanent	No action is needed.
0000000000000009	Attempting to apply a 9406 PTF on a 9404 machine.	Remove the PTF, it is not intended for your machine.
000000000000000A	PTF is defective.	Remove the PTF and call for assistance.
0000000000001000	Out of space in header pool	Install VLIC again.
0000000000002000	Out of space in user pool	Install VLIC again.
0000000000003000	Out of space in low load ID (LID) pool	Install VLIC again.
0000000000004000	Out of space in high LID pool	Install VLIC again.
0000000000005000	Out of space in machine pool	Install VLIC again.
0000000000006000	Read error	Install VLIC again.
0000000000007000	Not a valid change media	Mount error tape.
0000000000008000	Open error	Check media and install VLIC again if necessary.
0000000000009000	Duplicate external name	Depends on situation. Call for help if necessary.
000000000000A000	Index specification error	Install VLIC again.
000000000000B000	Index full error	Install VLIC again.
000000000000C000	Catastrophic index error	Install VLIC again.
000000000000D000	No temporary PTFs	Check for the PTF number and try again.
000000000000E000	PTF not found	Check for the PTF number and try again.
000000000000F000	Specified an incorrect option	Correct the option and try again.
0000000000010000	Materialize failure	Install VLIC again.
0000000000020000	Replaceable unit listed in PTF not found	Depends on situation. Call for help if necessary.
0000000000040000	Previous work with licensed internal code error	Install VLIC again.
00000000FFFFFFFF	Work with licensed internal code (link/loader) exception	Dump VLOG 0C00 BAD4 and call for assistance.

Note: Figure A-1 on page A-9 shows for a break down of this 8 byte qualifer.

Completion Codes

Table A-2. Hex FFFF Completion Code Qualifiers for Display Hardware Configuration

Qualifier (Hex)	Meaning	Recovery
0000000000000001	Number of buses exceeded limit	Call for assistance.
0000000000000002	Hardware on bus exceeded limit	Call for assistance.
0000000000000003	Hardware associated with I/O processor exceeded limit	Call for assistance.
0000000000000004	Failing hardware exceeded limit	Call for assistance.

Table A-3. Hex FFFF Completion Code Qualifiers for Work with Communications Trace

Qualifier (Hex)	Meaning	Recovery
C000010000000000	Get messages failed in Work with Communications Trace	For all the qualifiers in this table, see "CT—Communications Trace:" on page 4-44. If necessary, submit an APAR or LICTR.
C000040100000000	Main display is bad	
C000040900000000	Bad Main help display	
C000041500000000	Bad Change Maximum Size help display	
C000041700000000	Bad Change Maximum Size help display	
C000042500000000	Bad Start a Trace help display	
C000042700000000	Bad Start a Trace display	
C000043300000000	Bad Confirm Delete help display	
C000043500000000	Bad Confirm Delete display	
C000044300000000	Bad Display Message help display	
C000044500000000	Bad Display Message display	
C000050100000000	Unknown service function	
C000050200000000	Abort or end obtained from the service function driver	
C000400100000000	Bad Token-Ring Network display	
C000400200000000	Bad Ethernet display	
C000400300000000	Bad SDLC display	
C000400400000000	Bad X.25 display	
C000400500000000	Bad asynchronous display	
C000400700000000	Bad Format Progress display	
C000401000000000	Get messages failed for SNA	
C000401100000000	Get messages failed for Token-ring Network	
C000401200000000	Get messages failed Ethernet	
C000401300000000	Get messages failed for SDLC	
C000401400000000	Get messages failed for X.25	
C000401500000000	Get messages failed for asynchoronous	
C000401600000000	Get messages failed for bisynchronous	
C000401700000000	Get messages failed for a communications trace build	
C000401800000000	Get messages failed for a build SNA	
C000405000000000	Bad Token-Ring Network help display	
C000405100000000	Bad asynchronous help display	
C000405200000000	Bad SDLC help display	
C000405300000000	Bad X.25 help display	

Completion Codes

Table A-4. Hex FFFF Completion Code Qualifiers for Work with Error Log

Qualifier (Hex)	Meaning	Recovery
EE00010000000000	Bad invocation identifier	For all the qualifiers in this table, see "EREP—Work with Error Log:" on page 4-44. If necessary, submit an APAR or LICTR.
EE00010100000000	Bad parameters	
EE00010200000000	Storage allocation failed	
EE00010300000000	No entries found	
EE00010400000000	Error log communication bad	
EE00010500000000	Specific error in summary	
EE00010600000000	Unknown error log return message	
EE00010700000000	No memory space left	
EE00010800000000	Zero time stamp received	
EE00010900000000	Bad time stamp received	
4400010000000000	A terminate request received from the service function driver	
4400020000000000	An abort request received from the service function driver	
EE00040100000000	Invalid magnetic media	
EE00040200000000	Invalid communications IOA	
EE00040300000000	Invalid IOP	
EE00040400000000	Bad subsystem type	
EE00040500000000	Bad combination type	
EE00050100000000	Display could not be started	
EE00050200000000	Bad display	
EE00050300000000	Display could not be stopped	
EE00050400000000	Bad help display	
EE00060100000000	Bad start of a print display	
EE00060200000000	Bad print display	
EE00060300000000	Bad start of a print display	
EE00070100000000	Preferred time format not found	
EE00070200000000	Julian time conversion problem	
EE00070300000000	Time conversion problem	
EE00080100000000	Open data path error	
EE00080200000000	Write data path error	
EE00080300000000	Close data path error	
EE00090100000000	Retrieve message problem	
EE000A0100000000	Subsystem to display is bad	
EE000B0100000000	Bad error type found	
7000000000000000	Retrieve message key	

Completion Codes

Breakdown of the Hex FFFF Completion Code: This completion code is an 8-byte qualifier. Figure A-1 shows its break down.

Request Status	Input Request	Trace Action Code	Template Offset	Not Used

0 1 3 4 6 8

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Figure A-1. Breakdown of Hex FFFF Completion Code

- Request status:

Hex	Meaning
00	Request accepted
FF	There was an error in the request processing. See the other fields for the reason.

- Input request:

Bit	Meaning
1	End tracing
2	Start trace
3	Stop trace
4	Request to allocate the trace tables
5	Request to get the current trace status
6	Dump the trace tables
7	Clear trace table

- Trace action codes:

Hex	Meaning
00	Normal completion, request performed
01	The input template is not aligned on a quadword (16 byte) boundary.
02	A template value is invalid. See the template offset field for the offset of invalid value in the input template.
03	Defined limit exceeded.
04	There were not enough bytes provided in the input template.
05	The request is rejected, traces are still active.
06	The trace tables do not exist.
07	There are no traces recorded.
08	There was an error on the open request to the dump device (for example, tape, diskette, or printer).
09	There was an error on the close request to the dump device.
0A	There was a general output error on the dump device.
0B	The request can not be processed because VLIC tracing has shut itself off. It shut off because the table is full. This error is usually seen when a new trace is started without clearing the trace table first.

- Template offset:

  This fields tells the offset of the value in the input template that contains an error. The offset is zero based.

For more information about tracing vertical licensed internal code, see 17-12.

Appendix B. Preassigned Addresses

For information about system addressing schemes, see the applicable *Service Guide*. Table B-1 shows preassigned addresses, virtual addresses, or segment identifiers (SIDs) for the AS/400 system.

Table B-1 (Page 1 of 3). Preassigned Addresses

Address	Description
0000 0000 0000 through 0000 0200 0000	Reserved (invalid)
0000 0300 0000	Storage management permanent directory segment
0000 0400 0000	VLIC segment, paged into the machine pool
0000 0500 0000	Connection control block (CCB)
0000 0600 0000	VLIC nucleus
0000 0700 0000	Connection group control block (CGCB)
0000 0800 0000	MSCP queue
0000 0900 0000	Pageable static directory
0000 0A00 0000	Work with licensed internal code index
0000 0B00 0000	VLIC segment, paged into the user pool
0000 0C00 0000	Temporary management, temporary directory segment
0000 0D00 0000	Machine context
0000 0E00 0000	Database in-use table
0000 0F00 0000	Not used
0000 1000 0000	Reserved
0000 1100 0000	Copies of RU headers for all RUs on system
0000 1200 0000	Control address table (CAT)
0000 1300 0000	Storage management free space directory
0000 1400 0000	Allocated SID map
0000 1500 0000	Unavailable SID list
0000 1600 8000	Machine initialization status record (MISR) and storage management
0000 1700 0000	Volume IDs
0000 1800 0000	Object recovery list
0000 1900 0000	Storage management access group member directory
0000 1A00 0000	Lowest reserved storage management directory SID
0000 1B00 0000 through 0000 2000 0000	Not used
0000 2100 0000 through 0000 2400 0000	Reserved (permanent and free space directories)
0000 2500 0000	Highest reserved storage management directory SID
0000 2600 0000	Lowest reserved error log SID
0000 2A00 0000	Not used
0000 2B00 0000	Highest reserved error log SID
0000 2C00 0000	Licensed internal code debug SID
0000 2D00 0000	Address index build
0000 2E00 0000	OS/400 dump object list
0000 2F00 0000	Volume statistics (lifetime counters)
0000 3000 0000	Reserved
0000 3100 0000	Lowest reserved VLIC log SID
0000 3200 0000 through 0000 3D00 0000	Reserved
0000 3E00 0000	Highest reserved VLIC log SID
0000 3F00 0000	Task switch trace table
0000 4000 0000	Reserved
0000 4100 0000	General trace table
0000 4200	Trace scroll table
0000 4300 0000	Copy of the load ID (LID) directory table
0000 4400 0000	Execution map function
0000 4500 0000	Storage management (SM) special statistics
0000 4600 0000	Limited paging environment free space directory
0000 4700 0000	Limited paging environment temporary directory
0000 4800 0000 through 0000 4900 0000	Reserved (storage management)
0000 4A00 0000	System-wide journal
0000 4B00 0000	Attached commit list
0000 4C00 0000	TIPs data recording
0000 4D00 0000	Load ID (LID) segment
0000 4E00 0000	Alter log
0000 4F00 0000	CCIOM system log ID table
0000 5000 0000	Reserved
0000 5100 0000	Error log volume statistics (session)
0000 5200 0000	Bus unit blocks (BUBs)
0000 5300 0000	Limited paging environment VLIC log
0000 5400 0000	Limited paging environment trace table
0000 5500 0000	Limited paging environment task switch trace table
0000 5600 0000	APPN network topology index
0000 5700 0000	APPN directory services parent/child index
0000 5800 0000	APPN directory services child/parent index
0000 5900 0000	Location manager index
0000 5A00 0000 and 0000 5B00 0000	Not used

Table B-1 (Page 1 of 3). Preassigned Addresses

Table B-1 (Page 2 of 3). Preassigned Addresses

Address	Description
0000 5C00 0000	Mirror of the licensed internal code debug control table
0000 5D00 0000	Load ID (LID) segment
0000 5E00 0000 and 0000 5F00 0000	Not used
0000 6000 0000 through 0000 6F00 0000	Not used
0000 7000 0000	Reserved
0000 7100 0000 through 0000 7F00 0000	First main storage dump SID
0000 8000 0000	Reserved
0000 8100 0000	Last main storage dump SID
	Note: SID 000080 is not useable.
0000 8200 0000	Main storage dump status SID
0000 8300 0000	DST (shadow) error log
0000 8400 0000	Main storage history table
0000 8500 0000	VLIC test data SID
0000 8600 0000	Main storage reload bit map
0000 8700 0000	Load source IOP dump area
0000 8800 0000	Reserved
0000 8900 0000	Rack configuration data
0000 8A00 0000	Stand-alone utility logout area
0000 8B00 0000 through 0000 8F00 0000	Not used
0000 9000 0000	Reserved
0000 9100 0000 through 0000 9F00 0000	Not used
0000 A000 0000	Reserved
0000 A100 0000 through 0000 AF00 0000	Not used
0000 B000 0000	Reserved
0000 B100 0000 through 0000 BF00 0000	Not used
0000 C000 0000	Reserved
0000 C100 0000 through 0000 CF00 0000	Not used
0000 D000 0000	Reserved
0000 D100 0000 through 0000 DF00 0000	Not used
0000 E000 0000	Reserved
0000 E100 0000 through 0000 EF00 0000	Not used
0000 F000 0000	Set in main storage dump headers to indicate bad main storage frames
0000 F100 0000 through 0000 F300 0000	Not used
0000 F400 0000	MWS freed block address
0000 F500 0000	Address of owning user profile for permanent objects assigned no owner

Table B-1 (Page 2 of 3). Preassigned Addresses

Address	Description
0000 F600 0000	Initial value for pointer to signal pointer-not-set exception
0000 F700 0000	Directory recovery read errors
0000 F800 0000	Used by storage management to indicate unallocated pages in an access group extent less than 32K
0000 F900 0000	Address set by work with licensed internal code for unresolved references
0000 FA00 0000	Stored in disk headers to indicate a sector that has an error
0000 FB00 0000	Pointer set by SID wrap for invalid segment identifiers
0000 FC00 0000	Used by auxiliary storage management to mark large free space blocks
0000 FD00 0000	Pointer set for space addressing violations
0000 FE00 0000	Pointer set for internal parameter not set
0000 FF00 0000	Pointer set if no associated space
0001 0000 0000 through 0001 0200 0000	Reserved (invalid)
0001 0300 0000	Not used
0001 0400 0000	VLIC machine pool code backup SID
0001 0500 0000	Not used
0001 0600 0000	VLIC nucleus backup SID
0001 0700 0000 through 0001 0900 0000	Not used
0001 0A00 0000	Work with licensed internal code index backup SID
0001 0B00 0000	VLIC user pool code backup SID
0001 0C00 0000 through 0001 0F00 0000	Not used
0001 1000 0000	Reserved
0001 1100 0000	RU headers backup SID
0001 1200 0000	Control address table (CAT) backup SID
0001 1300 0000 through 0001 4C00 0000 0000	Not used
0001 4D00 0000	Load ID (LID) segment backup SID
0001 4E00 0000 through 0001 5C00 0000	Not used
0001 5D00 0000	Load ID (LID) segment backup
0001 5E00 0000 through 0001 FF00 0000	Not used
8000 0000 0000 through 8000 FF00 0000	Real storage address or MCA (This is the first page of main storage.)
A000 0100 0000	Configured unit table (CUT)
A000 0200 0000	Nonconfigured unit table (NUT)

Table B-1 (Page 3 of 3). Preassigned Addresses

Address	Description
A000 0300 0000	Storage management task control table (TCT) that is allocated and controlled by the storage management task manager module, #SMTKMGR
A000 0400 0000	Bus manager segment
A000 0500 0000	Device configuration table (DCT)
A000 0600 0000	Storage management global error recovery control block
A000 0700 0000	Machine wide storage (MWS) supervisor anchor control segment
A000 0800 0000	Storage management error recovery trace table
A000 0900 0000	Device configuration table extension
A000 0A00 0000	ASP mirroring control blocks
A000 0B00 0000	Mirrored unit table
A000 0C00 0000 through A000 0F00 0000	Not used
A000 1000 0000	Reserved
A000 1100 0000	First SID used by #SMRCLAm for V=V addressability to the main storage dump PDEs up to main storage size of 256 megabytes
A000 1200 0000	Second SID used by #SMRCLAm for V=V addressability to the main storage dump PDEs up to main storage size of 512 megabytes
A000 1300 0000	Used by #SMRCLAM for V=V addressability to main storage management structures in the main storage dump area
A000 1400 0000	First SID used by #SMVVDA for V=V addressability to main storage dump PDEs up to main storage size of 256 megabytes
A000 1500 0000	Second SID used by #SMVVDA for V=V addressability to main storage dump PDEs up to main storage size of 512 megabytes
A000 1600 0000	Recovered device configuration table
A000 1700 0000	Database inuse table bitmap
A000 1800 0000 through A000 1C00 0000	Storage for performance data
A000 2100 0000	Special SID used to test reallocation of sectors
A000 2200 0000 and A000 2300 0000	Special SID used to test elimination of SID wrap
A000 2400 0000 and A000 2500 0000	Not used
A000 2600 0000	Save storage SID.
A000 2700 0000	Machine wide storage (MWS) system anchor control segment
A000 2800 0000 through A00D 2C00 0000	Not used
A000 2D00 0000	Find the VLIC module address index created by #SDAIBLD

Table B-1 (Page 3 of 3). Preassigned Addresses

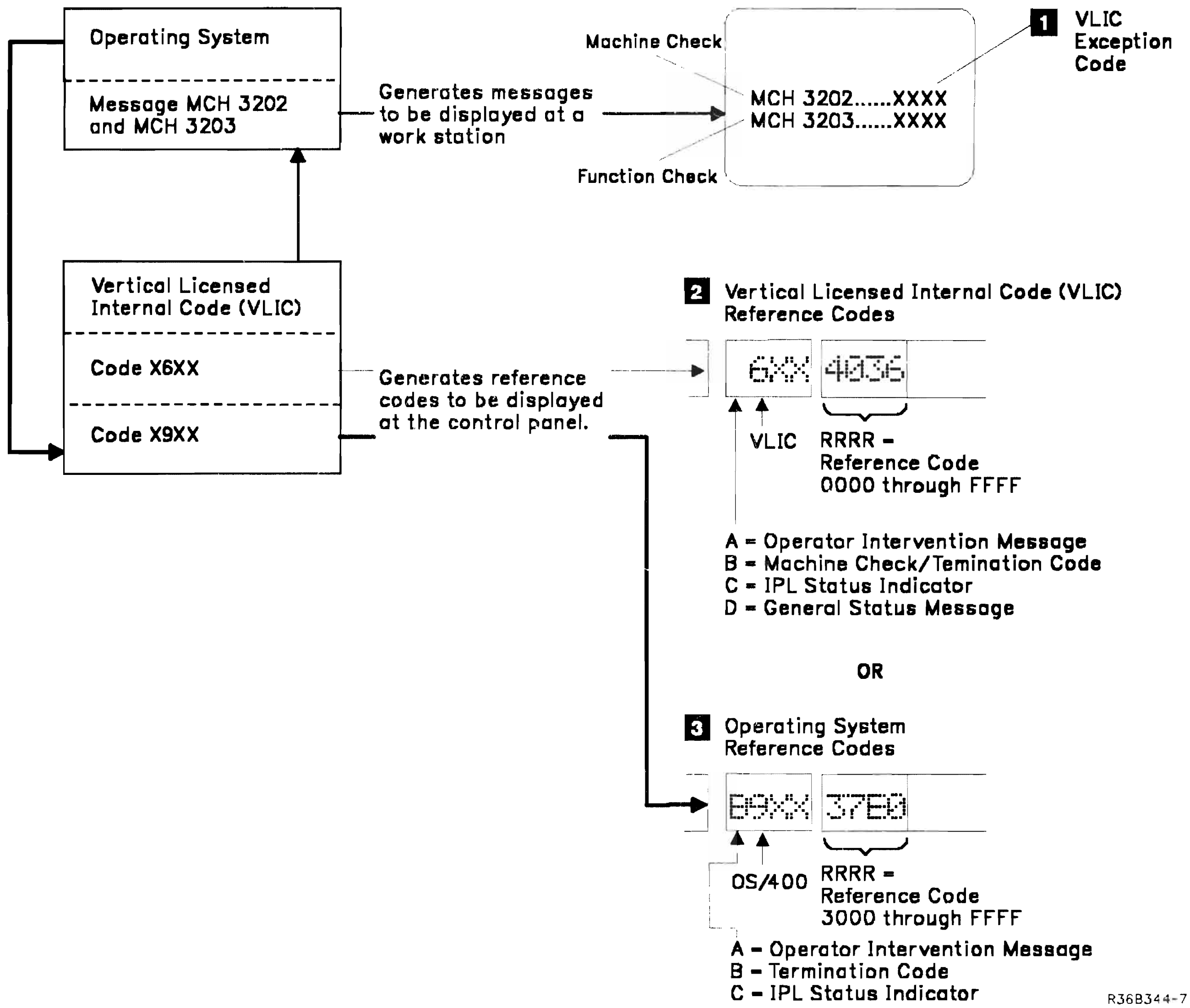
Address	Description
A000 2E00 0000 through A000 4400 0000	Not used
A000 4500 0000	Reallocate segments for manufacturing spread utility
A000 4600 0000 through A000 4D00 0000	Not used
A000 4E00 0000 through A000 4F00 0000	General hold record tables
A000 5001 0000	Hash table for general hold records
A000 5100 0000 through A000 5E00 0000	General hold record tables
A000 6001 0000	Hash table for database hold records
A000 6100 0000 through A000 6F00 0000	Database hold record tables
A000 7000 0000	Not used
A000 7100 0000	Database entry check count statement
A000 7200 0000 through A000 FC00 0000	Not used
A000 FD00 0000	CPU usage trace summary element, see #SMINIT and #RMBSYX, and macros RMCTC, RMCTE, and RMCSE
A000 FE00 0000	CPU usage trace element, see #SMINIT and #RMBSYX, and macros RMCTC, RMCTE, and RMCSE
A000 FF00 0000	CPU usage trace control table, see #SMINIT and #RMBSYX, and macros RMCTC, RMCTE, and RMCSE
A001 0000 0000 through A001 FF00 0000	Not used

Preassigned Addresses

URCs

Appendix C. System and Unit Reference Codes

Figure C-1 shows the relationship of the reference codes and exception codes that are detected by OS/400, VLIC, and the operating system.



For a description of the codes, see:

1 Appendix D on page D-1

These codes appear in the following messages:

MCH3202 Machine check exception
MCH3203 Function check exception

2 "VLIC Unit Reference Codes" on page C-4

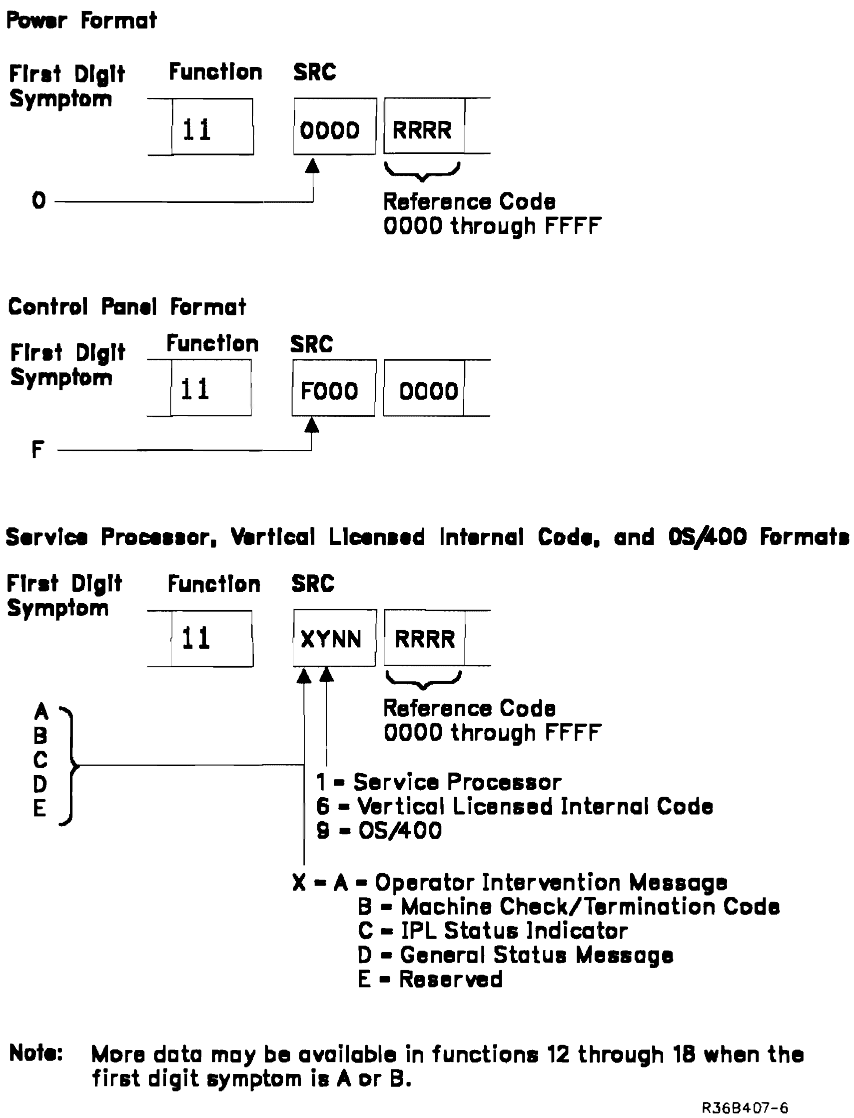
These codes appear on the control panel.

3 "OS/400 Unit Reference Codes" on page C-57

These codes appear on the control panel.

Figure C-1. Relationship of Exception and Reference Codes

URCs



Note: On the AS/400 9402 System Unit, the formats are the same; however, the Enter switch is used to toggle between the function and the SRC.

Figure C-2 (Part 1 of 2). Formats of SRCs Displayed at the Control Panel

URCs

First Digit Symptom: 1, 2, 3, 4, 5, 6, 7, 8, 9

IOP SRC Format Function	SRC		Device SRC Format Function	SRC	
11	TTTT	LMMM	11	tttt	lmmm
12	ZZZZ	RRRR	12	ZZZZ	rrrr
13	AAAA	●●●●	13	ssss	ssss
14	tttt	lmmm	14	uuuu	uuuu
15	ZZZZ	rrrr	15	TTTT	LMMM
16	ssss	ssss	16	ZZZZ	RRRR
17	uuuu	uuuu	17	AAAA	●●●●
18	ZZZZ	ZZZZ	18	ZZZZ	ZZZZ

TTTT - Type Number or Card Identification Number (for example 6110, 6040)
LMMM - Level Indicator Plus the 3 Digit Model Number
RRRR - Reference Code
AAAA - BBcb (BB - bus, c - card, and b - board)
●●●● - Unit Address
t t t t - Outboard Failing Unit Type Number (for example 9352, 9335)
lmmm - Level Indicator Plus 3 Digit Model Number of the Failing Device
r r r r - Outboard Failing Unit Reference Code
s s s s - Serial Number of the Failing Unit
u u u u - Unit Specific Data
ZZZZ - Reserved

Note: For functions 14 through 17, data may not be displayed for some SRCs.

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Figure C-2 (Part 2 of 2). Formats of SRCs Displayed at the Control Panel

Comparing VLIC and OS/400 SRC Formats

For SRCs of functions 11 through 18, Figure C-1 on page C-1 shows VLIC reference codes at **2** are identified by a 6 and OS/400 reference codes at **3** are identified by a 9 in the second position of the unit identifier. The second set of four characters is the reference code.

Figure C-2 on page C-2 compares VLIC, OS/400, power, control panel, service processor, IOP, and device codes.

Notes:

1. In Figure C-1 on page C-1 the data for functions 12 through 18 have no defined format. These functions depend on what is displayed by function 11. However, Figure C-2 on page C-2 also shows IOPs and device SRCs that have defined formats for functions 12 through 18.
2. Figure C-2 on page C-2 does not show all possible formats.

URCS

How SRC Information is Displayed in OS/400: The path that leads to **1** in Figure C-1 on page C-1 shows that for certain function and machine check exceptions, VLIC informs OS/400 of the failure. OS/400 logs this information into the problem log and sends a message to the system operators message queue. The SRC is translated into a message that is displayed in QSYSOPR. The following levels of message text can be displayed:

- First level text or a 1-line text description of the failure
- Second level text or recovery actions to be performed by the customer or service representative

Use the command DSPMSG QSYOPR to view the first level text.

Then from the first and second level message text, press F14 (Problem Analysis) to enable any message that has problem isolation procedures. Pressing F14 is similar to using the WRKPRB command.

VLIC Unit Reference Codes

The four digit unit reference codes follow. These codes are grouped by their first 2 or 4 digits. The groups are:

Group Number	Description
01	Machine check handler, see page C-5
02	Storage management, see page C-6
03	Exception management, see page C-12
04	IPL, see page C-13
05	Process management, see page C-20
06-11	Resource management, see page C-20
12	Database, see page C-21
13	Journal
14	Reclaim
15	Translator
16	Source/sink, see page C-22
17	Common type, see page C-22
20-27	Hardware related machine checks
40	Storage management IPL status, see page C-22
41	Bus manager IPL status, see page C-25
42	Storage management IPL status, see page C-27
43	CCIOM IPL status, see page C-28
50	DST status, see page C-28
5100-5125	Bus manager machine check, see page C-30
5126-5150	CCIOM machine check, see page C-31
5151-5175	IPCF machine check, see page C-31
52	I/O processor failure, see page C-32
60-63	Stand-alone utilities, see page C-38
69	I/O hardware error, see page C-50

Each reference code is divided into these sections:

- Description
- Service recovery action
- Service problem analysis procedure

The action and procedure sections are to be used as shown in the SRCs. Look up the SRC in the SRC section that follows to find and use the service recovery actions and the problem analysis procedures. When necessary, submit the required information to your next level of service support.

| **Note:** A main storage dump is taken for most of the VLIC URCs unless otherwise indicated in the description of the URC.

URCs

VLIC URCs

0101	Machine Check Handler

Description: A machine check occurred while the processor was in the wait state.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Verify that the Problem Isolation procedures in the applicable *Service Guide* for the reference code are completed.

IPL the system again. Obtain the following information and submit with an APAR or LICTR:

- Enough information to produce the problem again.
- A main storage dump on tape for the problem, if the dump to tape has not already been done.
- VLIC log data for the period of time surrounding the problem.

Service Problem Analysis Procedure: The MCLB in the main storage dump contains the reason for the failure. This failure may be caused by hardware or software.

0102	Machine Check Handler

Description: HLIC reported error that could not be handled by VLIC.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0101 on page C-5.

0103	Machine Check Handler

Description: Not able to signal HVVA pin count exception.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0101 on page C-5.

0104	Machine Check Handler

Description: Bad reference code specified for TI instruction.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Submit an APAR or LICTR. There is no further action that can be taken.

0105	Machine Check Handler

Description: Not able to run shutdown in the machine check handler.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0106	Machine Check Handler

Description: Invalid flags associated with the TI reference code.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0107	Machine Check Handler

Description: Not able to get CRE for the machine check handler.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0108	Machine Check Handler

Description: The machine check handler received a bad designation number.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0101 on page C-5 and code 0104 on page C-5.

0110	Machine Check Handler

Description: A machine check uncorrectable address occurred while in wait state.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: IPL the system. One of the following conditions occur:

- The main store frame that caused the problem is removed from use. The system loads normally and functions properly.
- The main store card containing the frame that caused the problem is identified as failing. Follow the procedures for the SRC displayed. Replace the main store card.

Service Problem Analysis Procedure: These procedures are the same as the service recovery action for this code.

0115	Machine Check Handler

Description: Invalid main storage size or type has been deleted.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0101 on page C-5.

0116	Machine Check Handler

Description: Uncorrectable main storage address machine check while in run state.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: See the service recovery procedures for code 0110.

Service Problem Analysis Procedure: To find the failing main storage card for this SRC:

1. Select the *Start a Service Tool* option from the SST or DST main menu.
2. Select the *Print stand-alone* option from the Start a Service Tool menu.
3. Select the *Select items to print* option from the Select Options for Main Storage Dump menu.
4. Select the *Print the task summary* option from the Select Items to Print menu. For more information about the task summary report, see page 12-59.
5. Find the task which has module #MCIMCH.
6. Write down the value of register 4. For example, 800002DE 00EF.
7. Get from this value the 64 K block. In this example, hex 02DE.
8. Use display/alter/dump and go to the MCA and get the pointer at field MCA2RVPD (hex B2).
9. Get from the main storage dump the first hex 40 bytes at this address. This is the main storage VPD. Each entry here is 8 bytes long and shows the starting and ending 64 K block for this entry. For example, 20070000 200700FF means this entry is for the first 255 64 K blocks (or 16 megabytes).
10. Scan the entries and see where the failing 64 K block fits. For example, the main storage VPD is: 20070000 200700FF 20070100 200701FF 20070200 200702FF 20070300 200703F. The 64 K block fits in the third entry and this entry points to the third card slot.

0150	Machine Check Handler

Description: Corrected main storage error threshold has been reached. VLIC no longer logs corrected main storage errors.

Service Recovery Action: The corrected main storage error threshold has been reached. VLIC no longer logs corrected main storage errors due to it being a performance impact. A IPL of the machine corrects this situation because HLIC basis assurance tests (BATs) removes the pages in main storage from being used. VLIC begins logging again on the next IPL.

Service Problem Analysis Procedure: Corrected main storage errors are no longer logged. This SRC appears only in the error log. Re-IPL of the system causes this condition to be set again.

Same as Service Recovery Action.

0201	Storage Management

Description: The system could not find enough contiguous, usable main storage to IPL. This could be caused by large numbers of defective main storage pages.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The machine was not able to find any pages in a pageable status. Either all pages beyond the nucleus were defective or a VLIC logic error occurred in the routine signaling the machine check. Register 0 in the machine check log buffer contains the virtual address of the module that signaled the machine check. The problem may be circumvented by doing another IPL.

0202	Storage Management

Description: A permanent, unrecoverable read error occurred in a critical machine area such as the vertical licensed internal code.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5. If not done, perform a licensed internal code restore.

Service Problem Analysis Procedure: Install VLIC again to force reassignment of the failing segment. If the problem persists, it may be necessary to force assignment of an alternative sector using the work with DASD option under DST.

0204	Storage Management

Description: All available machine addresses for the current segment ID (SID) extender have been used. The system is no longer able to create any new addresses. The next IPL allocates a new SID extender value, and the system is able to create new addresses using the new extender.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Perform an IPL again, if it has not been done.

Service Problem Analysis Procedure: This is a normal consequence of the machine remaining in use for a long period of time. To avoid this forced re-IPL, the customer should monitor the percentage of addresses used (both temporary and permanent) with the Work with the System Status (WRKSYSSTS) command and schedule a system power down and IPL again when either percentage approaches 100 percent.

0208	Storage Management

Description: A request was made to storage management to deallocate a page frame that was not allocated.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: A VLIC module has requested storage management to deallocate a page frame which was not previously allocated. The main storage dump shows the failing component.

0209	Storage Management

Description: Storage management directory error.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: If the problem persists, determine if it is file related (initially signaled from VLIC module #SVE8PPR). Directory recovery should write the failing sector again, causing an alternative assignment if necessary. If it does not, it may be necessary to manually assign an alternate using the Work with DASD option under DST.

0215	Storage Management

Description: Storage management maintains two bit maps identifying all addresses in use. One of the lists has become unreadable, making it impossible to create new segments. The directory recovery runs on the next IPL, creating the bit maps again.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Storage management maintains two lists of addresses in use when the address generator was last reset. These addresses are not eligible for reuse until the address generator is set again. This list has become unreadable, making it impossible to create new segments. The machine is stopped immediately when this condition is detected because normal execution is no longer possible. Directory recovery determines what addresses are in use and creates the lists again. Directory recovery runs during the next IPL.

0217	Storage Management

Description: A destroyed temporary segment has been referenced, whose segment identifier (SID) was made available for use during the debug mode of the reusable SID function. If this reference violation is not detected, it could lead to the destruction of data.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0219	Storage Management

Description: A storage management directory is full and could not be extended.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Perform an IMPL. VLIC initializes the directories to a smaller size and extend them if necessary. If they cannot be extended, this machine check is issued again. If another machine check occurs determine the number of entries in the static directory. The first page of the static directory can be found by displaying virtual address 00000900 0000. If the 2 byte value at offset zero added to the 2 byte value at offset two is less than the 2 byte value at offset six, then no free space is available. If another DASD drive can be added to the system, the IPL should be successful. If the sum of the numbers is not less than the value at offset six, then the static directory is full and the system must be initialized.

0222	Storage Management

Description: The temporary or free space limited paging directory was found to be full during an insert and is not allowed to be extended.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: IPL should always reset this condition. The directories empty during the IPL.

0223	Storage Management

Description: The storage management static directory was found to be invalid during IPL.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Parts of the storage management static directory were found to be invalid during IPL.

0224	Storage Management

Description: An unexpected error occurred when examining the main store dump usability.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: none

0227	Storage Management

Description: Permanent read error on invocation work area segment.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Obtain all the main storage dumps. IPL the system again. If the problem persists, the unit number of the drive that the permanent read error occurred can be found in the following way:

1. Find the current task's TDE in the main storage dump.
2. Follow the chain of CREs attached to the TDE until the CRE indicating an exception 82 is found (hex 82 at CRE plus hex 75).
3. The configured unit number is the single byte at CRE plus hex 79.

Service Problem Analysis Procedure: Perform pack scan of data on the drive identified. Force alternates to be assigned for any sectors with unrecovered errors.

0228	Storage Management

Description: An unexpected exception occurred while DASD management may have a partially updated DASD configuration in main storage. To prevent the configuration from being written to DASD, the machine is taken down.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0101 on page C-5.

0234	Storage Management

Description: The internal counts of the free space available do not agree with the amount of free space represented in the storage management free space directory. Directory recovery runs on the next IPL and corrects the counts.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: IPL should always reset this condition. Directory recovery corrects the counts.

0235	Storage Management

Description: There is insufficient main memory available to allocate storage and start the tasks necessary to preform check sum or directory recovery.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0236	Storage Management

Description: Severe error detected by DASD check summing support code.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0237	Storage Management

Description: A permanent extent could not be found by directory recovery because of permanent read errors. An attempt was made to exchange the missing extent so that other extents for that segment are not lost. However, no free space could be found to exchange the extent.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0241	Storage Management

Description: Check sum device recovery is not possible because more than one member of a single check sum set requires recovery.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: All units in the auxiliary storage pool (ASP), in which the check sum set for which recovery is not possible, must be initialized. The data in the ASP is lost. The ASP number may be found in the primary MCLB. Halfword register 13 contains the one-byte ASP number followed by the one-byte check sum set ID.

Service Problem Analysis Procedure: See the service recovery action.

0242	Storage Management

Description: Storage management error recovery received a BSTAT, SIOA error code, or ERAC which was not defined in it's internal table. The error which was received is logged on the load source DASD if possible.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Verify that the problem isolation procedure in the applicable *Service Guide* for the reference code have been followed.

Obtain the following information and submit with an APAR or LICTR:

- Enough information to create the problem again
- A main store dump on tape for the problem, if the dump to tape has not been done
- The APAR or LICTR information for a storage subsystem IOP, if this has not been done
- VLIC log data for the period around the time of the problem.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0243	Storage Management

Description: A command was rejected by the IOP or the device. Most likely, the command was *overlaid* in main storage. It is also possible that the IOP or device is wrongfully rejecting the command.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0244	Storage Management

Description: Contact was lost with the device indicated. An I/O operation to this device resulted in an error code that *may* indicate a power outage at the device, or a loose connection.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0245	Storage Management

Description: Device or IOP failure without an SRC.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0246	Storage Management

Description: A critical operation (open or close) did not complete in the allotted time. This failure is likely to be in the IOP, and a dump of the IOP memory has been attempted to the load source DASD.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0247	Storage Management

Description: A command to a device did not complete in the allotted time, and subsequent time-out recovery (close/re-open) did not clear the condition.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0248	Storage Management

Description: VLIC detected a condition during the process of sector reallocation that indicates that the device is bad. Possible reasons for this condition are that the device has run out of reallocation space, or that a data check was received on a reallocate command.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0249	Storage Management

Description: A condition was detected which indicates an error on the VLIC/HLIC interface. This may be due to HLIC rejecting a command, VLIC tries to do I/O to a device that has no connection, or similar reasons.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0250	Storage Management

Description: Storage management error recovery detected a bus error, but no SRC was sent to storage management by the bus manager.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0251	Storage Management

Description: Contact was lost with the device indicated while mini-UPS was active. An I/O operation to this device resulted in an error code that *may* indicate a power outage at the device, or a loose connection.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0252	Storage Management

Description: AER received from IOP without error log information.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0253	Storage Management

Description: An IOP failure was detected by the bus manager, but no SRC was passed to storage management error recovery.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0255	Storage Management

Description: Contact was lost with the device indicated. An I/O operation to this device resulted in an error code that *may* indicate a power outage at the device, or a loose connection.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0261	Storage Management

Description: The Service Processor card has failed when writing the CEC VPD.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Replace the Service Processor Card.

Service Problem Analysis Procedure: None.

0262	Storage Management

Description: Writing the CEC VPD to the Service Processor card failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Service Processor licensed internal code failed.

Service Problem Analysis Procedure: None.

0266	Storage Management

Description: Contact was lost with the device indicated. An I/O operation to this device resulted in an error code that *may* indicate a power outage at the device, or a loose connection.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0297	Storage Management

Description: A system error occurred for which the SRC's from the IOP, the device, and storage management error recovery are all zero.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0242 on page C-9.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0298	Storage Management

Description: The system is shutting down. Changed data is being written from main storage to its proper DASD location.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0299	Storage Management

Description: A logic error has been detected by storage management code.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0301	Exception Management

Description: Exception with no IWA available.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0302	Exception Management

Description: Recursion in the second level exception handler or the third level exception handler.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0304	Exception Management

Description: Invalid component specific exception handler return code.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0305	Exception Management

Description: Exception while storage management lock is held.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: An exception occurred while a storage management lock was held, preventing further processing. This occurs when an exception happens in storage management or in a routine called by storage management. Find the current task dispatching element (TDE) pointed to by the current TDE pointer in the control address table. The first in-use call return element (CRE) contains the status of the module in which the exception occurred. This should be a storage management module. See the service problem analysis procedures for code 0104 on page C-5.

0308	Exception Management

Description: Component specific exception handler recursion.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: An exception handler has received an exception it is not able to handle. This makes it impossible to terminate the process without the possibility of causing damage to user data.

Look at the most recent CRE with an exception indicated in the VLIC log dump. This exception is the cause of the error.

0309	Exception Management

Description: Component specific exception handler block out of order. Component specific exception handler not cleared.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: This error is probably due to improper linkage between VLIC modules or an error in the ICB. If possible, create the problem again and activate VLIC call trace near the point of the failure. This gives a trail of the linkages before the failure.

0310	Exception Management

Description: Register three in the component specific exception handler block does not match any register three in any call/return element nor does it match any register three in owing invocation control block.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0312	Exception Management

Description: Component specific exception handler left enabled by module which is no longer invoked.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The major 0402, minor 00C9 VLIC log entries contain the identities of the detector of the invalid conditions, the enabler of the CSEH, and the CSEH itself. For more information, see Chapter 29 on page 29-1.

URCs

0401	Initial Program Load

Description: A machine check occurred during IPL.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Note the last status SRC displayed and if past DST, the last IPL status display. See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: A machine check or unrecoverable exception occurred during IPL. Examine the machine check log buffer or the execution data to determine the cause of the failure. The directories are left in the state they were in at the time of the failure. If they are unusable, directory recovery will be required.

0402	Initial Program Load

Description: A machine check occurred during Authority initialization. Halfword register 14 contains a qualifier.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The halfword portion of register 14 in the primary machine check log buffer contains a 2-byte code that indicates the source of the problem.

Code	Problem Description
0001	Machine context damaged. The next IPL should cause the machine context to be rebuilt.
0002	Storage management permanent directory damaged. The next IPL should cause directory recovery to build the directory again.
0003	Base segment index damaged. This is a temporary index used only by authority initialization. The next IPL causes a new temporary index to be built.
0004	UPR index damaged. This is a temporary index used only by authority initialization. The next IPL causes a new temporary index to be built.
0005	Not able to create segment. There is not sufficient free space for authority initialization to create a temporary segment.
0006	Not able to create a queue. Authority initialization tried to allocate temporary space for a queue and messages. This problem is probably related to the preceding code, hex 0005.
0007	Not able to create a task. Authority initialization creates subtasks in order to speed the verification of object sizes. This problem is probably related to code hex 0005.
0008	Abnormal subtask termination. One of the authority initialization subtasks has terminated abnormally. The main storage dump should contain the applicable data.
0009	Machine storage limit reached. There is not sufficient free space for authority initialization to allocate permanent space for a user profile.
000A	Undefined error. The cause of the error cannot be determined. The main storage dump should contain the applicable data.

0403	Initial Program Load

Description: Unhandled exception during IPL or install.

Service Recovery Action: Note the last IPL status display and the last status SRC. See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Examine the exception data to determine the cause of the failure. If VLIC log has been started, the exception has been logged in the VLIC log.

0405	Initial Program Load

Description: Unhandled exception in authority recovery.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0406	Initial Program Load

Description: Unhandled exception in data base recovery.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0407	Initial Program Load

Description: Unhandled exception in data base initialization.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0408	Initial Program Load

Description: Unhandled exception in journal recovery.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0409	Initial Program Load

Description: Unhandled exception in journal synchronization.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0410	Initial Program Load

Description: Unhandled exception in journal IPL clean up.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0411	Initial Program Load

Description: Unhandled exception in commit recovery.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0412	Initial Program Load

Description: Unhandled exception in commit initialization.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0403 on page C-13.

0413	Initial Program Load

Description: Rebuild of recovery object index failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Using the IMPIAL listing of the module where the machine check occurred, locate the pointer to the header of the base segment machine index. The machine check is signalled for the following reasons, the index:

- Header is not readable.
- Header had an invalid type byte.
- A catastrophic error occurred and has been built again.

0414	Initial Program Load

Description: The install of the operating system failed attempting to read from the tape. An I/O command to the tape device failed.

Service Recovery Action: This machine check may have resulted from selecting the End the install option from an install error display. The information from the install error display identifies the problem.

If there was no install error display or the install error does not identify the problem, then perform the following. See the service recovery procedures for code 0101 on page C-5. Then obtain the error log for the tape device.

Service Problem Analysis Procedure: An I/O command to the tape device failed. Analyze the error log for tape failures. Run problem analysis on the tape device. This error can be caused by a defective tape (a media error) or the tape device requires maintenance (head cleaning).

0415	Initial Program Load

Description: Create user profile failed when installing the operating system.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: An exception occurred when creating a user profile using the create user profile template just loaded from the install tape. The create user profile template from the tape is invalid. Examine the exception data to identify the problem with the create user profile template.

0416	Initial Program Load

Description: Create program failed when installing the operation system.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

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Service Problem Analysis Procedure: An exception occurred when creating a program using the create program template just loaded from the install tape. The create program template from the tape is invalid. Examine the exception data to identify the problem with the create program template.

0417	Initial Program Load

Description: Initiating the initial process of the operating system failed.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Field MISEXCEP in the MISR YYMISR include contains the exception ID (see the YYMISR include in the *AS/400 System Support: Diagnostic Aids Addendum*) that indicates why the initiate process failed:

Exception ID	Failure Type
1004	User profile damaged
3201	No process definition template
3801	Error in process definition template
2002	Machine check
2003	Function check
3A01	Process event time out

Install or IPL could not initiate the initial process of the operating system because of an error in the initial process definition template. For IPL, the initial process definition template could not be found in the machine or was in error. For install the initial process definition template was loaded from tape. This template, which maps to include ZZPDT, should contain a tagged pointer to a user profile, program, PASA, PSSA, and process control storage (PCS). If the pointers are valid, the structures that the pointer address should be verified. For IPL, the initial process definition template machine attribute should be examined. This attribute is located at hex 0000 1601 0000. For a failure during IPL, an install may be necessary to obtain a valid initial process definition template.

0418	Initial Program Load

Description: The information loaded from the install tape is invalid.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The space object loaded from file QFILEIPL from the install tape does not contain valid information. The error can be one of the following:

- There is no associated space for the object
- One of the templates has an invalid size
- One of the required templates is missing

The required templates are the create user profile template, the create program template, and the initial process definition template. Verify that the correct install tape is loaded.

0419	Initial Program Load

Description: The information loaded from the install tape is invalid.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem determination procedure for code 0418 on page C-15.

0420	Initial Program Load

Description: The information loaded from the install tape is invalid.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem determination procedure for code 0418 on page C-15.

0421	Initial Program Load

Description: Request to create a queue or message came back with a bad return code meaning one or the other wasn't created.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0422	Initial Program Load

Description: The install of the operating system failed attempting to load file QFILEIPL from the install tape. The Load/Dump command failed.

Service Recovery Action: This machine check may have resulted from selecting the End the install option, from an install display. The information from the install error display identifies the problem.

If there was no install error display or the install error display does not identify the problem, then see the service recovery procedures for code 0101 on page C-5. Then obtain the error log for the tape device.

Service Problem Analysis Procedure: The Load/Dump command to the tape device failed. Analyze the error log for tape failures. Run problem anaylsys on the tape device. This error can be caused by a defective tape (a media error) or the tape device requires maintenance (head cleaning).

0423	Initial Program Load

Description: The switching of the bus control unit (BCU) function from the service processor to IMPI failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Note the last status SRC displayed before the machine check.

Verify that the problem isolation procedure in the applicable *Service Guide* for the reference code have been followed.

Obtain the following information and submit with an APAR or LICTR.

- Enough information to create the problem again.
- A main storage dump on tape for the problem, if the dump to tape has not been done.

Service Problem Analysis Procedure: The bus manager initialization failed. The bus manager was not able to complete the switch of the bus control unit from the service processor to IMPI. The modifier (digits 3 and 4) of the SRC identify the cause of the failure. A modifier of 00 means the bus manager initialized did not respond. Otherwise the bus manager include YYBMSRM contains labels BMEXIBnn describing the failure caused by the *nn* matching the SRC modifier.

0424	Initial Program Load

Description: Invoke IPL All for bus units other than the load source IOP failures. The bus manager and the load ID (LID) manager failed attempting to load the other bus units.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Note the last status SRC displayed before the machine check. See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: The bus manager was not able to start all the bus units. The modifier (digits 3 and 4) of the SRC identify the cause of the failure. A modifier of 00 means the bus manager invoke IPL All did not respond. Otherwise, the bus manager include YYBMSRM contains labels BMEXIBnn describing the failure caused by the *nn* matching the SRC modifier.

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0425	Initial Program Load

Description: VLIC IPL failed starting the service processor IOM task.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Note the last status SRC displayed before the machine check. See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: The service processor I/O manager VLIC task failed. Examine the VLIC log for the reason of the failure.

0427	Initial Program Load

Description: Opening the IPCF services connection to the load source IOP fails. This is a VLIC code problem because the services connection is implicit and no commands on the bus are required.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0428	Initial Program Load

Description: CCIOM has found a DASD unit in the resource configuration record (RCR), but storage management cannot find its record of the DASD unit.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0429	Initial Program Load

Description: Storage management has received a message with an invalid type. The message was sent by CCIOM, VLIC IPL, or storage management. This is a VLIC code problem.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0430	Initial Program Load

Description: The DASD control information for a required DASD unit is invalid.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: Verify that the problem isolation procedure in the applicable *Service Guide* for the reference code has been followed.

Obtain the following information and submit with an APAR or LICTR:

- Enough information to create the problem again
- A main storage dump on tape for the problem, if the dump to tape has not been done
- The APAR or LICTR information for a storage subsystem IOP, if this has not been done

Service Problem Analysis Procedure: The system is not able to use a required DASD unit or has invalid information about the unit. The DASD Unit Descriptor (DUD) from the unit may be invalid.

If the failure is before DST, the failing DASD unit is the load source. If the problem persists, it may be necessary to install VLIC again.

If the failure is after DST, the failing DASD unit can be any configured unit.

0431	Initial Program Load

Description: The service processor IOM failed attempting to display an IPL status SRC.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: The service processor IOM is not able to display a status SRC. The failure may be in the VLIC service processor IOM or the service processor.

0432	Initial Program Load

Description: The bus manager command of *Invoke IPL for the load source IOP* failed. The IOP attached to the DASD unit that provided the VLIC nucleus code cannot be identified.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: The bus manager was not able to identify the load source IOP. The modifier (digits 3 and 4) of the SRC identify the cause of the failure. A modifier of 00 means the bus manager invoke IPL for the load source IOP did not respond. Otherwise, the bus manager include YYBMSRM contains labels BMEXIBnn describing the failure caused by the *nn* matching the SRC modifier.

0433	Initial Program Load

Description: VLIC IPL failed opening the RAS connection to the load source IOP.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0430 on page C-17.

Service Problem Analysis Procedure: VLIC IPL failed opening the IPCF RAS connection to the load source IOP. The failure is in the VLIC IPL task or in the storage subsystem IOP. Collect APAR or LICTR information for the system and the IOP.

0434	Initial Program Load

Description: The Assign RAS Focal Point command to the load source IOP failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0430 on page C-17.

Service Problem Analysis Procedure: VLIC IPL failed issuing the Assign RAS Focal Point command to the load source IOP. The failure is in the VLIC IPL task or in the storage subsystem IOP. Collect APAR or LICTR information for the system and the IOP.

0436	Initial Program Load

Description: The Report Status command to the load source IOP failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0430 on page C-17.

Service Problem Analysis Procedure: VLIC IPL failed issuing the Report Status Table command to the load source IOP. The failure is in the VLIC IPL task or in the storage subsystem IOP. Collect APAR or LICTR information for the system and the IOP.

0438	Initial Program Load

Description: The DASD unit that provided the VLIC nucleus code cannot be identified. The report status table from the load source IOP fails to indicate the load source unit.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0430 on page C-17.

Service Problem Analysis Procedure: The output of the Report Status Table command form the load source IOP fails to identify the load source DASD unit. The failure is in the VLIC IPL task or in the storage subsystem IOP. Collect APAR or LICTR information for the system and the IOP.

0439	Initial Program Load

Description: Opening the functional IPCF connection (the SIOA connection) failed. This DASD unit is in the system's DASD configuration so the system is not useable.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0430 on page C-17.

Service Problem Analysis Procedure: Storage management failed opening a functional, SIOA IPCF connection to a storage IOP. The failing IPCF Open is for the load source DASD unit before DST or for the configured DASD unit after DST. The failure is in storage management or in the storage subsystem IOP. Collect APAR or LICTR information for the system and the IOP.

0440	Initial Program Load

Description: Invalid termination code on terminate machine processing. An invalid termination code was specified on the terminate machine processing MI instruction.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0441	Initial Program Load

Description: Power off system command failed. A message was sent to the service processor IOM requesting that the system be powered off. No response from the IOM expected, but a response was received.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0443	Initial Program Load

Description: Programmed IPL command failure. A message was sent to the service processor IOM requesting that a programmed IPL be run. No response from the IOM expected, but a response was received.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0444	Initial Program Load

Description: No response from service processor IOM. Time-out occurred while waiting for a response from the service processor IOM during machine termination.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0445	Initial Program Load

Description: Error in message time-out processing. A logic error was detected in the code which times the responses from the service processor IOM during machine termination.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0446	Initial Program Load

Description: Error return code from service processor IOM during machine termination.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0447	Initial Program Load

Description: Failure to reach MI boundary. The machine could not be brought to an MI boundary as requested by the operator (power off delayed) or through DST.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

This is an abnormal situation. It does not necessarily indicate any system failure.

Service Problem Analysis Procedure: Some long running machine function may cause this SRC to be displayed after requesting *power off delayed*. If it is perceived to be a problem, perform the following. See the service problem analysis procedures for code 0104 on page C-5.

0448	Initial Program Load

Description: Invalid input to MI boundary shutdown. An invalid request was input to the shutdown module.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0449	Initial Program Load

Description: Exception in MI boundary manager. An unhandled exception occurred in the MI boundary manager task.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0451	Initial Program Load

Description: System utility power did not return. Mainstore has been copied to disk and the system was powed down.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: IPL the system again when utility power returns. The system will automatically IPL when utility power returns if the QPWRRSTIPL system value is set accordingly.

Service Problem Analysis Procedure: None.

0480	Initial Program Load

Description: Trying to reach a machine instruction (MI) boundary. A signal was received indicating that the utility power is down and the user specified delay time has been exceeded.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: If the reference code appears when there is no utility power failure or for a time period greater than 30 minutes, submit an APAR or LICTR.

0481	Initial Program Load

Description: Trying to reach a machine instruction (MI) boundary. A signal was received indicating that the utility power is down and the UPS battery is low.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: If the reference code appears when there is no utility power failure or for a time period greater than 20 minutes, submit an APAR or LICTR.

0482	Initial Program Load

Description: Attempting to reach a machine instruction (MI) boundary. The *power off delayed* was selected at the control panel or *abnormal termination* was selected from the DST main menu.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: If the reference code appears when there is no utility power failure or for a time period greater than 30 minutes, submit an APAR or LICTR.

0485	Initial Program Load

Description: System has lost utility power and is attempting to ride out the power loss on basic UPS batteries.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0486	Initial Program Load

Description: Copying main storage to disk. System is running on basic UPS and utility power has not returned.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0487	Initial Program Load

Description: System utility power has returned and the system is no longer using basic UPS battery support.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

0504	Process Management

Description: Recursion in terminate process wait.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0506	Process Management

Description: Attempt to destroy a task or process with the critical flag on.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0607	Resource Management

Description: Reserved invocation work area used up.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The portion of the IWA reserved for process termination has been used up. This makes it impossible to terminate the process without the possibility damaging customer data. Look at the invocation control block (ICB) listing in the VLIC log dump. The probable cause of this error is a loop or exception loop causing multiple invocations of the same VLIC or OS/400 program. Register 0 (offset hex 7A in the ICB) is probably repeated, or there may be a sequence of modules repeated. The call trace function may be useful in finding the loop.

0611	Resource Management

Description: Try to extend hold record beyond 65K.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: Locate the hold record area, offset 0 from the segment identification (SID) number at location hex 0000 0100 0092. In the header (mapped by include ZZHRH), determine the current number of hold records used. If the maximum has not been reached, check the hold record data as directed below but also check the procedure for no more storage available. Examine the individual hold records to see if one TDE is seizing or locking many more objects than any other TDE. If this is the case, try to determine what function is executing and examine the seize parameter list and determine what function called seize. This condition has four probable causes:

- General system load too high.
- Trying to dump/restore a large number of objects while the system is heavily loaded.
- Internal VLIC error.
- Many data base entries simultaneously locked.

If no TDE stands out with a majority of the hold records in use, a general overload is probable. The load/dump function seizes objects before performing its function. If one TDE has seized a large number of objects, attempt to determine if it was executing the load/dump function. If so, attempt to handle fewer objects or run load/dump when the system is less heavily loaded. If one TDE is seizing a very large number of objects but not for the load/dump function, an internal VLIC error is possible. Locate the ICB/IWA stack to determine what function called seize.

0612	Resource Management

Description: A VLIC routine has tried to release an object or address which it does not hold a seize on, or the release is not for the same type of seize.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5. See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

0615	Resource Management

Description: An invocation work area segment could not be extended by ASM.

Service Recovery Action: The probable cause of this condition is not enough auxiliary storage available in the machine. If the problem analysis indicates this to be the case, steps should be taken to ensure enough auxiliary storage is available to avoid this condition. If enough auxiliary storage is available, see the service recovery procedure for code 0101 on page C-5 on page C-5.

Service Problem Analysis Procedure: A segment used for IWA could not be extended to hold more invocations. The IWA is temporary storage used by VLIC as invocation storage and for VLIC program variables. This storage is provided by the MI user in a process control space or is created by VLIC for an internal VLIC task. This error occurs during an implicit request to extend the IWA. An IMP stack exception caused the effective address overflow exception to be entered to extend the segment. The halfword portion of register 12 in the primary MCLB contains a 2 byte return code from the extend segment function. See function check code 1705, extend segment failed, for a list of return codes.

0616	Resource Management

Description: Recursion on receive wait/time-out.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: A process in MI wait enters another MI wait without first saving the status of the previous MI wait and clearing the MI wait flag. Normally, a process in MI wait can be interrupted out of the wait state to process asynchronous events. In this case, the previous wait status is saved and the wait flag bit for the interrupted processes is cleared. To determine which VLIC module(s) caused this error, the data that describes the status of the process at the time this error occurred is saved in the VLIC log. This data includes the task dispatching element (TDE), call return element (CRE), and invocation work area (IWA) of the process that incurred the error. At the time of error, the process was executing the IMP Terminate Immediate instruction in the receive/wait time-out module. The module that called RCFRWTO was the direct cause of the error, but likely was called by another module that could be the cause of the error.

0617	Resource Management

Description: TDE access exception in microtask.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: VLIC implementation restricts the use of monitored TDE access exception for processes to the implementation of MI waits. VLIC tasks should never cause a monitored TDE access exception to be presented by the IMP code. The monitored TDE exception mask in the TDE of a VLIC is always masked to disallow TDE access exception. In an MI process, that mask is unmasked to allow a monitored TDE access exception in receive wait/time-out and masked to disallow further presentation of the exception in the TDE access exception handler once the exception is presented. Should this error occur, it is detected in module #RMAEHAS executing under the failing task. The dump for the TDE, CREs, and IWA (if any) of that task could provide a clue as to which VLIC module that was executing an IMP receive message instruction from an send/receive queue (SRQ) that caused the monitored TDE access exception to be presented. The direct cause of the error is that the monitored TDE exception mask in the TDE of the erring task is unmasked. Normally, the monitored TDE exception mask bit is be masked (zero). The VLIC module that set the bit to a 1 was the real cause of the error. There is no apparent way to find out the real cause of the error but dumps of TDEs, CREs, invocation work areas (IWAs), and process control block (PCBs) if any, of all the tasks and processes in the machine at the time of error provide information as to how the error occurred. These dumps include most of the main storage and parts of auxiliary storage that was paged out.

0620	Resource Management

Description: Event management index is not usable.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: The event management index is located using the virtual address in the VCA (VLIC communication area) labeled VCAEVIX@. This machine index has incurred a catastrophic error. Use procedures for determining index errors to locate the cause of the problem. Entries are placed in the VLIC log for this machine check.

1210	Database

Description: Object not found in the in-use table when attempting to decrement IN-USE count.

Service Recovery Action: Verify the problem determination procedure and obtain the following information:

- The control panel codes associated with the system failure
- The stand-alone dumps
- Enough information to create the problem again

Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period around the time of the problem (see Chapter 31). Obtain the VLIC log entries before or after the identified one (-10 or +10 default). If the problem persists, call your service representative.

Service Problem Analysis Procedure: The data base in-use table is located at hex location 0000 0E00 0000. When activating or deactivating a DB object, the object is placed into or removed from the data base in-use table. If an object is activated more than once, a count in the table is incremented (a duplicate entry). If an attempt is made to decrement it to less than 0, or if the object cannot be found in the table, then the table (used to interlock data base objects) is invalid. Because this table is invalid, there is a danger that data base objects may be damaged. Machine processing was terminated. Directory recovery is not necessary after this machine check.

1215	Database

Description: Error in critical code sequence (requires IPL to ensure recovery).

Service Recovery Action: Obtain the VLIC log for 20 entries before and including the machine check. Obtain the information necessary to create the problem again. Examine the VLIC log and error log information and/or run hardware diagnostics to determine if an intermittent failure of the CPU, main storage, or auxiliary storage is causing the errors. If the problem persists, call your service representative.

Service Problem Analysis Procedure: If the machine check was signaled directly (see the VLIC log), a licensed internal code error has been detected. If the machine check was signaled from an exception handler, examine the original exception data, and determine whether the exception is the result of a hardware failure or a licensed internal code error.

1217	Database

Description: Duplicate initial extents in permanent directory.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

1219	Database

Description: A back leveled driver has been detected.

Service Recovery Action: Install the latest level of VLIC. If the problem persists, obtain the VLIC log for 20 entries before and including the machine check, and call your service representative.

Service Problem Analysis Procedure: None.

1604	Source/sink

Description: Not able to create APPN task.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

1719	Source/sink

Description: Unexpected condition requires shutdown.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

4001	Storage Management IPL Status

Description: This is displayed when VLIC first receives control. This verifies that VLIC code has started to run.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: When a status SRC remains without work station activity and the processor active light is not blinking, the system is hung. This is a VLIC code problem.

4002	Storage Management IPL Status

Description: Storage management initialization has built the primary directory, built storage management tables and created storage management tasks.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4003	Storage Management IPL Status

Description: The bus manager has successfully switched the bus control unit function from the service processor.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4004	Storage Management IPL Status

Description: The load source IOP has been identified. The DASD unit that provided the VLIC nucleus load is attached to the load source IOP.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4005	Storage Management IPL Status

Description: The DASD unit that provided the VLIC nucleus load has been identified.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4006	Storage Management IPL Status

Description: The SIOA connection to the load source DASD unit has been successfully opened. I/O commands to it are successful.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4007	Storage Management IPL Status

Description: Limited paging is operational. This means:

- Pageable VLIC code can run.
- Temporary segments can be created.
- Permanent segments cannot be created or accessed unless in static directory.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4008	Storage Management IPL Status

Description: The bus manager successfully completed Invoke IPL All. All bus units have been identified, loaded (if necessary), and IPLed.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4010	Storage Management IPL Status

Description: Following resource management initialization successfully completed:

- Machine wide storage (MWS) is set up.
- Locking facilities initialized.
- Timing facilities initialized.
- Resource management service task created.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4011	Storage Management IPL Status

Description: Exception management initialization is complete.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4012	Storage Management IPL Status

Description: Process management initialization is complete.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4013	Storage Management IPL Status

Description: Source sink initialization is complete. The following tasks are created.

- Error log
- MSCP
- CCIOM
- IPCF open manager

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4014	Storage Management IPL Status

Description: The RAS focal point IPCF connection to the load source IOP which was opened by VLIC IPL is now owned by CCIOM.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4020	Storage Management IPL Status

Description: Programmed IPL is started.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4021	Storage Management IPL Status

Description: The SRC is displayed when directory recovery starts.

Service Recovery Action: See the service recovery procedures for code 0423 on page C-16.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4022	Storage Management IPL Status

Description: The VLIC log function started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4023	Storage Management IPL Status

Description: Context rebuild has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4024	Storage Management IPL Status

Description: This SRC is displayed when error log is informed of full paging to use the permanent error log and MSCP is notified to start APPN.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4025	Storage Management IPL Status

Description: Authority recovery has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4026	Storage Management IPL Status

Description: Journal recovery has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4027	Storage Management IPL Status

Description: Data base recovery has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4028	Storage Management IPL Status

Description: Journal synchronization has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4029	Storage Management IPL Status

Description: Commit recovery has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4030	Storage Management IPL Status

Description: Data base initialization has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4031	Storage Management IPL Status

Description: Journal IPL clean up has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4032	Storage Management IPL Status

Description: Commit initialization has started.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4036	Storage Management IPL Status

Description: The transition from VLIC to OS/400 has started. The operating system is starting.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 4001 on page C-22.

4101	Bus Manager IPL Status

Description: Invoke IPL All for bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4102	Bus Manager IPL Status

Description: Invoke IPL for bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4103	Bus Manager IPL Status

Description: Invoke IPL for a particular bus unit on bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4104	Bus Manager IPL Status

Description: Invoke IPL Disable on bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4105	Bus Manager IPL Status

Description: Invoke IPL Enable on bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4106	Bus Manager IPL Status

Description: Invoke IPL for the load source on bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4107	Bus Manager IPL Status

Description: Invoke IPL for address request on bus 0 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4108	Bus Manager IPL Status

Description: No IOPs found on bus 0.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4109	Bus Manager IPL Status

Description: Cable test failure on bus 0.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

410A	Bus Manager IPL Status

Description: Bus extension unit on bus 0 has no power.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4111	Bus Manager IPL Status

Description: Invoke IPL All for bus 1 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4112	Bus Manager IPL Status

Description: Invoke IPL for bus 1 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4113	Bus Manager IPL Status

Description: Invoke IPL for a particular bus unit on bus 1 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4114	Bus Manager IPL Status

Description: Invoke IPL Disable on bus 1 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4115	Bus Manager IPL Status

Description: Invoke IPL Enable on bus 1 in progress

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4117	Bus Manager IPL Status

Description: Invoke IPL for address request on bus 1 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4118	Bus Manager IPL Status

Description: No IOPs found on bus 1.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4119	Bus Manager IPL Status

Description: Cable test failure on bus 1.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

411A	Bus Manager IPL Status

Description: Bus extension unit on bus 1 has no power.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4121	Bus Manager IPL Status

Description: Invoke IPL All for bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4122	Bus Manager IPL Status

Description: Invoke IPL for bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4123	Bus Manager IPL Status

Description: Invoke IPL for a particular bus unit on bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4124	Bus Manager IPL Status

Description: Invoke IPL Disable on bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4125	Bus Manager IPL Status

Description: Invoke IPL Enable on bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4127	Bus Manager IPL Status

Description: Invoke IPL for address request on bus 2 in progress.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4128	Bus Manager IPL Status

Description: No IOPs found on bus 2.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4129	Bus Manager IPL Status

Description: Cable test failure on bus 2.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

412A	Bus Manager IPL Status

Description: Bus extension unit on bus 2 has no power.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4205	Storage Management IPL Status

Description: DASD Mirroring synchronization is being done.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4210	Storage Management IPL Status

Description: Validation of all outstanding check sum updates is being performed.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4220	Storage Management IPL Status

Description: New check summed units are being zeroed.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4230	Storage Management IPL Status

Description: Recovery of check sum data for a device(s) that has lost all or a portion of its data is being performed.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4240	Storage Management IPL Status

Description: Pages are being reclaimed from the main storage dump. Pages need to be reclaimed from the main storage dump because at the time the main storage dump occurred the page was in main storage and the page:

- Has changed but not written.
- A write had been issued for the page but was still in the I/O pending status when dump occurred.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4250	Storage Management IPL Status

Description: Completion of all outstanding auxiliary storage management operations is being performed.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4260	Storage Management IPL Status

URCs

Description: All configured disk units are being read to find all permanent data and free space on the devices.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4270	Storage Management IPL Status

Description: Validation (recalculation) of the check sum for all check sum sets is being performed.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4275	Storage Management IPL Status

Description: Data is being moved from the load source to create space for dumping main storage.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4280	Storage Management IPL Status

Description: Space is being allocated on the load source DASD to equal the size of main storage. This reserved area is increased or decreased to fit the current system's main storage for taking a main storage dump.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4300	CCIOM IPL Status

Description: Begin CCIOM task initialization during IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4301	CCIOM IPL Status

Description: Open an IPCF RAS connection to an IOP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4302	CCIOM IPL Status

Description: Send an Assign Focal Point command to an IOP.

Service Recovery Action. None.

Service Problem Analysis Procedure: None.

4303	CCIOM IPL Status

Description: Send a Report Status Table command to an IOP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4304	CCIOM IPL Status

Description: Process report status table data received from an IOP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4305	CCIOM IPL Status

Description: Process vital product data (VPD) received from an IOP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4306	CCIOM IPL Status

Description: Process download response received from an IOP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

4307	CCIOM IPL Status

Description: CCIOM task initialization complete.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

5001	DST Status

Description: There was no response from a workstation controller card on bus 0.

Service Recovery Action: Exchange the first workstation controller card on bus 0. Select function 3 on the control panel and press the Enter key to start the IPL.

Service Problem Analysis Procedure: None.

5002	DST Status

Description: A service program problem occurred when attempting to use the system console.

Service Recovery Action: Select function 21 on the control panel and press start function to start DST again. If the DST sign-on display does not appear at the console and reference code 5002 appears at the control panel, enter SST if it is available and collect problem determination information. If SST is not available, take a main storage dump and IPL the system again.

Service Problem Analysis Procedure: None.

5003	DST Status

Description: The primary console failed to respond. DST could not find a display device on an ASCII workstation controller on bus 0.

Service Recovery Action: Check the power and address switches to the console display. When the problem is corrected, select function 21 on the control panel and press start function to start DST again. If DST is started again and the primary console is still not available, an attempt is made to start the alternate console.

Service Problem Analysis Procedure: None.

5004	DST Status

Description: The primary console failed to respond. DST could not find a display device on an twinaxial work station controller on bus 0.

Service Recovery Action: Check the power and address switches to the console display. When the problem is corrected, select function 21 on the control panel and press start function to start DST again. If DST is started again and the primary console is still not available, an attempt is made to start the alternate console.

Service Problem Analysis Procedure: None.

5010	DST Status

Description: The IPL service function ended abnormally when the system was being IPLed in unattended mode.

Service Recovery Action: Place the Keylock switch in the Manual position and IPL the system. Use DST to IPL the system in attended mode.

Service Problem Analysis Procedure: None.

5082	DST Status

Description: DST lost contact with the console in use at the time. This may be due to a power failure in the console or changing the address switches on the display.

Service Recovery Action: Check the power and address switches to the console display. When the problem is corrected, select function 21 on the control panel and press the start function to start DST again. If DST is started again and the primary console is still not available, an attempt is made to start the alternate console.

Service Problem Analysis Procedure: None.

5083	DST Status

Description: The IPL service function terminated abnormally due to loss of the IPL console during an IPL to OS/400.

Service Recovery Action: Select function 21 on the control panel and press the start function to start DST again. If the DST sign-on display does not appear at the console and reference code 5002 appears at the control panel, enter SST if it is available and collect problem determination information. If SST is not available, take a main storage dump and IPL the system again. If the DST sign-on display appears, sign on to DST and select the IPL the system option on the DST main menu to IPL the system again.

Service Problem Analysis Procedure: None.

5090	DST Status

Description: System startup failed in unattended IPL mode.

Service Recovery Action: Make sure all configured disk units are powered up and connected correctly to the system. Make sure all disk units have the correct address set in the disk unit address switches. Select function 21 on the control panel and press the start function to enter DST. Work with disk units may be used to verify or correct the disk configuration. When the problem is corrected, select the IPL the system option to continue the IPL or the install operating system option to continue the install.

Service Problem Analysis Procedure: Select function 21 on the control panel and press the Enter key to start DST. Use the Work with disk units option on the DST main menu. Display the disk configuration and verify that all devices in the configuration are on line. If all devices are on line and the problem continues, use the Work with disk unit option to determine the cause of the failure.

5091	DST Status

Description: A disk unit did not report a valid type or model.

Service Recovery Action: Sign on to DST. Select the work with disk units option. Use the Display disk configuration option to locate the disk unit that does not have a valid type or model. Determine the correct type and model for the device. Use the Display/change device information option to correct the vital product data for that device. End work with disk devices and then perform an IPL.

Service Problem Analysis Procedure: None.

50FF	DST Status

Description: An unrecoverable program error occured in dedicated service tools (DST) or a program error occured when initiating DST.

Service Recovery Action: IPL the system again. If the DST sign-on display appears at the primary console, sign on to DST and use the print stand-alone dump option to copy the main storage dump to tape and submit an APAR. If the DST sign-on display does not appear at the primary console, load the licensed internal code again from the most recent save tape. When the DST sign-on display appears at the primary console, sign on to DST and use the print stand-alone dump option to transfer the main storage dump to tape. Submit an APAR.

Service Problem Analysis Procedure: None.

5100	Bus Manager Machine Check

Description: Bus manager software failure in #BMINTF0. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5101	Bus Manager Machine Check

Description: Bus manager software failure in #BMINTF1. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5102	Bus Manager Machine Check

Description: Bus manager software failure in #BMINTF2. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5103	Bus Manager Machine Check

Description: Bus manager software failure in #BMIPL. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5104	Bus Manager Machine Check

Description: Bus manager software failure in #BMREMST. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5105	Bus Manager Machine Check

Description: Bus manager software failure in #BMCFBM. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5106	Bus Manager Machine Check

Description: Bus manager software failure in #BMCFBMR. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5107	Bus Manager Machine Check

Description: Bus manager software failure in #BMCINTF. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5108	Bus Manager Machine Check

Description: Bus manager software failure in #BMKERNR. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5109	Bus Manager Machine Check

Description: Bus manager software failure in #BMGETD. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5110	Bus Manager Machine Check

Description: Bus manager software failure in #BMCFRTR. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5111	Bus Manager Machine Check

Description: Bus manager software failure in #BMTIMER. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5112	Bus Manager Machine Check

Description: Bus manager software failure in #BMBIPCF. The system is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5126	CCIOM Machine Check

Description: CCIOM software failure occurred during task initialization. The system is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

5151	IPCF Machine Check

Description: APAR or LICTR condition detected in the VLIC IPCF component. The system is inoperative.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5200	I/O Processor Failure

Description: IPL detected bus or hardware error on Direct Select command. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5201	I/O Processor Failure

Description: IPL detected bus or hardware error on Address Select command. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5202	I/O Processor Failure

Description: IPL detected IOP did not set immediate status. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5203	I/O Processor Failure

Description: IPL detected IOP returned nonzero status in message wrap acknowledgement. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5204	I/O Processor Failure

Description: IPL detected IOP returned nonzero status in IBT acknowledgement. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5205	I/O Processor Failure

Description: IPL detected IOP returned nonzero status in get load ID acknowledgement. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5206	I/O Processor Failure

Description: IPL detected IOP load not found. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5207	I/O Processor Failure

Description: IPL detected IOP returned nonzero status in the bus command. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5208	I/O Processor Failure

Description: IPL detected IOP did not remain loaded after Operation Load Complete Bus Command received. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5209	I/O Processor Failure

Description: Expired IPL timer. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520A	I/O Processor Failure

Description: Prior IOP failure encountered. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520B	I/O Processor Failure

Description: Failure on Write Address-D command. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520C	I/O Processor Failure

Description: Failure on Read Immediate Status-D command. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520D	I/O Processor Failure

Description: Match not found in IPL branch table. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520E	I/O Processor Failure

Description: IOP responded to get load ID with zero LID or IOP requested zero LID. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

520F	I/O Processor Failure

Description: Data miscompare on message wrap. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5210	I/O Processor Failure

Description: Message wrap acknowledge received out of sequence. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5211	I/O Processor Failure

Description: Initial bus test acknowledge received out of sequence. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5212	I/O Processor Failure

Description: Get load ID acknowledge received out of sequence. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5213	I/O Processor Failure

Description: Bus command received out of sequence. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5214	I/O Processor Failure

Description: Bus command received out of sequence. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5215	I/O Processor Failure

Description: Request load message not valid at this time. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5216	I/O Processor Failure

Description: Restart after critical IOP operation complete. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5217	I/O Processor Failure

Description: Reset timeout message not valid at this time. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5218	I/O Processor Failure

Description: OLC not valid at this time. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5219	I/O Processor Failure

Description: Critical IOP operation in progress. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5220	I/O Processor Failure

Description: Get dump or get error log rejected by the IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5221	I/O Processor Failure

Description: IOP rejected because not in suspend state. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5222	I/O Processor Failure

Description: Status returned by IOP is invalid. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5223	I/O Processor Failure

Description: An AER was received, but no error log could be retrieved. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5240	I/O Processor Failure

Description: Storage size or length of buffers field in message invalid. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5241	I/O Processor Failure

Description: IOP does not support reverse flow 2. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5242	I/O Processor Failure

Description: IOP does not have master direct memory access. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5243	I/O Processor Failure

Description: Address field in message is invalid. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5244	I/O Processor Failure

Description: Storage list to be returned not found. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5245	I/O Processor Failure

Description: Flag field in message is invalid. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5246	I/O Processor Failure

Description: IOP does not support reverse flow 2. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5247	I/O Processor Failure

Description: IOP does not have master direct memory access capability. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5248	I/O Processor Failure

Description: Invalid for IOP to send storage list available message. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5249	I/O Processor Failure

Description: Invalid for IOP to send return storage list message. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5260	I/O Processor Failure

Description: Unexpected bus unit message was received from the failing IOP. Minimal recovery is to vary off and on all source/sink objects associated with the failing IOP. There is a possible APAR or LICTR condition. Use the Work with error log option under SST or DST to dump all error log entries that have the error log ID value associated with the failure.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5261	I/O Processor Failure

Description: Failing IOP reported unit check direct memory access condition. This may be an intermittent problem, attempt recovery by varying off and on all source/sink objects associated with the failing IOP.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5262	I/O Processor Failure

Description: Failing IOP reported an Imprecise bus time-out condition. This may be an intermittent problem, attempt recovery by varying off and on all source/sink objects associated with the failing IOP.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5270	I/O Processor Failure

Description: Invalid base load ID in bus configuration SRM. Cannot open an IPCF RAS connection to the IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5271	I/O Processor Failure

Description: IPCF error when opening a RAS connection to an IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5272	I/O Processor Failure

Description: IPCF or IOP error code on Assign Focal Point command to an IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5273	I/O Processor Failure

Description: IPCF or IOP error code on Report Status Table command to an IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

5274	I/O Processor Failure

Description: Invalid report status table data received from an IOP. The IOP is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: See the service recovery procedures for code 0101 on page C-5.

Service Problem Analysis Procedure: See the service problem analysis procedures for code 0104 on page C-5.

6001	Stand-Alone Utilities

Description: The load/restore utility is requesting which utility to run.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6002	Stand-Alone Utilities

Description: Licensed internal code install (build DASD) was requested; however, the load source disk unit found contains valid information. Continuing to install licensed internal code will result in the loss of this information. This message is to give you a chance to verify what you are doing is what you want.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6003	Stand-Alone Utilities

Description: Licensed internal code install (build DASD) was requested and the load source disk unit found contains valid information. However, it does not contain the system licensed internal code, only customer data. To continue with licensed internal code install will result in the loss of this information. This message is to give you a chance to verify what you are doing is what you want.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6004	Stand-Alone Utilities

Description: Licensed internal code restore was requested and the load source disk unit found contains valid information. However, it does not contain the system licensed internal code, only customer data. Licensed internal code cannot be restored to this disk unit. This message is to give you a chance to verify what you are doing is what you want.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6005	Stand-Alone Utilities

Description: The load source disk can not be located. The disk unit is not reporting in (resource status table) at the address expected. Expect disk to be off the first or second IOP with a controlled device address of 0000 for 9406 System Unit and 0001 for 9404 System Unit. When the device reports in, the utility automatically continues.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6006	Stand-Alone Utilities

Description: The License Internal Code level found on tape is not compatible with the License Internal Code found on disk. Continuing to restore this code will result in system failure.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6007	Stand-Alone Utilities

Description: Download Disk Licensed Internal Code was requested. The system found a disk unit attached at the correct location for being the load-source disk unit. However, the disk unit found is not in the correct format to be the load-source disk. The wrong disk unit may be attached at the location where the load-source disk unit should be, or the correct load-source disk unit may not be powered on.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6008	Stand-Alone Utilities

Description: You are installing a mirrored system, and no load-source with the current level data was found. You should try to make this device operational. If you find a load-source device that is not powered on, powering the device on will cause the program to loop again to look for the device. Otherwise, you may select Function Key 27 to search device.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6009	Stand-Alone Utilities

Description: You are installing a mirrored system. Both load-source devices were wanted, but only one was found. You should try to make the device operational. If you find a load-source device that is not powered on, powering the device on will cause the program to loop again to look for the device. Otherwise, you may select Function Key 27 to have the program ignore not finding the other load source and continue.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6010	**Stand-Alone Utilities**

Description: You are installing a mirrored system. One of the load-source devices wanted is not a load-source device. If you power on the device needed, the program will loop again. Otherwise, select Function Key 27 to have the program continue.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6011	**Stand-Alone Utilities**

Description: Confirm the request to load the tape volume for the model-unique licensed internal code, or cancel the request.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6030	**Stand-Alone Utilities**

Description: The disk has become not ready or operative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6041	**Stand-Alone Utilities**

Description: The tape drive has become inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6042	**Stand-Alone Utilities**

Description: The tape drive has become not ready.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6043	**Stand-Alone Utilities**

Description: The tape is not loaded properly.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6048	**Stand-Alone Utilities**

Description: Mount requested tape volume.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6049	**Stand-Alone Utilities**

Description: Mount requested tape volume.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6050	**Stand-Alone Utilities**

Description: Duplicate tape volume label check.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6051	**Stand-Alone Utilities**

Description: Mount the tape volume for the model-unique licensed internal code.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6052	**Stand-Alone Utilities**

Description: Mount requested tape volume.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6101	**Stand-Alone Utilities**

Description: This reference code and reference codes beginning with 61 describe problems that should not occur. The reference code suggests the failure.

Service Recovery Action: None.

Service Problem Analysis Procedure: The same load/restore task requested a lock that it owns. This would suggest a programming error in the load/restore utility. This error was displayed in place of allowing the task to wait for the lock a second time and hanging the system.

6102	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: A load/restore task has received a program exception that has not been defined. This suggests that a programming error exists in the load/restore utility. Either the exception occurred and was not allowed for or the code (probably HLIC) detected an exception that should not have been raised suggesting an improper load/restore task. The CC field of the SRC shows the exception code that caused this condition.

6103	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: Insure there is enough pages available to run the load/restore utility. The utility has been designed to run in a minimum of 2 megabytes of memory.

Service Problem Analysis Procedure: There is insufficient main storage to run the load/restore utility. This may be caused by an excessive number of memory pages being marked as bad, thus removing them from use by the load/restore utility. The number of pages remaining was insufficient to run load/restore. Another possibility is that the utility used up all its storage. The following describes the rest of the SRC:

Function Code	Description
11	B6006103
12	Displays location of error detector
13	Reserved
14	Count of bad pages
15	Count of nucleus pages
16	Count of assigned pages
17	Count of available pages (zero)
18	Reserved

6104	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: There is an error detected by load/restores #SEMAIN function. This is probably a programming error in the load/restore utility.

6105	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: A load/restore task tried to touch a virtual address that has not been defined. Either the task itself has made an error or information passed to the task is incorrect and a bad virtual address value has been passed. There is a coding error in the load/restore utilities.

6106	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore utility has exhausted its supply of call/return elements. An insufficient number of CREs has been defined. There is a programming error in the load/restore utility.

6107	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The service processor I/O manager has responded to a panel request with a return code that was not expected. Either the service processor I/O manager should not have returned that response or the requesting task failed to acknowledge a possible valid response. There is a coding error in the load/restore utility.

6108	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: During the load/restore utility initialization an unexpected response was received that should not have occurred. There is a coding error in the load/restore utility.

6109	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An error was detected while attempting to create, extend, truncate or expunge a range of virtual address. There is a coding error in the load/restore utility.

6110	Stand-Alone Utilities

Description: The user has requested (by using the control panel) that the load/restore utility be ended. If the utility was in the process of restoring or installing the licensed internal code on the system, the system may be in an unusable state. Complete the install or restore load/restore function before the system is usable again.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6111	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: A routine was called by a load/restore task that should not have been called. There exists a set of routines that supports externals required by code that runs both in the load/restore environment and in the disk VLIC environment. This shared code was not expected to call this external, but seems to have anyway. This is probably a coding error in the load/restore utility. Either a condition existed that caused the shared code to call a tie off routine or the routine should have been coded but was not.

6112	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred attempting to change the primary directory. Probably attempting to define a new page reference. This probably is a programming error in the load/restore utility. An unexpected return code was received from HLIC.

6113	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: A load/restore task or HLIC task has request an undefined function via the function request address table (FRAT). The CC field suggests which FRAT entry was requested. There is a programming error in the load/restore utility.

6114	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: There is an error detected by the support code for the IMPI Perform Paging Request (PPR) function. The requester of PPR probably coded an unsupported PPR function. Or PPR uncovered a condition that was not expected. This is probably a programming error in the load/restore utility.

6115	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore has detected an unexpected error attempting to program check the system. The code that has called termination is in error. There is a programming error in the load/restore utility.

6116	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: A load/restore CCIO Manager router has detected an internal programming error. There is a programming error in the load/restore utility.

6117	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore SIOA response decode function has detected a programming error. There is a programming error in the load/restore utility.

6118	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore CCIOM configuration function has detected a programming error. There is a programming error in the load/restore utility.

6119	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore CCIOM bus function has detected a programming error. There is a programming error in the load/restore utility.

6120	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore CCIOM error logging function has detected a programming error. This probably is a programming error in the load/restore utility.

6121	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore CCIOM IOP down load function has detected a programming error. This error may indicate the disk being down loaded is not supported by this version of the load/restore utility. This probably is a programming error in the load/restore utility.

6122	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore IPCF reverse flow receive function has detected a programming error. This probably is a programming error in the load/restore utility.

6123	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected bus error was received while attempting to decode IPCF response code. Normally, an SRC describing the bus error should have been displayed but was not. There is a possible programming error in the load/restore utility. The utility should have reported the bus SRC instead, but the bus manager failed to respond with the error code.

6124	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore IPCF send response has detected a programming error. There is a programming error in the load/restore utility.

6125	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred while initializing the load/restore IPCF function. There is a programming error in the load/restore utility.

6126	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred while opening an IPCF connection. There is a programming error in the load/restore utility.

6127	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred while attempting to build an IPCF request. There is a programming error in the load/restore utility.

6128	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred while attempting to analyze the an IPCF IORM response. There is a programming error in the load/restore utility.

6129	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error occurred during load/restore IPCF close function. There is a programming error in the load/restore utility.

6130	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

A request was made of the disk IOP to perform an operation (most likely a read). The disk IOP returned an unexpected return code. The load/restore utility did not know what to do with the return code.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected IPCF SIOA response was received from the load source disk IOP and a disk IOP SRC was not found. This could be either a failure of load/restore to recognize a possible response code or the disk IOP responded incorrectly or failed to provide an SRC.

6131	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

A request was made of the disk IOP and a command reject was returned. This suggests that the request made of the IOP was invalid or in error.

Service Recovery Action: None.

Service Problem Analysis Procedure: An IPCF SIOA command reject was received from the load source disk IOP and either a disk SRC was not given or could not be located. Command reject usually suggests a device protocol error and possibly is a coding problem with the load/restore utility. This can also be an invalid response from the IOP itself and an IOP licensed internal code error.

The CC field gives a clue about the failure. The following is a list of possible values:

Code	Definition
01	Invalid command
02	Invalid modifier
03	Invalid command length
04	Invalid area
05	Invalid use of reserved field
06	Invalid scan key length
07	Invalid data length
08	Invalid read block count
09	Invalid container extent
0A	Invalid action code
0F	Invalid extent count
10	Invalid container image
14	Invalid device position
15	Boundary error
16	Format exception
81	Invalid label count

6132	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the disk IOP and an operation exception was returned. This suggests that the request made of the IOP could not be done because of some problem with the hardware, device or media. Some of these errors have specific recovery actions. However, when this error is displayed either there is no recovery or the recovery action failed.

Service Problem Analysis Procedure: An IPCF SIOA operation exception was received from the load source disk IOP and either a disk SRC was not given or could not be located. An operation exception suggests that the device is in a state that would prevent the request operation from occurring. The recovery action for the exception could not resolve the exception. There could be a problem with the disk unit. The IOP did not specify a hardware SRC. This is probably a licensed internal code error in the disk IOP or possibly a coding problem in the load/restore utility.

6133	Stand-Alone Utilities

Description: A request was made of the disk IOP and an unknown unrecoverable response was received. The load/restore utility did not know what to do with the error. Usually, this error suggests a hardware or media problem.

Service Recovery Action: None.

Service Problem Analysis Procedure: An IPCF SIOA unrecoverable error was received from the load source disk IOP and either a disk SRC was not given or could not be located. The response received from the disk IOP was not expected. This probably means that the load/restore utility being used does not support the disk IOP being used. The could also mean that the IOP returned an undefined SIOA status.

6134	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The disk IOP returned a IPCF SIOA physical link error. There should have been a device SRC associated with the link error but one was not received. The rest of this SRC describes which IOP and device were involved. There are basically two problems here, the first being the link error itself and the second because the disk IOP failed to report an SRC describing the link error.

6135	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the disk IOP and the IOP responded with an *equipment check*. Usually this means that the IOP was not able to communicate with the disk IOA and the IOA may be bad. Because you are seeing this message, the IOP was not able to respond with a more definitive SRC. Some of these errors have specific recovery actions. However, when this error is displayed, either there is no recovery or the recovery action failed.

Service Problem Analysis Procedure: The disk IOP returned an IPCF SIOA equipment check. There should have been a device SRC associated with the link error, but one was not received. The rest of this SRC describes which IOP and device were involved. Either the problem is caused by the equipment check itself or the disk IOP failed to report an SRC describing the equipment check.

6136	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the disk IOP and the IOP responded with a *data check*. Usually this means that the IOP was not able read from or write to disk IOA and the IOA or the media may be bad. Because you are seeing this message, the IOP was not able to respond with a more definitive SRC. Some of these errors have specific recovery actions. However, when this error is displayed, either there is no recovery or the recovery action failed.

Service Problem Analysis Procedure: The disk IOP returned a IPCF SIOA data check. There should have been a device SRC associated with the link error but one was not received. The rest of this SRC describes which IOP and device were involved. Either the problem is caused by the data check itself or the disk IOP failed to report an SRC describing the data check.

6138	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore disk management function. There is a programming error in the load/restore utility.

6139	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore disk I/O function. There is a programming error in the load/restore utility.

6140	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the tape IOP to perform an operation. The tape IOP returned an unexpected return code. The load/restore utility did not recognize the return code.

Service Problem Analysis Procedure: An unexpected IPCF SIOA response was received from the tape IOP and a tape IOP SRC was not found. This could be either a failure of load/restore to recognize a possible response code or the tape IOP responded incorrectly or failed to provide an SRC.

6141	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the tape IOP and a command reject was returned. Usually the request made of the IOP was invalid or in error. The CC field gives a clue about the failure. The following is a list of possible values:

Code	Definition
01	Invalid command
02	Invalid modifier
03	Invalid command length
04	Invalid area
05	Invalid use of reserved field
06	Invalid scan key length
07	Invalid data length
08	Invalid read block count
09	Invalid container extent
0A	Invalid action code
0F	Invalid extent count
10	Invalid container image
14	Invalid device position
15	Boundary error
16	Format exception
81	Invalid label count

Service Problem Analysis Procedure: An IPCF SIOA command reject was received from the tape IOP and either a tape SRC was not given or could not be located. Command reject usually suggests a device protocol error and possibly is a coding problem in the load/restore utility. This can also be an invalid response from the IOP itself and an IOP licensed internal code error.

6142	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: A request was made of the tape IOP and an operation exception was returned. This suggests that the request made of the IOP could not be done because of some problem with the hardware, device, or media. Some of these errors have specific recovery actions. However, when this error is displayed, either there is no recovery or the recovery action failed.

Service Problem Analysis Procedure: An IPCF SIOA operation exception was received from the tape IOP and either a tape SRC was not given or could not be located. An operation exception suggests that the device is in a state that would prevent the request operation from occurring. The recovery action for the exception could not resolve the exception. There could be a problem with the tape device. The IOP did not specify a hardware SRC. This is probably a licensed internal code error in the tape IOP or possibly a coding problem in the load/restore utility.

6143	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

A request was made of the tape IOP and an unknown unrecoverable response was received. The load/restore utility did not recognize the error. Usually, this error is a hardware or media problem.

Service Recovery Action: None.

Service Problem Analysis Procedure: An IPCF SIOA unrecoverable error was received from the tape IOP and either a tape SRC was not given or could not be located. The response received from the tape IOP was not expected. This probably means that the load/restore utility being used does not support the tape IOP being used. This could also mean that the IOP returned an undefined SIOA status.

6144	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

A request was made of the tape IOP and the IOP responded with a *physical link error*. Usually this means that the IOP was not able to communicate with the tape IOA and the IOA may be bad. Because you are seeing this message, the IOP was not able to respond with a more definitive SRC. Some of these errors have specific recovery actions. However, when this error is displayed, either there is no recovery or the recovery action failed.

Service Recovery Action: None.

Service Problem Analysis Procedure: The tape IOP returned an IPCF SIOA physical link error. There should have been a device SRC associated with the link error but one was not received. The rest of this SRC describes which IOP and device were involved. Either the problem is because the link error itself or the tape IOP failed to report an SRC describing the link error.

6145	Stand-Alone Utilities

Description: A request was made of the tape IOP and the IOP responded with an *equipment check*. Usually this means that the IOP was not able to communicate with the tape IOA and the IOA may be bad. Because you are seeing this message, the IOP was not able to respond with a more definitive SRC. Some of these errors have specific recovery actions. However, when this error is displayed either there is no recovery or the recovery action failed.

Service Recovery Action: None.

Service Problem Analysis Procedure: The tape IOP returned an IPCF SIOA equipment check. There should have been a device SRC associated with the link error but one was not received. The rest of this SRC describes which IOP and device were involved. Either the problem is because the equipment check itself or the tape IOP failed to report an SRC describing the equipment check.

6146	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

A request was made of the tape IOP and the IOP responded with a *data check*. Usually this means that the IOP was not able read from or write to tape IOA and the IOA or the media may be bad. Because you are seeing this message, the IOP was not able to respond with a more definitive SRC. Some of these errors have specific recovery actions. However, when this error is displayed, either there is no recovery or the recovery action failed.

Service Recovery Action: None.

Service Problem Analysis Procedure: The tape IOP returned an IPCF SIOA Data Check. There should have been a device SRC associated with the link error but one was not received. The rest of this SRC describes which IOP and device were involved. Either the problem is because the data check itself or the tape IOP failed to report an SRC describing the data check.

6148	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore tape I/O function. There is a programming error in the load/restore utility.

6149	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore tape management function. There is a programming error in the load/restore utility.

6150	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore LID management function. There is a programming error in the load/restore utility.

6151	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore tape does not contain valid standard labels. The tape either is not a tape created by SAVSYS or SAVSYS function has a programming error.

6152	Stand-Alone Utilities

Description: Probable user error.

Service Recovery Action: None.

Service Problem Analysis Procedure: The tape mounted contains no files. The wrong tape was mounted.

6158	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load/restore disk I/O function detected an error with the load source disk IOP. The SIOA residual count is in error. There is a disk IOP interface problem with the load/restore utility.

6159	Stand-Alone Utilities

Description: An attempt to reallocated a failing sector and the disk has reported that all available reallocation sectors are used up.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6160	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

URCs

Service Problem Analysis Procedure: An unexpected error has occurred during a load/restore main line utility. There is a programming error in the load/restore utility.

6161	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The system that was used to preform the SAVSYS did not contain the loads needed to support the disk unit being restored. There is a user error during SAVSYS.

6162	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred in a common conversion routine. There is a programming error in the load/restore utility.

6163	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: An unexpected error has occurred while IPLing the next IOP on the bus. There is a programming error in the load/restore utility.

6167	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The SAVSYS tape does not support the processor model being loaded. There is an error with the licensed internal code tapes.

6168	Stand-Alone Utilities

Description: See the error description for reference code 6101 on page C-39.

Service Recovery Action: None.

Service Problem Analysis Procedure: The LID value for the model dependent code does not match the LID value specified by the processor VPD. There is an error with the licensed internal code tapes.

6169	Stand-Alone Utilities

Description: Stand-alone utility function selected that requires authorization. IBM must be contacted for authorization and description of how to use this function.

Service Recovery Action: A valid cipher code is needed to run this function.

Service Problem Analysis Procedure: No error exists.

6201	Stand-Alone Utilities

Description: This reference code and the following 62XX reference codes represent load/restore utility IPL stages.

If one of these reference codes appear with the attention light and/or does not change in a reasonable length of time (about 5 minutes), an error has occurred. The system is probably looping or waiting for an event that did not happen.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6202	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6203	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6204	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6205	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6206	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6208	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6209	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6210	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6211	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6299	Stand-Alone Utilities

Description: See the error description for reference code 6201 on page C-47.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6301	Stand-Alone Utilities

Description: This reference code and the following 63XX reference codes represent load/restore utility stages.

If one of these reference codes appear with the attention light and/or does not change in a reasonable length of time (about 5 minutes), an error has occurred. The system is probably looping or waiting for an event that did not happen.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6330	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: The load source disk unit has currently declared itself busy. The operation is attempted until the device is not busy. The CC field contains the following code:

Code	Description
03	Disk unit is busy
0A	Disk ready transition

6340	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: Tape has declared itself busy. The operation is attempted until the device is not busy. The CC field contains the following code:

Code	Description
03	Tape device is busy
0A	Tape ready transition

6350	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

URCs

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6351	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6352	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6353	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6354	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6355	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6356	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6357	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6360	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6361	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6362	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6363	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6364	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6365	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6366	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6367	Stand-Alone Utilities

Description: See the error description for reference code 6301 on page C-48.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6901	I/O Hardware Error

Description: During time-out analysis the master select line remained active. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6902	I/O Hardware Error

Description: During time-out analysis the ready line remained active. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6903	I/O Hardware Error

Description: During time-out analysis the master steering line remained active. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6904	I/O Hardware Error

Description: During time-out analysis the ACKB line remained active. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6905	I/O Hardware Error

Description: During time-out analysis the bus grant line remained active. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6906	I/O Hardware Error

Description: During time-out analysis the REQB line remained active. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6907	I/O Hardware Error

Description: During time-out analysis the REQP0 line remained active. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6908	I/O Hardware Error

Description: During time-out analysis the REQP1 line remained active. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6909	I/O Hardware Error

Description: During time-out analysis the REQP2 line remained active. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6920	I/O Hardware Error

Description: The secondary bus extension unit timed out. The bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6921	I/O Hardware Error

Description: The secondary bus extension unit timed out. The board or bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6922	I/O Hardware Error

Description: The secondary bus extension unit received parity check. The bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6923	I/O Hardware Error

Description: The primary bus extension unit timed out or received parity check. The bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6924	I/O Hardware Error

Description: The primary bus extension unit timed out or received parity check. The board or bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6925	I/O Hardware Error

Description: The primary bus extension unit re-connection failed. The board or bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6926	I/O Hardware Error

Description: IOP failure with parity check. The board or I/O processor is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6927	I/O Hardware Error

Description: BCU miscompared with the primary bus extension unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6928	I/O Hardware Error

Description: The primary bus extension unit miscompared with the secondary bus extension unit. The board or bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6929	I/O Hardware Error

Description: The secondary bus extension unit miscompared with the primary bus extension unit. The board or bus extension unit is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6930	I/O Hardware Error

Description: Rack power sequence failure detected by bus manager. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6931	I/O Hardware Error

Description: Time-out threshold count exceeded when no primary or controlled device exists. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6932	I/O Hardware Error

Description: More than one read immediate status failure occurred during time-out recovery. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6933	I/O Hardware Error

Description: BCU failure detected during time-out recovery. BCU table search failed. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6934	I/O Hardware Error

Description: Bus extension unit lost power. Rack is inoperative.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6935	I/O Hardware Error

Description: Cable test failed. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6936	I/O Hardware Error

Description: Bus lost power. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6937	I/O Hardware Error

Description: Misplugged card was found after the primary bus extension unit.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6938	I/O Hardware Error

Description: Address 0 was received.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6939	I/O Hardware Error

Description: MSW analysis failed.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6940	I/O Hardware Error

Description: Parity check routine encountered error and did not detect a valid parity check.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6941	I/O Hardware Error

Description: Parity check routine detected a valid parity check.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6942	I/O Hardware Error

Description: Power control cable to expansion tower is disconnected or has failed.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Attach or exchange the power control cable.

Service Problem Analysis Procedure: None.

6943	I/O Hardware Error

Description: Dead Bus Encountered. Command was attempted 10 times with no results.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6950	I/O Hardware Error

Description: Time out threshold count exceeded. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6951	I/O Hardware Error

Description: Read immediate status failed with 04 BSTAT during time-out recovery. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6952	I/O Hardware Error

Description: I/O processor received parity check during timeout recovery. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6953	I/O Hardware Error

Description: I/O processor is a participant on the bus, and passed the poll. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6954	I/O Hardware Error

Description: I/O processor reported IOP check or SYNC check. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6955	I/O Hardware Error

Description: I/O processor read wrap operation failed. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6956	I/O Hardware Error

Description: I/O processor recovery control operation failed. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6960	I/O Hardware Error

Description: IOP encountered unit check error during direct memory access operation. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6961	I/O Hardware Error

Description: IOP encountered imprecise time-out during direct memory access operation. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6962	I/O Hardware Error

Description: A stopped condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6963	I/O Hardware Error

Description: Internal error condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6964	I/O Hardware Error

Description: Invalid command condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6965	I/O Hardware Error

Description: Unit check condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6966	I/O Hardware Error

Description: Sync error condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6967	I/O Hardware Error

Description: A critical operation (open or close) did not complete in the allotted time. This failure is likely to be in the IOP, and a dump of the IOP memory has been attempted to the load source DASD.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6968	I/O Hardware Error

Description: Parity error condition was reported by the hardware. The bus unit is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6980	I/O Hardware Error

Description: 24V under voltage, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6981	I/O Hardware Error

Description: Feature voltage fault, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6982	I/O Hardware Error

Description: 24V over current, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6983	I/O Hardware Error

Description: Logic cage fault, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6984	I/O Hardware Error

Description: Tower 1 UEPO, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6985	I/O Hardware Error

Description: 24V over voltage, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6986	I/O Hardware Error

Description: AC fault, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6987	I/O Hardware Error

Description: No faults, and expansion battery is low. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6988	I/O Hardware Error

Description: 24V under voltage on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

6989	I/O Hardware Error

Description: Feature voltage fault on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698A	I/O Hardware Error

Description: 24V over current on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698B	I/O Hardware Error

Description: Logic cage fault on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698C	I/O Hardware Error

Description: Tower 1 UEPO on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698D	I/O Hardware Error

Description: 24V over voltage on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698E	I/O Hardware Error

Description: AC fault on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

698F	I/O Hardware Error

Description: No faults on expansion unit. The bus is inoperative.

There is a high probability that this SRC results in a long IPL. A main storage dump is not automatically taken for this SRC.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

69FF	I/O Hardware Error

Description: Bus extension unit lost power. Rack is inoperative.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

OS/400 Unit Reference Codes

The four digit unit reference codes follow. The last four are grouped by their first two digits. The groups are:

Group Number	Description
20	OS/400 operator intervention, see page C-71
28-2C	OS/400 IPL status, see page C-71
30	Installation of OS/400, see page C-73
31	Initial OS/400, see page C-75
32-37	Start OS/400, see page C-77
38	System arbiter process during startup or normal system operation, see page C-83
3C	Subsystem monitor process, see page C-83
3E	Message handler termination, see page C-84
3F	System arbiter process during system or subsystem termination, see page C-85

Each reference code is divided into these sections:

- Description
- Service recovery action
- Service problem analysis procedure

The action and procedure sections are to be used as shown in the SRCs. Look up the SRC in the SRC section that begins on page C-71 to find and use the service recovery actions that begin on this page and the problem analysis procedures that begin on page C-61. When necessary, submit the required information to your next level of service support.

The reference codes can be viewed by displaying functions 12 through 18 on the control panel. The following functions 12 through 18 are displayed for OS/400 codes 3100 through 3FFF unless a different format is described for the code.

Table C-1. Information on the Control Panel for Functions 12 through 18

Function	Byte(s)	Description
12	1 2 3, 4	Phase number Function number Subfunction number **Note:** For more information about these numbers, see page 21-9.
13	5-8	The object name appears here if a failure occurred during a resolve.
14	9-12	Function 13 continued here.
15	13, 14 15, 16	Functions 13 and 14 continued here. Object type or subtype shown here if a failure occurred during a resolve.
16-18	17-28	Reserved, no data displayed.

Service Recovery Actions: The following is a list of service recovery actions or procedures that an OS/400 reference code may identify.

1. For this service recovery action, do the following:
   - Take a main storage dump.
   - Install OS/400 again.
2. For this service recovery action, do the following:
   - Install OS/400 again.
     - If install was in progress when the problem occurred, install with the same options that were used before.
     - If no install was in progress when the problem occurred:
       - On the Install the Operating System display, select the option to change installing options.
       - On the Installing Options display, select:
         - For the Restore option: Do not restore program or language objects.
         - For the Clear job and output queues option: NO.
     - If the problem continues to occur, install OS/400 again using the following options:
       - On the Install the Operating System display, select the option to change installing options.
       - On the Installing Options display, select:
         - For the Restore option: restore programs and languages objects from current tape.
         - For the Clear job and output queues option: YES.
       - On the Restore Options display, select YES for all the options.
   - If the problem continues to occur, contact your next level of service support.
3. For this service recovery action, do the following:
   - Take a main storage dump.
   - Install OS/400 again using the defaults.
4. For this service recovery action, do the following:
   - Take a main storage dump.
   - Install OS/400 again.
     - On the Install the Operating System display, select the option to change installing options.
     - On the Installing Options display, select:
       - For the Restore option: restore program and language objects from current tape.
       - For the Clear job and output queues option: YES.
     - On the Restore Options display, select YES for all the options.

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5. For this service recovery action, do the following:
   - Either:
     - Install a Kanji system, or
     - Change the console device from a Kanji device to a non-Kanji device and begin the install again.
6. For this service recovery action, do the following:
   - Either:
     - Install a Kanji system, or
     - Change the console device from a Kanji device to a non-Kanji device and begin the IPL again.
7. For this service recovery action, do the following:
   - Take a main storage dump.
   - IPL the system.
   - If the problem continues to occur, install OS/400 again.
8. For this service recovery action, do the following:
   - IPL the system.
   - If the problem continues to occur:
     - Take a main storage dump.
     - Install OS/400 again.
9. For this service recovery action, do the following:
   - Take a main storage dump.
   - IPL the system.
   - On the IPL Options display, select:
     - NO for the Clear output queues option.
     - NO for the Clear incomplete job logs option.
   - If the problem continues to occur, install OS/400 again.
10. For this service recovery action, do the following:
    - IPL the system.
    - On the IPL Options display, select:
      - YES for the Clear job queues option.
      - YES for the Clear output queues option.
    - If the problem continues to occur:
      - Take a main storage dump.
      - Install OS/400 again.
11. For this service recovery action, do the following:
    - Get the correct sign-on information from the security officer or obtain the necessary authority to the controlling subsystem description.
    - If you are unable to get the correct password, under the dedicated service tools (DST) reset the security password.
    - IPL the system.
    - If the problem persists:
      - Take a main storage dump.
      - Contact your next level of service support.
12. For this service recovery action, do the following:
    - IPL the system.
    - On the IPL Options display, select:
      - YES for the Define or change system at IPL option.
    - On the Define or Change System at IPL display:
      - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the system value contents involved for possible use by the service representative.
      - Display the system value: QMCHPOOL.
      - Change the system value, QMCHPOOL, to a smaller value.
13. For this service recovery action, do the following:
    - IPL the system.
      - On the IPL Options display, select:
        - YES for the Define or change system at IPL option.
      - On the Define or Change System at IPL display:
        - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the names of the contents involved in system value operations for possible use by the service representative.
        - Display the QCTLSBSD system value to verify that it is spelled correctly.
        - If the name is incorrect, change the system value to the correct name. If the library is damaged, change the system value to a controlling subsystem description in a different library if such an alternative is available. The IBM supplied backup subsystem description is QSYSSBSD in library QSYS.
      - If the problem continues to occur,
        - Take a main storage dump.
        - Install OS/400 again.
14. For this service recovery action, do the following:
    - IPL the system.
    - If the problem continues to occur:
      - IPL the system again.
      - On the IPL Options display, select:
        - YES for the Define or change system at IPL option.
      - On the Define or Change System at IPL display:
        - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the system value contents involved for

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possible use by the service representative.

- Change the system value, QCTLSBSD, to an alternative controlling subsystem description name. The IBM supplied backup subsystem description is QSYSSBSD in library QSYS.

— If the problem continues to occur, install OS/400 again.

15. For this service recovery action, do the following:
    - Take a main storage dump.
    - IPL the system.
    - If the problem continues to occur:
      - IPL the system again.
      - On the IPL Options display, select:
        - NO for the Clear output queues option.
        - NO for the Clear incomplete job logs option.
        - YES for the Define or change system at IPL option.
      - On the Define or Change System at IPL display:
        - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the system value contents involved for possible use by the service representative.
        - Change the system value, QCTLSBSD, to an alternative controlling subsystem description name. The IBM supplied backup subsystem description is QSYSSBSD is library QSYS.
      - If the problem continues to occur, install OS/400 again.
16. For this service recovery action, do the following:
    - If another controlling subsystem description exists with another signon file, switch to that controlling subsystem description. To accomplish this:
      - IPL the system.
      - On the IPL Options display, select:
        - NO for the Clear output queues option.
        - NO for the Clear incomplete job logs option.
        - YES for the Define or change system at IPL option.
      - On the Define or Change System at IPL display:
        - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the system value contents involved for possible use by the service representative.
        - Change the system value, QCTLSBSD, to an alternative controlling subsystem description name.
    - If the problem continues to occur, or you are unable to switch to an alternate controlling subsystem description because one does not exist:
      - Take a main storage dump.
      - Install OS/400 again.
17. For this service recovery action, do the following:
    - IPL the system.
    - On the IPL Options display, select:
      - NO for the Clear incomplete job logs option.
      - YES for the Define or change system at IPL option.
    - On the Define or Change System at IPL display:
      - If you do not have the necessary authority for system value operations, contact the security officer. Keep a record of the system value contents involved for possible use by the service representative.
      - Display the system value, QPWRDWNLMT, and verify that it is sufficiently large enough. If it is too small, change the system value to a larger value.
    - If the problem persists,
      - Take a main storage dump.
      - Install OS/400 again.
18. For this service recovery action, do the following:
    - Sign on to a workstation to perform problem analysis. If the problem occurred after an initial install of the operating system, the IPL console controller, QCTL, and console device, QCONSOLE, may be varied on and usable. In this case, a user controller and device description need to be created for the console.
    - If no workstation can be used:
      - Turn the Keylock switch to the Manual position.
      - Power down the system.
      - IPL the system.

        If the sign on screen appears during IPL, sign on.
        - On the IPL Options display, select YES to Define or change system at IPL.
        - Use System value commands to make sure auto configuration, QAUTOCFG, is on or
        - Use Configuration commands to make sure the console controller description and console device description are created and correct or

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- Change system value QIPLTYPE to '2' and continue the IPL. This will keep controller QCTL varied on after the IPL. (This prevents devices on this controller other than the console from varying on.)

If the sign on screen does not appear during IPL.
- *Take a* main storage dump.
- Contact your next level of service support.

19. For this service recovery action, do the following:

The SRC data has the following format (Starting at function 13):

Number of Char(s)	Description
10	Message file
10	Library

- IPL the system.
- If the problem continues to occur, install OS/400 again.
- If the library was for a second language, restore that language again.

20. For this service recovery action, do the following:
    - IPL the system.
    - If the problem continues to occur:
      - Check the console or the workstation requesting ENDSBS *ALL to ensure that it is powered on and operating correctly.
      - Contact your next level of service support.

21. For this service recovery action, do the following:
    - Record information about the install attempt which failed:
      - The current release level of the operating system.
      - The release level you were attempting to install.
      - Whether IBM-supplied, SAVSYS, or distribution format tapes were being used.
      - Any install options selected up to the point of failure.
      - Whether a manual or an automatic install was being performed.
    - Record all the SRC data in functions 11-18 on the control panel.
    - If any message appeared on the console before the SRC was displayed, record the message data:
      - Message ID
      - From Program
      - Object (if any)
      - Library (if any)
      - Instruction (if any)
      - Unexpected message ID (if any)
      - Error codes (if any)

      Take any recovery actions indicated by the message.
    - Attempt the install again.
    - If the problem continues to occur:
      - Follow the instructions in the Service Problem Analysis Procedures associated with this SRC.
      - Take a main storage dump.
      - Submit all gathered data to the next level of service support.

22. For this service recovery action, do the following:
    - Record information about the install attempt which failed:
      - The current release level of the operating system.
      - The release level you were attempting to install.
      - Whether IBM-supplied, SAVSYS, or distribution format tapes were being used.
      - Any install options selected up to the point of failure.
      - Whether a manual or an automatic install was being performed.
    - Record all the SRC data in functions 11-18 on the control panel.
    - If any message appeared on the console before the SRC was displayed, record the message data:
      - Message ID
      - From Program
      - Object (if any)
      - Library (if any)
      - Instruction (if any)
      - Unexpected message ID (if any)
      - Error codes (if any)

      Take any recovery actions indicated by the message.
    - Check the console to ensure that it is turned on and operating correctly.
    - Check to ensure that the console is connected correctly.
    - Correct any errors you find on the console.
    - Attempt the install again.
    - If the problem continues to occur:
      - Follow the instructions in the Problem Determination Procedure associated with this SRC.
      - Take a main storage dump.
      - Submit all gathered data to the next level of service support.

23. For this service recovery action, do the following:
    - Record information about the install attempt which failed:

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- The current release level of the operating system.
- The release level you were attempting to install.
- Whether IBM-supplied, SAVSYS, or distribution format tapes were being used.
- Any install options selected up to the point of failure.
- Whether a manual or an automatic install was being performed.

- Record all the SRC data in functions 11-18 on the control panel.
- If any message appeared on the console before the SRC was displayed, record the message data:
  - Message ID
  - From Program
  - Object (if any)
  - Library (if any)
  - Instruction (if any)
  - Unexpected message ID (if any)
  - Error codes (if any)

  Take any recovery actions indicated by the message.
- See the Service Problem Analysis Procedure for this SRC to get the format of the SRC data.

  If the feedback record summary, device dependent error code, and first hardware error code in the SRC data match any in the list below, then take the action listed.

Code	Action
C012 0000 0289	The tape is blank. Attempt the install again with the correct tapes.
C016 0000 0283	Ensure that you have the correct tapes. If you did not have the correct tapes, attempt the install again with the correct tapes.
C017 0000 0285	Ensure that you have the correct tapes. If you did not have the correct tapes, attempt the install again with the correct tapes.
C4C0 xxxx xxxx	There is not enough storage on the system to install OS/400. Ensure that all arms for the disk drive are activated. Attempt the install again.
C4CE xxxx xxxx	Ensure that the tape being used for the install is for the correct release. Attempt the install again.
C5C0 xxxx xxxx	Ensure that all arms for the disk drive are activated. Attempt the install again.
E010 0018 0201	Ensure that the tape drive is turned on and is ready. Attempt the install again.
E014 0013 0202	Ensure that the tape drive is turned on and is ready. Attempt the install again.
x6xx xxxx xxxx, x7xx xxxx xxxx	The validation value for an install program is not correct (an install program has been altered). Attempt the install again with a different set of tapes, preferably the ISD tapes.

  If the error data does not match any of these, follow the Service Problem Analysis Procedure associated with this SRC.
- Clean the tape drive.
- Attempt the install again.
- If the problem continues to occur:
  - Follow the instructions in the Problem Determination Procedure associated with this SRC.
  - Take a main storage dump.
  - Submit all gathered data to the next level of service support.

Service Problem Analysis Procedures: The following is a list of service problem analysis procedures that an OS/400 reference code may identify.

1. For this problem analysis procedure, do the following:

   For an explanation of the information shown in the SRC data on the operator panel, see C-57.

   For more information than what was shown in the SRC data on the operator panel, look in the start OS/400 data object. The start OS/400 data object can be located by displaying the MI object, QWCSCPF, which has a type of 19 and a subtype of DE. The object is located in the QSYS library.

   The start OS/400 data object contains the termination data until the operating system is initiated by VLIC on the next IPL. Once the operating system is initiated, the start OS/400 data object is cleared of the information from the prior IPL or system termination. The object and the information therein should be accessable on the next IPL *after* storage management recovery has been run and *before* the operating system is intitiated. Using the Dedicated Service Tools (DST), select the step mode of IPL to stop the IPL at the proper point.

   For a visual layout of the start OS/400 data object, see page 21-1.

2. For this problem analysis procedure, do the following:

   Determine why the QICO object is not being destroyed by the install code. This object is destroyed by the

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program, QINCPF, at the end of the Install process. This occurs before the Sign On display appears.

One possible scenario where the QICO object did not get destroyed is if an error occured which caused the termination of the IPL in the install code after the object was created but before it was destroyed. If the subsequent action taken was to just IPL the system rather than begin the installation of the operating system again, then the QICO object will still exist which leads the IPL code to believe that an installation of the operating system is in progress.

3. For this problem analysis procedure, do the following:

   If it was neccessary to install the operating system again to get the system in working condition, then the information in the logs about the problem has been lost.

   If the re-IPL succeeds, print the system arbiter (QSYSARB) job log to obtain more information about the problem.

4. For this problem analysis procedure, do the following:

   If it was neccessary to install the operating system again to get the system in working condition, then the information in the logs about the problem has been lost.

   If the re-IPL succeeds, print the following logs to obtain more information about the problem:
   - The history log (QHST).
   - The start OS/400 (SCPF) job log.
   - The system arbiter (QSYSARB) job log.

5. For this problem analysis procedure, do the following:

   If it was neccessary to install the operating system again to get the system in working condition, then the information in the logs about the problem has been lost.

   If the re-IPL succeeds, print the following logs to obtain more information about the problem:
   - The history log (QHST).
   - The start OS/400 (SCPF) job log.
   - The controlling subsystem job log.
   - The system arbiter (QSYSARB) job log.

6. For this problem analysis procedure, do the following:

   If it was neccessary to install the operating system again to get the system in working condition, then the information in the logs about the problem has been lost.

   If the re-IPL succeeds, print the following logs to obtain more information about the problem:
   - The history log (QHST).
   - The controlling subsystem job log.
   - The system arbiter (QSYSARB) job log.
   - Job logs of user jobs that were active at the time of the termination to see if any indicate why they did not terminate.

7. For this problem analysis procedure, do the following:

   For an explanation of the information shown in the SRC data on the operator panel, see C-57.

   For more information than what was shown in the SRC data on the operator panel, look in the start OS/400 data object. The start OS/400 data object can be located by displaying the MI object, QWCSCPF, which has a type of 19 and a subtype of DE. The object is located in the QSYS library.

   The start OS/400 data object contains the termination data until the operating system is initiated by VLIC on the next IPL. Once the operating system is initiated, the start OS/400 data object is cleared of the information from the prior IPL or system termination. The object and the information therein should be accessable on the next IPL *after* storage management recovery has been run and *before* the operating system is intitiated. Using the Dedicated Service Tools (DST), select the step mode of IPL to stop the IPL at the proper point.

   For a visual layout of the start OS/400 data object, see page 21-1.

   If it was neccessary to install the operating system again to get the system in working condition, then the information in the logs about the problem has been lost.

   If the re-IPL succeeds, print the following logs to obtain more information about the problem:
   - The history log (QHST).
   - The start OS/400 (SCPF) job log.
   - The controlling subsystem job log.
   - The system arbiter (QSYSARB) job log.

8. For this problem analysis procedure, do the following: OS/400 materializes from DST an indication of what console it used, the system console or an alternate console. This indication is mapped by two bits in the include, ZZMISR. The field, MIMPRICN, indicates the system console was used. The field, MIMSECCN, indicates an alternate console was used.

   However, on this IPL neither bit is turned on and therefore OS/400 does not know what device DST used as a console. Problem determination should focus on determining why neither bit is on following the materialize by OS/400 of the Machine Initialization Status Record (MISR) for console information.

9. For this problem analysis procedure, do the following: Because OS/400 can only IPL the system in the attended mode in this situation, problem determination efforts must concentrate on fixing the system console so that DST uses the console. DST then passes to

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OS/400 information about the system console which enables OS/400 to use it to IPL the system.

10. For this problem analysis procedure, do the following: OS/400 has an interface with DST for DST to pass OS/400 with information about the console and console controller DST used. The console and controller information is materialized from DST using the machine initialization status record (MISR). This information is saved for debugging purposes in the start OS/400 data object. To find what was materialized, look at the sections in the start OS/400 data object showing the MISR data that was materialized.

    For more information on the start OS/400 data object, see page 21-1.

11. For this problem analysis procedure, do the following: The start OS/400 process has an interface to device configuration to vary on the console and console controller. Because the hardware resource manager data base is not available at this point in the IPL, device configuration has special code to vary the console controller on. They do this using the console and controller information materialized from DST using the machine initialization status record (MISR) by the start OS/400 process and passed to device configuration when it is invoked. To find what was materialized, look at the section in the start OS/400 data object showing the MISR data with the console DST used information.

    For more information on the start OS/400 data object, see page 21-1.

12. For this problem analysis procedure, do the following: Look in the start OS/400 data object at the field: QWCIDSPR return code. This return code indicates where in the QWCIDSPR module the function check occurred. The function check may be in the module itself or in one of the macros the module invokes to perform specific functions.

    Following is a list of possible return codes for function checks:

Code (Hex)	Description
0098	Function check handling a function check in the QWCIDSPR module.
0099	Function check in QWCIDSPR module.
0198	Function check in CHKCDLUD macro while working with controller.
0199	Function check in CHKCDLUD macro while working with console.
0298	Function check in FIXCDLUD macro while working with controller.
0299	Function check in FIXCDLUD macro while working with console.
0398	Function check in CRTCDLUD macro while working with controller.
0399	Function check in CRTCDLUD macro while working with console.
0499	Function check in VARYIPL macro.

    The QWCIDSPR module handles the system console and controller function for the operating system during the IPL. The CHKCDLUD macro checks the console and controller for damage. The FIXCDLUD macro deletes the specified console or controller. The CRTCDLUD macro creates the *specified* console or controller.

    For more information on the start OS/400 data object, see page 21-1.

13. For this problem analysis procedure, do the following: Display the following information to determine why the user console did not vary-on during IPL:
    - The user console controller description.
    - The user console device description.
    - The system value QIPLTYPE.
    - The system arbiter (QSYSARB) job log.

    Attempt to vary-off and vary-on the console.
14. For this problem analysis procedure, do the following:

    For an explanation of the information shown in the SRC data on the operator panel for function 12, see C-57. Function 13 - 18 provide the following information if the exception data could be retrieved into the start OS/400 data object:

Function	SRC Data	Description
13	PPPP PPPP	PPPP... is the program name
14	PPPP PPPP	
15	PPPP IIII	IIII is the instruction number
16	MMMM MMMM	MMMM... is the exception message ID
17	MMMM MM00	
18	0000 0000	not used

    For more information than what was shown in the SRC data on the operator panel, look in the start OS/400 data object. The start OS/400 data object can be located by displaying the MI object, QWCSCPF, which has a type of 19 and a subtype of DE. The object is located in the QSYS library.

    The start OS/400 data object contains the termination data until the operating system is initiated by VLIC on the next IPL.
    Once the operating system is initiated, the start OS/400 data object is cleared of the information from the prior IPL or system termination. The object and the information therein should be accessable on the next IPL *after* storage management recovery has been run and *before* the operating system is intitiated. Using

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the Dedicated Service Tools (DST), select the step mode of IPL to stop the IPL at the proper point.

For a visual layout of the start OS/400 data object, see "Start OS/400 Data Object."

Function 21 and PSI should not be done without dump review. Use the dump review to find the source of a problem for this SRC. Although the phases, function, and subfunction may be exact match for an APAR, the termination may be for an entirely different reason. The following review process can be completed in about 10 minutes (not counting dump process and IPL) and can be used to confirm whether the problem is an existing or a new problem.

a. Initiate a main storage dump using function 22 on the control panel.
b. IPL to DST.
c. Find the QWCSCPF as described in Chapter 21.
d. Change the address field to 000016008040, the address of the pointer to QWCSCPF, once the dump is displayed.
e. Press the Enter key.
f. Once the address is displayed, put an S in the first position of the hex data (offset 8040) and press F10 to push the stack. You should now be looking at QWCSCPF starting at offset 0100.

   Offset 0110 should contain the same data that was displayed with F12 at the time the machine check occurred. Exception data should also be shown on this display. Chapter 21 shows the break down of the QWCSCPF module.
g. Check the SCPF job log area of the dump. To do this, go to offset 02B0 of QWCSCPF and put an S at this position and use F10 to push the stack. You should see QWCBT on the third line of the 'eyecather'.
h. Put an S at offset 0430, the pointer to the joblog, and press F10 to push the stack. You should see QJOBMSGQ on the third line of the 'eyecatcher'. This is the SCPF job log.
i. Scroll forward and find the messages in the 'eyecather' associated with the IPL. The last few messages are generally the source of the machine check. Some of the messages are very long. For example, during installation of OS/400, there is an offset to the last page of the message queue at displacement hex 0118. Scroll by the offset to get to the last page.

15. For this problem analysis procedure, do the following:

    The SRC data has the following format (Starting at function 13):

Number of Char(s)	Description	
10	Program	
1	Error code	
	01	unexpected MCH exception
	02	escape message signalled off the top of the stack
	03	job message queue is full

    If the job message queue is full, the messages in the job message queue might help determine the problem.

16. For this problem analysis procedure, do the following:

    The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**xxxx nnnn**	**xxxx** is the exception ID . **nnnn** is the instruction number.
14	**pppp pppp**	**pppp pppp pppp pppp pppp** is the name of the program which received the exception.
15	**pppp pppp**	
16	**pppp** 0000	
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the exception data. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the data through DST.
18	**aaaa aaaa**	

    Use DST to dump 5B4 hex bytes at the address in the SRC data. If an APAR has not already been submitted on this topic, submit an APAR with this supporting data.

17. For this problem analysis procedure, do the following:

    Look at the console error information in the SRC. The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**ee**00 **ffff**	**ee** is the screen I/O error code. **ffff** is the feedback record (FBR) error summary or the message index number (if the SRC code is 3017).
14	**cccc pppp**	**cccc** is the command from the SSR/RD. **pppp** is the primary service function driver return code.
15	**ssss** 0000	**ssss** is the secondary service function driver return code.
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

    This SRC probably indicates a system program error. The screen I/O error codes and their meanings are as follows:

Code (Hex)	Meaning
00	Attempted to display message but ICO pointer passed was null. **ffff** in the SRC data contains the index number of the message that would have been displayed.
01	Not expected feedback record
02	Not expected command
03	Not able to start the service function
04	Bad install service function return code
05	Bad message index
06	Too many SSR/SSD spaces created
07	Service function returned *Stop service session* or *Destroyed service function*

The primary return codes are broken into three groups.

- VLIC Install Service Function Specific

Return Code	Description
FF00	No mode was specified
FF03	Acknowledge mode coded with write-only
FF05	Input mode coded with write-only
FF06	Input mode coded with acknowledge
FF07	Input mode coded with acknowledge and write-only
FF1X	Function key requested and is reserved. X is 0 for the F13 key and B for the F24 key.
FF30	SML version number mismatch. The secondary code contains the SML version number that was found. For this code, reload as much of the system as necessary to get the SML version, VLIC, and OS/400 to match.
FF31	Reserved control bits set. The secondary code indicates the bit offset of the first nonzero control bit.
FF32	An invalid request ID was found. The invalid request ID is returned in the secondary return code field.
FF33	The length of the request is too short for the request ID. The invalid length is returned in the secondary return code field.

- Service Function Driver display return codes
  - Primary return codes:

Return Code	Description
3001	Internal error in the display modules (in VLIC)
3002	This is indicative of a coding error in install
3003	Conversion error encountered in the data stream
300A	Service function was requested to abort by its invoker

  - Secondary return codes:

Return Code	Description
3010	Invalid MI buffer pointer was found
3011	An invalid MI buffer length was encountered
3012	An SSD status of FFFF was found
3013	SSD status indicated not open
3014	An invalid SSD status was encountered
3015	A bad return code was found in the MI
3016	The MI buffer returned was too long
3017	An invalid termination key was received from the MI
3023	An invalid synchronous function key was specified by the invoker
3024	An invalid logical screen line definition line number was specified
3025	The specified screen number was not found in the specified screen initialization table
3026	A required message number was not found in the specified message initialization table
3027	More than 80 characters were encountered in the line without an EOL indicator
3028	The specified text replacement number was not found in the text replacement search table
3029	Too many input field were defined for the requested screen. Limit is 127
302A	Open was requested when file was already open
302B	A display request was received using an unopened display control block
302C	The number of roll lines specified exceded the maximum lines allowed
302D	Close issued when there is no open MI display session
302E	An invalid ROLL logical screen definition was encountered

302F	An invalid type was encountered while searching the TRST for a required text replacement field
3030	There is no type 3 TRST entry found for a type 2 field. This is caused by a bad TRST or MIT in the SML

- Service Function Driver Common Display Facility
  - Primary return codes:

Return Code	Description
3201	Error in common display code
3202	Error in install code
320A	Service function was told to abort

  - Secondary return codes:

Return Code	Description
3221	Invalid display mode was found
3222	Specified input TRL field was not found
3223	Specified message TRL field not found
3224	Conversion error occurred on the input TRL field
3225	Conversion error occurred on the message TRL field
3226	No open display control block was specified for use on this display
3227	Input TRL specified without a corresponding TRL number
3228	Message TRL specified without a corresponding message TRL number

For more information about the ICO object, see page 20-1. Use DST to dump the Installation Communications Object using the pointer in the SRC data.

18. For this problem analysis procedure, do the following:

    Look at the device error information in the SRC. The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**aaaa bbbb**	**aaaa** is the feedback record (FBR) error summary. **bbbb** is the device dependent error code.
14	**cccc dddd**	**cccc** is the first hardware error code. **dddd** is the second hardware error code.
15	**eeee** 0000	**eeee** is the request ID from the SSR
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

The feedback record error summary, device dependent error code, and first hardware error code may match one of the following. If so, follow the specified instructions.

- 45D9 xxxx xxxx: Object could not be loaded

  Recovery: Print the VLIC logs around the time the error occurred. In particular, look for any VLIC log entries with a major code of 1200 and be sure to print these. Contact the next level of support with the gathered error data.

- C00B 0000 xxxx: IOM partial damage

  Recovery: Print the VLIC logs about 5 minutes before the problem happened until just after the problem happened. Rerun the install again with a source/sink and device trace. If the problem occurs again, send the printout of the trace to development. Each time you install, the tape drive LUD is created again, so that the damage is cleared. When the damage appears again, it means that the problem has occurred again.

- C012 0000 0289: Blank tape

  Recovery: Check the tape, it is blank. Attempt the install again with a good SAVSYS tape.

- C016 0000 0283: Tape mark encountered

  Recovery: Attempt the install again with the source/sink and device traces turned on. If the problem occurs again, print the traces and send to development. Have the tape drive checked.

- C017 0000 0285: End of tape encountered

  Recovery: Attempt the install again with the source/sink and device traces turned on. If the install fails again, send the traces to development and have the tape drive checked.

- C018 0000 020D: Device reset delay

  Recovery: Attempt the install again with the source/sink and device traces turned on. If the

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problem occurs again, print the traces and send to development. Have the tape drive and the IOP checked.

- C019 0000 0A80: Ready transition

  This is probably a user error. Ensure that the tape is ready. Then attempt the install again with the source/sink and device traces turned on. If the problem occurs again, print the traces and send to development.

- C4C0 xxxx xxxx: Machine storage exceeded

  Recovery: Ensure that all arms for all the storage on the system are activated. Then attempt the install again. If the failure occurs again, attempt a scratch install or add additional storage to the system.

- C4C2 xxxx xxxx: Invalid lock

  Recovery: Attempt the install again with the load/dump and device traces activated. The traces will help development to determine what the problem is.

- C4C6 xxxx xxxx: Object destroyed

  Recovery: Turn on the load/dump and source/sink traces for the tape drive. Attempt the install again. If the problem occurs again, print the traces and contact development.

- C4C7 xxxx xxxx: Invalid object

  Recovery: Turn on the load/dump and source/sink traces for the tape drive. Attempt the install again. If the problem occurs again, print the traces and contact development.

- C4C8 xxxx xxxx: Unexpected condition in load/dump

  Recovery: Print the VLIC logs for the time period where the problem occurred. Turn on the load/dump trace for the tape. Attempt install again from a different tape.

- C4C9 xxxx xxxx: Mismatch on object name, type, or subtype

  Recovery: Turn on the load/dump and source/sink device traces for the tape drive. Attempt the install again.

- C4CC xxxx xxxx: Damaged data base objects

  Recovery: Attempt the install again. If the problem occurs again, attempt a scratch install.

- C4CD xxxx xxxx: Object was damaged

  Recovery: Print the VLIC logs for the time period when the error occurred. If an attempt of the install does not work and the user has good backup for the system, attempt to clear the system and then install again.

- C4CE xxxx xxxx: Invalid release level

  Recovery: Ensure that the tape being used for the install is for the correct release. Then attempt the install again.

- C5C0 xxxx xxxx: Machine storage exceeded

  Recovery: Ensure that all arms for all the storage on the system are activated. Then attempt the install again. If the failure occurs again, you might want to attempt a scratch install or add additional storage to the system.

- C5C2 xxxx xxxx: Invalid lock

  Recovery: Attempt the install again with the load/dump and device traces activated. The traces help development to determine what the problem is.

- C5C3 xxxx xxxx: Invalid lock

  Recovery: Attempt the install again with the load/dump and device traces activated. The traces help development to determine what the problem is.

- C5C5 xxxx xxxx: Data base network violation

  Recovery: Turn on the load/dump and source/sink traces for the tape drive. Attempt the install again from a different tape. If the problem occurs again, print the traces and contact development.

- C5C6 xxxx xxxx: Object destroyed

  Recovery: Turn on the load/dump and source/sink traces for the tape drive. Attempt the install again. If the problem occurs again, print the traces and contact development.

- C5C8 xxxx xxxx: Unexpected condition in load/dump

  Recovery: Print the VLIC logs for the time period where the problem occurred. Turn on the load/dump trace for the tape. Attempt the install again from a different tape.

- C5CD xxxx xxxx: Object was damaged

  Recovery: Print the VLIC logs for the time period when the error occured. If an attempt of the install does not work and the user has good backup for the system, attempt to clear the system and then install again.

- C5D5 xxxx xxxx: Object was damaged

  Recovery: Print the VLIC logs for the time period when the error occured. If an attempt of the install does not work and the user has good backup for the system, attempt to clear the system and then install again.

- D4FF xxxx xxxx: Invalid load/dump object descriptor

  Recovery: Ensure that the tapes are the correct tapes. Attempt the install again. If the problem occurs again, attempt the install from a different set of SAVSYS or distribution tapes.

- E010 0002 0202: Device failure—physical link error

Recovery: Have the service representative check the tape drive and determine why the physical link is failing. When that is fixed, attempt the install again.

- E010 0003 0305: Load failure

  Recovery: Ensure the door is closed and the tape mounts correctly and the ready light is on. Start the install again, making sure that the tape mounts correctly and the ready light comes on a little before pressing Enter to continue the install each time the tape is changed.

- E010 0007 0304: Not capable—data check

  Clean the tape drive. Then attempt the install again with another set of tapes. If the install fails again, have the tape drive checked out.

- E010 0012 0303: Equipment check

  Turn on the traces for source/sink and for the tape device. Attempt the install again. If the problem occurs again, have the service representative check the tape drive and determine why the equipment check happened. When it is fixed, attempt the install again.

- E010 0018 0201: Tape not operational

  Recovery: Make sure that the tape drive is turned on and ready. Attempt the install again. If the problem occurs again, use whatever routines you have to detect why the tape is not operational.

- E010 0019 0304: Data check

  Recovery: Clean the tape drive. Then attempt the install again with a different set of tapes. If the problem occurs again, have the service representative check the tape drive and determine why the data check is happening. When it is fixed, attempt the install again.

- E010 001A 0304: Data check

  Recovery: Clean the tape drive. Then attempt the install again with a different set of tapes. If the problem occurs again, have the service representative check the tape drive and determine why the data check is happening. When it is fixed, attempt the install again.

- E014 0013 0202: Tape drive not ready

  Recovery: Make sure that the tape drive is ready and begin the install again. If the drive drops ready again, use whatever routines you have to detect why the tape drive dropped ready.

- E018 000A 0284: BOT encountered

  Recovery: Try the install again with the source/sink and device traces turned on. If the install fails again, send the traces to development and have the tape drive checked.

- E018 000B 0205: Data length exception—underlength

  Recovery: First check to ensure that the tapes involved are really SAVSYS tapes and that they were mounted in the correct order. If everything there is OK, then check to make sure that the last SAVSYS ran correctly. If that all seems true, then turn on the Load/Dump trace for the device being used and run the job again. The trace should be sent in with the APAR. Then attempt to install again using a different version of SAVSYS tape.

- E018 000B 0206: Data length exception—overlength

  Recovery: First check to ensure that the tapes involved are really SAVSYS tapes and that they were mounted in the correct order. If everything there is OK, then check to make sure that the last SAVSYS ran correctly. If that all seems true, then turn on the Load/Dump trace for the device being used and run the job again. The trace should be sent in with the APAR. Then attempt to install again using a different version of SAVSYS tape.

- x6xx xxxx xxxx, x7xx xxx xxx: Program validation value not correct

  Recovery: The validation value for an install program is not correct (an install program has been altered). Attempt the install again with a different set of tapes, preferably the ISD tapes.

Note: Other C4xx, C5xx, D4xx, D5xx, E4xx, E5xx, F4xx, or F5xx codes are the corresponding device errors ORed with 0400 or 0500. Look for the same errors with zero as the second digit.

19. For this problem analysis procedure, do the following:

    The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

    Dump the ICO object. Take a main storage dump. Call your next level of service support.

20. For this problem analysis procedure, do the following:

    Look at the console error information in the SRC. The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**ee**00 **ffff**	**ee** is the screen I/O error code. **ffff** is the feedback record (FBR) error summary or the message index number (if the SRC code is 3017).
14	**cccc pppp**	**cccc** is the command from the SSR/RD. **pppp** is the primary service function driver return code.
15	**ssss** 0000	**ssss** is the secondary service function driver return code.
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

This is probably a system program error. See Problem Determination Procedure 17 for additional information. For more information about the ICO object, see page 20-1. Dump this object using DST. Call your next level of service support if you cannot determine what is wrong.

21. For this problem analysis procedure, do the following:

    Look at the exception data in the SRC. The SRC data has the followimg format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**xxxx nnnn**	**xxxx** is the exception ID . **nnnn** is the instruction number.
14	**pppp pppp**	**pppp pppp pppp pppp pppp** is the name of the program which received the exception.
15	**pppp pppp**	
16	**pppp 0000**	
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

There may be a message on the console giving the exception ID, the instruction number, and the program in which the exception occurred.

For more information about the ICO object, see page 20-1. Dump this object using DST and the pointer in the SRC data. Call your next level of service support. If this is an APAR situation, submit all gathered materials with the APAR.

22. For this problem analysis procedure, do the following:

    Look at the exception data in the SRC. The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**xxxx nnnn**	**xxxx** is the exception ID . **nnnn** is the instruction number.
14	**pppp pppp**	**pppp pppp pppp pppp pppp** is the name of the program which received the exception.
15	**pppp pppp**	
16	**pppp 0000**	
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

The information for the second exception is found in the SRC data. There may be a message on the console which gives the message number and the instruction number and program in which the original error occurred. Save this information.

For more information about the ICO object, see page 20-1. Dump this object using DST and the pointer in the SRC data. Call your next level of service support. If this is an APAR situation, submit all gathered materials with the APAR.

23. For this problem analysis procedure, do the following:

    The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

For more information about the ICO object, see page 20-1. Dump this object using DST and the pointer in the SRC data. The name of the user profile or other system object which cannot be found will be stored in the ICO. Call your next level of service support.

24. For this problem analysis procedure, do the following:

    The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

Damage has been detected during an install. The damage could be to user profiles, libraries and their OIRs, or to the authorized user table.

Attempt the install again.

- If the problem occurs again and the OS/400 objects are not being loaded in this install, attempt an install again and load the OS/400 objects.
- If the problem occurs again when loading OS/400 objects, a method of getting rid of the damaged objects must be tried. Attempt doing a scratch install if the user has good backup.

25. For this problem analysis procedure, do the following:

The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

In the first program of the OS/400 install (QINITT), a resolve is done to each install part 1 program. This resolve did not work because the program was not found. Try a different SAVSYS tape.

For more information about the ICO object, see page 20-1. Dump this object using DST and the pointer in the SRC data.

26. For this problem analysis procedure, do the following:

The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

For more information about the ICO object, see page 20-1. If the problem occurs again, use the pointer to the ICO shown in the SRC data to dump the ICO.

27. For this problem analysis procedure, do the following:

The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

Note the data in the message and the options that were used for the install. The data in the message must be used to determine what the problem is.

For more information about the ICO object, see page 20-1. Dump this object using DST and the pointer in the SRC data.

28. For this problem analysis procedure, do the following:

The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	0000 0000	not used
13	0000 0000	not used
14	0000 0000	not used
15	0000 0000	not used
16	0000 0000	not used
17	0000 0000	not used
18	0000 0000	not used

The install part 1 process default exception handler (QINPDEH) was invoked due to an unexpected exception. Another exception occurred while processing the first exception. QINPDEH was recursively invoked due to the second exception.

Dump the ICO object. Take a main storage dump. Call your next level of service support.

29. For this problem analysis procedure, do the following:

The SRC data has the following format:

Function	SRC Data	Description
11	B900 **ssss**	**ssss** is the SRC code
12	**zzzz zzzz**	**zzzz zzzz** is the phase/function/subfunction.
13	**ee**00 **ffff**	**ee** is the screen I/O error code. **ffff** is the feedback record (FBR) error summary or the message index number (if the SRC code is 3017).
14	**cccc pppp**	**cccc** is the command from the SSR/RD. **pppp** is the primary service function driver return code.
15	**ssss** 0000	**ssss** is the secondary service function driver return code.
16	0000 0000	not used
17	**iiii aaaa**	**iiii aaaa aaaa aaaa** is the pointer to the ICO. The last six bytes (**aaaa aaaa aaaa**) is the address portion used when displaying or printing the ICO through DST.
18	**aaaa aaaa**	

For more information, see Chapter 20 on page 20-1. Use DST to dump the Installation Communications Object using the pointer in the SRC data. In many cases the "Service function terminated completion code" and "Service function terminated completion qualifier" fields in the ICO will be necessary to determine the cause of the problem.

OS/400 URCs

2000	OS/400 Startup or Normal System Operation

Description: User console did not vary-on during IPL.

Service Recovery Action: See service recovery action 18 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 13 on page C-63.

2810	OS/400 IPL Status

Description: Reclaim machine context processing. This function can take longer during an IPL after an abnormal termination. Program QWCIINSR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2820	OS/400 IPL Status

Description: Resolve to system objects needed during IPL. Program QWCIINSR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2830	OS/400 IPL Status

Description: Initialize the system value object. Program QWCSCRLR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

28C0	OS/400 IPL Status

Description: Prepare the SCPF job and initiate the SCPF process. Program QWCIINSR. This also includes early SCPF processing: resolving to the QSYS library, the SCPF object; verifying the SCPF message queue (QMHVSCPF); and establishing event handlers. Program QWCISCFR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2910	OS/400 IPL Status

Description: Initialize system message queues and logs. Program QMHLINIT.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2920	OS/400 IPL Status

Description: Clean up libraries and OIR objects. Program QLICLNUP.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2930	OS/400 IPL Status

Description: Establish event monitors needed by data base and journal. Program QWCISCFR. Check or rebuild data base cross reference queues. Program QDBXFIXQ.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2940	OS/400 IPL Status

Description: Configure and vary on the console device and controller. Program QWCIDSPR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2950	OS/400 IPL Status

Description: Perform second part of install. Program QINCPF.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2960	OS/400 IPL Status

Description: Sign on processing. Program QWCIDIOR. This also includes installing PTFs during attended and unattended IPLs. Macro TSTSRV.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2970	OS/400 IPL Status

Description: Data base recovery part 1, journal, and commit. Program QRCIMPLN.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2980	OS/400 IPL Status

Description: Check storage requirements for auxiliary and main storage. Also create command analyzer space queue. Program QWCISCFR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2990	OS/400 IPL Status

Description: Performance adjustment during IPL. Program QWCITUNR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

29A0	OS/400 IPL Status

Description: Initialize system control block. Also initialize machine and base pools, recreate job structure queue if not large enough, initialize prototype NRL, Program QWCISCFR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

29B0	OS/400 IPL Status

Description: Spool system level object check. Macro SPLCKOBJ. Program QSPFFACB.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

29C0	OS/400 IPL Status

Description: Work control block table initialization. Program QWCICLSR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2A80	OS/400 IPL Status

Description: Before system arbiter initialization. Change security level, create temporary job structures, storage recovery, clean up IGC tables and dictionaries, alert initialization, and system arbiter initialization. Program QWCISCFR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2B10	OS/400 IPL Status

Description: Establish event monitors. Program QWCAINAR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2B20	OS/400 IPL Status

Description: Resource manager initialization. Program QRZHRMIN.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2B30	OS/400 IPL Status

Description: Initiate the QLUS job. Program QWCAINAR and QWCAMNAR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2B40	OS/400 IPL Status

Description: Device configuration start up. Program QDCSTF.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2C10	OS/400 IPL Status

Description: After system arbiter initialization. Set up an alternate SCPF WCBT entry for writing the SCPF joblog. If a user is signed on, set up job structure for user session. Program QWCISCFR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2C20	OS/400 IPL Status

Description: Office recovery. Macro OSIPLR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

2C30	OS/400 IPL Status

Description: SNA distribution services recovery. Macro ZDIPLR.

Service Recovery Action: None.

Service Problem Analysis Procedure: None.

3000	Install of OS/400

Description: During the execution of the first program of OS/400 install (QINITT), an unexpected exception occurred. When this happened the exception data was retrieved and a pointer to it was stored in the SRC data.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 16 on page C-64.

3001	Install of OS/400

Description: An unexpected response or error was returned from console processing during execution of QINITT.

Service Recovery Action: See service recovery action 22 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 17 on page C-64.

3002	Install of OS/400

Description: An error was detected during the first tape command.

Service Recovery Action: See service recovery action 23 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 18 on page C-66.

3004	Install of OS/400

Description: Install does a wait for the licensed internal code to release the workstation designated as the console. If the wait times out, install ends with this code.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 19 on page C-68.

3005	**Install of OS/400**

Description: An unexpected response or error was returned from console processing during execution of an install part 1 program.

Service Recovery Action: See service recovery action 22 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 17 on page C-64.

3006	**Install of OS/400**

Description: The LIC tape processing returned an error to program QINTAPE while loading OS/400.

Service Recovery Action: See service recovery action 23 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 18 on page C-66.

3007	**Install of OS/400**

Description: An unexpected exception occurred during the install of OS/400.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 21 on page C-69.

3008	**Install of OS/400**

Description: Operator responded to a message requesting that the install should be cancelled.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 27 on page C-70.

3010	**Install of OS/400**

Description: Install program QSYINT2 could not find a user profile that was previously found or created during install.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 23 on page C-69.

3011	**Install of OS/400**

Description: Install program QSYINT2 could not find a system object that should have been loaded from the tape.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 23 on page C-69.

3012	**Install of OS/400**

Description: During installation, previously unmarked damage was detected to the authorized user table, user profiles, libraries, or OIRs.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 24 on page C-69.

3013	**Install of OS/400**

Description: Install part 1 program not found in QINSTALL library.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 25 on page C-70.

3014	**Install of OS/400**

Description: A wait time-out or some other error occurred while attempting to start the OS/400 process.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 26 on page C-70.

3015	**Install of OS/400**

Description: A terminating error message was issued during an install.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 27 on page C-70.

3016	Install of OS/400

Description: Link/load VLIC MRI failed.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 29 on page C-71.

3017	Install of OS/400

Description: Internal failure while attempting to display an install message.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 20 on page C-68.

308D	Install of OS/400

Description: Unexpected exception occurred while attempting to handle previous unexpected exception.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 28 on page C-70.

308F	Install of OS/400

Description: Internal failure in install code.

Service Recovery Action: See service recovery action 21 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 19 on page C-68.

3100	Initial OS/400

Description: The QSYS library was not found during Initial OS/400 processing.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

3110	Initial OS/400

Description: The QSYS library is damaged.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

3120	Initial OS/400

Description: Damage was detected in the installation communications object (QICO).

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3121	Initial OS/400

Description: Trying to IPL after a failed install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3130	Initial OS/400

Description: A function check occurred before the QWCSCPF data object, used to track the IPL, is created during Initial OS/400 processing.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: None.

3140	Initial OS/400

Description: A system object was not found during Initial OS/400 processing.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3150	Initial OS/400

Description: A system program was not found during Initial OS/400 processing.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3160	Initial OS/400

Description: System library not found during Initial OS/400 processing.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3170	Initial OS/400

Description: Authorized user table could not be found. Install required.

Service Recovery Action: See service recovery action 3 on page C-57.

Service Problem Analysis Procedure: None.

3180	Initial OS/400

Description: Not enough main storage to divide between the machine and base pools to satisfy their minimums.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3190	Initial OS/400

Description: Failure to initiate the start OS/400 process.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

31A0	Initial OS/400

Description: Object to be rebuilt is not recoverable at this time.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31B0	Initial OS/400

Description: Unknown resolve failure.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31C0	Initial OS/400

Description: Damage has been detected in a recoverable system object needed for start OS/400. The object is destroyed and is created again on the next IPL.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31D0	Initial OS/400

Description: Damage has been detected in a recoverable system library needed for start OS/400. The library is recovered by the machine on the next IPL.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31E0	Initial OS/400

Description: Damage has been detected in an unrecoverable system object needed for start OS/400. The user must install OS/400 again.

Service Recovery Action: See service recovery action 4 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31F0	Initial OS/400

Description: Recursive exceptions in the initial OS/400 process.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

31FF	Initial OS/400

Description: A function check exception occurred in the initial OS/400 process.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3210	Start OS/400

Description: The QSYS library was not found during start OS/400 processing.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

3211	Start OS/400

Description: QAPDSMOD gave invalid return code during Start OS/400 processing.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3220	Start OS/400

Description: A function check occurred before the QWCSCPF data object, used to track the IPL, is resolved to during start OS/400 processing.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: None.

3240	Start OS/400

Description: System object not found during start OS/400 processing.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3250	Start OS/400

Description: A system program was not found during start OS/400 processing.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3260	Start OS/400

Description: A system library was not found during start OS/400 processing.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3270	Start OS/400

Description: Not authorized to user console during automatic install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3278	Start OS/400

Description: OS/400 unable to access the system console during automatic install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3280	Start OS/400

Description: OS/400 unable to use installation profile during automatic install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

32A0	Start OS/400

Description: Error in initializing the message handler log.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

32D0	Start OS/400

Description: Authorized user table could not be found. An install is needed.

Service Recovery Action: See service recovery action 3 on page C-57.

Service Problem Analysis Procedure: None.

32E0	Start OS/400

Description: Authorized user table change error.

URCS

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3300	Start OS/400

Description: DST did not inform OS/400 which console DST used, whether the system console or an alternate console.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 8 on page C-62.

3308	Start OS/400

Description: During an install, DST did not inform OS/400 which console DST used, whether the system console or an alternate console.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 8 on page C-62.

3310	Start OS/400

Description: DST used an alternate console.

OS/400 does not use an alternate console to IPL the system, but rather switch to the unattended mode of IPL. However, the current setting of the system value QSCPFCONS is set to 0 which does not allow the IPL to switch from an attended mode to an unattended mode. The console is needed for the IPL to continue in an attended mode.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 9 on page C-62.

3318	Start OS/400

Description: DST used an alternate console, and to OS/400 this appears to be an install.

DST prevents an install from being selected from an alternate console. However, to the IPL code the existence of the installation communication object (QICO) means an install is in progress. While an install may not have been selected, the QICO exists at the present time. This object is destroyed by the install function when the install completes. A possible reason for the existence of the QICO is that the system ended before install of the operating system completed.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 9 on page C-62.

3320	Start OS/400

Description: DST still has control of the console.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

3328	Start OS/400

Description: During an install, DST still has control of the console.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: None.

3340	Start OS/400

Description: Not able to delete a damaged system console controller description.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3348	Start OS/400

Description: Not able to delete a damaged system console controller description during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3350	Start OS/400

Description: Not able to delete a damaged system console description.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3358	Start OS/400

Description: Not able to delete a damaged system console description during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3360	Start OS/400

Description: Not able to create a system console controller description.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 10 on page C-63.

3368	Start OS/400

Description: Not able to create a system console controller description during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 10 on page C-63.

3370	Start OS/400

Description: Not able to create a system console description.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 10 on page C-63.

3378	Start OS/400

Description: Not able to create a system console description during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 10 on page C-63.

337C	Start OS/400

Description: The system was not able to create a system console description because an attempt was made to use a Kanji device for the console on a non-Kanji system.

Service Recovery Action: See service recovery action 6 on page C-58.

Service Problem Analysis Procedure: None.

337D	Start OS/400

Description: During an install the system was unable to create a system console description because an attempt was made to use a Kanji device for the console on a non-Kanji system.

Service Recovery Action: See service recovery action 5 on page C-58.

Service Problem Analysis Procedure: None.

3380	Start OS/400

Description: Not able to resolve to the system console controller description following its creation.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3388	Start OS/400

Description: Not able to resolve to the system console controller description following its creation during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3390	Start OS/400

Description: Not able to resolve to the system console description following its creation.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3398	Start OS/400

Description: Not able to resolve to the system console description following its creation during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

33A0	Start OS/400

Description: Not able to vary-on the system console controller.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 11 on page C-63

33A8	Start OS/400

Description: Not able to vary-on the system console controller during an install.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 11 on page C-63.

33B0	Start OS/400

Description: Not able to vary-on the system console.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 11 on page C-63.

33B8	Start OS/400

Description: Not able to vary-on the system console during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 11 on page C-63.

33F0	Start OS/400

Description: Function check occured while working with the console and the controller.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 12 on page C-63.

33F8	Start OS/400

Description: Function check occured while working with the console and the controller during an install.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 12 on page C-63.

3400	Start OS/400

Description: Installation communication object (QICO) exists, but this is an unattended IPL. Because the install displays cannot be presented, the IPL cannot continue.

When a problem was encountered, the IPL switched from the attended to the unattended mode. See the phase, function, subfunction indicators in the start OS/400 data object, QWCSCPF, for more detailed information.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 2 on page C-61.

3430	Start OS/400

Description: The start OS/400 display file, QDSTRCPF, is missing or damaged.

The current setting of the system value QSCPFCONS is set to 0 which does not allow the IPL to switch from an attended mode to an unattended mode. The display file is necessary for the IPL to continue in an attended mode.

Service Recovery Action: See service recovery action 3 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3460	Start OS/400

Description: An error occurred in the install code called from the start OS/400 process. This is before the Sign On display.

Service Recovery Action: See service recovery action 1 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 14 on page C-63.

3490	Start OS/400

Description: The start OS/400 display file, QDSTRCPF, could not be opened.

The current setting of the system value QSCPFCONS is set to 0 which does not allow the IPL to switch from an attended mode to an unattended mode. The display file is necessary for the IPL to continue in an attended mode.

Service Recovery Action: See service recovery action 3 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3498	Start OS/400

Description: An I/O error occurred during sign on at IPL.

The current setting of the system value QSCPFCONS is set to 0 which does not allow the IPL to switch from an attended mode to an unattended mode.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

34B0	Start OS/400

Description: The maximum number of allowed sign-on attempts was exceeded.

Service Recovery Action: See service recovery action 11 on page C-58.

Service Problem Analysis Procedure: None.

3530	Start OS/400

Description: A function check occurred during the processing of the Define or change system at IPL function. This function was an option selected from the IPL Options menu during the IPL.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3560	Start OS/400

Description: A function check occurred during data base recovery part 1.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3590	Start OS/400

Description: Not enough storage to establish machine minimum for base storage pool. This is probably caused by too much storage assigned to the machine pool (the system value QMCHPOOL is too large.)

Service Recovery Action: See service recovery action 12 on page C-58.

Service Problem Analysis Procedure: None.

35B0	Start OS/400

Description: Failure to resolve to the controlling subsystem description.

Service Recovery Action: See service recovery action 13 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3600	Start OS/400

Description: Damage has been detected in a spooling related object.

Service Recovery Action: See service recovery action 10 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3630	Start OS/400

Description: Damage has been detected in a recoverable system object needed for start OS/400. The object is destroyed and is created again on the next IPL.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

3660	Start OS/400

Description: QWCICLSR work control block table (WCBT) recovery error.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3690	Start OS/400

Description: Failure to initiate the system arbiter process.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

36B0	Start OS/400

Description: Document interchange Architecture (DIA) recovery error.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

36D0	Start OS/400

Description: SNA distribution services (SNADS) recovery error.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3700	Start OS/400

Description: Controlling subsystem description damaged.

Service Recovery Action: See service recovery action 13 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

3730	Start OS/400

Description: The user is not authorized to the controlling subsystem description.

Service Recovery Action: See service recovery action 11 on page C-58.

Service Problem Analysis Procedure: None.

3760	Start OS/400

Description: Time-out occurred while waiting to lock the controlling susbsytem description.

Service Recovery Action: See service recovery action 14 on page C-58.

Service Problem Analysis Procedure: None.

3790	Start OS/400

Description: The attempt to start the controlling subsystem failed during the Initiate Process (INITPR) MI instruction.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 4 on page C-62.

37B0	Start OS/400

Description: A function check occurred in system arbiter module QWCASUUM while starting the controlling subsystem.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

37C0	Start OS/400

Description: The start OS/400 process is not able to monitor for the never event.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

37D0	Start OS/400

Description: Recoverable object test failure from a resolve.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: None.

37E0	Start OS/400

Description: Damage is detected in an installed system object needed by start OS/400. The object can be recovered by installing OS/400 again.

Service Recovery Action: See service recovery action 2 on page C-57.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

37F0	Start OS/400

Description: Unknown resolve failure.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 1 on page C-61.

37FF	Start OS/400

Description: A function check exception occurred in the start OS/400 process.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 14 on page C-63.

3810	System Arbiter Process during Startup or Normal System Operation

Description: Unexpected end of the controlling subsystem.

Service Recovery Action: See service recovery action 15 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3830	System Arbiter Process during Startup or Normal System Operation

Description: QSYS library not found by the system arbiter process.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

3850	System Arbiter Process during Startup or Normal System Operation

Description: Start OS/400 data object (QWCSCPF) cannot be found.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

3870	System Arbiter Process during Startup or Normal System Operation

Description: System object not found by system arbiter process.

Service Recovery Action: See service recovery action 7 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 3 on page C-62.

3890	System Arbiter Process during Startup or Normal System Operation

Description: System program not found by system arbiter process.

Service Recovery Action: Install OS/400 again.

Service Problem Analysis Procedure: None.

38E0	System Arbiter Process during Startup or Normal System Operation

Description: System arbiter process initial function had a function check exception.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

38F0	System Arbiter Process during Startup or Normal System Operation

Description: The system arbiter process initial function had a function check exception while handling a function check exception.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3C10	Subsystem Monitor Process

Description: Unexpected function check exception in controlling SBS monitor process during monitor startup.

Service Recovery Action: See service recovery action 15 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3C20	Subsystem Monitor Process

Description: No *SIGNON type console job entry in subsystem decsription of the controlling subsystem.

Service Recovery Action: See service recovery action 16 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3C30	Subsystem Monitor Process

Description: Signon file could not be opened (or found) by the controlling subsystem.

Service Recovery Action: See service recovery action 16 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3C50	Subsystem Monitor Process

Description: Unexpected function check exception in controlling subsystem monitor process during monitor shutdown.

Service Recovery Action: See service recovery action 15 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3C60	Subsystem Monitor Process

Description: Requestor device unusable by the controlling subsystem monitor, during monitor shutdown to the restricted state, or the system startup to the restricted state. This can occur when the console or requestor device is powered off or DST is selected using option 21 from the panel while the controlling subsystem is in the restricted state. The controlling subsystem is in the restricted state when the ENDSYS command or ENDSBS command is used to end all subsystems or the controlling subsystem.

Service Recovery Action: See service recovery action 20 on page C-60.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3C80	Subsystem Monitor Process

Description: Miscellaneous termination from an active monitor. The reason could be that the monitor queue is damaged or destroyed; the PCS is damaged and the controlling subsystem was in termination; or the controlling subsystem description is damaged.

Service Recovery Action: See service recovery action 15 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3CF0	Subsystem Monitor Process

Description: Maximum number of allowed sign-on attempts was exceeded. (This can occur while the controlling subsystem is in the restricted state. The controlling subsystem is in the restricted state when the ENDSYS command or ENDSBS command is used to end all subsystems or the controlling subsystem.)

Service Recovery Action: See service recovery action 11 on page C-58.

Service Problem Analysis Procedure: None.

3CFF	Subsystem Monitor Process

Description: An unknown process termination code was received by the subsystem termination event handler (QWCASCUE module) from the subsystem monitor process.

Service Recovery Action: See service recovery action 15 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3E10	Message Handler Termination

Description: The system arbiter process has terminated because of an error with the job message queue.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 15 on page C-64.

3E20	Message Handler Termination

Description: The system arbiter process has terminated because the job message queue is full.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 15 on page C-64.

3E30	Message Handler Termination

Description: The SCPF process has terminated because of an error with the job message queue.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 15 on page C-64.

3E40	Message Handler Termination

Description: The SCPF process has terminated because the job message queue is full.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 15 on page C-64.

3E50	Message Handler Termination

Description: The system message file, QCPFMSG, is damaged.

Service Recovery Action: See service recovery action 19 on page C-60.

Service Problem Analysis Procedure: None.

3E51	Message Handler Termination

Description: The system message file, QCPFMSG, is not found.

Service Recovery Action: See service recovery action 19 on page C-60.

Service Problem Analysis Procedure: None.

3F10	System Arbiter Process during System or Subsystem Termination

Description: Immediate POWER down time limit expired. At least one active subsystem had not ended in the time limit. Possibly, a user job could not end.

Service Recovery Action: See service recovery action 17 on page C-59.

Service Problem Analysis Procedure: See service problem analysis procedure 6 on page C-62.

3F40	System Arbiter Process during System or Subsystem Termination

Description: A function check exception occurred in system arbiter process module QWCASDSM while processing an immediate POWER down.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 5 on page C-62.

3F60	System Arbiter Process during System or Subsystem Termination

Description: System arbiter had function check exception during vary-off processing.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3F70	System Arbiter Process during System or Subsystem Termination

Description: System arbiter had function check exception during LUS termination in QWCASCUE.

Service Recovery Action: See service recovery action 8 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3FA0	System Arbiter Process during System or Subsystem Termination

Description: A function check exception occurred in QWCASCUE while processing the subsystem monitor process termination event. Cannot end OS/400 cleanly.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3FB0	System Arbiter Process during System or Subsystem Termination

URCS

Description: The system arbiter process had a function check exception while processing a subsystem monitor process termination event in QWCASCUE. This setting means that the normal inline code cannot be executed properly. It is not even sure that the TERMMPR instruction will execute.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3FC0	**System Arbiter Process during System or Subsystem Termination**

Description: The system arbiter process had two function check exceptions in the subsystem monitor process termination event handler QWCASCUE.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

3FFF	**System Arbiter Process during System or Subsystem Termination**

Description: The system arbiter process ended unexpectedly for unknown reasons.

Service Recovery Action: See service recovery action 9 on page C-58.

Service Problem Analysis Procedure: See service problem analysis procedure 7 on page C-62.

Appendix D. VLIC Exception Codes

VLIC exception codes cause an exception to be signaled to the machine interface. For a description of each of these codes and their related service recovery actions and problem analysis procedures, see the machine and function check exception codes starting on page D-1.

Figure C-1 on page C-1 shows some VLIC exception codes **1** are displayed at the work station. VLIC exception codes can be either a function check exception or a machine check exception. A function check exception is identified by message MCH3203. A machine check exception is identified by message MCH3202. For more information about machine and function check exceptions, see page 31-2.

What is a Function Check Exception?

A function check is signaled by VLIC when a possible VLIC coding error is encountered.

What Is a Machine Check Exception?

A machine check exception is signaled by VLIC when VLIC recognizes an error relating to the operation of the machine. This error is not severe enough to cause the machine to not operate; whereas, a machine check stops the system. Use the applicable *Analyzing Problems Guide* to determine the specific 4 digit reference code associated with the machine check.

What Is a Machine Check? A machine check exception is not to be confused with a machine check. A machine check causes the system attention light to be on and displays an SRC on the control panel. A machine check stops the system from operating. All machine checks that appear on the control panel are SRCs, but not all SRCs are machine checks.: The primary means of problem analysis is the description of the code on the control panel and the primary MCLB or MCLB. The address of the primary MCLB is found at virtual address hex 8000 0000 003A and resides in V=R storage. For more information about the machine check log buffer (MCLB), see 34-1.

Machine and Function Check Exception Codes

Each reference code is divided into these sections:

- Description
- Service recovery action
- Service problem analysis procedure

The action and procedure sections are to be used as shown in the SRCs. Look up the SRC in the SRC section that follows to find and use the service recovery actions and the problem analysis procedures. When necessary, submit the required information to your next level of service support.

Note: A main storage dump must be taken manually for each of the VLIC exception codes, if a main storage dump is needed.

0207	Machine Check Exception Code

Description: Damage has occurred to the header of an object. This damage may be the result of an auxiliary storage failure. The VLIC cannot signal damage to the object because it cannot determine the type of object.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. If possible, leave the system in its current state.

Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period around the time of the problem (see Chapter 31). Using the Print Error Log (PRTERRLOG) command, obtain the related error log data. Perform an IPL. If the problem persists, install OS/400 again. Select the *Change installing options* option from the Install the Operating System display. Then, select the *Restore programs and languages objects from current tape* option from the Installing Options display. At this time, do not clear the job and output queues. If the problem persists, install OS/400 again. Select the *Change installing options* option from the Install the Operating System display. Then, select the *Restore programs and languages objects from current tape* option from the Installing Options display. At this time, clear the job and output queues.

Service Problem Analysis Procedure: Look for the machine check exception CRE. This machine check exception is only signaled from the MI default exception handler. The segment identifier of the object is located in the invocation work area of the MI default exception handler, or in one of the machine check exception CRE registers.

0218	Function Check Exception Code

Description: A VLIC component has requested the creation of a segment with a specific identifier that was in use. All segments must have unique identifiers.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Start the job or session again. Obtain the VLIC log entry—by dump ID. Check for an error in the program. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: This error is signaled by auxiliary storage management. Using the VLIC log dump, find the ASM parameter list and the module that issued the auxiliary storage management SVL.

0220	Function Check Exception Code

Description: A VLIC component is using an invalid asynchronous I/O key. Storage Management will not allow an invalid asynchronous I/O key to be used. The component using the invalid asynchronous I/O key has an error.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Obtain the VLIC log entry—by dump ID. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: None.

0306	Function Check Exception Code

Description: An IMP exception occurred in an MI program in code generated by the translator and could not be related to an MI object. The exception was not handled by the hold/free exception handler, the MI default exception handler, the verify exception handler, the specification exception handler, or the segment group exception handler.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Find the exception CRE in the VLIC log dump for this error. Look at an object dump of the MI program that incurred the exception. Check the contents of registers referenced by the failing instruction. There may be references to segments that are not part of MI objects. The error may have also been caused by overlaid code in the MI program object.

0307	Function Check Exception Code

Description: An IMP exception occurred in VLIC code that was not handled by a component specific exception handler (CSEH).

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: The VLIC log dump contains the exception CREs associated with the failing process. The most recent CRE containing an IMP exception code is the cause of the failure.

0311	Function Check Exception Code

Description: An attempt to mark an MI system object damaged failed because the damage exception handler or the set damage function could not access the encapsulated program architecture (EPA) header of the segment containing the object.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Obtain the VLIC log entries before or after the identified one (-10 or +10 default). Check for an error in the program.

Service Problem Analysis Procedure: Find the machine check exception CRE from the VLIC log dump. Find which of the above modules signaled the machine check. Look in the IMPI listing to find the point where the machine check was signaled. The address of the object where damage was attempted to be set can be determined from the code. The object itself cannot be recovered because it has either been destroyed or the address itself is not valid.

0313	Function Check Exception Code

Description: A component specific exception handler (CSEH) incurred an exception or exceeded the count of exceptions it was able to handle in itself.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Refer to code 0307, unhandled IMP exception.

0501	Function Check Exception Code

Description: When an MI process is initiated, an MI lock is placed on the user profile governing the execution of that process. When the process is ended, this lock is removed. The error code 1084 results from an error return code from MI lock function.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: None.

0502	Function Check Exception Code

Description: A task tried to destroy another task (not an MI process) other than itself. This is invalid because of asynchronous processing restrictions.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: This function check is signaled by destroy task. Find register 3 in the machine check CRE. Register 3 in the machine check CRE points to the ICB for destroy task. Register 15 in the ICB pointed to by register 3 points to the caller of destroy task. Halfword register 14 is the instruction address register (IAR) of the instruction following the call to destroy task. Use the listing of the module calling destroy task to find the address of the task being destroyed. It must be the same as the containing TDE.

0507	Function Check Exception Code

Description: An error occurred transferring MI locks to a new process being initiated. The transfer lock function returned an error return code to initiate process part 2.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Using the VLIC log dump, find the machine check CRE. Find register 3 in that CRE. Using the listing of initiate process part 2, find the point where the machine check was signaled.

0601	Function Check Exception Code

Description: The CRE generation program found more than one CRE with the monitor exception enabled bit on when it was restoring CREs in the machine. This monitor bit causes an IMP monitor exception to be raised when the machine is running out of CREs. If more than one CRE is monitored, this violates an internal convention used to keep track of the number of CREs in use in the machine.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: See description.

0605	Function Check Exception Code

Description: The destroy object common function is operational in two parts so the caller can call part 1 to check the object's eligibility. If part 2 of destroy object is called to destroy the object and the same work area is not used as in part 1, this function check is signaled. If the object address in the work area is not the same as part 1, this function check is signaled.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: See description.

0606	Function Check Exception Code

Description: The invocation work area (IWA) in a process is exhausted. There is no more storage left for any calls.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Look at the VLIC log dump. This error is caused by a loop in the VLIC causing many calls to be active at the same time. This may also be caused by excessive AS/400 program calls.

0608	Function Check Exception Code

Description: A VLIC *module* has called wait/time-out service repeatedly for some time interval. The specified time interval is smaller than the timer routines can reliably service the request.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Determine what program called wait/time-out and examine the parameter list (map by include ZZWTO) which was passed to wait/time-out. This data should be in the ICB/IWA stack addressed by register 3.

0609	Function Check Exception Code

Description: Excessively large time-out value requested. A VLIC module has called the wait/time-out function to request a timer service with a time interval larger than the maximum allowed value.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Determine what program called wait/time-out and examine the parameter list (mapped by include ZZWTO) which was passed to wait/time-out. This data should be in the ICB/IWA stack addressed by register 3.

0610	Function Check Exception Code

Description: Wait/time-out cancel was called to cancel a timeout request. However, the type of request to be cancelled was not one of the valid type codes.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Determine what program called wait/time-out and examine the parameter list (mapped by include ZZWCT) which was passed to wait/time-out. This data should be in the ICB/IWA stack addressed by register 3.

0618	Function Check Exception Code

Description: The handling of the monitored SRQ, SRM, or TDE access exceptions is supported by VLIC only if the IMP instruction that caused the exception is one of the following IMP instructions: DQM, EQM, SENDM, RECM, EQTDE, or DQTDE, or one of the above IMP instructions is the target of an execute (EX) IMP instruction.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: The cause of this error is one of the following: VLIC code that caused a monitored TDE access exception while executing an SVL0, SVL1, SVL2, or SVL monitored IMP instruction. VLIC resource management implementation disallows the second cause. That is, no VLIC task, or process is allowed to run an explicit SVL type IMP instruction while the monitored TDE access exception mask is unmasked (allow exception). If there is no apparent cause of failure, then task switching trace, resource management trace, queue management trace, and process management trace and dumps of the TDEs, CREs, IWAs, and PCBs of all the tasks and processes at the time of error would be useful in determining the problem. The customer could perform an IPL and this problem could go away if the cause was intermittent hardware failure or timing dependent on the VLIC module execution.

0619	Function Check Exception Code

Description: Freeing a shared-no-wait seize on a process control space is part of the process interrupt function in the VLIC. When a process interrupts another process to change the status of the target process or to cause the target process to alter its execution sequence or to pass object locks to the target process, the interrupting process is required first to seize the PCS of the target process, then initiate the interrupt function, and lastly, free the seize on the PCS. This free seize of the PCS ensures that the target does not disappear before the interrupt function is initiated. Sometimes the target process could be the interrupting process itself. The seize of PCS is a shared-no-wait seize performed by inline code expansion of the macro INTHOLD; the free of the shared-no-wait seize is performed by inline code expansion of macro INTFREE. The number of shared-no-wait seizes on a process in a 2-byte binary number in the resident portion of the PCB (PCBRES) with the name PCBITHWF or PCBITHW2. When that number is 0 and the code expansion of INTFREE decrements it by -1, then function check hex 0619 is signaled. The error is logged and the process that was running the INTFREE code is destroyed.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: The process that is destroyed could be, but is not necessarily, the process that caused the error. For instance, two processes are holding a shared-no-wait seize on a third process. If the first process erroneously freed the seize twice, then the second process causes the function check to be signaled when it attempts to free the seize it issued earlier. Should this error occur, dumps of TDEs, CREs, PCBs, and IWAs of all the processes in the machine could be useful in the determination of the cause of the error. If the error could be produced again, then task switch traces and call traces of all the processes would give an indication as to which process erroneously attempted to free more seizes on a PCS than it held. A process failing to issue the INTHOLD macro before it issued the INTFREE macro is a good possibility that would cause the error. The possibility of producing this error again is low because this error depends on the workload environment and the sequences in which the VLIC modules run under different processes. Therefore, the customer could perform an IPL and the problem could disappear.

0622	Function Check Exception Code

Description: A bad return code was received from the service processor when requesting a function supported by the service processor.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. If the problem persists, perform another IPL. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. For more information about APARs or licensed internal code trouble reports see Chapter 6. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period around the time of the problem (see Chapter 31). Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again.

0623	Function Check Exception Code

Description: Invalid memory ID in the memory VPD Table.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. If the problem persists, perform another IPL. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period around the time of the problem (see Chapter 31). Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again.

0624	Function Check Exception Code

Description: Invalid processor model number.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. If the problem persists, perform another IPL. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period of time surrounding the problem (see Chapter 31). Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again.

1202	Function Check Exception Code

Description: Bad return code from MI lock function signaled from #DBSETCR when attempting to lock a data space entry.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. If the problem persists, perform another IPL. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period of time surrounding the problem (see Chapter 31). Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again.

1203	Function Check Exception Code

Description: Bad return code from MI unlock function signaled from #DBCINX in two places:

A main storage dump is not automatically taken for this SRC.

1. Attempted to unlock the created data space index and got a nonzero return code from the MI unlock function.
2. Attempted to unlock the data spaces referenced by the data space index template and got a nonzero return code from the MI unlock function.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. If the problem persists, perform another IPL. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period of time surrounding the problem (see Chapter 31). Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again.

1207	Function Check Exception Code

Description: During a Create Data Index instruction, the data space index being created could not be locked. No other processes should have the addressability to the object necessary to lock it.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. For more information about APARs or licensed internal code trouble reports see Chapter 6. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period of time surrounding the problem (see Chapter 31).

Service Problem Analysis Procedure: See description.

1209	Function Check Exception Code

Description: The machine index function returned an unexpected return code following a request to insert, delete, retrieve, or modify a data space index key. This generally indicates that the request was incorrectly formatted by the requesting module.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: See description.

1211	Function Check Exception Code

Description: An exception was detected by the database general exception handler and, while preparing to return the exception information to the module which had enabled the exception handler, it was discovered that not enough room had been allocated to return the minimum amount of exception information.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: From the VLIC log dump, find the exception-causing module (from the CRE/IWA chains).

1214	Function Check Exception Code

Description: A request was made to extend a valid data space index. However, the requested size is less than the current size, and a valid data space index may not be truncated.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID and using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period around the time of the problem (see Chapter 31). Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: See description.

1218	Function Check Exception Code

Description: Unexpected return code from select/omit program while performing deletes on a select/omit logical file.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Destroying the offending select/omit logical file (if it is not needed) on which the function check occurred may prevent the function check from constantly re-occurring while the problem is being investigated. The address of the offending index can be determined by examining the most recent VLIC log entry with major ID 0600 and minor ID 4398.

1220	Function Check Exception Code

Description: An unexpected return code from translator was received while generating derived mapping code.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain all VLIC level 3 VLIC log entries surrounding the time of failure. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Attempt the command causing the problem again. If the problem persists then see the service recovery action.

13C0	Function Check Exception Code

Description: A request to open a journal through a journal port could not be completed because a useable journal space was not available.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. If the name of a journal space is indicated in the dump, and the journal space has an equivalent copy on offline media, restore the journal space and attempt the operation again. The 13C0 function check occurs if a missing or hard damaged journal space is encountered while attempting to open through a journal port and no twin journal space is available for the unuseable journal space.

Service Problem Analysis Procedure: Same as above.

1401	Machine Check Exception Code

Description: While processing the Reclaim instruction, the machine discovered that the machine context was destroyed.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Perform an IPL.

Service Problem Analysis Procedure: Perform an IPL. The machine context is built again. The Reclaim instruction must be run again by the programming system.

1501	Function Check Exception Code

Description: Page not allocated exception against nonextendable translator work segment. Nonextendable translator work segment groups are preallocated to the correct size and should never be the subject of a page not allocated exception.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Check for an error in the program. Check for an error in the program.

Service Problem Analysis Procedure: See description.

1601	Function Check Exception Code

Description: This is a source/sink error. This error occurred because a unique ID for a line IOM or a local IOM was not assigned.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Perform an IPL. Dump the VLIC log. Obtain the VLIC log entry—by dump ID. Contact the next level of service support or submit an APAR or licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Verify that the first-level service problem determination procedures were processed. If they were done correctly, either contact your next level of service support or submit an APAR or licensed internal code trouble report.

1602	Function Check Exception Code

Description: This is a source/sink error. This error occurred because of the following conditions:

- Not able to create an IOM task because of a bad return code from a Create Task instruction.
- An error occurred while attempting to create a source/sink object.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Dump the VLIC log. Obtain the VLIC log entry—by dump ID. Contact the next level of service support or submit an APAR or licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Verify that the recovery actions were processed. If they were done correctly, either contact your next level of service support or submit an APAR or licensed internal code trouble report.

1603	Machine Check Exception Code

Description: This is a source/sink error. This error occurred because an attempt was made to use a VLIC source/sink management module that was not on the system or could not be located by the address constant in the accessing module.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: DST program debug to ensure that all source/sink management modules are on the system. See Program Debug for a description of how to initiate the DST program debug. If the problem persists, dump the VLIC log. Obtain the VLIC log entry—by dump ID. Contact the next level of service support or submit an APAR or licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Provide information to create the problem again. Perform an IPL to load VLIC again.

Service Problem Analysis Procedure: Verify that the service recovery actions were processed. If they were done correctly, contact your next level of service support or submit an APAR or licensed internal code trouble report.

1701	Function Check Exception Code

Description: Bad return code from GETIWA. A request to allocate (free) a block of invocation work area (IWA) in that process failed. The IWA is a space in a temporary segment that is part of the process control space MI object. The space is used by VLIC as working storage.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check an error in the program.

Service Problem Analysis Procedure: Find the machine check CRE in the VLIC log dump. Offset hex E from register 3 contains the return code field from GET/FREE IWA. A return code of 4 from FREEIWA indicates an invalid size was requested. The return code from GETIWA is the return code from any extend segment operation (see code 1705).

1702	Function Check Exception Code

Description: Bad return code from FREEIWA. A request to free a block of invocation work area (IWA) in that process failed. The IWA is a space in a temporary segment that is part of the process control space MI object. The space is used by VLIC as working storage.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check an error in the program.

Service Problem Analysis Procedure: Find the machine check CRE in the VLIC log dump. Offset hex E from register 3 contains the return code field from GET/FREE IWA. A return code of 4 from FREEIWA indicates an invalid size was requested.

1703	Function Check Exception Code

Description: A request to create a segment was unsuccessful. This function check is signaled by the module starting the create segment function. This function check may be indicated by the component generating the function check for any nonzero return code or some particular error. The list of return codes from the create segment follows:

Return Code	Description
0	Request completed normally.
1	Space allocated, not on requested unit.
2	Space allocated, not contiguous on unit.

3	Both 1 and 2.
4	Not enough space available in machine.
6	The auxiliary storage limit authorized for the user profile governing this process has been exceeded (permanent segment requests only).
7	There is insufficient space in the access group if the segment is to be created into an access group.
8	The size requested is invalid (less than 0 and greater than 16 megabytes).

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Using the machine check CRE from the VLIC log, find the module that signaled the error. Using the IMPI listing for that module, locate the ASM parameter list. It contains the return code from ASM and the caller's input.

1704	Function Check Exception Code

Description: The destroy segment function failed. This function check is signaled from the component requesting the destroy. These are the possible return codes:

Return Code	Description
0	Request completed normally.
8	Segment to be destroyed does not exist.
9	The segment is not the base segment of a segment group (byte 3 of the segment identifier is nonzero).

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Same as code 1703—create segment failed.

1705	Function Check Exception Code

Description: A request to extend (add more space on auxiliary storage) a segment did not complete satisfactorily. Refer to descriptions of bad return codes from destroy and create segment return codes.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Same as code 1703—create segment failed.

1706	Function Check Exception Code

Description: A request to truncate (reduce space on auxiliary storage) a segment did not complete satisfactorily. Refer to the descriptions of bad return codes from the create and destroy segment. See codes 1703 and 1704.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Submit an APAR or a licensed internal code trouble report. Check for an error in the program.

Service Problem Analysis Procedure: Same as code 1705—extend segment failed.

1707	Function Check Exception Code

Description: A get machine-wide storage request was incorrectly specified to the get machine-wide storage module. The error occurs if the size requested was less than or equal to 0 bytes or more than 65,024 bytes, or the owner ID specified was not a TDE.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Find the CRE associated with the signaling of the error in the VLIC log. Register 10 contains a reason code that determines the cause of the failure. The reasons are as follows:

Reason	Cause
1	An invalid TDE address was specified.
2	An invalid size request was specified.
3	All MWS control segments are in use.
4	An invalid address for the MWS block-to-free was specified.
5	An invalid owner of a MWS block-to-free was specified.

Register 11 contains the address of the caller.

Register 12 contains the address of the MWS local data area. Register 13 contains the address of the MWS parameter list that was passed to the MWS code.

Service Problem Analysis Procedure: Same as the service recovery action.

1708	Function Check Exception Code

Description: Same as code 1707, except an invalid request was made to free machine-wide storage.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: See the service recovery procedures for code 1707 previously described.

Service Problem Analysis Procedure: Same as the service recovery action.

1709	Function Check Exception Code

Description: The initialization of an IMP index failed. The initialize trunk page function could not set up the trunk page (first page of machine index which contains control information).

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID.

Service Problem Analysis Procedure: This error is signaled by the module that requested the index initialization. Find the machine check CRE in the VLIC log dump. Use the listing of the VLIC module that signaled the function check and find the place where it was signaled. There are three parameters in the initialize trunk page function. The first parameter is a 6-byte virtual address of the trunk page of the index to be initialized. The last 2 bytes of the address must be hex 0000. The second parameter is a 4-byte number of pages associated with the index. It must be between 0 and 32,765.

1710	Function Check Exception Code

Description: Bad return code from EXCB. A catastrophic index error or other error resulted from an Execute Index Control Block (EXCB) IMP instruction. This function check is signaled by the module executing the EXCB instruction.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain the VLIC log entry—by dump ID. Start the job or session again. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Find the machine check CRE in the VLIC log dump. Find the EXCB instruction in the module listing that was executed before the machine check. Use the base/displacement address of the IXCB in the EXCB instruction. The address of the trunk page is at offset 32 in the IXCB. If offset 6, bit 5 in the IXCB is set, the index is full and the signaling module did not extend it. If offset 6, bit 7 is set, a catastrophic index error occurred and the index is permanently damaged. Use the module listing of execute IXCB and find the offset specified by the halfword at offset 20 in the trunk page. The comment preceding the BAL instruction gives the cause of the error. If bit 1, byte 7 of the IXCB is a binary 1, then a specification error has occurred. This is caused by:

1. Offset 4 into the trunk page is not hex CC. It is not an index. If it is hex 3C, the index is damaged.
2. Offset 1 or 3 in the IXCB is greater than hex 80 (argument or result length greater than 128).
3. The pointer at offset 32 is not aligned.
4. Offset 0 in the IXCB is greater than hex 10 (the function code is bad).
5. Offset 0 in the IXCB is hex 08 or hex 09 and offset 2 is greater than or equal to offset 1 (suffix length too large on insert).
6. On an insert operation, the suffix length is greater than the argument length.

1711	Function Check Exception Code

Description: A request to destroy an object was initiated and could not complete because of an unexpected return code was received.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain all VLIC level 3 VLIC log entries surrounding the time of failure. Obtain APAR or licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: Attempt the command causing the problem again. If the problem persists then see service recovery action.

1712	Machine Check Exception Code

Description: Control segment is exceeded.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Start the job or session again. Obtain a trace number (type). Obtain the VLIC log entry—by dump ID. Check an error in the program.

Service Problem Analysis Procedure: Use VLIC call trace to find an excessive user of get machine-wide storage. This problem is caused by a loop in a module or modules requesting machine-wide storage, a failure in a module to free machine-wide storage, or an excessively large request by a module. See error code 1707, invalid GETMWS request for a description of how to find GETMWS input parameters.

1713	Function Check Exception Code

Description: In the MI default exception handler or the effective address overflow exception handler, an effective address overflow exception is handled by incrementing byte 3 of the virtual address against which the effective address overflow (EAO) exception was signaled and constructing a new virtual address. The instruction is then run again by the EAO exception handler. The MI default exception handler also handles EAO exception to find the last page of the object. If, when using the reconstructed address, an IMP exception other than hex 80, 81, 82, or 86 occurs, the hex 1713 function check is signaled.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Obtain the VLIC log entry—by dump ID. Perform an IPL.

Service Problem Analysis Procedure: Find the exception CRE from the VLIC log dump. From the exception CRE, the module, IAR, and unexpected exceptions can be determined. From the module listing, try to determine what caused the error. The error is probably a VLIC error that should be evident from the VLIC instruction and its operands (determined from the exception CRE).

1714	Function Check Exception Code

Description: An attempt was made to signal/set partial damage against the machine context. It is invalid for the machine context to be partially damaged.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Obtain the VLIC log entry—by dump ID. Check for an error in the program.

Service Problem Analysis Procedure: Check the VLIC log for any other damage reports against the machine context. The machine context is always at virtual address hex 0000 0D00 0000. At this time, the machine context is damaged. The MI Reclaim Lost Objects instruction should be executed to build the machine context and its contents again.

1715	Function Check Exception Code

Description: Bad return code from add index pages. An attempt to add storage to an IMP index failed. This involved attempting to extend the segment containing the index.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Obtain the VLIC log entry—by dump ID. Start the job or session again. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6.

Service Problem Analysis Procedure: This function check is signaled by the module calling add index pages. Find the machine check CRE from the VLIC log dump. The call to add index pages precedes the signaling of the function check. There are 4 parameters to add index pages. The first is a 6-byte virtual address of the trunk page of the index. Offset hex four from the address pointed to by the first add index pages must be hex CC for the trunk to be a valid IMP index. The second parameter is a 6-byte virtual address. The third parameter is a 2-byte number of pages to be added to the index. If the second parameter is binary 0's and the number of pages to be added times 2 plus the 2-byte number at offset hex E from the beginning of the page addressed by the first parameter is more than 65 536, the index segment is full and cannot be extended. If the second parameter is not binary 0's, add bytes 4 and 5 of the second parameter to the third parameter times 2. If the result is more than 65 536, the index is full and cannot be extended.

1716	Function Check Exception Code

Description: An invalid VLIC condition is detected. A VLIC component detected a logical inconsistency in its input. The VLIC component was entered with parameters or conditions that are logically impossible.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Provide information to create the problem again. Obtain an APAR or a licensed internal code trouble report data using the Create APAR (CRTAPR) command. Submit an APAR or a licensed internal code trouble report. For more information about APARs or licensed internal code trouble reports see Chapter 6. Start the job or session again. Using the Print Internal Data (PRTINTDTA) command, print the notes portion of the machine internal data for the period of time surrounding the problem (see Chapter 31). Check an error in the program.

Service Problem Analysis Procedure: This function check is used only to signal conditions that are logically impossible. It is used to signal intracomponent logic errors. Forward VLIC log dump to programming support personnel.

1718	Function Check Exception Code

Description: A non-MI object used by VLIC could not be read from auxiliary storage due to a disk read error.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Record the system console lights. Perform an IPL.

Service Problem Analysis Procedure: Look in the hardware error log for the most recent disk error before the function check was signaled. If it was an unrecovered read error, the error log record contains the failing sector. Because this error occurs in non-MI storage, it will automatically be corrected at next IPL. Some data (such as the error log and VLIC log) may not be readable.

1720	Function Check Exception Code

Description: The MI Reclaim Lost Objects instruction attempted to locate the machine context and failed. The machine context header is either destroyed or not readable.

A main storage dump is not automatically taken for this SRC.

Service Recovery Action: Start the job or session again. Provide information to create the problem again. Obtain the VLIC log entry – by dump ID.

Service Problem Analysis Procedure: None.

Appendix E. List of VLIC Exception, OS/400 Reference, and VLIC Reference Codes

Table E-1 (Page 1 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
0101	Machine Check Handler	C-5
0102	Machine Check Handler	C-5
0103	Machine Check Handler	C-5
0104	Machine Check Handler	C-5
0105	Machine Check Handler	C-5
0106	Machine Check Handler	C-5
0107	Machine Check Handler	C-5
0108	Machine Check Handler	C-5
0110	Machine Check Handler	C-6
0115	Machine Check Handler	C-6
0116	Machine Check Handler	C-6
0150	Machine Check Handler	C-6
0201	Storage Management	C-6
0202	Storage Management	C-7
0204	Storage Management	C-7
0207	Machine Check Exception Code	D-1
0208	Storage Management	C-7
0209	Storage Management	C-7
0215	Storage Management	C-7
0217	Storage Management	C-7
0218	Function Check Exception Code	D-1
0219	Storage Management	C-8
0220	Function Check Exception Code	D-2
0222	Storage Management	C-8
0223	Storage Management	C-8
0224	Storage Management	C-8
0227	Storage Management	C-8
0228	Storage Management	C-8
0234	Storage Management	C-8
0235	Storage Management	C-9
0236	Storage Management	C-9
0237	Storage Management	C-9
0241	Storage Management	C-9
0242	Storage Management	C-9
0243	Storage Management	C-9
0244	Storage Management	C-10
0245	Storage Management	C-10
0246	Storage Management	C-10
0247	Storage Management	C-10
0248	Storage Management	C-10
0249	Storage Management	C-10
0250	Storage Management	C-10
0251	Storage Management	C-10
0252	Storage Management	C-11
0253	Storage Management	C-11
0255	Storage Management	C-11
0261	Storage Management	C-11
0262	Storage Management	C-11
0266	Storage Management	C-11
0297	Storage Management	C-11
0298	Storage Management	C-11
0299	Storage Management	C-11
0301	Exception Management	C-12
0302	Exception Management	C-12
0304	Exception Management	C-12
0305	Exception Management	C-12
0306	Function Check Exception Code	D-2
0307	Function Check Exception Code	D-2
0308	Exception Management	C-12

Table E-1 (Page 1 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
0309	Exception Management	C-12
0310	Exception Management	C-12
0311	Function Check Exception Code	D-2
0312	Exception Management	C-12
0313	Function Check Exception Code	D-2
0401	Initial Program Load	C-13
0402	Initial Program Load	C-13
0403	Initial Program Load	C-13
0405	Initial Program Load	C-13
0406	Initial Program Load	C-13
0407	Initial Program Load	C-13
0408	Initial Program Load	C-13
0409	Initial Program Load	C-14
0410	Initial Program Load	C-14
0411	Initial Program Load	C-14
0412	Initial Program Load	C-14
0413	Initial Program Load	C-14
0414	Initial Program Load	C-14
0415	Initial Program Load	C-14
0416	Initial Program Load	C-14
0417	Initial Program Load	C-15
0418	Initial Program Load	C-15
0419	Initial Program Load	C-15
0420	Initial Program Load	C-15
0421	Initial Program Load	C-15
0422	Initial Program Load	C-15
0423	Initial Program Load	C-16
0424	Initial Program Load	C-16
0425	Initial Program Load	C-16
0427	Initial Program Load	C-16
0428	Initial Program Load	C-16
0429	Initial Program Load	C-16
0430	Initial Program Load	C-17
0431	Initial Program Load	C-17
0432	Initial Program Load	C-17
0433	Initial Program Load	C-17
0434	Initial Program Load	C-17
0436	Initial Program Load	C-17
0438	Initial Program Load	C-18
0439	Initial Program Load	C-18
0440	Initial Program Load	C-18
0441	Initial Program Load	C-18
0443	Initial Program Load	C-18
0444	Initial Program Load	C-18
0445	Initial Program Load	C-19
0446	Initial Program Load	C-19
0447	Initial Program Load	C-19
0448	Initial Program Load	C-19
0449	Initial Program Load	C-19
0451	Initial Program Load	C-19
0480	Initial Program Load	C-19
0481	Initial Program Load	C-19
0482	Initial Program Load	C-19
0485	Initial Program Load	C-20
0486	Initial Program Load	C-20
0487	Initial Program Load	C-20
0501	Function Check Exception Code	D-3
0502	Function Check Exception Code	D-3
0504	Process Management	C-20
0506	Process Management	C-20
0507	Function Check Exception Code	D-3
0601	Function Check Exception Code	D-3
0605	Function Check Exception Code	D-3
0606	Function Check Exception Code	D-3
0607	Resource Management	C-20
0608	Function Check Exception Code	D-4
0609	Function Check Exception Code	D-4

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Table E-1 (Page 2 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
0610	Function Check Exception Code	D-4
0611	Resource Management	C-20
0612	Resource Management	C-20
0615	Resource Management	C-21
0616	Resource Management	C-21
0617	Resource Management	C-21
0618	Function Check Exception Code	D-4
0619	Function Check Exception Code	D-4
0620	Resource Management	C-21
0622	Function Check Exception Code	D-5
0623	Function Check Exception Code	D-5
0624	Function Check Exception Code	D-5
1202	Function Check Exception Code	D-5
1203	Function Check Exception Code	D-5
1207	Function Check Exception Code	D-6
1209	Function Check Exception Code	D-6
1210	Database	C-21
1211	Function Check Exception Code	D-6
1214	Function Check Exception Code	D-6
1215	Database	C-22
1217	Database	C-22
1218	Function Check Exception Code	D-6
1219	Database	C-22
1220	Function Check Exception Code	D-7
13C0	Function Check Exception Code	D-7
1401	Machine Check Exception Code	D-7
1501	Function Check Exception Code	D-7
1601	Function Check Exception Code	D-7
1602	Function Check Exception Code	D-8
1603	Machine Check Exception Code	D-8
1604	Source/sink	C-22
1701	Function Check Exception Code	D-8
1702	Function Check Exception Code	D-8
1703	Function Check Exception Code	D-8
1704	Function Check Exception Code	D-9
1705	Function Check Exception Code	D-9
1706	Function Check Exception Code	D-9
1707	Function Check Exception Code	D-9
1708	Function Check Exception Code	D-10
1709	Function Check Exception Code	D-10
1710	Function Check Exception Code	D-10
1711	Function Check Exception Code	D-10
1712	Machine Check Exception Code	D-10
1713	Function Check Exception Code	D-11
1714	Function Check Exception Code	D-11
1715	Function Check Exception Code	D-11
1716	Function Check Exception Code	D-11
1718	Function Check Exception Code	D-12
1719	Source/sink	C-22
1720	Function Check Exception Code	D-12
2A80	OS/400 IPL Status	C-72
2B10	OS/400 IPL Status	C-73
2B20	OS/400 IPL Status	C-73
2B30	OS/400 IPL Status	C-73
2B40	OS/400 IPL Status	C-73
2C10	OS/400 IPL Status	C-73
2C20	OS/400 IPL Status	C-73
2C30	OS/400 IPL Status	C-73
2000	OS/400 Startup or Normal System Operation	C-71
28C0	OS/400 IPL Status	C-71
2810	OS/400 IPL Status	C-71
2820	OS/400 IPL Status	C-71

Table E-1 (Page 2 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
2830	OS/400 IPL Status	C-71
29A0	OS/400 IPL Status	C-72
29B0	OS/400 IPL Status	C-72
29C0	OS/400 IPL Status	C-72
2910	OS/400 IPL Status	C-71
2920	OS/400 IPL Status	C-72
2930	OS/400 IPL Status	C-72
2940	OS/400 IPL Status	C-72
2950	OS/400 IPL Status	C-72
2960	OS/400 IPL Status	C-72
2970	OS/400 IPL Status	C-72
2980	OS/400 IPL Status	C-72
2990	OS/400 IPL Status	C-72
3CFF	Subsystem Monitor Process	C-84
3CF0	Subsystem Monitor Process	C-84
3C10	Subsystem Monitor Process	C-83
3C20	Subsystem Monitor Process	C-84
3C30	Subsystem Monitor Process	C-84
3C50	Subsystem Monitor Process	C-84
3C60	Subsystem Monitor Process	C-84
3C80	Subsystem Monitor Process	C-84
3E10	Message Handler Termination	C-84
3E20	Message Handler Termination	C-84
3E30	Message Handler Termination	C-85
3E40	Message Handler Termination	C-85
3E50	Message Handler Termination	C-85
3E51	Message Handler Termination	C-85
3FA0	System Arbiter Process during System or Subsystem Termination	C-85
3FB0	System Arbiter Process during System or Subsystem Termination	C-85
3FC0	System Arbiter Process during System or Subsystem Termination	C-86
3FFF	System Arbiter Process during System or Subsystem Termination	C-86
3F10	System Arbiter Process during System or Subsystem Termination	C-85
3F40	System Arbiter Process during System or Subsystem Termination	C-85
3F60	System Arbiter Process during System or Subsystem Termination	C-85
3F70	System Arbiter Process during System or Subsystem Termination	C-85
3000	Install of OS/400	C-73
3001	Install of OS/400	C-73
3002	Install of OS/400	C-73
3004	Install of OS/400	C-73
3005	Install of OS/400	C-74
3006	Install of OS/400	C-74
3007	Install of OS/400	C-74
3008	Install of OS/400	C-74
3010	Install of OS/400	C-74
3011	Install of OS/400	C-74
3012	Install of OS/400	C-74
3013	Install of OS/400	C-74
3014	Install of OS/400	C-74
3015	Install of OS/400	C-74
3016	Install of OS/400	C-75
3017	Install of OS/400	C-75
308D	Install of OS/400	C-75
308F	Install of OS/400	C-75
31A0	Initial OS/400	C-76

Table E-1 (Page 3 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
31B0	Initial OS/400	C-76
31C0	Initial OS/400	C-76
31D0	Initial OS/400	C-76
31E0	Initial OS/400	C-76
31FF	Initial OS/400	C-76
31F0	Initial OS/400	C-76
3100	Initial OS/400	C-75
3110	Initial OS/400	C-75
3120	Initial OS/400	C-75
3121	Initial OS/400	C-75
3130	Initial OS/400	C-75
3140	Initial OS/400	C-75
3150	Initial OS/400	C-75
3160	Initial OS/400	C-75
3170	Initial OS/400	C-76
3180	Initial OS/400	C-76
3190	Initial OS/400	C-76
32A0	Start OS/400	C-77
32D0	Start OS/400	C-77
32E0	Start OS/400	C-77
3210	Start OS/400	C-77
3220	Start OS/400	C-77
3240	Start OS/400	C-77
3250	Start OS/400	C-77
3260	Start OS/400	C-77
3270	Start OS/400	C-77
3278	Start OS/400	C-77
3280	Start OS/400	C-77
33A0	Start OS/400	C-80
33A8	Start OS/400	C-80
33B0	Start OS/400	C-80
33B8	Start OS/400	C-80
33F0	Start OS/400	C-80
33F8	Start OS/400	C-80
3300	Start OS/400	C-78
3308	Start OS/400	C-78
3310	Start OS/400	C-78
3318	Start OS/400	C-78
3320	Start OS/400	C-78
3328	Start OS/400	C-78
3340	Start OS/400	C-78
3348	Start OS/400	C-78
3350	Start OS/400	C-78
3358	Start OS/400	C-79
3360	Start OS/400	C-79
3368	Start OS/400	C-79
337C	Start OS/400	C-79
337D	Start OS/400	C-79
3370	Start OS/400	C-79
3378	Start OS/400	C-79
3380	Start OS/400	C-79
3388	Start OS/400	C-79
3390	Start OS/400	C-79
3398	Start OS/400	C-80
34B0	Start OS/400	C-81
3400	Start OS/400	C-80
3430	Start OS/400	C-80
3460	Start OS/400	C-80
3490	Start OS/400	C-81
3498	Start OS/400	C-81

Table E-1 (Page 3 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
35B0	Start OS/400	C-81
3530	Start OS/400	C-81
3560	Start OS/400	C-81
3590	Start OS/400	C-81
36B0	Start OS/400	C-82
36D0	Start OS/400	C-82
3600	Start OS/400	C-81
3630	Start OS/400	C-81
3660	Start OS/400	C-82
3690	Start OS/400	C-82
37B0	Start OS/400	C-82
37C0	Start OS/400	C-82
37D0	Start OS/400	C-82
37E0	Start OS/400	C-83
37FF	Start OS/400	C-83
37F0	Start OS/400	C-83
3700	Start OS/400	C-82
3730	Start OS/400	C-82
3760	Start OS/400	C-82
3790	Start OS/400	C-82
38E0	System Arbiter Process during Startup or Normal System Operation	C-83
38F0	System Arbiter Process during Startup or Normal System Operation	C-83
3810	System Arbiter Process during Startup or Normal System Operation	C-83
3830	System Arbiter Process during Startup or Normal System Operation	C-83
3850	System Arbiter Process during Startup or Normal System Operation	C-83
3870	System Arbiter Process during Startup or Normal System Operation	C-83
3890	System Arbiter Process during Startup or Normal System Operation	C-83
4001	Storage Management IPL Status	C-22
4002	Storage Management IPL Status	C-22
4003	Storage Management IPL Status	C-23
4004	Storage Management IPL Status	C-23
4005	Storage Management IPL Status	C-23
4006	Storage Management IPL Status	C-23
4007	Storage Management IPL Status	C-23
4008	Storage Management IPL Status	C-23
4010	Storage Management IPL Status	C-23
4011	Storage Management IPL Status	C-23
4012	Storage Management IPL Status	C-23
4013	Storage Management IPL Status	C-23
4014	Storage Management IPL Status	C-24
4020	Storage Management IPL Status	C-24
4021	Storage Management IPL Status	C-24
4022	Storage Management IPL Status	C-24
4023	Storage Management IPL Status	C-24
4024	Storage Management IPL Status	C-24
4025	Storage Management IPL Status	C-24
4026	Storage Management IPL Status	C-24
4027	Storage Management IPL Status	C-24
4028	Storage Management IPL Status	C-24
4029	Storage Management IPL Status	C-25
4030	Storage Management IPL Status	C-25
4031	Storage Management IPL Status	C-25
4032	Storage Management IPL Status	C-25
4036	Storage Management IPL Status	C-25
410A	Bus Manager IPL Status	C-26

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Table E-1 (Page 4 of 6). List of VLIC Exceptions, OS/400 Reference, and VLIC Refernce Codes

SRC	Description	Page
4101	Bus Manager IPL Status	C-25
4102	Bus Manager IPL Status	C-25
4103	Bus Manager IPL Status	C-25
4104	Bus Manager IPL Status	C-25
4105	Bus Manager IPL Status	C-25
4106	Bus Manager IPL Status	C-25
4107	Bus Manager IPL Status	C-25
4108	Bus Manager IPL Status	C-25
4109	Bus Manager IPL Status	C-26
411A	Bus Manager IPL Status	C-26
4111	Bus Manager IPL Status	C-26
4112	Bus Manager IPL Status	C-26
4113	Bus Manager IPL Status	C-26
4114	Bus Manager IPL Status	C-26
4115	Bus Manager IPL Status	C-26
4117	Bus Manager IPL Status	C-26
4118	Bus Manager IPL Status	C-26
4119	Bus Manager IPL Status	C-26
412A	Bus Manager IPL Status	C-27
4121	Bus Manager IPL Status	C-26
4122	Bus Manager IPL Status	C-26
4123	Bus Manager IPL Status	C-26
4124	Bus Manager IPL Status	C-27
4125	Bus Manager IPL Status	C-27
4127	Bus Manager IPL Status	C-27
4128	Bus Manager IPL Status	C-27
4129	Bus Manager IPL Status	C-27
4205	Storage Management IPL Status	C-27
4210	Storage Management IPL Status	C-27
4220	Storage Management IPL Status	C-27
4230	Storage Management IPL Status	C-27
4240	Storage Management IPL Status	C-27
4250	Storage Management IPL Status	C-27
4260	Storage Management IPL Status	C-27
4270	Storage Management IPL Status	C-28
4275	Storage Management IPL Status	C-28
4280	Storage Management IPL Status	C-28
4300	CCIOM IPL Status	C-28
4301	CCIOM IPL Status	C-28
4302	CCIOM IPL Status	C-28
4303	CCIOM IPL Status	C-28
4304	CCIOM IPL Status	C-28
4305	CCIOM IPL Status	C-28
4306	CCIOM IPL Status	C-28
4307	CCIOM IPL Status	C-28
50FF	DST Status	C-30
5001	DST Status	C-28
5002	DST Status	C-29
5003	DST Status	C-29
5004	DST Status	C-29
5010	DST Status	C-29
5082	DST Status	C-29
5083	DST Status	C-29
5090	DST Status	C-29
5091	DST Status	C-29
5100	Bus Manager Machine Check	C-30
5101	Bus Manager Machine Check	C-30
5102	Bus Manager Machine Check	C-30
5103	Bus Manager Machine Check	C-30
5104	Bus Manager Machine Check	C-30
5105	Bus Manager Machine Check	C-30
5106	Bus Manager Machine Check	C-30
5107	Bus Manager Machine Check	C-31
5108	Bus Manager Machine Check	C-31
5109	Bus Manager Machine Check	C-31
5110	Bus Manager Machine Check	C-31
5111	Bus Manager Machine Check	C-31

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SRC	Description	Page
5112	Bus Manager Machine Check	C-31
5126	CCIOM Machine Check	C-31
5151	IPCF Machine Check	C-31
520A	I/O Processor Failure	C-33
520B	I/O Processor Failure	C-33
520C	I/O Processor Failure	C-33
520D	I/O Processor Failure	C-33
520E	I/O Processor Failure	C-33
520F	I/O Processor Failure	C-33
5200	I/O Processor Failure	C-32
5201	I/O Processor Failure	C-32
5202	I/O Processor Failure	C-32
5203	I/O Processor Failure	C-32
5204	I/O Processor Failure	C-32
5205	I/O Processor Failure	C-32
5206	I/O Processor Failure	C-32
5207	I/O Processor Failure	C-32
5208	I/O Processor Failure	C-32
5209	I/O Processor Failure	C-33
5210	I/O Processor Failure	C-33
5211	I/O Processor Failure	C-34
5212	I/O Processor Failure	C-34
5213	I/O Processor Failure	C-34
5214	I/O Processor Failure	C-34
5215	I/O Processor Failure	C-34
5216	I/O Processor Failure	C-34
5217	I/O Processor Failure	C-34
5218	I/O Processor Failure	C-34
5219	I/O Processor Failure	C-35
5220	I/O Processor Failure	C-35
5221	I/O Processor Failure	C-35
5222	I/O Processor Failure	C-35
5223	I/O Processor Failure	C-35
5240	I/O Processor Failure	C-35
5241	I/O Processor Failure	C-35
5242	I/O Processor Failure	C-35
5243	I/O Processor Failure	C-36
5244	I/O Processor Failure	C-36
5245	I/O Processor Failure	C-36
5246	I/O Processor Failure	C-36
5247	I/O Processor Failure	C-36
5248	I/O Processor Failure	C-36
5249	I/O Processor Failure	C-36
5260	I/O Processor Failure	C-36
5261	I/O Processor Failure	C-37
5262	I/O Processor Failure	C-37
5270	I/O Processor Failure	C-37
5271	I/O Processor Failure	C-37
5272	I/O Processor Failure	C-37
5273	I/O Processor Failure	C-37
5274	I/O Processor Failure	C-37
6001	Stand-Alone Utilities	C-38
6002	Stand-Alone Utilities	C-38
6003	Stand-Alone Utilities	C-38
6004	Stand-Alone Utilities	C-38
6005	Stand-Alone Utilities	C-38
6006	Stand-Alone Utilities	C-38
6007	Stand-Alone Utilities	C-38
6008	Stand-Alone Utilities	C-38
6009	Stand-Alone Utilities	C-38
6010	Stand-Alone Utilities	C-39
6011	Stand-Alone Utilities	C-39
6030	Stand-Alone Utilities	C-39
6041	Stand-Alone Utilities	C-39
6042	Stand-Alone Utilities	C-39

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SRC	Description	Page
6043	Stand-Alone Utilities	C-39
6048	Stand-Alone Utilities	C-39
6049	Stand-Alone Utilities	C-39
6050	Stand-Alone Utilities	C-39
6051	Stand-Alone Utilities	C-39
6052	Stand-Alone Utilities	C-39
6101	Stand-Alone Utilities	C-39
6102	Stand-Alone Utilities	C-40
6103	Stand-Alone Utilities	C-40
6104	Stand-Alone Utilities	C-40
6105	Stand-Alone Utilities	C-40
6106	Stand-Alone Utilities	C-40
6107	Stand-Alone Utilities	C-40
6108	Stand-Alone Utilities	C-40
6109	Stand-Alone Utilities	C-40
6110	Stand-Alone Utilities	C-41
6111	Stand-Alone Utilities	C-41
6112	Stand-Alone Utilities	C-41
6113	Stand-Alone Utilities	C-41
6114	Stand-Alone Utilities	C-41
6115	Stand-Alone Utilities	C-41
6116	Stand-Alone Utilities	C-41
6117	Stand-Alone Utilities	C-41
6118	Stand-Alone Utilities	C-41
6119	Stand-Alone Utilities	C-42
6120	Stand-Alone Utilities	C-42
6121	Stand-Alone Utilities	C-42
6122	Stand-Alone Utilities	C-42
6123	Stand-Alone Utilities	C-42
6124	Stand-Alone Utilities	C-42
6125	Stand-Alone Utilities	C-42
6126	Stand-Alone Utilities	C-42
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6983	I/O Hardware Error	C-55
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Glossary of Terms and Abbreviations

This glossary includes terms and definitions from the *ISO Vocabulary—Information Processing* and the *ISO Vocabulary—Office Machines*, developed by the International Organization for Standardization, Technical Committee 97, Subcommittee 1. Definitions of published segments of the vocabularies are identified by the symbol (I) after the definition; definitions from draft international standards, draft proposals, and working papers in development by the ISO/TC97/SC1 vocabulary subcommittee are identified by the symbol (T) after the definition, indicating final agreement has not yet been reached among participating members.

A

AAM. Assign alternate message.

abbr. Abbreviated.

abbreviated installation. A process in which the verification and error recovery part of installation is done without restoring the saved version of the operating system. Contrast with *normal installation*.

abnormal end. A system failure or operator action that causes a job to end unsuccessfully.

abstract. A part of an APAR that summarizes a problem.

AC. APPC component of OS/400.

access [n]. To read; the ability to use or read.

access method. A method used to read a record from, or to write a record into a file. Access can be sequential (records are referred to one after another in the order in which they appear in the file), it can be random (the individual records can be referred to in any order), or it can be dynamic (records can be accessed sequentially or randomly, depending on the specific request).

access path. The order that records in a database file are organized for processing by a program. See *arrival sequence access path* and *keyed sequence access path*.

acknowledgment. Positive response to a data transmission.

acknowledgment (ACK) character. (1) (BSC) The BSC transmission control character that is sent as a positive response to a data transmission. See also *ACK0* and *ACK1*. (2) (RJE) A transmission control character *sequence* that is sent as a positive response to a data transmission.

ACK0. The even-numbered, positive acknowledgment character, which indicates that text was received without transmission errors. See *acknowledgment (ACK) character*.

ACK1. The odd-numbered, positive acknowledgment character, which indicates that text was received without transmission errors. See *acknowledgment (ACK) character*.

across IPLs. From one type of IPL to another.

ACQ. Available CRE queue.

acquire. To assign a display station or session to a program.

active record. Any record format that is currently displayed or an active subfile record. In a database file, a nondeleted record.

activity level. A characteristic of main storage or of the processing unit that specifies the maximum number of jobs that can run at the same time in the main storage or in the processing unit.

adapter. (1) A part that electrically or physically connects a device to a computer or to another device. (2) A device for attaching parts, for example, parts having different diameters or voltages.

address. (1) The location in the storage of a computer where particular data is stored. Also, the numbers that identify such a location. (2) In data communications, the unique code assigned to the location of each device or system connected in a network. (3) The second part of a two-part user identification used to send distributions. See also *user ID/address*.

addressing. (1) In data communications, the way that the sending or control station selects the station to which it is sending data. (2) A method of identifying storage locations.

adjust. To move text so that it fits between the defined left and right margins or between the first and last typing lines.

all object authority. A special authority that allows users to use all system resources without having specific authority to the resources. See also *save system authority*, *job control authority*, *security administrator authority*, *service authority*, and *spool control authority*.

ADT. Application development tools.

advanced peer-to-peer networking (APPN). Data communications support that routes data in a network between two or more APPC systems that are not directly attached.

advanced printer function (APF). A function of the Application Development Tools (ADT) licensed program that allows a user to design symbols, logos, special characters, large characters, and forms tailored to a business or data processing application, and supports printing of any design on the 5224 or 5225 dot matrix printer.

advanced program-to-program communications (APPC). Data communications support that allows programs on an AS/400 system to communicate with programs on other systems having compatible communications support. APPC is the AS/400 method of using the SNA LU session type 6.2 protocol.

AER. Asynchronous error report.

| **AFP**. Advanced function printer.

| **AFPDS**. Advanced function printer data stream.

AG. Access group.

AGMDE. Access group member directory entry.

AGTOC. Access group table of contents.

AI. Activation or invocation component.

AL. Alerts in network management component.

ALE. Address list element.

alert. A record sent to a focal point to identify a problem or an impending problem.

alert controller description. The alert receiver system specified on the Change Network Attributes (CHGNETA) command by the ALRCTLD parameter that collects and processes the alerts.

alias. An alternative name used by a high-level language program to identify (file definition) an object.

allocate. To reserve (lock) a resource for use in performing a specific task. Contrast with *deallocate*.

alphameric. Pertaining to the letters, A-Z; numbers, 0-9; and special symbols, $, #, @, ., or _. Synonymous with *alphanumeric*.

alphanumeric. Pertaining to the letters, A-Z; numbers, 0-9; and special symbols, $, #, @, ., or _. Synonymous with *alphameric*.

alternative console. A display device assigned by DST to function as the console if the console is not working. OS/400 does not use an alternative console.

American National Standard Code for Information Interchange (ASCII). The code developed by American National Standards Institute for information exchange among data processing systems, data communications systems, and associated equipment. The ASCII character set consists of 7-bit control characters and symbolic characters, plus one parity-check bit.

AOB. Address operation block.

AP. Access path.

APAR. See *authorized program analysis report (APAR)*.

APF. See *advanced printer function*.

API. Application program interface.

APPC. See *advanced program-to-program communications (APPC)*.

application. A particular business task, such as inventory control or accounts receivable.

application program. A program used to perform a particular data processing task such as inventory control or payroll.

application program interface. A functional interface supplied by the operating system or a separately orderable licensed program that allows an application program written in a high-level language to use specific data or functions of the operating system or the licensed program.

APPN. See *advanced peer-to-peer networking (APPN)*.

APT. Application programming tools.

AR. 5251 reliability, availability, serviceability.

argument. (1) An independent variable. (2) Any value of an independent variable, for example, a search key; a number identifying the location of an item in a table. (3) A parameter passed between a calling program and a called program.

arithmetic comparison. A comparison of signed numeric values. See also *bit comparison*, *character comparison*.

array. (1) (RPG/400) A series of elements with like characteristics. An array can be searched for a uniquely identified element, or elements in an array can be accessed by their position relative to other elements. Contrast with *table*. (2) (BASIC) A named set of data items, all of which are of the same type, arranged in a pattern (for example, rows and columns). An array can be implicitly declared through use or explicitly declared in a DIM statement. Contrast with *scalar*. (3) (PL/I) A collection of one or more elements with identical characteristics, grouped into one or more dimensions.

arrival sequence access path. An access path to a database file that is arranged according to the order in which records are stored in the physical file. See also *keyed sequence access path* and *access path*.

AS/400 Business Graphics Utility (BGU). The IBM licensed program that can be used to design, plot, display, and print graphics.

AS/IS. Address stop/instruction step.

ASC. Area Support Center.

ASCII. See *American National Standard Code for Information Interchange (ASCII).*

ASDE. Auxiliary storage directory entry.

ASM. Auxiliary storage management.

ASMPL. Auxiliary storage management parameter list.

ASP. See *auxiliary storage pool.*

assumed value. A value supplied by the system when no value is specified by the user.

Async. See *asynchronous.*

asynchronous. (1) Not occurring in a regular or predictable pattern. (2) Without regular time relationship.

asynchronous I/O. A series of input/output operations that are being done separately from the job that requested them.

asynchronous processing. A series of operations that are done separately from the job in which they were requested; for example, submitting a batch job from an interactive job at a work station. Contrast with *synchronous processing.*

attribute. A characteristic or property of one or more objects.

AU. Authority component.

audit trail. Data in the form of a chronological path linking a sequence of events that allows the system to trace the transactions that have affected the contents of a record, such as a customer account or item record.

AUT. Authorized user table.

authority checking. A function of the system that looks for and verifies a user's authority to an object.

authority holder. An object that specifies and reserves an authority to a program-described database file before the file is created. When the file is created, the authority specified in the holder is linked to it.

authorization list. A list of two or more user IDs and their authorities for system resources.

authorized program analysis report (APAR). A request for correction of a defect in a current release of an IBM-supplied program.

automatic configuration. The process of letting the system provide the name and configure the local devices and controllers.

automatic vary on. An option specified during the creation of configuration objects that allows them to be available when the system is started (IPL).

auxiliary storage. All addressable storage other than main storage.

auxiliary storage pool. A group of disk units defined from the auxiliary storage devices. Abbreviated ASP. See also *system ASP* and *user ASP.*

B

B. 6-byte register.

backup. Pertaining to an alternative copy used as a substitute if the original is lost or destroyed.

BART. BSC automactic recovery task.

BAS. See *BASIC.*

base. The numbering system in which an arithmetic value is represented.

base pool. A storage area that contains all unassigned main storage on the system and whose minimum size is specified in the system value QBASPOOL. The system-recognized identifier is *BASE.

based variable. A variable that provides attributes for data (such as data located in a buffer) for which the storage address is provided by a pointer. It does not identify a fixed location in storage.

BASIC (beginner's all-purpose symbolic instruction code). A programming language with a small list of commands and a simple syntax, primarily designed for numeric applications.

basic characters. Frequently used double-byte characters that are stored in the hardware of a DBCS device. The number of double-byte characters that are stored in the device varies with the language supported and the storage size of the device. A DBCS device can display or print basic characters without using the extended character processing function of the operating system. Contrast with *extended characters.* See also *extended character processing.*

basic telecommunications access method (BTAM). A System/370-type access method that permits read or write communications with remote devices.

batch. Pertaining to a group of jobs to be run on a computer sequentially with the same program with little or no operator action. Contrast with *interactive.*

batch job. A predefined group of processing actions submitted to the system to be performed with little or no interaction between the user and the system. Contrast with *interactive job.*

BCB. See *block control byte.*

BCC. See *block-check character* (BCC).

BCU. See *bus control unit*.

| **BED**. Bus extension drivers.

| **BER**. Bus extension receivers.

BEU. Bus extension unit.

BGU. See *AS/400 Business Graphics Utility (BGU)*.

BID. (1) Byte identifier. (2) (SNA) A command used to request permission to start a bracket. (3) (BSC) A protocol exchange in preparation for sending and receiving data. The sending station sends an ENQ character and the receiving station acknowledges receipt of the ENQ character by sending an ACK0 control character.

binary. (1) (ISO) Pertaining to a selection, choice, or condition that has two possible values. (2) A numbering system with a base of two (0 and 1).

binary format. Representation of a decimal value in which each field must be 2 or 4 bytes long. The sign (+ or -) is in the far left bit of the field, and the number value is in the remaining bits of the field. Positive numbers have a 0 in the sign bit and are in true form. Negative numbers have a 1 in the sign bit and are in twos complement form.

binary synchronous communications (BSC). A data communications line protocol that uses a standard set of transmission control characters and control character sequences to send binary-coded data over a communications line. Contrast with *synchronous data link control (SDLC)*.

bit. Either of the binary digits, 0 or 1. Compare with byte.

bit comparison. A left-to-right, bit-by-bit comparison of binary values. See also *arithmetic comparison*, *character comparison*.

bit string. A series of bits consisting of the values 0 and 1.

bit value. A sequence of binary numbers stored in consecutive bits.

block. (1) A group of records that are recorded or processed as a unit. (2) A set of adjacent records stored as a unit on a disk, diskette, or magnetic tape. (3) In data communications, a group of records that are received, processed, or sent as a unit. (4) A sequential group of statements (defined using line commands) that are processed as a unit. (5) (OfficeVision/400) A sequential string of text (defined using cursor movement keys or line commands) that is processed as a unit. (6) (COBOL) A unit of data that is moved into or out of the computer storage. (7) (PL/I) A sequence of statements, processed as a unit, that specify the scope of names and the allocation of storage for names declared within it. Contrast with *do group*.

block control byte (BCB). Multileaving telecommunications access method, a control character used for transmission block status and sequence count.

block-check character (BCC). The BSC transmission control character that is used to determine if all of the bits that were sent were also received.

BOM. Break offset mapping.

BPR. Base pointer register.

branch instruction. An instruction that changes the sequence of instructions processed in a computer program. The sequence of instructions continues at the address specified in the branch instruction.

breakpoint. A place in a program (specified by a command or a condition) where the system stops the processing of that program and gives control to the display station user or to a specified program.

BR0. Base register zero.

| **BS**. BSC (binary synchronous communications) support or
| byte string space management

BSC. See *binary synchronous communications (BSC)*.

BSCEL (binary synchronous communications equivalence link) support. The system support that provides BSC communication with another AS/400 system and many other BSC computers and devices.

BSCT. Binary synchronous communications terminal.

BSM. Basic storage module.

BSTAT. Basic status.

BTAM. See *basic telecommunications access method (BTAM)*.

| **bus control unit**. The IOBU responsible for the control and
| error recovery of an I/O bus. There is one BCU for each
| I/O bus and the system processor controls each BCU.

business graphics. See *graphics*.

Business Graphics Utility (BGU). See *AS/400 Business Graphics Utility (BGU)*.

byte. A group of eight adjacent bits. In the EBCDIC coding system, one byte can represent a character. In the double-byte coding system, two bytes represent a character.

C

C & SM. See *communications and systems management (C & SM)*.

CA. Command analyzer.

cache. A fixed area of main storage, reserved for the user, that is continually updated with the most recently used disk data.

call. (1) To transfer control to a specified closed subroutine or program. (2) To try or attempt to establish communications.

call level. The position of a program in a nest of programs called explicitly by the CALL instruction or implicitly by some event. The first program has a call level of 1. Any program called by a level 1 program has a call level of 2, and so on.

CALNDR. Calendar.

card. A plug-in circuit module.

card [n]. A plug-in circuit module.

CAT. Concatenation or control address table.

CB. Control block.

CBL. See *COBOL*.

CC. Confidence checker, condition code, computation and control.

CCIOM. Common class input/output manager.

CCPF. Common customer profile facility.

CD. Controller description, control unit description, or command definition.

| **CDCB**. Control unit control block.

| **CDINIT**. Cross domain initiate.

CDO. Command definition objects.

CE area. The name of an area on disk used for analyzing hardware.

CF. Common function.

CGU. See *character generator utility (CGU)*.

chain. (1) A group of logically linked records. (2) A character set on an impact printer. (3) (DFU) A way to change from one display format to another after the user signals that the first display format was completed. (4) (BASIC) An operation in which a program passes control to another program then ends. (5) (RPG/400) An operation code that reads input records identified by specified relative record numbers or keys. (6) (SNA) A group of logically linked records that are transferred over a communication line. See RU chain.

chaining. A method of storing records in which each record belongs to a list or group of records and has a linking field for tracing the chain.

character. Any letter, number, or other symbol in the data character set that is part of the organization, control, or representation of data.

character comparison. A left-to-right, character-by-character comparison according to the collating sequence. See also *arithmetic comparison*, *bit comparison*.

character field. An area that is reserved for information that can contain any of the characters in the data character set. Contrast with *numeric field*.

character generator utility (CGU). A function of the Application Development Tools licensed program that is used to define and maintain user-defined double-byte characters and related sort information.

character key. A keyboard key that allows the user to type into the system the character shown on the key. See also *function key*.

character set. (1) A group of characters used for a specific reason; for example, the set of characters a printer can print or a particular set of graphic characters in a code page. (2) (COBOL) All the valid COBOL characters. (3) The 256 EBCDIC characters.

character string. (1) A sequence of consecutive characters consisting of any of the 256 EBCDIC characters that are used as a value. (2) (COBOL) A sequence of characters that form a COBOL word, a literal, a PICTURE character-string, or a comment-entry.

chart. Displayed, printed, or plotted output that compares two or more sets of variable data in chart form. The types of charts are bar, line, pie, surface, and text.

chart format. The arrangement of design characteristics, such as the chart type and the chart characteristics. The chart format does not include the data values to be plotted.

checksum. (1) The sum of a group of data associated with the group and used for checking purposes. (2) On a diskette, data written in a sector for error detection purposes; a calculated checksum that does not match the checksum of data written in the sector indicates a bad sector.

Note: The data are either numeric or other character strings regarded as numeric for the purpose of calculating the checksum.

checksum protection. A function that protects data stored in the system auxiliary storage pool from being lost because of the failure of a single disk. When checksum protection is in effect and a disk failure occurs, the system automatically reconstructs the data when the system program is loaded after the device is repaired.

checksum set. Units of auxiliary storage defined in groups to provide a way for the system to recover data if a disk failure occurs when checksum protection is in effect.

CI. OS/400 component for System/36 environment. Same as *EX*.

CL. See *control language (CL)*.

class of service. The priority level (high, medium, or low) assigned to the transmission groups and intermediate routing nodes included in an advanced peer-to-peer networking (APPN) session after the session is established. See also *class-of-service description*.

class-of-service description. A system object created for advanced peer-to-peer networking (APPN) that provides the information required to assign relative priority to the transmission groups and intermediate routing nodes for an APPN session.

CLEAR. A command used to delete all requests and responses related to the active session.

close. The function that ends the connection between a file and a program, and ends the processing. Contrast with *open*.

CLS. Class.

CM. Communication device.

CMC. Connection manager control.

CMD. Command.

CMPL. Compile.

CN. Control.

CO. Console or VLIC commit.

COBOL (common business-oriented language). A high-level programming language, based on English, that is used primarily for commercial data processing.

cold start. A process in which all temporary objects (objects created by the system after the operating system is installed) are deleted and created again as a group.

comm. Communication.

command. (1) A statement used to request a function of the system. A command consists of the command name, which identifies the requested function, and parameters. (2) (SNA) Any field set in the transmission header (TH), request header (RH), or a request unit that states an action or that starts a protocol.

command definition. An object that contains the definition of a command (including the command name, parameter definitions, and validity checking information) and identifies the program that performs the function requested by the command. The system-recognized identifier for the object type is *CMD.

command file. A remote job input stream that can contain host system commands and job control language (JCL), data, and RJE control statements (READFILE or EOF). Contrast with *data file*.

command line. The blank line on a display where commands, option numbers, or selections can be entered.

command processing program (CPP). A program that processes a command. This program performs some validity checking and processes the command so that the requested function is performed.

commit. To make all changes permanent that were made to one or more database files since the last commit or rollback operation, and make the changed records available to other users.

communications and systems management (C & SM). A part of the system that contains the remote management support (also referred to as DHCF), the change management support (referred to as DSNX), and the problem management support (referred to as alerts).

communications controller. The I/O processor card in the card enclosure.

communications line. The physical link (such as a wire or a telephone circuit) that connects one or more work stations to a communications control unit, or connects one control unit to another. Contrast with *data link*.

compatibility. Ability to work in the system or ability to work with other devices or programs.

compatible. Pertaining to the characteristics that make devices, programs, products, or systems work together.

compile. To translate a program written in a high-level programming language into a machine language program.

compiler. A program that translates programming language into machine language for use by the computer.

compiler listing. A printout that is produced by compiling a program or creating a file and that optionally includes, for example, a line-by-line list of the high-level language source, a cross-reference list, diagnostic information; and for programs, the description of the externally described files. See also *source listing*.

component. Software that is part of a functional unit.

compress. To replace repetitive characters in a file or folder with control characters so that the file or folder takes up less space when saved on diskette.

compression. A function that removes duplicate characters from the data being processed, and reduces the amount of storage space required for it. See also *decompression*.

computer graphics. The use of a computer to produce images of relationships, such as charts, and two- or three-dimensional drawings by means of dots, lines, curves, and so forth.

condition. An expression in a program for which a value is determined at run time. Conditions include the simple conditions (relational condition, class condition, condition-name condition, switch-status condition, sign condition) and the complex conditions (negated simple conditions, combined conditions, negated combined conditions).

conditional force. A function that replaces the specified control field character before the record is sorted only if the control field in the input record contains a particular entry.

CONFIG.PCS. The AS/400 PC Support configuration file. A personal computer file that allows a user to change AS/400 PC Support for business or personal requirements.

CONFIG.SYS. The personal computer configuration file. A personal computer file that contains the device assignments required for personal computer applications.

configuration. The arrangement of devices and programs that make up a data processing system. See also *system configuration*.

configuration list. (1) A list of local and remote locations and network addresses. (2) A list of connection numbers, addresses, or locations used by some types of communications configurations.

configure. (1) To describe the interconnected arrangement of the devices, programs, communications, and optional features installed on a system. (2) To describe setting up auxiliary storage pools and checksum protection.

confirm. In the calendar function, to change the status of a tentative appointment. A confirmed appointment can only be changed by the owner or a user authorized to the calendar.

| **CONLOSER**. Contention loser.

console. (1) A display station from which an operator can control and observe the system operation. (2) (COBOL) A function name associated with the operator's display station.

consumer transaction facility (CTF). A stand-alone finance device used to handle transactions for banking customers. Also called an automatic teller machine (ATM).

control block. A storage area used by a program to hold control information.

control field. (1) (RPG/400) One or more fields that are compared from record to record to determine when the information in the fields changes. When the information changes, the control level indicator (L1 through L9) assigned to a control field is set on. (2) (Sort) One or more specified fields that are compared to determine the record sequence in the output file.

control language (CL). The set of all commands with which a user requests system functions.

control panel. A panel located on the processing unit on the front of the rack that contains lights and switches to operate or service the system.

control point. A collection of tasks, which provide directory and route selection functions for advanced peer-to-peer networking (APPN). An end node control point provides its own configuration, session, and management services with assistance from the control point in its serving network node. A network node control point provides session and routing service.

control station. The controlling or primary computer on a multipoint line. The control station controls the sending and receiving of data.

control storage. Storage in the computer that contains the programs used to control input and output operations and the use of main storage. Contrast with *main storage*.

controller. A device that coordinates and controls the operation of one or more input/output devices (such as work stations) and synchronizes the operation of such devices with the operation of the system as a whole.

controller description. An object that contains a description of the characteristics of a controller that is either directly attached to the system or attached to a communications line. The system-recognized identifier for the object type is *CTLD.

controlling subsystem. The interactive subsystem that is automatically started first when the system is started and through which the system operator controls the system.

conversation. In interactive communications, the communication between the application program and a specific item (usually another application program) at the remote system.

| **CONWINNER**. Contention winner.

| **COS**. Class of service.

| **CP**. Copy or control point.

| **CPCB**. Control point control block.

CPP. See *command processing program (CPP)*.

| **CPPS**. Control point presentation services.

Glossary

CPU. Control processing unit, see *processing unit*.

CRC. Cyclic redundancy check.

CRE. Call or return element.

creation date. The system date when an object is created. See also *job date*, and *system date*.

CRT. Create.

CS. Control storage.

CSEH. Component-specific exception handler.

CSEHB. Component-specific event handler block.

CSP. Cross system product.

CSU. Channel service unit.

CTF. See *consumer transaction facility (CTF)*.

CTL. Control.

CTLD. See *controller description*.

CTX. Context.

CUD. Control unit description.

CUR. Cursor.

current device. The device being used for the application program, usually a display station.

current library. The library that is specified to be the first user library searched for objects requested by a user. The name for the current library can be specified on the Sign-On display or in a user profile. When you specify an object name (such as the name of a file or program) on a command, but do not specify a library name, the system searches the libraries in the system part of the library list, then searches the current library before searching the user part of the library list. The current library is also the library that the system uses when you create a new object, if you do not specify a library name.

cursor. A movable symbol, often a blinking or solid block of light, that tells the user where to type, or identifies a choice to select.

CUT. Configured unit table.

D

D/A. Display/alter.

D/A/D. Display/alter/dump.

DACTLU. A command used to end a session on a logical unit.

DACTPU. A command used to end a session on a physical unit.

DAF. See *destination address field (DAF)*.

DASD. Direct access storage device.

data area. A storage area used to communicate data such as CL variable values between the programs within a job and between jobs. The system-recognized identifier for the data area is *DTAARA.

database. The collection of all data files stored in the system.

database file. An object that contains descriptions of how input data is to be presented to a program from internal storage and how output data is to be presented to internal storage from a program. See also *physical file* and *logical file*.

data definition. Information that describes the contents and characteristics of a field, record format, or file. A data definition can include such things as field names, lengths, and data types. See also *field definition*, *file definition*, and *record format definition*.

data description specifications (DDS). A description of the user's database or device files that is entered into the system in a fixed form. The description is then used to create files.

data dictionary. An object for storing field, record format, and file definitions.

data file. (1) A collection of related data records organized in a specific order. (2) A file created by the specification of FILETYPE(*DATA) on the create commands. Contrast with *source file*. (3) (BASIC) The table containing the values from the DATA statements of a program. (4) (RJE) A remote job input stream that can contain host system commands and job control language as well as data. Contrast with *command file*.

data file utility (DFU). The part of the AS/400 Application Development Tools licensed program that is used to enter, maintain, and display records in a database file.

data item. (1) A unit of information to be processed. (2) (COBOL) A character or a set of consecutive characters (excluding literals in either case) defined as a unit of data by the COBOL program. (3) (FORTRAN) A constant, variable, or array element.

data link. The physical connection (communications lines, modems, controllers, work stations, and other communications equipment), and the rules (protocols) for sending and receiving data between two or more locations in a data network. Contrast with *communications line*.

data management. See *disk data management*.

data object. A program variable that provides operational and possibly representational characteristics to byte strings in spaces. Contrast with *machine object*.

data pointer. A pointer that provides addressability and scalar representational attributes to a byte string in a space.

data queue. An object that is used to communicate and store data used by several programs in a job or between jobs. The system-recognized identifier is *DTAQ.

data stream. All information (data and control commands) sent over a data link in a single read or write operation.

data structure. An area in storage that defines the layout of the fields, called subfields within the area. A data structure can be either program-described or externally described.

data type. A characteristic used for defining data as numeric or character.

data value. A single data item entered as a horizontal line or vertical line value.

DB. Database.

DBASP. Database associated space.

DBCS. Double-byte character set.

DBCS font file. A system-supplied file that holds the 24x24 character images of one of the following groups of commonly used characters: 1) Japanese non-Kanji and basic-Kanji, 2) Korean non-Hangeul/non-Hanja, Hangeul, and a subset of Hanja, 3) Traditional Chinese non-Chinese and a subset of primary Chinese characters, or 4) all IBM-defined Simplified Chinese characters.

DBCS font table. A system-supplied table that holds either 24x24 or 32x32 character images of a double-byte character set. Japanese 24x24 font table holds Japanese extended Kanji and user-defined characters. Korean 24x24 font table holds a subset of Hanja and user-defined characters. Traditional Chinese 24x24 font table holds a subset of primary Traditional Chinese, all secondary Chinese, and user-defined characters. Simplified Chinese 24x24 font table holds user-defined characters. A 32x32 DBCS font table holds character images of a complete double-byte character set, including its user-defined characters.

DBIUT. Database in-use table.

DBRCVR. Database recovery object.

DC. Device configuration.

| **DCE**. Data circuit-terminating equipment.

DCO. Debug communications object.

DCT. Device configuration table.

DD. Data description.

DDM. See *distributed data management (DDM)*.

DDS. See *data description specifications (DDS)*.

DE. Diagnostic engineering.

deadlock. A standstill that occurs when several processes are waiting for a resource that will not become available because it is being held by another process that is in a similar wait condition.

deallocate. To release a resource that is assigned to a specific task. Contrast with *allocate*.

debug mode. An environment in which programs can be tested.

decompression. A function that exchanges control characters for actual data. See also *compression*.

dedicated system. A system intentionally reserved for a single job or task.

dedicated service tools (DST). The part of the service function used to service the system when the operating system is not working.

dedicated system. A system intentionally reserved for a single job or task.

default. A value automatically supplied or assumed by the system or program.

default [n]. A value automatically supplied or assumed by the system or program.

default network message queue. A message queue to which messages related to network activity are sent when either the user profile does not have a message queue specified or the message queue named in the user profile cannot be used.

default network output queue. An output queue to which spooled files are sent when either the user does not have an output queue specified or the output queue name in the user profile cannot be used.

default printer. A printer that is assigned to a system or user and accepts all the printed output from that system or user, if no other printer is specified.

default program. A user-specified program that is assumed when no other program is specifically named on a debug command, or a user-defined program for handling error messages.

default reply. A system-assigned reply to an inquiry or notify message, which is used when the message queue at which the message arrives is in default delivery mode.

Glossary

default value. A value supplied by the system that is used when no value is specified by the user, or the value specified by the user with the DFT keyword in DDS. See also *assumed value*.

definite response. A value in the response-requested field of the request header (RH). The value directs the receiver of the request to return a response unconditionally, whether positive or negative, to that request. Contrast with *exception response*.

delayed power off (DPO). A switch on the control panel used to power off the system when the Keylock switch is set to Manual position.

DENT. Data space entry.

dequeue. Taking an item off a queue.

destination address field (DAF). A field in a format identification 0 or format identification 1 transmission header that contains the network address of the destination. In a format identification 2 header, the field is called destination address field prime (DAF). Contrast with *origin address field (OAF)*.

detail report. A report that contains all the information produced by a query. Contrast with *summary report*.

DEVD. See *device description*.

device class. The generic name for a group of device types. For example, all display stations belong to the same device class. Contrast with *device type*.

device configuration. The process of creating configuration descriptors for the local and remote devices or equipment that make up a data processing system.

device description. Information describing a particular device that is attached to the system. The system-recognized identifier for the object type is *DEVD.

device emulation. The programming that allows one device to appear to the user or to a system as another device. See also *5250 emulation* and *3270 device emulation*.

device file. A file that contains a description of how data is to be presented to a program from a device or how data is to be presented to the device from the program. Devices can be display stations, printers, a diskette unit, tape units, or a communications line.

device type. The generic name for a group of devices. For example, 5219 for IBM 5219 Printers. Contrast with *device class*.

DF. Device file description.

DFT. Defective frame table.

DFU. See *data file utility (DFU)*.

DHCF. See *distributed host command facility (DHCF)*.

DIA. See *Document Interchange Architecture (DIA)*.

diagnostic. Pertaining to the detection and isolation of an error.

diagnostic aids. Logs, traces, dumps, messages, problem handling and service tools used to analyze and solve system problems.

diagnostic message. A message that contains information about errors or possible errors. This message is generally followed by an escape message.

DIB. Device information block.

digit. Any of the numerals from 0 through 9.

DIR. Database directory.

directory. A list of the files that are stored on a disk or diskette. A directory also contains information about the file, such as size and date of last change.

discovery. Something found or a finding.

disk. (1) A storage media made of one or more flat, circular sheets with magnetic surfaces on which information can be stored. (2) A direct-access storage medium with magnetically recorded data.

disk data management. The system programs that provide access to data, perform or monitor storage of data, and control input/output devices.

disk operating system. An operating system for computer systems that uses disks and diskettes for auxiliary storage of programs and data.

diskette file. A device file created by the user for a diskette device.

displacement. The distance from the beginning of a record, block, or segment to the beginning of a particular record.

display area. For double-byte character set support, the area that is used to display the character currently being defined or changed.

display image. In 3270 emulation, the 1920-character block that contains data in the sequence in which it would appear on the display screen or the printer. The user can specify the screen image with or without field definitions, such as position, length, and other attributes, when creating the BSC file. Do not call this a screen image.

display screen. The part of the display device, which is similar to a television (TV) picture tube, used to display information entered or received at a work station.

display station. A device that includes a keyboard from which an operator can send information to the system and a display screen on which an operator can see the information sent to or the information received from the system.

display station pass-through. A communications function that allows a user to sign on to one system (either an AS/400 system, System/38, or System/36) from another system (either an AS/400 system, System/38, or System/36) and use that system's programs and data. Sometimes called pass-through.

distributed data management (DDM). A function of the operating system that allows an application program or user on one system to use data files stored on remote systems. The systems must be connected by a communications network, and the remote systems must also be using DDM.

distributed host command facility (DHCF). A function of the operating system that supports the data link between a System/370 terminal using an AS/400 application in an Host Command Facility (HCF) environment.

distributed systems node executive (DSNX). A function of the operating system that receives and analyzes requests from the NetView Distribution Manager licensed program on a host system. If the request is directed to the system that receives it, the request is processed on that system or on a personal computer directly attached to that system. If the request is intended for a different system, it is routed toward its destination.

distribution list. A list of system distribution directory entries, which allows users to send messages, notes, and documents to a group of users in one step.

distribution queue. A list of documents or mail waiting to be sent to users or libraries on remote systems.

distribution services. The support provided by the operating system to receive, forward, and send electronic mail in an SNA network.

DKT. Diskette.

DLC. Data link control.

| **DLU**. Destination logical unit.

DM. Data management (OS/400) or DASD management (VLIC).

DMA. Direct memory access.

DMCQ. Data management communications queue.

DMS. Diskette header identifier for main storage dump.

DO. Machine observation.

do group. (1) A set of commands in a control language program defined by a DO command and an ENDDO command that is conditionally processed as a group. (2) (RPG/400) A group of calculations done one or more times based on the results of comparing factor 1 and factor 2 of certain calculation operations (for example, DOUXX). A DO operation and an END operation are the delimiters for a do group. (3) (PL/I) A sequence of statements, run as a unit, that may be processed several times, once, or not at all. Contrast with *block*.

DOC. Document or documentation.

Document Interchange Architecture (DIA). The rules and structure for the exchange of information between office applications. Document interchange architecture includes document library services and document distribution services.

document list. A grouping of filed documents that have common characteristics. The document list identifies which documents satisfy a search pattern specified by an office user at the time the search is used. The system-recognized identifier for a document list is *DOCL.

documentation. (1) The management of documents, which may include the actions of identifying, acquiring, processing, storing, and disseminating them. (2) A collection of documents on a given subject. (3) The aids provided for understanding the structure and intended uses of an information system or its components, such as flowcharts, textual material, dumps, computer printouts, messages, and manuals.

dot matrix. (1) In computer graphics, a two-dimensional pattern of dots used for designing an image on the display. (2) In word processing, a pattern of dots used to form characters. See also *picture element*.

double-byte character set (DBCS). A set of characters in which each character is represented by 2 bytes. Languages such as Japanese, Chinese, and Korean, which contain more symbols than can be represented by 256 code points, require double-byte character sets. Because each character requires 2 bytes, typing, displaying, and printing DBCS characters requires hardware and supporting programs that are DBCS-capable.

downline. Pertaining to devices that are below a controller, and controllers that are below a communications line in a communications configuration. Contrast with *upline*.

DP. Data pointer.

DPO. See *delayed power off (DPO)*.

DR. (1) Diskette repair. (2) See *definite response*.

draft. A printed copy of a document that is not yet a finished version.

DRQ. Distribution recipient queue.

DS. Data space, descriptor space, or directory services.

DSA. Direct select address.

DSF. Display screen format.

DSI. Data space index.

DSID. Dump session ID.

DSNX. See *distributed systems node executive (DSNX)*.

DSPI. Data space index directory block.

DST. See *dedicated service tools (DST)*.

| **DSU**. Data service unit.

DTAARA. Data or dump area.

| **DTE**. Data terminal equipment.

DTO. Distribution tracking objects.

DUA. Dump useability area.

DUD. DASD unit descriptor.

dummy argument. A variable in a FUNCTION or SUBROUTINE statement or statement function definition that is associated with the actual arguments from the calling program or function reference.

dump. (1) To write, at a particular instant, all or part of the contents of main or auxiliary storage onto another data medium for the purpose of protecting the data or collecting error information. (2) To copy data from main or auxiliary storage onto an external medium, such as tape, diskette, or printer.

dynamic. Occurring at run time, or during processing.

E

EAO. Effective address overflow.

EBCDIC. See *extended binary-coded decimal interchange code (EBCDIC)*.

EBCDIC character. Any one of the symbols included in the 8-bit EBCDIC set.

edit. (1) To interactively add, change, delete, or rearrange the data; for example, to insert or remove characters, sentences, or paragraphs, or to insert or remove characters in dates or decimal numbers. (2) To make changes to a document by adding, changing, or removing text.

edit description. A description of a user-defined edit code. The system-recognized identifier is *EDTD.

EDTD. Edit description.

EE. Work with error log. Contrast with EREP.

EF. Temporary, space.

ELA. Error log analysis.

ELEM. Element.

element. (1) In a list of parameter values, one value. (2) (RPG/400) (BASIC) The smallest addressable unit of an array or table.

ELI. Error log initialization.

ELOG. Error log.

EM. Event management.

emulation. Imitation of one system by another.

EN. Error notification record or end node.

end node. A node in an APPN network that can be a source or target node, but does not provide any routing or session services to any other node.

end-of-transmission (EOT) character. The BSC transmission control character used to end transmission with the remote system.

enqueue. Placing an item onto a queue.

EOB. End of block.

EOC. End operation complete latch.

EOE. End of extent.

EOF. End of file.

EOJ. End of job.

EOT. See *end-of-transmission (EOT) character*.

EOV. End of volume.

EPA. Encapsulated program architecture.

EPO. Emergency power off.

| **EPT**. Entry point table.

EQ. Equal or at the same value.

ERAP. See *error recording analysis procedure (ERAP)*.

EREP. Environmental recording, editing, and printing. Contrast with EE.

ERP. Error recovery procedure

error log. A record of machine checks, device errors, and tape or diskette statistics.

error recording analysis procedure (ERAP). An IBM-supplied program that processes and records errors related to the devices (disk, for example) of the system.

ES. Error status register.

escape message. A message that reports a condition that caused the program to end before the requested function was complete.

| **ETC**. Error recovery task control block.

ETT. ERP task table.

EVIDX. Event index.

EX. (1) Exception register. (2) Exception management. (3) See *exception response*.

EXC. Exception.

EXCB. Exception control block, execute index operation.

exception. (1) Something that does not conform to normal. (2) Something excluded.

exception response. A value in the form-of-response-requested field of a request header. The value requests the receiver to return a response only if the request is unacceptable as received or cannot be processed; that is, only a negative response can be returned. Contrast with *definite response*.

expiration date. (1) The date after which a diskette or tape file is no longer protected from being automatically deleted by the system. (2) The date after which a data-base file member should not be used.
(3) (OfficeVision/400) The date that an action item, a document, or a reference to a document should be deleted from the system by the user.

exponent. (1) A number, indicating to which power another number (the base) is to be raised. (2) In floating-point format, an integer constant specifying the power of ten by which the base of the decimal floating-point number is to be multiplied. (3) (COBOL) (PL/I) Exponentiation is indicated with the symbol ** followed by an exponent.

exponent (of an E-format number). An integer constant specifying the power of ten by which the base (mantissa) of the decimal floating-point number is to be multiplied.

expression. (1) (Query) A representation of a value with variables and constants appearing alone or in combination with operators. (2) (PL/I) A representation of a value; it can consist of constants, variables, and function references, along with operators or parentheses or both.

extended binary-coded decimal interchange code (EBCDIC). A coded character set of 256 eight-bit characters.

extended character processing. A function of the operating system that is required to make characters stored in a DBCS font file available to a DBCS device. Basic characters, which are stored in the device, do not require extended character processing. Extended characters, which are stored in a DBCS font table, require extended character processing before they can be displayed or printed. See also *basic characters* and *extended characters*.

extended characters. Double-byte characters that are stored in a DBCS font file, not in the hardware of a DBCS device. When displaying or printing extended characters, the device receives them from the DBCS font table under control of the extended character processing function of the operating system. Contrast with *basic characters*. See also *extended character processing*.

extent. The number of integers between and including the lower and upper bounds of an array.

external function. A function the compiler supplies when the program refers to the function by name. Contrast with *intrinsic function*.

external message queue. The part of the job message queue that sends messages between an interactive job and the work station user. For batch jobs, messages sent to the external message queue appear only in the job log.

external object. An object that has a defined object type (such as *FILE or *PGM). In general, external objects can be displayed by a user. See also *object*. Contrast with *internal object*.

external procedure. A procedure that is not contained within a block. Contrast with *internal procedure*.

external storage. Data storage not located in main or auxiliary storage, such as tape or diskette.

F

F. Fixed.

FACB. File available control block.

FAT. Function address table.

FB. Fixed block.

FBR. Feedback record.

FCB. File control block.

FDT. File description template.

FEL. Forced error logging.

FEOD. Force end of data.

FESN. Field engineering service number.

field. A group of related characters (such as name or amount) that are treated as a unit on a record.

field definition. (1) (IDDU) Information that describes the characteristics of data in a field. A field definition is contained in a data dictionary or in the file itself. (2) (DDS) Data description specifications that describe the characteristics of data in a field.

FIFO. First-in-first-out.

file. A generic term for the object type that refers to a database file, a device file, or a set of related records treated as a unit. The system-recognized identifier for the object type is *FILE.

file definition. (1) (RPG/400) File description and input specifications that describe the records and fields in a file. (2) (IDDU) Information that describes the contents and characteristics of a file. A file definition resides in a data dictionary.

file description. (1) The data description specifications that describe the file and its contents. (2) (AS/400 PC Support) A personal computer file that describes another personal computer data file. The description includes the name, data type, field length, and format of the data file. This information is used by the AS/400 PC Support transfer function to transfer data to the AS/400 system.

file name. (1) The name used by a program to identify a file. See also *label*. (2) (COBOL) A name associated with a file and defined in a file description entry or in a sort-merge file description entry.

file overrides. Attributes specified at run time that change the attributes specified in the file description or in the program.

fixed-length. Pertaining to a characteristic of a file in which all of the records are the same length.

floating-point. A mathematical notation in which a quantity of a number is shown as one number multiplied by a power of the number of the base.

FM. Function manager.

FMS. Folder management services.

FMT. File format.

FMWA. Function manager work area.

FN. Friend.

folder. A directory for documents. A folder is used to group related documents and to find documents by name. The system-recognized identifier for the object type is *FLR. Compare with *library*.

font. The size and shape of type; type style.

footer. One or more lines of text that prints at the bottom of every page of a document, such as a page number, the date, an outline heading, or the document ID. Contrast with *header*.

format. (1) A defined arrangement of such things as characters, fields, and lines, usually used for displays, printouts, files, or documents. (2) A group of related fields, such as a record, in a file. (3) The arrangement or layout of data on a storage medium, such as disk, tape, or diskette. (4) To set the block size for the 9332 Disk Unit, either automatically by the system or specifically by the user. (5) (BASIC) A representation of the correct form of a command or statement.

formatted data. Data that is transferred between main storage and an input/output device according to codes specified in a FORMAT statement. See also *list-directed data* and *unformatted data*.

forms control table (FCT). An object that contains the special processing requirements for output data streams received from a host system by a remote job entry facility (RJE) session. The system-recognized identifier for the object type is *FCT.

| **FQPCID**. Fully qualified procedure correlation identifier.

frame. The name of the basic unit of transmission for all data.

| **FRSN**. Flow reduction sequence number.

FRU. Failing replaceable unit.

| **FS**. File server

function. A procedure that has a RETURNS option in the PROCEDURE statement. A function ends by running a RETURNS (expression) statement and returning a scalar value to the point of call. Contrast with *subroutine*.

function code. A 1- through 3-character code that a user enters to tell the system to do some action in the calendar function. A 1- through 3-character code that a user enters to tell the system to do some action in the calendar function.

function key. A keyboard key that allows the user to select keyboard functions or programmer functions. Contrast with *character key*.

function subprogram. A user-written subprogram defined by FORTRAN statements, the first of which is a FUNCTION statement. See also *statement function* and *subroutine*.

functional unit. An entity of hardware, software, or both capable of accomplishing a specified purpose.

G

GD. Component for GDDM.

GDDM. See *graphical data display manager (GDDM)*.

GDS. Generalized data service.

general-purpose library. The library shipped with the system that contains IBM-provided objects required for many system functions and user-created objects that are not explicitly placed in a different library when they are created. Named QGPL.

generic. Relating to, or characteristic of, a whole group or class.

global. Pertains to information available to more than one program or subroutine.

graphical data display manager (GDDM). A function of the operating system that processes both text and graphics for output on a display, printer, or plotter.

graphics. (1) Pictures and illustrations. (2) Pertaining to charts, tables, and their creation. See *computer graphics*.

graphics symbol set. An object that can contain either lines or images. The system-recognized identifier for the object type is *GSS.

group data area. A data area that is automatically created when an interactive job becomes a group job. This data area is shared by all jobs in the group but cannot be used by jobs outside the group.

group job. One of up to sixteen interactive jobs that are associated in a group with the same work station device and user.

H

half-session. One of the locations in a logical connection in a network. See also *session*.

hardware. Physical equipment, rather than programs, procedures, rules, and associated information.

HDC. hardware data compression or decompression.

header. (1) One or more lines of text that prints at the top of a document. For example, the header could be the subject of the document, the date, the page number, an outline heading, or the document ID. Contrast with *footer*. (2) In disk management, the 8-byte portion of the 520-byte disk sector used by the operating system for control and access information.

hex. See *hexadecimal*.

hexadecimal. Pertaining to a numbering system with a base of 16.

hidden field. A field in a display file that is passed to and from the program but is not sent to the display.

high-level language (HLL). A programming language, such as RPG, CL, BASIC, PL/I, PASCAL, and COBOL, that translates computer programs in this language into several different machine codes.

history log. (1) A summary of the system activities, such as system and job information, device status, system operator messages and a record of program temporary fix (PTF) activity on the system. (2) A log named QHST that contains information about system status and jobs.

HLE. Header list element.

HLL. High-level language.

HLIC. See *horizontal licensed internal code (HLIC)*.

horizontal licensed internal code. Programming that defines logical operations on data. The licensed internal code is primarily sequential in processing, and supports the machine instruction set.

Host Command Facility (HCF). A feature available on a System/370, 43XX, and 30XX host system that enables a user on the host system to use applications on an AS/400 system or other systems as if they were using remotely attached 5250-type display stations. See also *distributed host command facility (DHCF)*.

host system. The primary or controlling computer in a communications network. See also *control station*.

HRM. Hardware resource manager.

HVVA. Hash verify virtual address.

I

I/O. See *input/output*.

I/O bus unit. Nickname for I/O processors and bus controllers. For example, IOPs and BCUs are both I/O bus units (IOBUs).

IAR. See *instruction address register (IAR)*.

IB. Instruction buffer.

IC. Insert cursor.

ICB. Invocation control block.

ICDM. Intersystem communications data management.

ICF. Intersystem communications function.

ICO. Installation communications object.

ICPF. Install control program facilities and/or install OS/400 process or function.

ID. Identifier or identification.

IDDU. See *interactive data definition utility (IDDU)*.

identifier. (1) A sequence of bits or characters that identifies a user, program, device, or system to another user, program, device, or system. (2) (COBOL) A data name that is unique or is made unique by the correct combination of qualifiers, subscripts, or indexes.
(3) (OfficeVision/400) A name that identifies the type of group member. (4) (PL/I) A single alphabetic character or a string of alphabetic characters, digits, and break characters that starts with an alphabetic character.

ideographic. Pertaining to 2-byte characters consisting of pictograms, symbolic characters, and other types of symbols.

IDL. Instruction definition list.

IDU. Interactive database utilities.

IDX. Index.

IFET. Instruction fetch.

II. Independent index.

IL. Instruction length.

ILC. Instruction length count.

image. An electronic representation of an original document recorded by a scanning device.

IMP. Internal microprogramming

IMPI. Internal microprogrammed instruction.

IMPIP. Internal microprogramming instruction processor.

implicit. Capable of being understood from something else, though unexpressed.

IMSG. IPL message.

IN. Installation.

INAUT. Install authority object.

include. See *data area*.

IND. Independent.

indirect user. A person enrolled as an OfficeVision/400 user who is authorized to handle mail but has no mail log. An indirect user receives printed mail only. Contrast with *direct user*.

INFCB. Inline file control block

index. (1) A structure that contains the key value and location of each record in an indexed file. (2) (COBOL) A computer storage position or register, the contents of which identify a particular element in a table.

indicator. (1) A 2-character code that is used by a program to test a field or record or to tell when certain operations are to be performed. (2) An internal switch used by a program to remember when a certain event occurs and what to do when the event occurs.

initial program. A user-profile program that runs when the user signs on and after the command processor program QCMD is started. QCMD calls the first program.

initial program load (IPL). The process that loads the system programs from the system auxiliary storage, checks the system hardware, and prepares the system for user operations.

initialize. To set the addresses, switches, or the contents of storage to zero, or to the starting value set by the manufacturer.

inline. Data included in the job stream.

INITSP. Install initial template space.

INOP. Inoperative.

input field. A field specified in a display file or database file that is used for data you supply. Contrast with *output field*.

input file. A file from which data is read while the program is running.

input/output. Data provided to the computer or data resulting from computer processing.

input/output processor (IOP). One or more circuits of an input/output controller that processes programmed instructions, and controls one or more input/output devices or adapters.

installation. The act or result of installing.

INSTR. See *instruction*.

instruction. (1) An order, usually to a person. (2) To teach or give information. (3) A statement that specifies an operation to be performed by the computer and the locations in storage of all data involved in that operation.

instruction address register (IAR). A register in the processor that contains the address of the next instruction to be processed.

intelligent printer data stream (IPDS). An all-points-addressable data stream that allows users to position text, images, and graphics at any defined point on a printed page.

interactive. Pertaining to the exchange of information between people and a computer. Contrast with *batch*.

interactive data definition utility (IDDU). A function of the operating system that can be used to externally define the characteristics of data and the contents of files.

interactive job. A job started for a person who signs on to a work station. Contrast with *batch job*.

interactive subsystem. A subsystem in which interactive jobs are processed.

interactive terminal facility (ITF). An asynchronous communications feature that allows an AS/400 system to communicate with applications that can send and receive data such as electronic mail, memos, library members, and data files.

interface. A shared boundary. An interface might be the hardware to connect two devices or it might be a part of main storage, or registers used by two or more computer programs.

internal object. An object that the system program uses to store the information needed to perform some system functions. Internal objects cannot be displayed by a user. For example, you cannot use a display command (like the Display Library [DSPLIB] command) to display internal objects. Contrast with *external object*.

internal procedure. A procedure that is contained within a block. Contrast with *external procedure*.

intrinsic function. (1) (BASIC) A function supplied by the BASIC licensed program. Contrast with *user-defined function*. (2) (FORTRAN) A function supplied by the compiler when certain operations are specified in a source statement. Contrast with *external function*.

invocation. (1) The activation of a program or procedure. (2) An execution of a program.

| **IOBU**. See *I/O bus unit*.

IOM. I/O manager.

IOP. See *input/output processor (IOP)*.

IORM. Input/output request message.

IOS. Object specific header

IP. Instruction pointer.

IPL. See *initial program load (IPL)*.

IPARMS. IPL parameters area.

IPAT. IMPI processor address table

IPCF. Inter-process communication facility.

IPDS. See *intelligent printer data stream (IPDS)*.

IRL. IPL recovery list.

IRP. Intermediate representation of a program.

IS. Instruction stream register.

IS/IB. Instruction step/instruction buffer registers

ISD. IBM Software Distribution.

IST. Internal symbol table.

ITF. See *interactive terminal facility (ITF)*.

IWA. Invocation work area.

IX. Indexing.

IXCB. Index control block.

J

JAR. Job APAR repository.

JMQ. Job message queue.

JMSGQ. Job message queue.

JO. Journal.

job control authority. A special authority that allows a user to: change, delete, display, hold, and release all files on output queues; hold, release, and clear job queues and output queues; start writers to output queues; hold, release, change, and end other users' jobs; change the class attributes of a job; end subsystems; and start (IPL) the system. See also *all object authority*, *save system authority*, *security administrator authority*, *service authority*, and *spool control authority*.

job date. The date associated with a job. The job date usually assumes the system date, but it can be changed by the user. See also *creation date* and *system date*.

job description. A system object that defines how a job is to be processed. The object name is *JOBD.

job log. A record of requests submitted to the system by a job, the messages related to the requests, and the actions performed by the system on the job. The job log is maintained by the system program.

job message queue. A message queue that is created for each job. A job message queue receives requests to be processed (such as commands) and sends messages that result from processing the requests. A job message queue consists of an external message queue and a set of program message queues. See also *external message queue* and *program message queue*.

job name. The name of the job as identified to the system. For an interactive job, the job is assigned the name of the work station at which the job was started; for a batch job, the name is specified in the command used to submit the job. Contrast with *qualified job name*.

job queue. A list of batch jobs waiting to be started or processed by the system. The system-recognized identifier for the object type is *JOBQ.

JOBD. See *job description*.

JOBQ. See *job queue*.

join logical file. A logical file that combines (in one record format) fields from two or more physical files.

journal. A system object used to record entries in a journal receiver when a change is made to the database files associated with the journal. The object type is *JRN. See also *journal receiver*.

journal receiver. A system object that contains journal entries recorded when changes are made to the data in database files or the access paths associated with the database files. The object type is *JRNRCV. See also *journal*.

JSD. Job structure dump.

JSQ. Job structure queue.

JTLB. Job temporary library.

Julian date. A date format that contains the year in positions 1 and 2, and the day in positions 3 through 5. The day is represented as 1 through 366, right-adjusted, with zeros in the unused high-order positions. For example, the Julian date for April 6, 1987 is 87096.

K

Kanji. Chinese characters used in Japanese written language.

key. (1) The value used to identify a record in a keyed sequence file. (2) (COBOL) A data item that identifies the location of a record, or a set of data items that is used to place data in ascending or descending sequence.
(3) (Crypto) A 64-bit value (containing 56 independent bits and 8 parity bits) used by the Data Encryption Algorithm to determine the output of the algorithm.

keyed sequence access path. An access path to a database file that is arranged according to the contents of key fields contained in the individual records. See also *arrival sequence access path* and *access path*.

keylock switch. A switch on the control panel that can be set to one of four different positions by turning it in either a clockwise or counterclockwise direction.

keyword. (1) A name that identifies a parameter. Keywords are used for parameter names in some CL commands. (2) (DDS) A name that identifies a function.
(3) (OfficeVision/400) A user-defined word used as one of the search values to identify a document during a search operation. (4) (RPG/400) A word whose use is essential to the meaning and structure of a statement in a programming language. (5) (PL/I) An identifier used in a defined context that takes on a specific meaning, such as an action to be taken or the attributes of data.

keyword functions. The result of processing DDS keywords in a record format specified on an operation. See also *operation*.

KJ. Kanji.

L

L/D. Load/dump.

label. (1) The name of a file on a diskette or tape. (2) An identifier of a command or program statement generally used for branching. (3) (RPG/400) A symbolic name that represents a specific location in a program. A label can serve as the destination point for one or more branching operations. (4) (BASIC) The name that identifies a BASIC program line. (5) (PL/I) An identifier that names a statement so that it can be referred to at some other point in the program.

LAN. Local area network.

| **LCB**. Locate control block.

LCG. Loadable code group.

LCRM. Loadable code resource manager.

LD. Load/dump.

LDA. Local data area.

LDCHDR. Load/dump common header.

LE. Less than or equal.

LED. Light-emitting diode or light.

LEN. Low-entry networking.

LG. Database logging.

LI. Librarian or log information.

LIB. See *library*.

library. (1) An object on disk that serves as a directory to other objects. A library groups related objects, and allows the user to find objects by name. Compare with *folder*.
(2) The set of publications for a system.

library list. A list that indicates which libraries are to be searched and the order in which they are to be searched. The system-recognized identifier is *LIBL.

library name. A user-defined word that names a library.

LIBRCVR. Library recovery object.

licensed internal code. An instruction or group of instructions located in storage or device controllers that controls the operation of a device or controller. Licensed internal code cannot be called by the control program or an application program.

licensed program. An IBM-written program that performs functions

LICTR. Licensed internal code trouble report.

LIFO. Last-in-first-out.

LID. Load ID.

LIND. Line description.

line. The physical path in data transmission.

line description. The description of a communications line to the system. The system-recognized identifier is *LIND.

line number. The number that precedes a line of information in a printout or on a display. This number can be up to five digits long, from 00001 through 99999. See also *sequence number*.

link. (1) (IDDU) To connect a data file on disk with a file definition in a data dictionary. Contrast with *unlink*. (2) (SNA) The combination of the link connection (the transmission medium) and two link stations (one at each end of the link connection). See also *link level*.

link level. The combination of the transmission connection, protocol, devices, and programming joining network nodes. (X.25) A part of Recommendation X.25 that defines the link protocol used to get data into and out of the network across the duplex line connecting the subscriber's equipment to the network.

link protocol. The rules for sending and receiving data at the link level.

LIOM. Line I/O manager.

list. A series of items.

list-directed data. Data that is transferred between main storage and an input/output device according to the length and type of variables in the input/output list. See also *formatted data* and *unformatted data*.

LLD. Low-level debug.

LLD functions. These functions are enabled at the control panel when the service processor stops because of a severe error.

LO. Local devices.

load. (1) To move data or programs into storage. (2) To place a diskette into a diskette unit. (3) To insert paper into a printer. (4) To put a tape reel or a tape cartridge into a tape unit.

local. Pertaining to a device, system, or file that is connected directly or read directly from your system, without the use of a communications line. Contrast with *remote*.

local area network (LAN). The physical connection that allows transfer of information among devices located on the same premises.

local data area. A 1024-byte data area that can be used to pass information between programs in a job. A separate local data area is automatically created for each job.

local work station. A work station that is connected directly to system without need for data transmission facilities. Contrast with *remote work station*.

logic. The systematized interconnection of digital switching functions, circuits, or devices.

logical file. A description of how data is to be presented to a program. This type of database file contains no data, but it defines formats for one or more physical files. See also *join logical file*. Contrast with *physical file*.

logical unit. One of three types of network addressable units that serve as a port through which a user accesses the communications network. Abbreviated LU. See also *physical unit*, and *system services control point (SSCP)*.

logical unit description. An internal machine object (*LUD) created at the same time as the device description (*DEVD), is created from a CRTDEVDSP command in the operating system. The LUD resides in VLIC; the DEVD in XXX.

LP. Protocols.

LPP. Licensed program products.

LSSD. Level sensitive scan design.

LT. Less than.

LU. See *logical unit*.

LUD. See *logical unit description*.

LUSTAT. A command used to send logical unit status information.

LVL. Level.

L2S. L-register control latch.

M

M. M-register.

MA. Maintenance analysis procedure attributes.

mach. Machine.

machine check. Device errors that cause the system to stop. A detected machine malfunction may result in an AER.

machine check exception. Device errors that are not severe enough to cause the system to stop.

machine interface (MI). The instruction set that tells the computer how to operate.

machine object. A program object that has no defined storage form; the object is defined internally to the machine. The machine aspect is not available to the user. Contrast with *data object*.

machine storage pool. A storage pool used by the machine and certain highly shared OS/400 programs, whose size is specified in the system value QMCHPOOL.

main storage. The part of the processing unit where programs are run. Contrast with *control storage*.

main storage dump space. A section of storage reserved on the disk device that is used as a place to save main storage for recovery and debugging.

main storage pool. A division of main storage, which allows the user to reserve main storage for processing a job or group of jobs, or to use the pools defined by the system. Contrast with *auxiliary storage pool*.

mainline module. A sequence of instructions called by a program in the main path after it is compiled.

maintenance analysis procedure (MAP). Written information used by IBM customer engineers and by service representatives to repair IBM equipment. A MAP contains yes/no questions and procedures that direct the user to the failing part of the equipment.

MAP. Maintenance analysis procedure.

mask. A pattern of characters that is used to control the keeping, deleting, or testing of portions of another pattern of characters.

master programming temporary fix index. An index created and used by the system to record the program temporary fix activity for each licensed program installed. Each index contains a record of all PTF activity for a licensed program since the last release. The user's record of PTF activity is recorded in the history log.

MATMATR. Materialize machine attributes.

matrix. An arrangement in rows and columns.

MC. Name resolution.

MCA. Machine communications area.

MCB. Member control block.

MCH. Machine.

MCHK. Machine check.

MCK. Machine check or device error.

MCK/W. Machine check/wait latches.

MCR. Machine configuration record.

MCSAR. Machine check control storage address register.

MDCO. Master debug communications object.

medium. The disk, tape, or diskette used to store information in a save or restore operation.

megabyte. A unit of measure for storage capacity; 1 megabyte = 1,048,576 bytes.

MEM. Database file member.

member. Different sets of data within one file.

merge. (1) To insert records throughout a single output file. (2) To combine overrides for a file from the first call level up to and including a greater call level, producing the override to be applied when the file is used.

message description. Information describing a particular message.

message file. An object that contains message descriptions. The system-recognized identifier for the object type is *MSGF.

message identifier. A seven-character code that identifies a predefined message, and is used to get the message description from a message file. See *predefined message*.

message line. An area on the display where messages are displayed.

message queue. A list on which messages are placed when they are sent to a person or program. The system-recognized identifier for the object type is *MSGQ.

MG. VLIC messages.

MH. Message handler.

MI. See *machine interface (MI)*.

MIA. Machine interface assembler.

microfiche. A photographic negative containing reduced images of pages of a document, arranged in a grid pattern.

MIRQ. Machine interface response queue.

mirror configuration. The configuration of disk units to give mirrored protection.

misc. Miscellaneous.

MISR. Machine initialization status record.

MLOG. Macro interface to VLOG services.

MM. Address management.

MN. Menu, context management.

MNTXT. Configuration menu text.

mode. The session limits and common characteristics of the sessions associated with advanced-program-to-program communications (APPC) devices managed as a unit with a remote location.

mode description. A system object created for advanced-program-to-program (APPC) devices that describes the session limits and the characteristics of the session, such as the maximum number of sessions allowed, maximum number of conversations allowed, the pacing value for incoming and outgoing request/response units, and other controlling information for the session.

modem. A device (modulator-demodulator) that converts data from the computer to a signal that can be sent over a communications line, and converts the communications signal to data for the computer.

module [n]. A packaged functional hardware unit designed for use with other components.

monitor. (1) A functional unit that observes and records selected activities for analysis within a data processing system. (2) Devices or programs that observe, supervise, control, or verify system operations.

monitor status word. This is a word of data from the bus control unit (BCU) and bus extended unit (BEU) that contain diagnostic information on I/O bus failures.

MP. Microprocessor.

MPC. Mirrored pair control block.

MPL. Multiprogramming level.

MPTFI. See *master programming temporary fix index*.

MRI. Machine readable instruction.

MRJE. See *multi-leaving remote job entry (MRJE)*.

MRK. Message reference key.

MRQ. Mirrored recovery queue.

MRT. Multiple requestor terminal program.

MS. Main storage, machine services control point.

MSC. Main storage control.

MSCP. Machine services control point.

MSCSP. Permanent miscellaneous space.

MSD. Main storage dump.

msec. Millisecond.

MSGF. Message file.

MSGQ. Message queue.

MSP. Main storage pool.

MSRVI. Master service index.

MSSD. Main storage stand-alone dump.

MSW. See *monitor status word*.

MTAM. See *multi-leaving telecommunications access method (MTAM)*.

MULIC. Model-unique licensed internal code

multileaving remote job entry (MRJE). The fully synchronized, two-directional transmission of a variable number of data streams between two computers using binary synchronous communications.

multileaving telecommunications access method (MTAM). The programming that allows the AS/400 system to use MRJE functions.

multivolume file. A file that occupies more than one diskette or tape.

MWC. Mirrored write control block.

MWS. Machine-wide storage.

N

N. Null.

N/A. Not applicable.

NA. Network architecture.

NCB. Native control block.

ND. See *network descriptor (ND)* or *line description*.

Glossary

NE. Not equal.

NEP. See *never-ending program (NEP)*.

NetView Distribution Manager. A licensed program available for IBM host systems (System/370, 43xx, and 30xx) that allows the host system to use, send, and delete files and programs in a network of computers.

network. A collection of data processing products connected by communications lines for exchanging information between stations.

network unit description (NUD). The machine instruction name for line description.

network node. A node that can define the paths or routes, control route selection, and handle directory services for APPN.

Network Problem Determination Application (NPDA). A licensed program that helps the user identify network problems from a central control point using interactive display techniques.

never-ending program (NEP). A long-running program that does not share system resources, except for shared files and the spooled file.

NG. Not greater than.

NIOM. Native I/O manager.

NL. Nonlabel, not less.

node. (1) One of the systems or devices in a network. (2) A location in a communications network that provides host processing services. (3) (X.25) A point where packets are received, stored, and forwarded to another location (or data terminal equipment) according to a routing method defined for the network. (4) (APPN) See *network node* and *end node*.

nonswitched line. A connection between computers or devices that does not have to be made by dialing. Contrast with *switched line*.

normal installation. A process in which the XXX contained on tape is installed in auxiliary storage, replacing the XXX (if any) that is currently in the system. Contrast with *abbreviated installation*.

not-a-number (NaN). In binary floating-point concepts, a value, not interpreted as a mathematical value, which contains a mask and a sequence of binary digits.

NPDA. See *Network Problem Determination Application (NPDA)*.

NRL. Name resolution list.

NRZI. Nonreturn to zero inverted.

NS. Nonstandard label.

NSI. Next sequential instruction.

NSS. National support systems.

NSSCAD. National support systems computer assisted dispatch.

nucleus. That part of a control program residing in main storage.

null. The name for an EBCDIC character that represents hex 00. See *null character*.

null character. The character hex 00, used to represent the absence of a displayed or printed character.

numeric field. An area that is reserved for a particular unit of information and that can contain only the digits 0 through 9. Contrast with *character field*.

NUT. Nonconfigured unit table.

O

OB. Operation block.

object. A named unit that consists of a set of characteristics (that describe the object) and, in some cases, data. An object is anything that exists in and occupies space in storage and on which operations can be performed, such as programs, files, libraries, and folders.

object authority. A specific authority that controls what a system user can do to an entire object. For example, object authority includes deleting, moving, or renaming an object. There are seven types of object authorities: object operational, object management, object existence, all, change, use, and exclude.

object definition table (ODT). A table built at compile time by the system to keep track of objects declared in the program. The program objects in the table include variables, constants, labels, operand lists and exception descriptions. The table resides in the compiled program object.

object description. The characteristics (such as name, type, and owner name) that describe an object.

object management authority. An object authority that allows the user to specify the authority for the object, move or rename the object, and add members to database files.

object name. The name of an object. Contrast with *qualified name*.

observable. Able to observe. For example, a program is observable if the MI instruction stream is displayable.

OCUR. Database operational cursor.

ODP. See *open data path*.

ODPCB. Open data path control block.

ODT. See *object definition table (ODT)*.

ODV. ODT directory vector.

OES. ODT entry string.

OFC. Office.

OFCB. Output file control block.

offline. Pertaining to the operation of a functional unit that is not under the continual control of the system. Contrast with *online*.

offset. (1) The distance from the beginning of an object to the beginning of a particular field, or for substring operations, the number of character positions from the beginning of a field. (2) (Graphics) The number of character grid units from a reference point. (3) (OfficeVision/400) The first page from a printed copy from the 6670 printer that sticks out from the remaining pages to separate one job from another.

OIR. Object information repository.

| **OLU**. Origin logical unit.

omit function. A system function that determines which records from a physical file are to be omitted from a logical file. Contrast with *select function*.

online. Pertaining to the operation of a functional unit that is under the continual control of the system. Contrast with *offline*.

online information. Information, read on the display screen, that explains displays, messages, and programs.

open. The function that connects a file to a program for processing. Contrast with *close*.

open data path. The path that handles all input/output operations for the file.

operand. A quantity of data that is operated on, or the address in a computer instruction of data to be operated on.

operating system. A collection of system programs that control the overall operation of a computer system.

operation. The result of processing statements in a high-level language. See also *keyword functions*.

operation code. (1) A code used to represent the operations of a computer. (2) (RPG/400) A word or abbreviation, specified in the calculation specifications, that identifies an operation.

ORB. Operation request block

ORE. Operation request element.

origin address field (OAF). A field in a format identification 0, or format identification 1, transmission header that contains the network address of the originating location. In a format identification 2 heading, the field is called origin address field prime (OAF'). Contrast with *destination address field (DAF)*.

OS. See *operating system*.

OSH. Object specific header.

OS/400-ICF. A file that describes different types of communications devices. This file allows an application program to do other work while the devices are sending or receiving data.

output. Information or data received from a computer that is shown on a display, printed on the printer, or stored on disk, diskette, or tape.

output field. A field specified in a display file or database file that is reserved for the information processed by a program. Contrast with *input field*.

output queue. An object that contains a list of spooled files to be written to an output device, such as a printer. The system-recognized identifier for the object type is *OUTQ.

OUTQ. See *output queue*.

overflow. (1) The condition that occurs when the last line specified as the overflow line to be printed on a page has been passed. (2) (COBOL) (BASIC) A condition that occurs when a portion of the result of an operation exceeds the capacity of the intended unit of storage.

overlay. (1) To write over (and therefore destroy) an existing file. (2) A program segment that is loaded into main storage and replaces all or part of a previously loaded program segment.

override. A value that replaces a previous value.

owner. The user who creates an object (or is named the owner of an object).

P

packet assembly/disassembly (PAD). A functional unit that enables data terminal equipment (DTE) not equipped for packet switching to use a packet-switched network.

pad. To fill unused positions in a field with dummy data, usually zeros or blanks. See also *packet assembly/disassembly (PAD)*.

PAD. See *packet assembly/disassembly (PAD)*.

PAG. See *process access group (PAG)*.

page. (1) A 512-byte block of information that can be moved between auxiliary storage and main storage. (2) Each group of records in a subfile that are displayed at the same time. (3) One printer form. (4) (Graphics) The picture or chart. All specified graphics are added to the current page. An output statement always sends the current page to the device. (5) To move information up or down on the display.

page fault. An error that occurs when a page that is marked as not in main storage is referred to by a page that is in main storage.

page-out. The process of moving a page from main storage to auxiliary storage.

paging. To move a page of data between main and auxiliary storage.

PAP. Product Application Program.

PAR. Problem analysis and resolution.

parameter. (1) A value supplied to a command or program that either is used as input or controls the actions of the command or program. (2) (COBOL) A variable or a constant that is used to pass values between calling and called programs.

parameter list. A list of values that provide a means of associating addressability of data defined in a called program with data in the calling program. It contains parameter names and the order in which they are to be associated in the calling and called program.

PASA. Program automatic storage area.

pass-through. See *display station pass-through*.

path. The sequence of directories, specified by the user, to search when DOS is looking for a program or data.

PC. Programming change, see *PTF*.

PCB. Process control block.

PCCR. Programming change control record.

| **PCID**. Procedure correlation identifier.

PCO. Process communications object.

PCS. Process control space.

PCSAS. Process control space associated space.

PD. Primary directory.

| **PDA**. Product definition area.

PDE. Primary directory entry.

PDEH. Problem determination exception handler.

PDM. See *programming development manager (PDM)*.

PDP. Problem determination procedure.

PDT. Process definition template.

PDTPLLSP. Process definition template/process lock list space.

pending. Waiting or undecided, as in an operation is pending. A request that was submitted and that is awaiting processing.

peer-to-peer networking. See *advanced peer-to-peer networking (APPN)*.

PEM. Program event monitor.

personal identification number (PIN). A unique number assigned by an organization to an individual and used as proof of identity. PINs are commonly assigned by financial institutions to their customers.

PG. Program management.

PGM. Program-external object.

physical file. A description of how data is to be presented to or received from a program and how data is actually stored in the database. A physical file contains one record format and one or more members. Contrast with *logical file*.

physical level (X.25). A standard that defines the electrical, physical, functional, and procedural methods used to control the physical connection between the data terminal equipment (DTE) and the data circuit-terminating equipment (DCE).

physical unit. One of three types of network addressable units. A physical unit exists in each node of an SNA network to manage and monitor the resources (such as attached links and adjacent link stations) of a node, as requested by an system services control point logical unit (SSCP-LU) session.

picture element. In computer graphics, the smallest element of a display area, such as a dot, that can be independently assigned color and intensity.

pin. A count of the number of times a page is marked in use. A page in use is held in main storage.

PIN. See *personal identification number (PIN)*.

PL/1. Programming language 1.

PL/I. A programming language designed for use in a wide range of commercial and scientific computer applications.

PLL. Process lock list.

PLMI. Programming language machine interface.

PLMP. Programming language machine product.

PLS. Permanent local storage.

PM. Process management.

PMCH. Processor machine check handler.

PN. See *printer*.

PNL. Printer name list.

PNRL. Process name resolution list.

point. The second byte of a (DBCS) code, which uniquely identifies double-byte characters in the same ward. Contrast with *ward*.

pool. A division of main or auxiliary storage. See also *base pool*, *storage pool*.

| **POR**. Power on reset.

port. (1) System hardware where the I/O devices are attached. (2) An access point (for example, a logical unit) for data entry or exit. (3) A functional unit of a node through which data can enter or leave a data network. (4) In data communication, that part of a data processor that is dedicated to a single data channel for the purpose of receiving data from or transmitting data to one or more external, remote devices.

post. (1) To add information in a record to keep that record current. (2) To note the occurrence of an event.

predefined message. A message whose description is created and stored in a message file before it is sent by the program. Contrast with *immediate message*.

power down. An AS/400 command to turn the power off and bring an orderly end to system operation.

PPR. Perform paging request.

PR. Program resolution monitor.

| **PRE**. Paging request element.

predefined value. A fixed value defined by IBM that has a special use in the control language and is reserved in OS/400. A predefined value usually has an asterisk (*) as the first character in the value.

primary logical unit. The logical unit that contains the primary half-session for a particular logical unit to logical unit session. See also *logical unit*. Contrast with *secondary logical unit*.

print file. A file created by the host system that is printed on your system.

print image. A character set that corresponds to the characters on the printer.

print queue. A list of output waiting to be printed by the system.

print text. An option that allows the user to specify a line of text at the bottom of a listing.

printer. A device that writes data from a computer on paper or other media.

printer file. A device file created by the user to support a printer device.

PRM. Program resolution monitor.

problem analysis. The process of finding the cause of a problem. For example, a program error, device error, or user error.

problem log. A record kept by the system of all errors detected by the machine or by the user.

problem management. The part of the Communications and Systems Management function (C & SM) that allows the system to create and send alerts to a host system using APPC.

procedure. (1) (COBOL) One or more successive paragraphs or sections within the Procedure Division, which direct the computer to perform some action or series of related actions. (2) A set of BASIC commands, BASIC statements, input data, and/or comments that causes a specific set of functions to be performed. (3) (PL/I) A block that can be activated from various points within a program by use of a CALL statement and can process data passed to it from the block in which it was called. See also *external procedure* and *internal procedure*.

procedure call level. See *procedure recursion level*.

procedure recursion level. The count that is increased when an internal procedure is called recursively. The procedure recursion level cannot be specified on the system debug commands, and only the last (most recent) procedure recursion level is available for debugging. Contrast with *program recursion level*.

process. A structure used as the basic work element above the MI. A TDE is its lowest structure.

process access group (PAG). A group of objects that is primarily paged in and out of storage in a single operation when a job (process) enters a long wait.

processing. The action of performing operations and calculations on data.

processing unit. The part of the system that performs instructions and contains main storage.

PROCT. MI operand code table.

PRODT. MI operand descriptor table.

profile. Data that describes the characteristics of a user, program, device, or remote location.

PROG. Program-machine interface.

program call level. See *program recursion level*.

program message queue. An object used to hold messages that are sent between program calls of a routing step. The program message queue is part of the job message queue.

program name. A user-defined word that identifies a COBOL source program.

program object. One of two machine object classifications. It includes those objects used in programs that get their definition from an object definition table. Program objects are used as the parameter or values of machine instructions. Contrast with *system object*.

program recursion level. The count that is increased when a program or external procedure is called repeatedly. The program recursion level can be specified on the system debug commands through the RCRLVL parameter. Contrast with *procedure recursion level*.

program stack. A list of programs linked together as a result of programs calling other programs with the CALL instruction, or implicitly from some other event, within the same job.

program temporary fix (PTF). A temporary solution to, or bypass of, a defect in a current release of a licensed program.

program variable. A named changeable value that can exist only within programs. Its value cannot be obtained or used when the program that contains it is no longer running.

programming development manager (PDM). A part of the Application Development Tools licensed program that allows users to perform several operations (such as copy, delete, and rename) from lists of libraries, objects, and members. The PDM also allows users to create and perform operations using user-defined options.

Programming Request for Price Quotation (PRPQ). A licensed program designed especially for a particular group of customers or an application. Documentation for the program is provided only to those customers who order the PRPQ. Compare with *Request for Price Quotation (RPQ)*.

prompt. (1) A reminder or a displayed request for information or user action. The user must respond to allow the program to proceed. (2) A list of values or a request for information provided by the system as a reminder of the type of information or action required.

protocol. A set of rules controlling the communication and transfer of data between two or more devices in a communications system.

PRPQ. See *Programming Request for Price Quotation (PRPQ)*.

PRS. Permanent restriction.

PRTIMG. See *print image*.

PSD. Print stand-alone dump.

PSI. Problem source identification.

PSP. Program service package.

PSSA. Program static storage area.

PT. Prompter.

PTF. See *program temporary fix (PTF)*.

PTR. (1) Program trouble report (2) Pointer.

pwr. Power control.

Q

Q. Queue, OS/400 module prefix.

QCHG. PTF log message queue.

QCL. See *QCMD*.

QCMD. The IBM-supplied control language processor that interprets and processes CL commands for the system.

QDAG. Composite piece—access group.

QDDS. Composite piece—data space.

QDDSI. Composite piece—data space index.

QDIDX. Composite piece—index.

QDPCS. Composite piece—process control space.

QDQ. Composite piece—queue.

QDSP. Composite piece—space.

QDT. Temporary queue.

QGPL. See *general-purpose library*.

QHST. History log message queue. See *histcry log*.

QICO. OS/400 installation communications object.

QM. Queue management.

QPGMR. Programmer's user profile.

QRY. Query.

QSECOFR. Security officer's user profile.

QSRV. Service log message queue.

QSYSOPR. System operator's user profile or system operator's message queue.

QTAG. Temporary access group.

QTDS. Temporary data space.

QTDSI. Temporary data space index.

QTEMP. Job temporary.library.

QTIDX. Temporary index.

QTPCS. Temporary process control space.

QTQ. Temporary object queue.

QTSP. Temporary space.

quadword. Equivalent to four words or 16 bytes of an SRC.

qualified job name. A job name and its associated user name and a system-assigned job number. Contrast with *job name*.

qualified name. The name of the library containing the object and the name of the object. Contrast with *object name*.

qualifier. In data processing, all names in a qualified name other than the far right, which is called the simple name.

query. A request to select and copy from a file or files one or more records based on defined conditions. For example, a request for a list of all customers in a customer master file, whose balance is greater than $1,000.

query definition. Information about a query that is stored in the system.

queue. A list of messages, jobs, or files waiting to be read, processed, printed, or distributed in the order they appear in the list.

QUSER. Work station user's user profile.

R

r. 1-byte register.

R. Real, 2-byte register.

RA. Repeat to address.

rack. A free-standing framework that holds the devices and card enclosure.

rack configuration list. A list of all of the equipment within the rack.

RAR. Resolved address registers.

RAS. Reliability, availability, serviceability.

RASC. Region area support center.

RB. Request block.

RC. Recovery.

RCL. Rack configuration list.

RCR. Resource configuration record.

RCTT. Reference code translate table.

RD. Request descriptor, read.

read operation. An input operation that obtains a record from a file and passes it to a program.

reader. (1) An internal program that reads jobs from an input device or a database file and places them on a job queue. (2) (RJE) A program that reads jobs from a database file or interactive display station and sends them to the host system.

RECC. Receive count instruction.

receive time-out. In data communications, the result of no data being received in a given period of time.

receiver. See *journal receiver*.

recipient. The user to whom mail is sent.

RECM. Receive message.

record. A collection of related data or words, treated as a unit; such as one name, address, and telephone number.

record format. The arrangement of data in the records contained in, or processed by, a file. The record format includes the record name, field names, and field descriptions (such as length and data type). The record formats used in a file are contained in the file description (DDS) or in the record format definition (IDDU).

record format definition. A description of the characteristics of the fields (for example, type and length) and the arrangement of the fields in a record created by the user.

recursion. An operation done in several steps, with each step using the output of the previous step.

recursion level. The position of a program in a list of programs called by the first program and any following programs. The first occurrence of a program in a job has a recursion level of 1, the second occurrence of the same program has a recursion level of 2, and so on.

rediscover. To find again.

register. A storage area having a specified storage capacity and usually reserved for a special purpose.

relational expression. A logical statement that describes the relationship (such as greater than or equal to) of two arithmetic expressions or data items.

remote. Pertaining to a device, system, or file that is connected to another device, system, or file through a communications line. Contrast with *local*.

remote job entry (RJE). A function of the AS/400 Communications Utilities licensed program that allows a user to submit a job from an AS/400 display station to a System/370-type host system.

remote spooling communications subsystem (RSCS). A function of the AS/400 Communications Utilities licensed program that transfers spooled files, commands, and messages between PROFS users, remote work stations, and remote and local batch systems through HASP-compatible communications programs.

remote system. Any other system in the network with which your system can communicate.

remote terminal access method (RTAM). A function of IBM System/370-type computers that controls operations between the Job Entry Subsystems (JES2) (JES3) and remote work stations on the AS/400 system.

remote work station. A work station that is connected to the system by data communications. Contrast with *local work station*.

REQ. See *request*.

REQIO. Request input/output.

request. An asking for something.

request message. A message that requests a function from the receiving program.

request unit (RU). The record transmitted to the other system. This record can contain a request, data, or both. Contrast with

resident [adj]. Remaining in main storage. *response unit (RU)*.

resolution. (1) In computer graphics, a measure of the sharpness of an image, expressed as the number of lines per unit of length or the number of points per unit of area discernible in that image. (2) The act of determining.

resolve. In programming, to change a predefined, symbolic value to the actual value of the item being processed. For example, a symbolic value of *LAST defined for the name of a file member is resolved to the name of the last member when the member is processed.

resource. Any part of the system required by a job or task, including main storage, devices, the processing unit, programs, files, libraries, and folders.

resource name. A name assigned by the system that shows the relationship of the configuration description on the system to the physical equipment connected to the system.

response unit (RU). The record sent to respond to a request. The response can be either positive or negative and can include control information. Contrast with *request unit (RU)*.

restore. To copy data from tape, diskette, or a save file to auxiliary storage. Contrast with *save*.

result field. A field that contains the results of calculations performed on numeric fields in a file.

resulting indicator. An indicator that signals the result of a calculation, such as whether the result is plus, minus, or zero; whether a given field is greater than, less than, or equal to another field; or whether an operation was successfully completed.

return. A going back or sending back.

return code. In data communications, a value sent by the system to a program to indicate the results of an operation by that program.

return indicator. An indicator to the RPG/400 program that control should be returned to the calling program.

RI. RAS and instrumentation.

RJE. See *remote job entry (RJE)*.

| **RLSD**. Received line signal detector.

RM. Resource management or manager.

RMDB. Resource management database.

ROS. Read only storage.

router. A part of the AS/400 PC Support licensed program that handles requests to send and receive data from applications on the personal computer and routes them to the appropriate applications on the AS/400 system.

routine. A set of statements in a program that causes the system to perform an operation or a series of related operations.

routing. The list of users who are to receive an item when it is distributed, including all users named specifically and those users named on distribution lists by the sender.

RPG. Report Program Generator. A programming language designed for writing application programs for common business data processing requirements.

RQSDTA. Request data save area.

RRCB. Request response control block.

RSCS. See *remote spooling communications subsystem*.

RSCV. Route selection control vector.

RSF. Remote Support Facility.

RSHUTD. Command used to request an orderly end to a session.

RT. Run time support.

RTAM. See *remote terminal access method (RTAM)*.

RTGDTA. Routing data save area.

RTN. See *return*.

RU. See *request unit* or *response unit (RU)*.

RUF. Read under format.

RWCB. Read/write control block.

S

S/S. Source/sink.

SAA. System Application Architecture.

SAIE. System arbiter input event.

SAU. Stand-alone utility.

save. To copy specific objects or libraries by transferring them from main or auxiliary storage to magnetic media such as tape, diskettes, or a save file. Contrast with *restore*.

save file. A file allocated in auxiliary storage that can be used to store saved data on disk (without requiring diskettes or tapes), that can be used in I/O operations from a high-level language program, or can be used to receive objects sent through the network.

save system authority. A special authority that allows the user to save and restore all objects on the system and free storage of all objects on the system. See also *all object authority*, *job control authority*, *security administrator authority*, *service authority*, and *spool control authority*.

SBA. Set buffer address.

SBCE. Subsystem control event.

SBME. Subsystem message event.

SBS. Subsystem.

SBSD. Object type for the subsystem description.

SC. Service.

scalar. (1) Pertaining to a single data item. Contrast with *array*. (2) A type of program object that contains either string or numeric data. It provides the byte string it is mapped to with representation and operational characteristics. Contrast with *pointer*.

SCB. Spool control block.

SCM. Status control mode latch or session connector manager.

SCO. Service communications object.

SCP. System control programming.

SCPF. Start control program facilities and/or start OS/400 process or function.

SCPFSP. SCPF space.

scratch install. This install reformats DASD and loads licensed internal code and the operating system from tape. All the data on the DASD is lost when the DASD is reformatted.

screen design aid (SDA). A function of the AS/400 Application Development Tools licensed program that helps the user design, create, and maintain displays and menus.

SCS. See *SNA character string*.

SD. Service function driver.

SDA. See *screen design aid*.

SDC. Software data compression or decompression.

SDLC. See *synchronous data link control (SDLC)*.

SDR. Statistical data recording.

SE. Service common functions.

search argument. (1) (RPG/400) A literal or field name specified in factor 1 of certain file operations (such as

CHAIN) that identifies the record to be processed.
(2) (RPG/400) Data for which you want to find a match or a greater than or less than quantity in a table or array. The search argument is specified in the lookup statement.

secondary logical unit. The logical unit that contains the secondary half-session for one logical unit-to-logical unit (LU-to-LU) session. See also *logical unit*. Contrast with *primary logical unit.*

sector. (1) An area on a disk track or a diskette track to record information. (2) The smallest amount of information that can be written to or read from a disk or diskette during a single read or write.

secure. Controlling who can use and to what extent an object can be used by controlling the authority given to the user.

Glossary

security. Safety; protection from damage or theft.

security administrator authority. A special authority that allows a user to add users to the system distribution directory, to create and change user profiles, to add and remove access codes, and to perform office tasks, such as delete documents, folders, and document lists, and change distribution lists for other users. See also *all object authority*, *save system authority*, *job control authority*, *service authority*, and *spool control authority*.

security officer. A person assigned to control all of the security authorizations provided with the system. A security officer can, for example, remove password or resource security; or add, change, or remove security information about any system user.

segment identifier (SID). Refers to a 3 or 4 high-order byte of a six-byte virtual storage address. The SID extender is used internally to extend the size that can be specified.

select function. A system function that determines which records from a physical file are to be included in a logical file. Contrast with *omit function*.

separator. A punctuation character used to set apart character-strings.

SEPT. System entry point table.

sequence. To arrange in order.

sequence number. (1) The number of a record that identifies the record within the source member. (2) A field in a journal entry that contains a number assigned by the system. This number is initially 1 and is increased by 1 until the journal is changed or the sequence number is reset by the user.

service authority. A special authority that allows the user to perform the alter function in the service functions. See also *all object authority*, *save system authority*, *job control authority*, *security administrator authority*, and *spool control authority*.

service library. The system library provided in the system that is used temporarily for loading IBM-supplied programming changes and creating APARs. Named QSRV.

service support system. A computerized service information network.

session. (1) The length of time that starts when a user signs on and ends when the user signs off at a display station. (2) In communications, the logical connection by which a program or device can communicate with a program or device at a remote location. (3) (SNA) A logical connection between two network locations that can be started, tailored to provide various connection protocols, and stopped, as requested. See also *half-session*. Each session is uniquely identified in a header by a pair of network addresses, identifying the origin and destination of any transmissions exchanged during the session.
(4) (3270 emulation) The activity that occurs on the communications line between the time that the user enters the command to start emulation and the time the user ends the emulation job. (5) (RJE) The activity of all tasks within a single AS/400 system communicating with a single host system. (6) (AS/400 PC Support) The logical connection between the host system and a display station or printer.

session description. An object that contains a description of the operating characteristics of an RJE session. The system-recognized identifier for the object type is *SSND.

SEU. See *source entry utility (SEU)*.

severity code. A number that indicates how important a message is. The higher the number, the more serious the condition.

SF. Subfile.

SFD. Service function driver.

SFDM. Service function DASD management.

SFGR. Screen format generator.

SFID. Service function identifier.

shared access path. An access path used by more than one file member to get data common to both members.

shift. A keyboard action to allow uppercase or other characters to be entered.

SHUTC. A command used to complete a session.

SHUTD. A command used to begin an orderly end to a session.

SIB. Service interface buffer.

SID. See *segment identifier*.

SIOM. Station I/O manager.

SL. Standard label, SNA-T1.

SLEH. Second-level exception handler.

SM. Storage management or session manager.

SMVT. Storage management vector table.

SNA. See *systems network architecture (SNA)*.

SNA character string (SCS). A data stream composed of EBCDIC controls, optionally intermixed with end-user data, which is carried within a request/response unit.

SNA distribution services (SNADS). An IBM architecture that defines a set of rules to receive, route, and send electronic mail in a network of systems.

SNA upline facility (SNUF). The communications support that allows the AS/400 system to communicate with CICS/VS and IMS/VS application programs on a host system. For example, DHCF communicates with HCF and DSNX communicates with NetView Distribution Manager (NDM).

SNADS. See *SNA distribution services (SNADS)*.

| **SNBU**. Switched network backup.

SNMTBL. System program name table.

SNUF. See *SNA upline facility (SNUF)*.

SO. Space object management.

SOMC. Shared open MRK counter.

source file. (1) A file of programming code that is not compiled into machine language. Contrast with *data file*. (2) A file created by the specification of FILETYPE(*SRC) on the Create command. A source file can contain source statements for such items as high-level language programs and data description specifications.

source entry utility (SEU). A function of the AS/400 Application Development Tools licensed program that is used to create and change source members.

source listing. A portion of a compiler listing that contains source statements and, optionally, test results. See also *compiler listing*.

source program. (1) A set of instructions that are written in a programming language and must be translated to machine language before the program can be run. (2) In communications, the program that starts a session with a remote system. Contrast with *target program*.

SP. Space or spooling.

space pointer. A pointer that provides addressability to a byte string in the space part of machine interface object.

SPC. Service processor code.

SPCA. Service processor communications area.

spell aid. A document proofreading function that replaces a misspelled word when the correctly spelled version is chosen from a list of similarly spelled words provided by the system from one or more dictionaries.

SPLB. Service processor log buffer.

SPLCB. Spooling control block.

SPLQ. Spooling queue.

spool. The system function of putting jobs into a storage area to wait to be printed or processed.

spool control authority. A special authority that allows the user to perform spooling functions, such as display, delete, hold, and release spooled files on the output queue for himself and other users. This authority also allows the user to change the spooled file attributes, such as the printer used to print the file. See also *all object authority*, *save system authority*, *job control authority*, *security administrator authority*, and *service authority*.

spooled file. A file that holds output data waiting to be printed, or input data waiting to be processed by the program.

spooling. The system function that saves data in a disk file for later processing or printing.

SPP. Space pointer.

SPPTR. Space pointer.

SPTR. System pointer

SQL. Structured query language.

SR. Save/restore.

SRAUTH. Save/restore authority space.

SRC. (1) Send/receive counter. (2) See *system reference code (SRC)*.

SRDS. Save/restore descriptor space.

SRM. Send/receive message.

SRQ. Send/receive queue.

SS. Source/sink or session services.

SSADL. Source/sink active device list.

SSD. Source/sink data.

SSF. Service support facility.

SSR. Source/sink request.

SST. See *system service tool (SST)*.

ST. System test routines.

stand-alone dump. A printout of main storage requested separately from normal system operations, which does not require the system to be the condition for normal operations.

start. The beginning of a process.

state. A type of operation or condition of being.

statement. An instruction in a program.

statement function. A user-written function that is defined and referred to within the same program. The user-written function is defined in a statement function definition statement. See also *function subprogram* and *subroutine*.

status. The condition of something.

status message. A message that describes the status of the work done by a program.

storage. A device, or part of a device, that can hold data.

storage device controller. The I/O controller card in the card enclosure that controls the operation of the disk, diskette, and tape files.

storage device subsystem. A part of the computer consisting of the controller and one or more attached storage devices.

storage management recovery. A function that prepares the system to access data from all disk units configured to the system.

storage pool. A logical division of storage reserved for processing a job or group of jobs.

store. To put or keep data in a storage device.

string. (1) A group of auxiliary storage devices connected in a series on the system. The order and location in which each device is connected to the system determines the physical address of the device. (2) (PL/I) A sequence of characters or bits that is treated as a single data item.

string control byte. A control character in the SNA character string that identifies how user data is compressed. A control character in the SNA character string that identifies how user data is compressed.

structure. (1) Relationship of parts. (2) A collection of data items that need not have identical attributes.

subroutine. (1) A group of instructions within another group of instructions that can be called by another program or another subroutine. (2) In data communications, a group of statements in a program that can be run several times in that program. (3) (BASIC) A group of statements in a program started by a GOSUB statement, or a separately compiled program started by the CALL statement. (4) (RPG/400) A group of calculation specification statements in a program that can be run several times in that program. (5) (PL/I) A procedure that has no RETURNS option in the PROCEDURE statement. Contrast with *function*. (6) (FORTRAN) A subprogram consisting of FORTRAN statements, the first of which is a SUBROUTINE statement. It optionally returns one or more parameters to the calling program. See also *function subprogram* and *statement function*.

subsystem. (1) A piece of a system or system. (2) An operating environment, defined by a subsystem, where the system coordinates processing and resources.

subsystem description. A system object that contains information defining the characteristics of an operating environment controlled by the system. The system-reorganized identifier for the object type is *SBSD.

SUG. Suggestion.

summary report. A report that contains only summary information; such as the total, average, minimum, maximum, or count; by a query. Contrast with *detail report*.

SV. Supervisor linkages.

SVAL. System value.

SVL. Supervisor linkage.

SVX. Supervisor exit.

SW. Switch, switched line.

switched line. In data communications, a connection between computers or devices that is established by dialing. Contrast with *nonswitched line*.

SY. See *Security*.

synchronization (SYN) character. In binary synchronous communications, the transmission control character that provides a signal to the receiving station for timing the characters received.

synchronous data link control (SDLC). (1) A form of communications line control that uses commands to control the transfer of data over a communications line. (2) A communications discipline conforming to subsets of the Advanced Data Communication Control Procedures (ADCCP) of the American National Standards Institute (ANSI) and High-level Data Link Control (HDLC) of the International Standards Organization (ISO), for transferring synchronous, code-transparent, serial-by-bit information over a communications line. Transmission exchanges may be duplex or half-duplex over switched or nonswitched lines. The configuration of the connection may be point-to-point, multipoint, or loop. Compare with *binary synchronous communications (BSC)*.

synchronous processing. A series of operations that are done as part of the job in which they were requested; for example, calling a program in an interactive job at a work station. Contrast with *asynchronous processing*.

syntax. The rules for constructing a command or statement.

SYP. System pointer.

SYS. See *system*.

SYSCB. System control block.

SYSPRTI. System print image part numbers.

system. In data processing, a collection of machines, programs, and methods organized to accomplish a set of specific functions.

system ASP. The auxiliary storage pool where system programs and data reside. It is the storage pool used if a storage pool is not defined by the user. See also *auxiliary storage pool* and *user ASP*.

system configuration. A process that specifies the machines, devices, and programs that form a particular data processing system.

system configuration list. A list of devices and programs that are part of the total system.

system date. The date assigned in the system values when the system is started. See also *creation date*, and *job date*.

system name. (1) An IBM-supplied name that uniquely identifies the system. It is used as a network attribute for certain communications applications, such as, APPC.
(2) An IBM-defined name that has a predefined meaning to the COBOL compiler. System names include computer names, language names, device names, and function names.

system object. One of two machine object classifications. Any of the machine objects shipped with the system or any of the operating system objects created by the system.

system pointer. A pointer that contains addressability to a machine interface system object.

system reference code (SRC). A group of characters that identifies the machine status or a specific error condition. The system reference code can be displayed on the console from the problem log.

system security. A system function that restricts the use of files, libraries, folders, and devices to certain users.

system service tool (SST). The part of the service function used to service the system while it is running.

system services control point (SSCP). A focal point within an SNA network for managing the other systems and devices, coordinating network operator requests and problem analysis requests, and providing directory routing and other session services for network users.

system time. The elapsed time from the point where the system was started to the current time. If the system time is changed to the local time when the system is started, the current system time is the local time of day.

system unit. A part of a computer that contains the processing unit, and may contain devices such as disk units and tape units.

system value. Control information for the operation of certain parts of the system. A user can change the system value to define his working environment. System date and library list are examples of system values.

System/36 environment. A function of the operating system that processes most of the System/36 operator control language (OCL) statements and procedure statements to run System/36 application programs and allows the user to process the control language (CL) commands. Contrast with *System/38 environment*.

System/38 environment. A function of the operating system that processes most of the System/38 control language (CL) statements and programs to run System/38 application programs. Contrast with *System/36 environment*.

Systems Network Architecture (SNA). The description of the logical structure, formats, protocols, and operational sequences for transmitting information units through and controlling the configuration and operation of networks.

T

TA. Tape.

table. (1) (RPG/400) A series of elements with like characteristics. A table can be searched for a uniquely identified element, but elements in a table cannot be accessed by their position relative to other elements. Contrast with *array*. (2) (COBOL) A set of logically consecutive data items that are defined in the Data Division with the OCCURS clause. (3) See also *translation table*.

tag bits. Extra bits built into the memory cards for security. Tags can only be turned on in MI pointers. There is one tag bit for each word (4 bytes) of main storage. The bits may only be set by a few special HLIC instructions.

TAP. Timing analysis programs.

tape file. A device file created by the user to support a tape device.

tape mark. A unique mark written on the tape to distinguish file boundaries.

tape volume. A single reel of magnetic tape.

target. *(1) In* advanced program-to-program communications, the program or system to which a request for processing is sent. (2) (DDM) The remote system where the request for a file is sent.

target program. (1) In communications, the program that is started on the remote system at the request of the source system. Contrast with *source program*. (2) In display station pass-through, a program that runs on the remote system.

task. (1) A basic unit of work to be performed. (2) A structure used to track work in VLIC. Its base component is a TDE which is the basic work control structure used by HLIC and the hardware for task switching.

TBL. Table.

TCAM. See *telecommunications access method.*

TCB. Task control block.

TCP/IP. Transmission control protocol/internet protocol

TCT. Task control table.

TDE. Task dispatching element.

TDLC. See *twinaxial data link control.*

TDQ. Task dispatching queue.

TE. See *test.*

telecommunications access method (TCAM). A 370-type access method used to transfer data between main storage and terminals (local or remote) on an AS/400 system.

template. A pattern to help the user identify the location of keys on a keyboard, functions assigned to keys on a keyboard, or switches and lights on an operator panel.

temporary library. A library that is automatically created for each job to contain temporary objects that are created by the system for that job. The objects in the temporary library are deleted when the job ends. Named QTEMP.

temporary objects. Objects, such as data paths or compiler work areas, that are automatically deleted by the system when the control program is loaded.

test. A means of proving whether a product operates satisfactorily.

TG. Transmission group.

threshold. A level set in the system at which a message is sent or an error-handling program is called. For example, in a user auxiliary storage pool, the user can set the threshold level in the system values, and the system notifies the system operator when that level is reached.

TID. Transaction identifier.

time slice. The amount of processor time (specified in milliseconds) allowed for a routing step before other waiting routing steps are allowed to process data.

time stamp. (1) To apply the current system time. (2) The value on an object that indicates the system time at some critical point in the object's history.

TL. OS/400 component for SDLC and local IOM.

TLEH. Third-level exception handler.

TMP. Terminate machine processing.

TN. OS/400 component for commit.

TOD. Time of day.

token-ring network. A local area network that sends data in one direction throughout a specified number of locations by using the symbol of authority for control of the transmission line, called a token, to allow any sending station in the network (ring) to send data when the token arrives at that location.

topology. The schematic arrangement of the links and nodes of a network.

TP. Teleprocessing.

TPF. Transmission priority field.

track. A circular path on the surface of a disk, diskette, or tape on which information is magnetically recorded and from which recorded information is read.

translation table. (1) A system table that provides replacement characters for characters that cannot be printed. (2) An object that contains a set of hexadecimal characters used to translate one or more characters of data. For example, unprintable characters can be translated to blanks, and lowercase alphabetic characters can be translated to uppercase characters. The system-recognized identifier for the object type is *TBL.

transmission group. This establishes logical connections between adjacent nodes. SNA supports multiple link connection in a single transmission group but LEN stage 1 will only have a single link connection associated with each transmission group.

transmission services. A switched, nonswitched, or packet-switched communications line provided by a vendor.

TRCO. Trace communications object.

TRDO. Trace data object.

TRIO. Trace instruction object.

| **TRS**. Topology and routing services.

truncate. (1) To cut off data that cannot be printed or displayed in the line width specified or available. Contrast with *fold*. (2) To cut off data that does not fit in the specified field length in a field definition.

trunk. Synonymous with line, link, path, route.

TS. (1) 3270 help text component. (2) See *transmission services*.

TSID. Trace session ID.

TT. OS/400 component for the local area network IOM.

twinaxial cable. A cable made of two twisted wires inside a shield.

twinaxial data link control (TDLC). A type of communications line that allows personal computers, which are attached to the work station controller via twinaxial cable, to use APPC/APPN.

TX. OS/400 component for X.25 IOM.

T1. Twinaxial data link control.

T3. SNA-T3.

U

UA. Unit address.

UD. User data.

UDDS. User-defined data stream.

UEPO. Unit emergency power off.

UFCB. User file control block.

UIM. User interface manager.

underflow. A condition that occurs when a numeric value is so small that accuracy is lost during calculation, or it takes more numbers than will fit in the field to write the decimal positions.

unformatted data. Data that is transferred between main storage and an input/output device with a one-to-one relationship between bytes in main storage and positions in the record. See also *formatted data* and *list-directed data*.

uninterruptible power supply. A source of power from a battery installed between the commercial power and the system that keeps the system running, if a commercial power failure occurs, until it can complete an orderly end to system processing.

unit reference code. A group of numbers displayed on the console or control panel that identifies a failing part.

unlink. To remove the association between a data file on disk and a file definition in a data dictionary. Contrast with *link*.

unprotected storage. (1) The part of the system auxiliary storage pool that is not protected by the checksum option. (2) The storage reserved for temporary objects and internal machine data while a job is running.

unrecoverable error. An error that needs an IMPI to recover.

UP. User profile—machine interface.

upline. Pertaining to controllers that are above devices, and lines that are above controllers in a communications configuration. Contrast with *downline*.

UPS. See uninterruptible power supply.

URC. Unit reference code.

user ASP. One or more auxiliary storage pools used to isolate journals, journal receivers, and save files from the other system objects stored in the system ASP. See also *auxiliary storage pool* and *system ASP*.

user ID. See *user identification (user ID)*.

user ID/address. The two-part network name used in the system distribution directory and in the office applications to uniquely identify a user and send electronic mail.

user identification (user ID). (1) The name used to associate the user profile with a user when a user signs on the system. See also *user profile name*. (2) The first part of a two-part network name used in the system distribution directory and in the office applications to uniquely identify a user. The network name is usually the same as the user profile name, but does not need to be.

user password. A unique string of characters that a system user must enter to identify himself to the system, if the system resources are secured.

user profile. An object with a unique name that contains the user's password, the list of special authorities assigned to a user, and the objects the user owns. It is used by the system to verify the user's authorization to read or use objects, such as files or devices, to run the jobs on the system.

user profile name. The name or code that the system associates with a user when he or she signs on the system. Also known as user ID.

user table. A list of user IDs authorized to an AS/400 finance job.

USRPRF. User profile-external object.

UT. System test routines.

UTF. Unified testing facility.

V

V. Variable, virtual.

VA. Virtual address.

value. Smallest unit of data manipulated by the Structured Query Language/400 statements.

VAR. Variable-length.

variable. A name used to represent data whose value can be changed while the program is running by referring to the name of the variable.

vary off. To make a device, controller, or line unavailable for its normal intended use.

vary on. To make a device, controller, or line available for its normal, intended use.

VB. Variable blocked.

VCA. VLIC communications area.

vector. A directed line segment; a straight line between two points.

vertical licensed internal code (VLIC). Programming that defines logical operations on data. The licensed internal code is primarily sequential in processing, and supports the machine instruction set.

view. An alternative representation of data from one or more tables. A view can include all or some of the columns contained in the table or tables on which it is defined.

virtual storage (VS). An addressing scheme that allows external disk storage to appear as main storage.

virtual telecommunications access method. A set of programs that control communications between terminals and application programs running under the DOS/VS, OS/VS1, and OS/VS2 operating systems. Abbreviated VTAM.

vital product data. Self-identifying information from VLIC and OS/400 components. Hardware VPD is collected at IPL or when resources are added after IPL (device powers on). The software installation manager provides for collection and recording of software VPD and rack configuration information when code products or components are added or modified.

VL. VLIC log.

VLOG. VLIC log.

VLIC. See *vertical licensed internal code (VLIC)*.

VLIC log. A recorded list of trace entries.

VLICIR. VLIC initialization and recovery.

volume. A storage medium that is put on or taken off the system as a unit, for example, magnetic tape or diskette.

volume label. The first 80 bytes on a standard tape used to identify the tape volume and its owner. This area contains VOL1 in the first four positions.

volume table of contents (VTOC). An area on a disk or diskette that describes the location, size, and other characteristics of each file, library, and folder on the disk or diskette.

VPD. See *vital product data*.

VS. See *virtual storage (VS)*.

VTAM. See *virtual telecommunications access method*.

VTOC. See *volume table of contents (VTOC)*.

W

ward. A section of a double-byte character set (DBCS) where the first byte of the DBCS codes belonging to that section are the same value. According to IBM standards for DBCS codes, there are 190 wards, and each ward has up to 190 points on which DBCS characters can be assigned.

WC. Work control.

WCB. Work control block.

WCBJNQ. Job number assigned queue.

WCBT. Work control block table.

WCBTE. Work control block table entries.

WCBTEQ. WCBT entry queue.

WCBTRO. WCBT recovery object.

WD. Subsystem description.

WH. File reference function.

word. (1) A written, spoken, or transmitted group of characters. (2) A set of 4 bytes shown in an SRC.

quadword. Equivalent to four words or 16 bytes.

work space. The area that a BASIC program or BASIC procedure occupies when it is loaded.

work station. A device used to transmit information to or receive information from a computer; for example, a display station or printer.

work station address. (1) A number used in a configuration file to identify a work station attached to a computer port. (2) The address to which the switches on a work station are set, or the internal address assumed by the system, if no address is specified.

work station controller. An I/O controller card in the card enclosure that provides the direct connection of local work stations to the system.

work station entry. An entry in a subsystem description that specifies the work stations from which users can sign on to the subsystem or from which interactive jobs can transfer to the subsystem.

WP. Work station printer.

WRD. See *Word*.

write operation. An output operation that sends a processed record to an output device or output file.

writer. (1) The part of the operating system spooling support that writes spooled output to an output device independently of the program that produced the output. (2) (RJE) A program that receives output data (files) from the host system.

writing. The action of making a permanent or temporary recording of data in a storage device or on a data medium.

WS. Work station display.

WSC. See *work station controller*.

| **WSF**. Work station function.

WT. Work monitor.

WU. Where used.

X

X. Hexadecimal.

XC. Translator code generation.

XCA. Transfer communications area.

XCR. Translator communications region.

XD. Extent descriptor, translator data generation.

XE. Translator exception handler.

XGC. Check sum global control block.

XI. Translator initialization.

XID. Exchange identification command.

XL. Translator controller.

XO. Translator object definition table scan.

XR. Translator register optimization.

XS. Translator instruction stream register.

XT. Translator termination.

X.21. In data communications, a specification of the CCITT that defines the connection of data terminal equipment to an X.21 (public data) network.

X.25. In data communications, a specification of the CCITT that defines the interface to an X.25 (packet-switching) network.

X.75. In data communications, a specification that defines ways of connecting two X.25 networks.

Numerics

1024-byte format. A format for diskette 2D diskettes with 1024 bytes per sector and 8 sectors per track.

128-byte format. A format for diskette 1 diskettes with 128 bytes per sector and 26 sectors per track.

256-byte format. A format for diskette 2D diskettes with 256 bytes per sector and 26 sectors per track.

3270 device emulation. The operating system support that allows an AS/400 system to appear as a 3274 Control Unit in a BSC multipoint network or SNA/SDLC network. See also *3270 display emulation* and *3270 printer emulation*.

3270 display emulation. The function of the operating system 3270 device emulation that converts 3270 DSC data streams intended for a 3278 display station into data streams that can be recognized by a display station attached to the AS/400 system.

3270 display station. Any display station from the IBM 3270 Information Display System.

3270 printer emulation. The part of 3270 device emulation that converts 3270, DSC, and SCS data streams intended for a 328X printer into data streams that can be recognized by a printer attached to the AS/400 system.

512-byte format. A format for diskette 1 diskettes with 512 bytes per sector and 8 sectors per track.

5250 display station. Any display station from the IBM 5250 Information Display System, the 5290 Display System, or the 3180 Display Station. A 3270 display station is not a 5250 display station.

5250 emulation. Any one of many licensed programs that allows a personal computer to perform like a 5250 display station, and use the functions of an AS/400 system.

5290 display station. Any display station from the 5290 Display System.

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Reader's Comments

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System Support:
Diagnostic Aids (Volume 1)

Publication No. LY21-0597-2

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