DOS

IBM

Systems Reference Library

IBM System/360 Disk Operating System

1401/1440/1460 Emulator Programs

Compatibility Support/30

Compatibility Support/40

Program Number for CS/30: 360N-EU-484

Program Number for CS/40: 360N-EU-485

This publication contains information on the emulation of 1401, 1440, and 1460 object programs under the control of the Disk Operating System. Compatibility Support/30 and Compatibility Support/40 allow emulation of these programs on the IBM System/360 Models 30 and 40, respectively. Compatibility Support/30 comprises the IBM 1401/1440/1460 Emulator Program, Number 360N-EU-484, and applicable Compatibility Features for the Model 30. Compatibility Support/40 comprises the 1401/1440/1460 Emulator Program, Number 360-EU-485, and the applicable Compatibility Features for the Model 40. In addition, the 1401, 1440, and 1460 object programs can be run on the IBM System/360 Model 25 using the 1401/1440/1460 Emulator Program for Compatibility Support/30 in conjunction with applicable Compatibility Features for the Model 25.

General information concerning machine requirements, program generation, simulation techniques, data formats, control cards, and programming considerations is included, as are detailed explanations of Operator Service Functions, operating procedures, console messages, and special instructions added by the Compatibility Features for the Models 30 and 40.

The 1400 Emulator Programs under DOS allow the user to run 1401/1440/1460 programs, with little or no reprogramming, under the Disk Operating System in conjunction with the Compatibility Features. This allows 1400 programs to be run in a stacked job environment, mixed with System/360 jobs.

Note: All information in the body of this manual concerning the IBM 3420 Magnetic Tape Unit is for planning purposes only.

PREFACE

This publication provides information concerning the 1401/1440/1460 Emulator Programs under the Disk Operating System. The information is presented in eight sections.

The "Introduction" section contains a general description of the capabilities of the Emulator Programs and the levels of programming support; a description of the running of the Emulator Programs as background programs in a multiprogramming environment; and the minimum configuration required to operate the Emulator Programs under DOS, the devices from which problem programmers can request I/O operations for the Emulator Programs, additional features supported by the Emulator Programs, and the DOS units and features that cannot be utilized while the Emulator Programs are operating.

The "Program Generation" section contains information on the use of keyword macros to generate and assemble the Emulator Programs, the macro parameter values used to generate the Emulator Programs, and messages issued during Emulator-Program generation.

The "Simulation of IBM 1401/1440/1460 Facilities" section describes the layout of the Emulator Programs in main storage; the use of the registers by the Emulator Pro-

grams; program restrictions and limitations that the user must consider; information on unit-record, magnetic-tape, and disk-storage operations; I/O error recovery, buffering, and device independence, and simulation of I/O devices for which there is no hardware compatibility; and Emulator-Program support of I/O operations for card read punch, printer, magnetic tape, disk, and console inquiry, as well as an explanation of the differences in printer graphics.

The "Control Cards" section explains the use and format of all control cards used with the Emulator Programs.

The "Programming Considerations" section describes the calling of System/360 inquiry programs from the Core-Image Library and their execution while under control of the Emulator Programs, the ability to catalog and fetch programs from the Core-Image Library, the purpose and cataloging of overlay sections, use of the // FETCH card, and the procedure for fetching a program.

The "Operator Service Functions" section describes the available functions and how they are used, as well as discussing operator responses to system messages.

The "Appendix" section is organized as follows:

Appendix A presents a list of the Emulator-Program macro keyword parameters and a summary of their usage in tabular form.

Appendix B describes the six special System/360 instructions and the System/360 Diagnose instruction provided for use with the 1401/1440/1460 Basic Compatibility Feature.

Appendix C describes the use of the Programmed Mode Switch subfeature and the four special System/360 instructions provided with the subfeature.

Appendix D describes the two methods used by the Model 40 Emulator Program for fetching 1400 instructions, I-Fetch and I-Fetch at A-Address, and the special Diagnose instructions provided by the 1401/1440/1460 DOS Compatibility Feature for use by the Model 40 Emulator Program.

Appendix E presents character-conversion tables to illustrate the representation of BCD graphics in simulated storage and the buffer areas.

Appendix F provides a Model 40 address conversion table designed to aid the user in reading 1400 data and instructions as they appear in a System/360 storage dump.

Appendixes G and H present the algorithm for estimating the total storage requirement for the Emulator Programs on the Models 30 and 40, respectively, including a sample worksheet for computing the storage requirements.

Appendix I presents a sample program for use with Models 30 and 40. The sample program is designed to be executed either with a user-assembled Emulator Program, or with an Emulator Program described in the appendix.

Appendix J presents special programming considerations for the Model 25 users of the 1401/1440/1460 Emulator Program (360N-EU-484) under DOS.

Appendix K presents detailed descriptions of the console messages issued by the Emulator Programs.

PREREQUISITE PUBLICATIONS

Readers of this publication should be familiar with the information contained in the following IBM System/360 Disk Operating System (DOS) publications:

IBM System/360 Disk and Tape Operating Systems: Concepts and Facilities, GC24-5030
IBM System/360 Disk and Tape Operating Systems: Utility Program Specifications, GC24-3465
IBM System/360 Disk Operating System: Data Management Concepts, GC24-3427
IBM System/360 Disk Operating System: System Control and System Service Programs, GC24-5036
IBM System/360 Disk Operating System: System Generation and Maintenance, GC24-5033
IBM System/360 Disk Operating System: Operating Guide, GC24-5022

Model 30 users should be familiar with the following publications:

IBM System/360 Model 30 Operator's Guide, GA24-3373
IBM System/360 Model 30; 1401/1440/1460 Compatibility Feature, GA24-3255

Model 40 users should be familiar with the following publications:

IBM System/360 Model 40 Operating Procedures, GA22-6911
IBM System/360 Model 40 Functional Characteristics, GA22-6881

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GENERAL DESCRIPTION

This section contains general information concerning the 1401/1440/1460 Emulator Programs under the Disk Operating System. Compatibility Support/30 and Compatibility Support/40 allow emulation of 1401, 1440, and 1460 object programs on the IBM System/360 Models 30 and 40, respectively. Compatibility Support/30 comprises the following:

- IBM 1401/1440/1460 Emulator Program for the Model 30

- IBM 1401/1440/1460 Basic Compatibility Feature (#4456)

- IBM Programmed Mode Switch Subfeature (#5856)

Compatibility Support/40 comprises the following:

- IBM 1401/1440/1460 Emulator Program for the Model 40

- IBM 1401/1440/1460 DOS Compatibility Feature (#4460)

- IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462)

The IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) for the Model 40 provides the capability to relocate the Model 40 Emulator Program.

Note: When the 1401/1440/1460 DOS Compatibility Feature (#4460) is installed, operation of Model 40 Emulator Program 360C-EU-074 with the 1401/1460 Compatibility Feature (#4457) is excluded.

In addition, the 1401/1440/1460 Emulator Program for Compatibility Support/30 can be used to run 1401, 1440, and 1460 object programs on the IBM System/360 Model 25 in conjunction with the following Model 25 Compatibility features:

- 1400 Series Compatibility Feature (#4440)

- 1401/1440/1460 DOS Compatibility Feature (#4470)

Discussions within this publication of the 1401/1440/1460 Emulator Program for the Model 30 are generally applicable to the Model 25. However, Model 25 users must be familiar with the programming considerations described in Appendix J.

The Emulator Programs allow 1400 object programs to be run in a DOS stacked-job environment, mixed with System/360 jobs. All initialization required by the Compatibility Features is handled by the Emulator Programs except for the initialization (and clearing) of disk packs, which is performed by an option in the DOS Initialize Disk Utility program. All of the 1400 CPU instructions are executed by the Compatibility Features, except the Move Characters and Edit (MCE) and Move Characters and Suppress Zeros (MCS) instructions on the Model 40. The Emulator Programs use the physical input/output control system (PIOCS) capabilities of DOS to simulate the 1400 I/O instructions. In addition, when the 1400 end-of-job halt is recognized, the Emulator Programs call DOS Job Control to provide transition to the next job. 1400 error conditions optionally cause a halt to allow operator intervention or an abnormal end of job with a 1400-style main storage dump, followed by a release to end of job.

There are three main levels of support for the Emulator Programs. They are as follows:

- 1400 UNIT RECORD: Support for 1400 card programs and for reading and punching Binary Coded Decimal (BCD) and binary data is provided.

- 1400 TAPE: Support is provided for 1400 tape operations under the Emulator Programs. This support enhances the performance of 1400 original equipment, and requires no reprogramming of 1400 programs written consistent with 1400 System Reference Library (SRL) manuals published by IBM.

- 1400 DISK: Support is provided for 1311 Disk Storage Drives and 1301 and 1405 Disk Storages. Some 1316 Disk Packs previously used on 1400 devices can be used on System/360 devices. Since the 1311 disk drives write at a density different from that used on 2311 disk drives, data written on a 1311 cannot be read by a 2311, and vice versa, without reformatting. Disk programming support offers full upward and downward compatibility between the Model 30 and Model 40 Emulator Programs. Information on disk compatibility is given in the Section on "Direct Access Simulation."

Note: Input data is represented in a form known as the 8-bit representation of BCD as shown in Table 15. This representation is referred to throughout this publication as BCDIC-8, and is compatible with previous emulation representations.

MULTIPROGRAMMING CONSIDERATIONS

In a multiprogramming environment the Emulator Programs under DOS can run in any partition. In order to efficiently utilize this feature, it may be desirable to assign SYSRDR and SYSIPT (the combination known as SYSIN) to a magnetic-tape unit or disk extent. If SYSIN is assigned to a magnetic tape or disk, that device must input all of the control cards that normally are included in the job stream. A standard file-to-file utility program that recognizes a /* card as the end of data can be used to place the job stream on a magnetic tape or disk, where the /* card of the job stream contains a nonblank in card column 4.

If SYSIPT is assigned to a magnetic tape or disk, that device must contain 80-byte unblocked records (key length equals zero, if on disk). Records of greater length cause a channel program check, and the program is aborted due to an I/O error.

The assignment of SYSIN to a magnetic tape or disk for the background program also makes the card reader available to read the control cards and data cards for a foreground program. This has the effect of reducing the number of statements entered by the operator from the console type-writer.

Most 1400 unit-record output (card and printer) can be produced through concurrent peripheral operations by assigning the card punch SYSPCH and/or the printer SYSLST to either a magnetic tape or disk. The manner in which this feature is implemented is described in detail under "General Comments on I/O Simulation" in the "Simulation of IBM 1401/1440/1460 Facilities" section. SYSPCH and SYSLST may be assigned to the same tape unit by assigning SYSOUT to that unit; they must be assigned, however, to different extents when assigned to a disk unit.

If the Emulator Program does not fit into the partition, a storage protection check occurs and DOS cancels the job with message OP77I. On the Model 30, the values of the SEND and MPGMBLK parameters determine the beginning and ending locations of System/360 storage in which the Emulator Program and 1400 simulated storage will reside. On the Model 40, the RELOC parameter determines the beginning location of System/360 storage for 1400 simulated storage. The main phase of the Emulator Program begins immediately following 1400 simulated storage. When running the CS/40 Emulator Program in a foreground partition, the partition must begin at least 2K bytes below the location of 1400 simulated storage for that partition. Thus, partition size allocations must be evaluated before assembling the Emulator Program.

Only one copy of the Emulator Program can run on the Model 30 at any one time. Three Emulator Programs can run concurrently on the Model 40. To run Emulator Programs in either foreground partition on the Model 30 or the Model 40, the MPS parameter in the DOS SUPVR macro must be specified as BJF. The DOS, Single Program-Initiation (SPI) mode of operation is not supported.

FOREGROUND EXECUTION CONSIDERATIONS

The load point of the Model 40 Emulator Program is determined by the value of RELOC. If RELOC=0, or is defaulted, the Emulator Program is then assumed to begin at location 16,384. If RELOC≠0, or is not defaulted, the value specified by RELOC determines where the Emulator Program is to be loaded.

In the Model 30 Emulator Program, the load point is determined by the value of SEND. If SEND=0, or is defaulted, the Emulator Program is then assumed to run in the background partition. If SEND≠0 it's value is used as the load point. The "MPGMBLK= nn" parameter should be used if a foreground partition is to begin at the end of the Emulator Program. When specifying SEND=0 the Emulator Program can still be link edited to a foreground partition by the use of the ACTION (F1 or F2) statement. One should be familiar with the purpose of this statement before attempting to use it. Also care should be taken to ensure that the Emulator Program will not overlay 1400 storage by its being reallocated.

For a more detailed discussion of the above mentioned parameters see "Description of General Parameters".

MINIMUM REQUIREMENTS

The minimum requirements for the Emulator Programs under DOS are the same as for a 24K Model 30, or a 32K Model 40 Disk Operating System and the 1400 Compatibility Features, except that 1400 disks need not be on the multiplexor channel and 1400 tapes need not be on a single selector channel. The Model 30 1400 I/O Compatibility Features for unit-record equipment are

not required by the Model 30 Emulator
Program.

The following are the features required
for a minimum Model 30 configuration for
the Emulator Program under DOS:

- An IBM System/360 Model 30 with a 2030
  Processing Unit containing 24,576 (24K)
  bytes of main storage (the amount is
  variable and depends on the features of
  the Model 30 Emulator Program and DOS
  that are included)

- 1401/1440/1460 Basic Compatibility Fea-
  ture (#4456)

- Programmed Mode Switch (#5856)

- Decimal Arithmetic Feature (#3237)

- Storage Protection Special Feature
  (#7520) (for multiprogramming)

- File Scan Feature (#4385) (supported in
  Move-mode only, but not required)

- Magnetic Tapes (#4467 for multiplexor
  and #4468 for selector channels,
  required for 1400 overlap operations)

- I/O Compatibility Features for
  customer-engineer diagnostics of sup-
  ported devices (recommended, but not
  required):

    Column Binary (#1990)

    1402/1403 (#4463) or 1442/1443
    (#4464) Attachment

    Console Inquiry Station (#4465)

    Disk Storage Drives (#4466)

The following are the features required
for a minimum Model 40 configuration for
the Emulator Program under DOS:

- An IBM System/360 Model 40 with a 2040
  Processing Unit containing 32,768 (32K)
  bytes of main storage

- 1401/1460 Compatibility Feature (#4457)

- 1401/1440/1460 DOS Compatibility Fea-
  ture (#4460) (see Note 4)

- 1401/1440/1460 Relocatable DOS Compati-
  bility Feature (#4462) (required only
  if the Emulator Program is to be
  relocated.)

- Decimal Arithmetic Feature (#3237)

- 1311 Disk Compatability Feature (#9710)

- File Scan Feature (#4385) (supported in
  Move-mode only, but not required)

- Storage Protection Special Feature
  (#7520) (for multiprogramming)

The configuration may range from a card-
oriented System/360 Model 30 to a maximum
configuration of disk, tape, and tele-
processing. One of the purposes of emula-
tion under DOS is to provide complete flex-
ibility of external devices for the user
who needs to grow and needs system availa-
bility to do so. In addition to the fea-
tures previously listed the following are
specific requirements for a minimum Model
30 or Model 40 machine configuration for
the Emulator Programs:

- Standard instruction set (see Note 1)

- One I/O channel (either multiplexor or
  selector) (see Note 2)

- One card reader (1442, 2501, 2520, or
  2540) (see Note 3)

- One card punch (1442, 2520, or 2540)
  (see Note 3)

- One printer (1403, 1404, or 1443) (see
  Note 3)

- One 1052 Printer-Keyboard

- 1051 Attachment (#7915) and 1051 Con-
  trol Unit with CPU Attachment (#3130)
  for the Model 30

- 1052 Adapter (#7920) for the Model 40

- One 2311 Disk Storage Drive or 2314
  Direct Access Storage Facility for DOS
  system residence

- Whatever systems configuration is re-
  quired for operation of the user's DOS

Note 1: System/360 language translators
may require extended instruction sets.

Note 2: System/360 telecommunications
require a multiplexor channel and at least
one selector channel.

Note 3: One 2400- or 3200-Series Magnetic
Tape Unit (7- or 9-track) may be substi-
tuted for this device. (If SYSIPT, SYSPCH,
and/or SYSLST are assigned to 7-track tape
units, the Data Conversion Feature is
required).

Note 4: When the 1401/1440/1460 DOS Compa-
tibility Feature (#4460) is installed, the
operation of the Model 40 Emulator Program
360C-EU-074 is excluded on the system.

Table   1.   Input/Output Device Correspondence

1401/1440/1460 I/O Device[1]	System/360 I/O Device
IBM 1402 or 1442 Card Read Punch or 1444 Card Punch	IBM 2501 Card Reader or 1442, 2520, or 2540 Card Read Punch
IBM 1403, 1404, or 1443 Printer	IBM 1403, 1404, or 1443 Printer
IBM 729, 7330, or 7335 Magnetic Tape Unit	IBM 2401, 2402, or 3420 (Model 3 or 5) Magnetic Tape Unit, or 2403, 2404, or 2415 Magnetic Tape Unit and Control
IBM 1407 Console Inquiry Station or 1447 Console	IBM 1052 Printer-Keyboard
IBM 1301 or 1405 Disk Storage or 1311 Disk Storage Drive	IBM 2311 Disk Storage Drive or 2314 Direct Access Storage Facility

[1] 1400 program reading on more than one reader, punching on more than one punch, or printing on more than one printer is not supported.

Table   2.   Input/Output Feature Correspondence

1401/1440/1460 I/O Feature	System/360 I/O Feature
IBM 1402 Punch Feed Read and Control Unit (#5890 and #5895)	IBM 2540 Punch Feed Read (#5890); Punch Feed Read Control (#5895) on the 2821 Control Unit[1]
IBM Column Binary Feature (#1990), or IBM Binary Transfer (#1468) and Bit Test (#1470) Features, or IBM Card Image Features (#1531 and 9035)	IBM Column Binary Feature (#1990), on the 2821 Control Unit if 2540 Card Read Punch, or IBM Card Image Feature (#1531) if 2501 Card Reader or 2520 Card Read Punch, or IBM Card Image Feature (#1532) if 1442 Card Read Punch
IBM 1402 51-Column Interchangeable Read Feed (#4150) and Feed Adapter (#1013)	IBM 2540 51-Column Interchangeable Read Feed (#4151)[2]
IBM 1403 Preferred Character Set (#5523) and Adapter (#5524) IBM 1416 Interchangeable Train Cartridge equipped with Preferred Character Set Print chain	IBM 1403 Universal Character Set[3] for Model 2 (#8641) or Model N1 (#8640) with prerequisite Interchangeable Train Cartridge Adapter or Interchangeable Train Cartridge, and appropriate Universal Character Set Adapter for the 2821 Control Unit
IBM Scan Disk (#6396)	IBM File Scan (#4385) installed on the 2841 Storage Control Unit (supported in Move-mode only)

[1] If stacker selection of punch-feed-read cards or 1444 stacker selection is to be simulated, the 2540 Compatibility Attachment (#8065) must be installed on the 2821 Control Unit.

[2] When this feature is installed, reading speed is permanently reduced from 1000 cpm to 800 cpm.

[3] With this feature, printing speed is dependent upon the number of characters in the character set and unprintable characters in the print-line (see IBM 2821 Control Unit, Form A24-3312).

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INPUT/OUTPUT DEVICES

1400 programs operating with emulation
under DOS can request I/O operations on the
following System/360 devices:

- 1442 Card Read Punch

- 2501 Card Reader

- 2520 or 2540 Card Read Punches

- 1403 Printer

- 1404 Printer (for continuous-forms and
  cut-card operations)

- 1443 Printer

- 1052 Printer-Keyboard (for operator
  communications)

- 2311 Disk Storage Drive

- 2314 Direct Access Storage Facility

- 2400-Series Magnetic Tape Units

- 3400-Series Magnetic Tape Units

Input/output device correspondence be-
tween a 1401, 1440, or 1460 system and
System/360 Model 30 or Model 40 is listed
in Table 1.

ADDITIONAL FEATURES

Additional features supported by the
Emulator Programs under DOS are:

- Timer Feature

- Simultaneous Read-While-Write Tape Con-
  trol (2404 or 2804)

- Any channel configuration up to one
  multiplexor channel and two selector
  channels

- Tape Switching Unit (2816)

- Universal Character Set

Input/output feature correspondence be-
tween a 1401, 1440, or 1460 system and
System/360 Model 30 or Model 40 is listed
in Table 2.

1401/1440/1460 Basic Compatibility Features
(Model 30 and Model 40)

The Emulator Program under DOS in con-
junction with the 1401/1440/1460 Basic Com-
patibility Feature for the Model 30, and
the 1401/1440/1460 DOS Compatibility Fea-
ture for the Model 40, provides support for
all 1401, 1440, and 1460 standard opera-

tions and instructions, plus the following
special features:

Advanced Programming for the 1401
Bit Test
Column Binary*
Expanded Print Edit
51-Column Interchangeable Read Feed*
High-Low-Equal Compare
Multiply-Divide
Print Storage
Additional Print Control
Punch-Feed Read*
Space Suppression
Sense Switches
Scan Disk*
Direct Seek for the 1311
Track-Record for the 1311
Binary Transfer for the 1460*
Indexing and Store Address Register for
  the 1460

* Refer to Table 2.

In addition to the preceding features,
the 1401/1440/1460 DOS Compatibility Fea-
ture provides support for Processing Over-
lap on the Model 40. Processing Overlap is
not available as such on the Model 30, but
overlap is provided by the Emulator Program
for tape, disk, and 1400 unit record
devices.

EMULATOR/DOS EXCLUSIONS

The following IBM units and features,
supported by DOS, are not supported by the
Model 30 or Model 40 Emulator Programs
under DOS:

- 1445 Printer

- Paper Tape Devices

- 2321 Data Cell Drive

- 1285 and 1287 Optical Readers

- 1259, 1412, and 1419 Magnetic Character
  Readers

- 7770 and 7772 Audio Response Units

- Selective Tape Listing Features (1403)
  for continuous paper tapes

- Teleprocessing Devices

In addition, the Emulator Programs do not
support the IBM 1401 Processing System,
Model G.

Note: The 1259, 1412, and 1419 Magnetic
Character Readers require special consi-
deration if utilized while the Emulator
Programs under DOS are operating. See the
section on "Programming Restrictions and
Considerations" for additional details.

Introduction   5

PREPARATORY PROCEDURES

GENERAL DESCRIPTION

The Emulator Program under DOS for the
Model 30 or Model 40 is distributed as a
set of macros to enable the user to speci-
fy, through the utilization of macro para-
meters, the exact characteristics desired
in the Emulator Program. In general, these
parameters fall into two categories:

- Characteristics of the System/360 and
  the 1400 being simulated

- Options desired by the user, such as
  Operator Service Functions

The Emulator Program under DOS may be
tailored to fulfill all of the requirements
of an installation or may be tailored to
the requirements of a particular job.
Although only one Emulator Program need be
generated for any installation, under cer-
tain circumstances more than one generation
is desirable. If the storage requirements
exceed the available storage, separate
generations are required, each specifying
only those parameters actually needed for
that particular job or application. The
storage requirements can be calculated
using the information in Appendixes G and
H. Each Emulator Program is assembled by
the user under a different name and may be
executed as required.

If the System/360 has 64K of available
storage, any option may be selected without
regard to storage requirements except for
unusually large tape I/O buffers or when
storage is to be reserved for multiprogram-
ming. On a 32K system, a disk-only or
tape-only Emulator Program may be generated
along with most options. The amount of
tape I/O buffer area depends on block size
and the number of tape drives to be simu-
lated. For large tape blocks, the maximum
number of tape drives that can be simulated
may be less than six. The simulation of
tape/disk systems in 32K requires careful
analysis of storage requirements. Under
this condition, it is advisable to list the
individual requirements of various programs
and perform a "trial" generation or calcul-
ate the storage requirements. The two
major limiting factors are based on the
size of the 1400 system to be simulated and
the size of the tape buffer area.

The Model 30 Emulator Program under DOS
is composed of 12 macros, one of which is
considered to be the mainline that selec-

tively calls the other 11 macros as needed.
The Model 40 Emulator Program under DOS is
composed of 14 macros, one of which is con-
sidered to be the mainline that selectively
calls the other 13 macros as needed. These
mainline macros are cataloged in the user's
Source Statement Library under the names
EU30 and EU40. The Model 30 and Model 40
Emulator-Program macros are described in
Table 3, which contains a list of the
Source Statement Library name, card identi-
fication, and the function of each macro.

Before the Emulator Program can be
executed, the following must be considered
during DOS Supervisor generation:

- The EU parameter in the SUPVR macro
  instruction must be specified as YES
  unless relocation of 1400 simulated
  storage is desired on the Model 40. In
  this case the EU parameter must be
  specified as RELOC.

- The CPU model designation (MODEL=30 or
  MODEL=40) must be specified in the
  CONFG macro instruction.

- If the Emulator Operator service func-
  tions are to be requested by the
  external INTERRUPT key for the back-
  ground or by the console REQUEST key
  (MSG F1 or MSG F2) for the foreground,
  the OC parameter in the FOPT macro
  instruction must be specified as YES.

- If SYSLST, SYSIPT, or SYSPCH may be
  assigned to a disk extent, the SYSFIL
  parameter in the FOPT macro instruction
  must be specified as a 2311 or 2314.

- If an Emulator Program is to be run in
  the foreground, the MPS parameter in
  the SUPVR macro instruction must be
  specified as BJF.

EMULATOR PROGRAM GENERATION

The Disk Operating System (DOS) contains
all the macros necessary for generating a
1401/1440/1460 Emulator Program under DOS.
These macros are cataloged in the DOS
Source Statement Library.

The assembly of the Emulator Program
under DOS tailored to meet the user's spe-
cifications is indicated in Figure 1. The
sequence of cards is important. The Emula-
tor Program under DOS is a standard assemb-
ly language program and requires the

Table 3. Model 30 and Model 40 Emulator-Program Macros

Name	Card ID (cols. 73-76)	Function
EU30/EU40	A484/A485	Mainline; calls all other macros internally. All user parameters are analyzed in this macro. $$B-message transients are included here.
EU3ER/EU4ER	E484/E485	Processes 1400 error conditions. Contains the exit for user modifications for nonsupported devices.
EU3RD/EU4RD	R484/R485	Processes 1400 Card-Read instructions.
EU3PH/EU4PH	P484/P485	Processes 1400 Card Punch and Stacker Select instructions.
EU3PT/EU4PT	L484/L485	Processes 1400 printer instructions.
EU3MS/EU4MS	M484/M485	Processes miscellaneous 1400 I/O instructions (Forms Control, Branch on I/O, etc.).
EU3TP/EU4TP	T484/T485	Processes all 1400 magnetic-tape instructions.
EU3DK/EU4DK	D484/D485	Processes 1301, 1311, and 1405 disk instructions.
EU3EJ/EU4EJ	J484/J485	Emulator Program End-of-Job routine.
EU30S/EU40S	S484/S485	Emulator Program Operator Service routines.
EU3CG/EU4CG	G484/G485	Emulator Program Catalog-Option routine.
EU3FT/EU4FT	F484/F485	Emulator Program Fetch-Option routine.
EU4IN	I485	Contains the branch table entries and performs the scan for completion of the 1400 Move Characters and Edit (MCE) and Move Characters and Suppress Zeros (MCS) instructions. (Model 40 Emulator Program only.)
DIAG	X485	Provides a mnemonic for coding and assembly ease in programming the 1401/1440/1460 DOS Compatibility Feature. (Model 40 Emulator Program only.)

standard control cards in addition to those indicated. An object-module deck, however, must be punched. Therefore, the // OPTION CATAL statement must not be used.

Following the last parameter statement for each Emulator Program assembly, an end statement must be included in the group of cards as follows:

```
euname  EU30[EU40] parama,...      x
                    paramy,        x
                    paramz
        END         ACOMP01
```

These cards should be followed by standard /* and /& cards.

The output of the assembly consists of linkage-editor control cards followed by the Emulator Program object deck. The output of an EU30 assembly is illustrated in Figure 1. Figure 2 illustrates how the assembly output must be rearranged to perform the required cataloging of EU40 to the Core-Image Library. It should be noted that // ASSGN cards are not included; they must be provided if required by the user.

```
// JOB     EUJOB1
// OPTION  LIST,DECK,XREF
// EXEC    ASSEMBLY
euname     EU30        euparaml,...X
                       euparamn
           END   ACOMPØ1
/*
/&
```

/&

/*

End Statement

EU Macro Parameters

DOS Job Control Cards

DOS SYSRES → **Assemble Tailored EU Program** → **Assembly Listing**

EU Output Module

Consists of the output of EUJOB1:

```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
 I PHASE euname, + (SEND param value),NOAUTO
   INCLUDE, (ACOMPØØ)
   PHASE eunameX,ACOMPØØ+nnn
   INCLUDE, (ACOMPØ1)
   PHASE $$BEU3M1,+Ø
   INCLUDE, ($$BEU3M1)
   PHASE $$BEU3M2, +Ø
   INCLUDE, ($$BEU3M2)
   PHASE eunameB, ATRNAREA
   INCLUDE, (eunameB)
   and 'PHASE' and 'INCLUDE' cards
   for any of 11 other transients
   which are generated
   INCLUDE
*** REPLACE WITH OBJECT DECK
/*
   ENTRY EUENTRY
// EXEC LNKEDT
/&
(emulator object module)
```

Note: nnn = size of emulator communications
region (variable)

NOAUTO is specified to prevent
Automatic Library Lookup from
being performed in this phase.

Figure   1.   Assembly of User-Tailored Emulator Program Under DOS for the Model 30

PROGRAM GENERATION CONSIDERATIONS

The Model 30 or Model 40 Emulator Program under DOS is assembled and tailored to the user's particular needs by means of macro generation. The macro parameter values used to generate the program must be composed by the user in a manner similar to the way in which a define-the-file (DTF) macro instruction is composed. Continuation cards are allowed in the preparation of these parameters, with each parameter separated by a comma.

The symbolic parameters follow the // EXEC ASSEMBLY card, as shown in Figure 1. The first of these cards must have a program name punched in the label field (starting in column 1) and EU30 or EU40 punched in the operation field:

euname EU30

or

euname EU40

The "euname" parameter provides the name under which the object module of the user's Emulator Program is cataloged in the Core-Image Library. Therefore, it is the name that appears in the // EXEC card whenever the Emulator Program is executed. The name may consist of one to seven characters. No embedded blanks or special characters may appear in the name, and the first character must be an alphabetic character. An X is appended by the Emulator Program to the name to form the name of a second phase of the Emulator Program, which is then called

```
// JOB CATALOG euname TO CORE IMAGE LIBRARY
// OPTION CATAL
|  PHASE euname,+ (RELOC parameter value x 1024),NOAUTO
   INCLUDE,(ACOMP00)
   PHASE eunameX,+ (RELOC+IZ21400 parameter values x 1024)
   INCLUDE,(ACOMP01)
   PHASE $$BEU4M1,+0
   INCLUDE,($$BEU4M1)
   PHASE $$BEU4M2,+0)
   INCLUDE,($$BEU4M2)
   INCLUDE
   (emulator object module)
/*
   ENTRY EUENTRY
// EXEC LNKEDT
/&
```
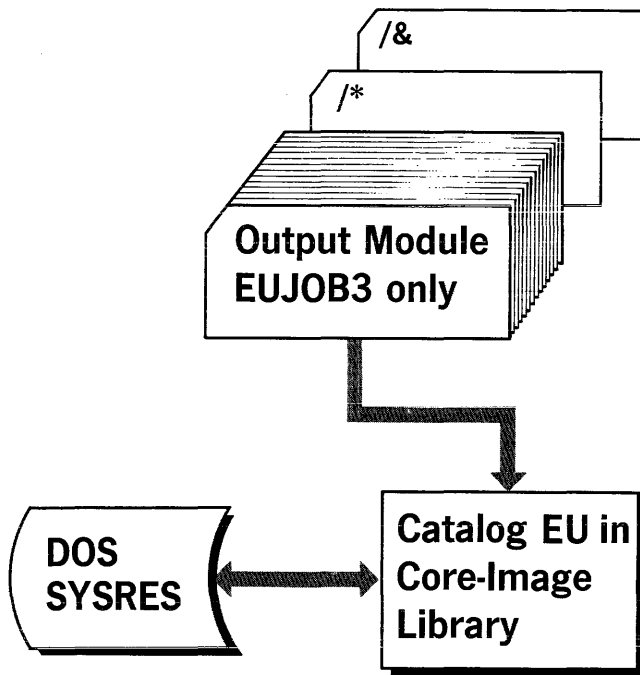
Figure 2. Cataloging of a Model 40 Emula-
tor Program into the Core-Image
Library

by the first phase. Other letters (A, B,
C, D, E, F, L, M, Q, S, T, or Z) are also
appended to the name to form the names of
transient phases which are called by the
second phase when requested. The parame-
ters may be inserted in any sequence, fol-
lowing the rules for the writing of macro
statements of the keyword variety.

CAUTION: Since transient phase names are
modified versions of the specified Emulator
Program name, care should be exercised when
assigning names for multiple Emulator Pro-
grams. For example: If an Emulator Pro-
gram, EMNAME, is generated, a second Emula-
tor Program should not be assigned the name
EMNAME since a transient phase, EMNAME,
would also be created. The transient
phase, EMNAME, would replace the generated
copy of the Emulator Program, EMNAME.

DESCRIPTION OF GENERAL PARAMETERS

CATALOG={YES}
        {NO }

If this parameter is included, the
generated version of the Emulator Program
under DOS is capable of producing a System/
360 object module from a 1400 object deck.
This module can be executed only under the
Emulator Program. FETCH=YES need not be
included in the same assembly. If the
CATALOG parameter is omitted or NO is spec-
ified, the System/360 object module cannot
be produced from a 1400 object deck.

EOJAADR=nnnnn

This parameter is used to specify the con-
tents of the 1400 A-Storage Address Regis-
ter (A-STAR) at normal end-of-job (EOJ)
halts. If this or the following parameter
("EOJBADR=nnnnn") is coded with a standard
value (for example, 00999), the Emulator
Program automatically calls in DOS Job Con-
trol upon encountering a 1400 end-of-job
halt. Valid entries are in the range of
00000 through 15999. The entry is compared
to the contents of the 1400 A-STAR each
time a 1400 halt is trapped by the Compati-
bility Feature and before the printing of
the 1400 registers. If a match occurs, the
Emulator Program automatically goes to its
EOJ and issues a DOS EOJ macro that calls
DOS Job Control for the next System/360 job
that is to be batched in the background
partition (see "EOJBADR=nnnnn"). If this
parameter is omitted, the routine to test
for A address is not generated.

EOJBADR=nnnnn

This is the same as the preceding parameter
("EOJAADR=nnnnn"), except the value of the
B-Storage Address Register (B-STAR) is
checked. If this parameter is omitted, the
routine to test for B address is not
generated.

    If only one of these two parameters is
included, only that compare is made to
satisfy EOJ. If both parameters are
included, both compares must be equal to
satisfy EOJ. If neither parameter is
included, no test for EOJ is made and mes-
sage EC81I or EC82I is displayed unless the
I-STAR option (parameter "hhhhh") in the
// 1400 control card is provided. (See
"The // 1400 Control Card" in the "Control
Cards" section for a description of this
parameter.)

ERROPNG={YES}
        {NO }

If this parameter is included, the Emulator
Program interprets a 1400 operation code of

G with a wordmark as a request for a "snap-shot" dump of 1400 storage. This invalid op code can be patched by the user into 1400 programs run under test mode. Control is returned to the next sequential instruction in the 1400 program. If this parameter is omitted or NO is specified, an operation code of G with a wordmark is treated as invalid. If PTR1400=1404, PTR360=1404, or PTRLNG=100, this parameter must be omitted or specified as NO.

FETCH={YES}
     {NO }

If this parameter is specified, the generated version of the Emulator Program is capable of executing 1400 programs that have been cataloged in the Core-Image Library. 1400 programs so cataloged may be called from the Core-Image Library and executed only by the Emulator Program. (1400 programs cannot be called by Job Control.) CATALOG=YES need not be included in the same version of the Emulator Program that fetches. (See "Cataloging 1400 Programs Into the Core-Image Library" in the "Programming Considerations" section.) The inclusion of this parameter does not preclude the use of a generated Emulator Program from loading a 1400 object program from cards or tape. If this parameter is omitted or NO is specified, the 1400 programs are not fetched from the Core-Image Library.

HALTS={YES}
      {NO }

If this parameter is included with the operand YES, the operator may call for the Sense Switch Operator Service routine in response to a halt message or through the external INTERRUPT key for the background or by the console REQUEST key (MSG F1 or MSG F2) for the foreground while in Compatibility mode (Dial F must be set at CI for the Model 30). If this parameter is omitted or NO is specified, the routine is not generated.

IOCDATE={82 }
        {195 }
        {BOTH}
        {NO }

The 1400 input/output control system (IOCS) requires a date in the form "yyddd" to be available in main storage during label checking. By specifying this parameter, the Emulator Program moves the date from the DOS communication region to the respective 1400 storage location 82-86, 195-199, or both.

The method of loading the program determines when the move occurs. The move occurs before a program is loaded from

cards, but after a program is fetched from the Core-Image Library. Clear Storage cards must be removed from card decks since they clear the IOCDATE that was placed there by the Emulator Program. The bootstrap card, however, should be retained. If this parameter is omitted or NO is specified, the date is not moved.

MPGMBLK={nn}
       {0 }

This parameter is used only for the Model 30 Emulator Program to specify the number of 2K (2,048 bytes) blocks of storage to be reserved for multiprogramming (foreground partitions). If MPGMBLK does not equal zero, the Emulator Program allocates 1400 program storage "nn" 2K blocks below the highest System/360 main storage location specified. The Emulator Program allocates storage from the top of memory down, and from the value in the SEND parameter up, in the following manner:

(a)   Highest storage location available from the "SIZ360=nn" parameter, specified by 1024*SIZ360 (minus 256 if SIZ360=64).

(b)   Highest 1400 storage location specified by the value of (a) minus 2048*MPGMBLK.

(c)   1400 storage location 0 specified by the value of (b) minus 1000*SIZ1400. Therefore, values (a), (b), and (c) allocate storage from the top of storage down at Emulator-Program generation time.

(d)   The size of the Emulator Program depends on the parameters specified and is linkage-edited according to the value of the SEND parameter.

(e)   Tape I/O buffer areas are allocated above the Emulator Program (value (d)), and the size of the area is indicated by the "BUFSIZE=nnnnn" parameter.

OSADDR={YES}
      {NO }

If this parameter is specified, the facility for converting 1400 decimal addresses to their System/360 hexadecimal equivalents is included in the Emulator Programs. This is done to facilitate address-stopping in 1400 programs. If this parameter is omitted or NO is specified, the facility for 1400-address conversion is not generated.

Note: Address conversion for the Model 40 is also provided in tabular form in Appendix F.

OSALTER=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$

If this parameter is specified, the facility for altering the current 1400 instruction address through the console typewriter is included in the Emulator Programs. This is done to allow the operator to perform a 1400-program branch. If this parameter is omitted or NO is specified, the facility for altering the 1400 instruction address is not included.

OSDSPLY=$\begin{Bmatrix} \text{YES} \\ \text{nn} \\ \underline{\text{NO}} \end{Bmatrix}$

If this parameter is specified, the facility for displaying 1400 storage on SYSLOG in blocks of 100 bytes (YES) or less ("nn") is included in the Emulator Programs. If this parameter is omitted or NO is specified, the display facility is not included.

OSDUMP=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$

If this parameter is specified as YES, the facility for dumping 1400 storage on the simulated printer device in standard 1400 format, whenever desired by the operator, is included in the Emulator Programs. (See "Available Functions" in the section on "Operator Service Functions".) Additionally a System/360 main storage dump is provided if the test-mode option in the // 1400 control card is specified as "S". If the OSDUMP parameter is omitted or NO is specified, the dumping facility is not included. If PTR1400=1404, PTR360=1404, or PTRLNG=100, this parameter must be omitted or specified as NO.

OSENTER=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$

If this parameter is specified, the facility for altering 1400 storage through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the alteration facility is not included.

OSINQRY=$\begin{Bmatrix} \text{1400} \\ \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$

If this parameter is specified with 1400, the facility for simulating the setting of the 1400 Q latch is included in the Emulator Programs. Also, support for 1400 Read and Write Console Printer instructions is included. If this parameter is specified with YES, the above facilities and the a-

bility to execute a System/360 native-language inquiry program are included in the Emulator Programs. If this parameter is omitted or NO is specified, none of the above facilities are included. However, if the 1400 program includes Read Console Printer instructions, message EC97I is issued, and the operator service functions may be used to obtain read-to-console messages. (See message EC97I in the section on "Console Messages.")

RELOC=$\begin{Bmatrix} \underline{0} \\ \text{nnn} \end{Bmatrix}$

This parameter is used only with the Model 40 Emulator Program. It is to be used in conjunction with the IBM 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) and EU=RELOC in the SUPVR macro instruction of the DOS Supervisor. RELOC will relocate 1400 simulated storage to the value specified by "nnn" where "nnn" is a multiple of the 16K byte boundary on which 1400 simulated storage is to be relocated. Acceptable values for "nnn" are 16, 32, 48, 64, 80, 96, and 112. The default value is 0 which provides operations without the relocation feature with 1400 simulated storage fixed at decimal location 16,384.

When the Model 40 Emulator Program is executed in the foreground, consideration must be given to the DOS register save areas that occupy the first 88 to 120 bytes of a foreground partition. Therefore, the foreground must begin on a 2K byte boundary below the beginning of 1400 simulated storage.

The Model 40 Emulator Program allocates storage in the following manner:

(a) If RELOC is equal to 0, 1400 simulated storage location 0 is 16,384. Otherwise, 1400 simulated storage location 0 is 1024*RELOC.

(b) The amount of simulated storage allocated is the value of 1024*SIZ1400.

(c) The total disk and tape buffer size then is calculated from the BUFSIZE, DISKDR, and SECTORS parameters. These buffers are allocated immediately above the Model 40 Emulator Program.

(d) The size of Model 40 Emulator Program depends on the parameters specified and is linkage-edited immediately above 1400 simulated storage.

(e) The Emulator Program will automatically add any space between the end of the Emulator Program and the next 2,048 byte boundary to the user's tape buffer pool.

SEND=$\left\{ {0 \atop nnnnn} \right\}$

This parameter is used only with the Model
30 Emulator Program. When specified, SEND=
nnnnn indicates the load point of the Emu-
lator Program. SEND must be specified to
execute the Emulator Program in a fore-
ground partition. To determine the value
for nnnnn, determine the starting address
of that partition in decimal and add 88
bytes decimal to it for the DOS foreground
save area. If FP=YES has been specified in
the CONFG macro of the supervisor genera-
tion, add another 32 bytes decimal to this
figure for the floating point register save
area. For example, if a foreground parti-
tion has been, or is to be, assigned to
start at 32K, the decimal starting address
of the forground partition is 32,768.
Adding 88 bytes, SEND is now equal to 32,
856 and, if FP=YES is specified in the DOS
Supervisor, add another 32 bytes. The
total of 32,888 bytes decimal is the SEND
address. The Emulator Program will then be
assembled to begin execution at this
address.

If the Emulator Program is to be
executed in the background, the value for
SEND should correspond to the value speci-
fied on the SEND macro for the Supervisor
Assembly. If SEND is defaulted or is spec-
ified as zero, the Emulator Program will be
defaulted to execution in the background
partition. SEND, if specified, will also
force the assembler to assign Emulator Pro-
gram storage addresses identical to those
at object time. Thus, a System/360 storage
dump of the Emulator Program can be related
directly to the Emulator Program listing.

SIZ1400=$\left\{ {nn \atop 16} \right\}$

This parameter is used to specify the
storage size of the 1400 system to be simu-
lated. Allowable values for "nn" are 2, 4,
6, 8, 10, 12, 14, and 16. If this paramet-
er is omitted, "nn" is assumed to be 16.

Note: 1400 programs that require more
storage than has been specified for the
SIZ1400 parameter may not execute properly.
See also restriction 19 on page 22 and con-
sideration 19 on page 24.

SIZ360=$\left\{ {nnn \atop 64} \right\}$

This parameter is used to specify the
storage size of the user's System/360.
Allowable values for "nnn" on the Model 30
are 24, 32, 48 and 64. Allowable values
for "nnn" on the Model 40 are 32, 64, 128,
192 and 256. If this parameter is omitted,
the assumed value for "nnn" is 64.

SYSIO=$\left\{ {ipl \atop 000} \right\}$

This parameter must be specified if the
user wishes to support device independence
for 1400 unit-record devices. "i", "p",
and "l", represent SYSIPT, SYSPCH, and SYS-
LST, respectively, and each may have a
value of 0 through 3. The meanings of the
values are:

0 - Associated device may be assigned
   only to unit record.

1 - Associated device may alternately be
   assigned to a unit-record device or a
   magnetic-tape drive (9-track or 7-
   track with the Data Conversion Fea-
   ture for SYSLST).

2 - Associated device may alternately be
   assigned to a unit-record device, a
   magnetic-tape drive, a 2311, or 2314
   disk drive.

3 - Associated device may alternately be
   assigned to a unit-record device, a
   2311, or 2314 disk drive.

If this parameter is omitted, the assumed
value for "ipl" is 000.

Note: If "i", "p", or "l" is specified as
a 2 or 3, a 2311 or 2314 disk drive must be
specified in the SYSFIL parameter of the
FOPT macro during DOS Supervisor genera-
tion. If SYSFIL=2314 is specified,
DISKTYP=2314 must also be specified (refer
to DISKTYP parameter under "Description of
Disk Parameter").

SYSROPT=$\left\{ {YES \atop NO} \right\}$

This parameter is used to specify whether
or not the user wants the Emulator Program
to change from input on SYSRDR to input
from SYSIPT during the execution of a 1400
program. If the SYSROPT parameter is spec-
ified YES, the // IP control card is
optional, but must be in the customer's
deck if he wishes the job stream trans-
ferred from input on SYSRDR to SYSIPT dur-
ing 1400 program execution. However, if
the // IP control card is used, the SYSROPT
parameter must be specified YES. If speci-
fied as YES, the Emulator job control cards
are read on SYSRDR, and then, the 1400 pro-
gram, data, and read operation control
cards are read on SYSRDR until a // IP card
is encountered. The // IP control card
transfers card read simulation to SYSIPT.
If this parameter is omitted or NO is spec-
ified, all Emulator job control cards, the
1400 program, data,
and read operation control cards are read
on SYSIPT. SYSRDR and SYSIPT may be speci-
fied as either card reader, disk or tape.

TIMER=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter specifies the availability of the interval timer to log the time of day on beginning and ending messages. Emulator-Program use of the timer in this manner does not prevent a foreground program from using the timer for interval interrupts. If this parameter is omitted or NO is specified, the timer is not used.

USRPROG=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify that the user wishes to insert a user-written routine to handle operation codes not supported by the Emulator Program. If this parameter is omitted or NO is specified, the entry to the user-written routine is not generated. If specified YES, the user-written routine must be included at assembly time. (See "User-Written Simulation Routines" section.)

DESCRIPTION OF CARD READER AND PUNCH PARAMETERS

COLBINP=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify whether or not the user wants column-binary support for the card punch. If COLBINP=YES is specified, support for Punch-Column-Binary or Card Image instructions is generated. If COLBINP=NO is specified or if this parameter is omitted, any such instructions are treated as invalid op codes.

COLBINR=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify whether or not the user wants column-binary support for the card reader. If COLBINR=YES is specified, support for Read-Column-Binary or Card Image instructions is generated. If COLBINR=NO is specified or if this parameter is omitted, any such instructions are treated as invalid op codes.

COL51=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify whether or not the user wants 51-Column Interchangeable-Read-Feed feature support for the 1402/2540 card reader. If COL51=YES is specified, support for reading 51-column cards is generated. If COL51=NO is specified or if this parameter is omitted, the 51-Column Interchangeable-Read-Feed feature is not supported. This parameter pertains to the 1402/2540 card reader only.

PCH1400=$\begin{Bmatrix} 1442 \\ 1444 \\ \underline{1402} \end{Bmatrix}$

This parameter is used to specify the 1400 punch to be simulated. If this parameter is omitted, it is assumed that the 1400 punch to be simulated is a 1402.

Note: If a 1440 is being emulated, this parameter must be coded PCH1400=1442 or 1444. This is so that punching can occur from any location in 1400 storage and be terminated by a groupmark with wordmark.

PCH360=$\begin{Bmatrix} 1442 \\ 2520 \\ \underline{2540} \end{Bmatrix}$

This parameter is used to specify the System/360 punch. If this parameter is omitted, it is assumed that the System/360 punch is a 2540.

PFR=$\begin{Bmatrix} YES \\ COM \\ \underline{NO} \end{Bmatrix}$

This parameter is used to specify whether or not the user wants his Emulator Program to use the Punch-Feed-Read (PFR) feature. If PFR=YES is specified, the Emulator Program provides support for 1402 Punch and Punch-Feed-Read (PFR) instructions, or 1442 read, stacker select (READRSS=YES), and punch operations utilizing the Punch-Feed-Read feature of the 2540. Specify PFR=COM and PUNCHSS=YES when simulating both 1402 punch-feed-read and stacker select operations with the 2540 Compatibility Attachment (#8065) installed on the 2821 Control Unit. If 1402 punch-feed-read is supported and 1402 stacker select is not supported, use PFR=YES. If PFR=NO is specified or if this parameter is omitted, any PFR instructions are treated as invalid operation codes. If PFR is used, separate routines for PFR and normal punching are generated so that the normal punch overlap is not lost if the 1400 program does not require any PFR instruction emulation.

PUNCHSS=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter specifies whether or not the user wants his Emulator Program to be able to simulate 1402 or 1444 punch stacker selection. (1442 punch stacker selection is supported by READRSS.) If coded as NO or if omitted, all punch stacker select commands are treated as No-Ops, or as unconditional branches if stacker selection and branch. A parameter ("d") must be inserted in the // 1400 control card (see "The // 1400 Control Card" in the "Control Cards" section) for each 1400 program in which 1402 or 1444 punch stacker selection

is to be simulated. Punch stacker selec-
tion is handled in this manner for 1402 or
1444 simulation because if it is to be
simulated but the 1400 program does not, in
fact, issue stacker select instructions,
all punch overlap is lost.

READRSS= {YES}
        {NO }

This parameter indicates whether or not the
user wishes to support reader stacker
selection or all 1442 stacker selection.
If coded NO or omitted, all Reader-Stacker,
or all 1442-Stacker instructions are
treated as No-Ops or unconditional
branches. If coded YES, the generated ver-
sion of the Emulator Program has the abili-
ty to simulate 1402 reader, or 1442 reader
punch stacker selection, but cannot auto-
matically do so. A parameter ("c") must be
included in the 1400 control card (see "The
// 1400 Control Card" in the "Control
Cards" section) for each 1400 control card
for each 1400 program in which reader
stacker selection is to be simulated.
Also, a // LC control card should be
included. (See item 7 in the section on
"Considerations.") This parameter is not
recommended if the System/360 reader is a
2540 or 2520, since simulated stacker
selection reduces card read speed, and
hence reduces throughput.

RDR1400= {1442}
         {1402}

This parameter is used to specify the 1400
reader to be simulated. If this parameter
is omitted, it is assumed that the 1400
reader is a 1402.

Note: If a 1440 is being emulated, this
parameter must be coded RDR1400=1442. This
is so that reading can occur from any loca-
tion in 1400 storage and be terminated by a
groupmark with wordmark.

RDR360= {1442}
        {2501}
        {2520}
        {2540}

This parameter is used to specify the
System/360 reader. If this parameter is
omitted, it is assumed that the System/360
reader is a 2540.

SSQUANT= {ONE }
         {MANY}

This parameter applies only when RDR360=
2540 is specified and the user wishes to
support reader stacker selection (READRSS=
YES). Normally, the Emulator Programs
handle several Stacker Select commands fol-
lowing a Read command. Only the last
Stacker Select command, however, is effec-

tive. No card movement occurs until the
next card is encountered. This method is
inefficient for users who have only one
Stacker Select command following the Card
Read.

If the value ONE is specified, the
Emulator-Program routine initiates a card
feed when it encounters the first Stacker
Select command. Subsequent Stacker Select
commands are ignored. If the value MANY is
specified, or if the parameter is omitted,
normal handling of Stacker Select commands
is generated.

This parameter is ignored if READRSS=YES is
not specified. If READRSS=YES is not spec-
ified, or if it is specified and the
SSQUANT parameter is omitted, the absence
of a Stacker Select command causes the Emu-
lator Program to wait until the next 1400
Read is encountered.

Note: If reader stacker selection is
required, maximum throughput can only occur
when a Stacker Select command follows most
or all Read Card commands and SSQUANT=ONE
is specified.

DESCRIPTION OF TAPE PARAMETERS

BLKSIZu= {nnnnn}
         {00000}

This parameter is used to specify the maxi-
mum block length plus one that is normally
read or written in Move mode on 1400 tape
drive "u" ("u" is 1 through 6). "nnnnn" is
the size of an area (maximum block length
plus one) of System/360 main storage set
aside for use as a tape buffer associated
with a given drive. If this parameter is
omitted for a given drive number, the
assumed value is zero.

The value given by this parameter may be
changed at execution time through the use
of a // TAPE control card. Normally, the
user should include as many "BLKSIZu=nnnnn"
parameters as he has 1400 drives to be
simulated, although the user with abundant
main storage may wish to include a
"BLKSIZu=nnnnn" for each drive that is
accessed by 1400 programs. Load-mode
operations do not depend on "BLKSIZu=nnnnn"
parameters. (See "BUFSIZE=nnnnn".)

BUFSIZE= {nnnnn}
         {00000}

This parameter is used to specify the total
main storage to be set aside by the Model
30 or Model 40 Emulator Program for use as
tape buffers for Move-mode operations.
This amount should not be less than the sum
of the "BLKSIZu=nnnnn" values, and may not

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be increased at object time. If this parameter is omitted, the assumed value is zero. The area defined by this parameter may be considered to be a pool of buffers that is divided among the 1400 tapes on line in a given job according to (1) the values given in the "BLKSIZu=nnnnn" parameters or (2) the revised values given by a // TAPE control card(s) at object time. Because Load-mode operations must be assumed to include the reading and writing of very large (checkpoint) blocks, each Load-mode operation has access to the entire area defined by "BUFSIZE=nnnnn". The user should be aware that 16K 1400 checkpoints require a buffer size in excess of 16,000 bytes since each wordmark in storage generates a word separator character in addition to the character associated with the wordmark when written out on tape.

For the Model 40, the Emulator Program will automatically add any space between the end of the Emulator Program and the next 2,048 byte boundary to the user's tape buffer pool.

OSTAPE= $\left\{ \begin{matrix} YES \\ \underline{NO} \end{matrix} \right\}$

If this parameter is specified, the facility for dynamically changing and/or displaying 1400 magnetic-tape drive assignments through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the facility for changing tape-drive assignments is not included.

TAPEDR= $\left\{ \begin{matrix} n \\ \underline{0} \end{matrix} \right\}$

This parameter is used to specify the number of physical tape units that the user has on his 1400, where "n" is a value from 1 to 6. If this parameter is omitted, the assumed value for "n" is 0.

TAPEMOD=MXEDPAR

This parameter must be included if the user's 1400 program requires the capability to read and/or write both BCD and binary records (mixed-parity records) on either a 7- or 9-track tape. This parameter may also be specified to read or write either even-or odd-parity records if it is desired to process tape errors in the 1400 program. (See parameter "y" in the // TAPE control card.) However, when this parameter is specified, tape reading on an applicable drive is not overlapped. If this parameter is omitted, the assumed mode for 7-track tapes is translator on and converter off, and the density is as specified on the DOS // ASSGN control card; for 9-track tapes even parity is assumed.

TAPERRS= $\left\{ \begin{matrix} LST \\ LOG \\ LSTCHAR \\ LOGCHAR \\ \underline{NO} \end{matrix} \right\}$

1400 hardware permits the reading of tape error blocks by means of an operator-initiated diagnostic read. The block of tape may then be scanned for out-of-parity characters, and the operator has the choice of correcting the characters and allowing the 1400 to process the block or of bypassing the error block. No direct equivalent to the diagnostic read exists in System/360 hardware, but the Emulator Program is able to approximately simulate the feature when a data-check condition is logged by DOS. The meanings of the values are:

LST   - The error block is printed on the device simulating the 1400 printer in EBCDIC after the block has been translated for unprintable characters and may then be printed in hexadecimal.

LOG   - Same as LST, except all printing occurs on SYSLOG. This is advisable if SYSLST is to be assigned to a magnetic device.

LSTCHAR - An EBCDIC-only printout of the error block on SYSLST, with asterisks replacing unprintable characters.

LOGCHAR - An EBCDIC-only printout of the error block on SYSLOG, with asterisks replacing unprintable characters.

Note: If PTR360=1404 is specified, LST and LSTCHAR facilities are not included.

After printing the error block, the operator is given the choice of allowing the 1400 to process the block or bypass the block. If the parameter is omitted or NO is specified, the only option available to the operator in the event of a tape data check is to ignore the data and bypass the block, or to cancel the job. No printout of the block in error occurs.

TAPEu=SYSnnn

This parameter is used to assign a DOS programmer logical unit (SYS000 - SYS221) to a 1400 tape unit, where "u" is the 1400 tape unit assignment (a number from 1 to 6). Assignments can be made for each of the six 1400 tape unit assignments. Several 1400 tape units can be assigned to the same programmer logical unit, but only during Emulator Program generation. The assignments may be changed during program execution if

OSTAPE=YES is specified. (See TAPE function in the "Operator Service Functions" section.) The default values for unassigned values of "u" are:

"u"	Programmer Logical Unit
1	SYS011
2	SYS012
3	SYS013
4	SYS014
5	SYS015
6	SYS016

TAPLDMD= $\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter must be included if tape Load-mode operations are to be simulated. If this parameter is omitted or NO is specified, tape Load-mode operations are not simulated. It should be noted that 1400 IOCS opens tape operations in the Load mode even though 1400 IOCS Move mode is specified.

DESCRIPTION OF DISK PARAMETERS

DISKDR= $\begin{Bmatrix} n \\ 130n \\ 1405 \\ \underline{0} \end{Bmatrix}$

This parameter is used to specify the number and·type of 1400 direct-access storage devices (DASDs) to be simulated on 2311 or 2314. To simulate 1311 drives only, the acceptable values for "n" are 1 through 5, and indicate the number of 1311 drives to be simulated. To simulate one module of a 1301 and also "n" 1311 drives, the correct value is "130n". To simulate one module of a 1301, the correct value for "130n" is 1300. To simulate a 1405, the value should be 1405. The following are given as examples:

DISKDR=5   All five 1311 drives to be simulated

DISKDR=1303 One 1301 module and three 1311 drives to be simulated (Drives 0, 2, and 4)

Note: When less than five 1311 drives are specified, the low-numbered 1400 drives are assumed.

DISKDR=1300 One 1301 module to be simulated (no 1311)

DISKDR=1405 1405 only to be simulated

Note: 1405 and 1301/1311 disk drives are mutually exclusive.

If this parameter is omitted, the default value for the parameter is 0 and indicates that no disks are to be simulated.

DISKTYP= $\begin{Bmatrix} 2314 \\ \underline{2311} \end{Bmatrix}$

This parameter is used to specify the type of System/360 device that is to simulate the 1400 disk unit. It also applies to SYSIPT, SYSPCH, and SYSLST when they are assigned to disk. If this parameter is omitted, the assumed value is 2311.

DISKu=SYSnnn

This parameter is used to assign a DOS programmer logical units (SYS000 - SYS221) to 1311 Disk Storage Drives, or to a 1405 Disk Storage. The proper values for "u" are 1 to 5 for 1311 Disk·Storage Drives, 1 and 2 for Model 1 1405 Disk Storages, and 1 to 4 for Model 2 1405 Disk Storages. When simulating a 1311 on a 2311 or 2314, the default values for "u" are:

"u"	1400 Drive	Programmer Logical Unit
1	0	SYS001
2	2	SYS002
3	4	SYS003
4	6	SYS004
5	8	SYS005

When simulating a 1405 on a 2311, the default values for "u" are:

"u"	1405 Sector Address		Programmer Logical Unit
1	00000-24999	(Models 1	SYS001
2	25000-49999	and 2)	SYS002
3	50000-74999	(Model 2	SYS003
4	75000-99999	only)	SYS004

When simulating a 1405 on a 2314, the default values for "u" are:

"u"	1405 Sector Address		Programmer Logical Unit
1	00000-49999	(Models 1 and 2)	SYS001
2	50000-99999	(Model 2 only)	SYS002

The assignments may be changed during program execution time if OSDISK=YES is specified.

DVOL= $\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$

This parameter, when specified as YES, provides the facility for verifying the volume serial number of disk packs accessed by the Emulator Program. Verification is performed for each disk pack specified on a // DVOL control card or initiated by the

operator using the operator service functions. Volume serial number verfication is recommended to avoid the possibility of the 1400 program accessing the wrong disk pack in the DOS multiprogramming environment. If this parameter is omitted, or NO is specified, verification is not performed.

D1301u=SYSnnn

This parameter is used to assign DOS programmer logical units (SYS000 - SYS221) to a 1301 Disk Storage. The proper values for "u" are 1 to 5 for emulation on a 2311, and 1 to 3 for emulation on a 2314. These assignments are required only when DISKDR= 130n is specified. When simulating a 1301 on 2311s, the default values for "u" are:

"u"	1301 Sector Address	Programmer Logical Unit
1	000000-039999	SYS001
2	040000-079999	SYS002
3	080000-119999	SYS003
4	120000-159999	SYS004
5	160000-199999	SYS005

When simulating a 1301 on a 2314, the default values for "u" are:

"u"	1301 Sector Address	Programmer Logical Unit
1	000000-079999	SYS001
2	080000-159999	SYS002
3	160000-199999	SYS003

OSDISK= {YES} {NO}

If this parameter is specified, the facility for changing 1400 disk-drive assignments in mid-program through the console typewriter is included in the Emulator Programs. If this parameter is omitted or NO is specified, the facility for changing disk-drive assignments is not included.

SCAN= {YES} {NO}

This parameter is used to specify that 1311 Scan Disk instructions are issued in the 1400 programs. If this parameter is omitted or NO is specified, 1311 Scan Disk instructions are not supported.

SCAN360= {YES} {NO}

If the user has the File Scan Feature, this parameter is used in conjunction with the SCAN=YES parameter to implement the 1400 Scan Disk Feature on System/360 direct-access storage devices. If SCAN360=NO is specified or if this parameter is omitted, the Emulator Program performs the Scan Disk function.

SECTORS= {nnn} {020}

This parameter is used to determine the disk I/O buffer size and dictates the simulation technique to be employed. Valid entries of "nnn" range in value from 001 through 020 for the Model 30 Emulator Program and 001 through 100 for the Model 40 Emulator Program. This value indicates the maximum number of sectors that can be read or written in one physical I/O operation. Program requests for disk I/O exceeding the number of sectors specified in this parameter cause two or more physical I/O operations to be executed. If this parameter is omitted, the assumed value for "nnn" is 020, which should be used, storage permitting. The only reason for specifying less than 020 is to conserve main storage. If TRACKOP=YES or OSINQRY=YES is specified, the assumed value 020 should be specified.

TRACKOP= {YES} {NO}

This parameter must be specified if track operations on 1311, 1301, or 1405 are to be simulated. If this parameter is included, the "SECTORS=nnn" parameter, if included, should be given a value of 020. If this parameter is omitted or NO is specified, track operations are not simulated.

VERIFY= {YES} {NO}

If this parameter is included, disk records written by the Emulator Programs are verified. Verification is accomplished in the standard System/360 manner (cyclic redundancy check). If this parameter is omitted or NO is specified, the 1400 Write Disk Check command is treated as a No-Op, except the simulated Write Disk Check Interlock switch is released.

DESCRIPTION OF PRINTER PARAMETERS

CARRCTL= {YES} {NO}

This parameter is used to specify whether or not the user wants to support the carriage-control tape pointer option. If CARRCTL=YES is specified, an image of the printer carriage-control tape is retained in main storage and a pointer is used to indicate the position of the carriage. Use of this parameter: (1) eliminates the need for moving the channel-9 or channel-12 punch up one line, and (2) allows complete simulation of variable-line and preprinted-form printing when SYSLST is assigned to tape or disk. If CARRCTL=NO is specified or if this parameter is omitted, the program uses the DOS "LINECT=nn" method to

control the printer spacing when SYSLST is
assigned to tape or disk.

EDITINV={YES
         NO}

This parameter is used only with Model 40
Emulator Program, and provides support for
Inverted Print Edit. If required, the user
specifies this parameter as EDITINV=YES.
Inverted Print Edit is primarily used in
countries outside the U.S.A., such as in
France where 1000 francs, 5 centimes is
represented as 1.000,05. The default for
this parameter is NO.

PTRASGN={SYSnnn
         SYSLST}

This parameter is used to assign the
System/360 printer to a specific programmer
logical unit (SYS000 - SYS221). This pa-
rameter must be used if PTR360=1404 is
specified. It also may be used when job
control statements directed to SYSLST are
not desired on the printer, such as on pre-
printed forms. PTRASGN=SYSnnn must identi-
fy a printer; no support is provided for
tape or disk. The default for this parame-
ter is SYSLST.

PTRLNG={nnn
        132}

This parameter is used to specify the
length of the print line on the 1400, where
"nnn" is 100, 120, or 132 for the 1403, 120
or 144 for the 1443, or 132 for the 1404.
PTRLNG must not be greater than the number
of print positions on the System/360 print-
er. Also, when PTRLNG=100 is specified,
the actual line-length assignment on the
System/360 device is 120 characters (padded
by blanks). If this parameter is omitted,
it is assumed that the print line is 132
characters long.

PTR1400={1443
         1404
         1403}

This parameter is used to specify the 1400
printer to be simulated. If this parameter
is omitted, it is assumed that the 1400
printer is a 1403. 1404 should be speci-
fied only if cut-card operations are to be
simulated; if continuous forms only are
printed on the System/360, 1403 should be
specified. If 1404 is specified, a 1404
must be installed on the System/360, and
the OSDUMP and ERROPNG parameters must be
omitted or specified as NO.

Note: If a 1440 is being emulated, this
parameter must be coded PTR1400=1443. This
is so that printing can occur from any
location in 1400 storage and be terminated
by a groupmark with wordmark.

PTR360={1443
        1404
        1403}

This parameter is used to specify the
System/360 printer. If this parameter is
omitted, it is assumed that the System/360
printer is a 1403.

MACRO NOTE MESSAGES

The following messages could be issued
during Model 30 or Model 40 Emulator-
Program system generation and are self-
explanatory:

BLKSIZu PARAMETER INCORRECTLY SPECIFIED
BUFSIZE PARAMETER INCORRECTLY SPECIFIED
BUFSIZE TOO SMALL FOR STANDARD BLOCKSIZES,
  BUFSIZE ASSUMED AS SUM OF BLOCKSIZES
CARRCTL NOT SUPPORTED IF PTR1400 IS A 1404
CARRCTL PARAMETER INCORRECTLY SPECIFIED
CATALOG PARAMETER INCORRECTLY SPECIFIED
COLBINP PARAMETER INCORRECTLY SPECIFIED
COLBINR PARAMETER INCORRECTLY SPECIFIED
COL51 PARAMETER INCORRECTLY SPECIFIED
DISKDR PARAMETER INCORRECTLY SPECIFIED
DISKTYP PARAMETER INCORRECTLY SPECIFIED
DISKu PARAMETER INCORRECTLY SPECIFIED
DVOL PARAMETER INCORRECTLY SPECIFIED
D1301u PARAMETER INCORRECTLY SPECIFIED
EDITINV INCORRECTLY SPECIFIED
EOJAADR PARAMETER INCORRECTLY SPECIFIED
EOJBADR PARAMETER INCORRECTLY SPECIFIED
ERROPNG NOT SUPPORTED IF PTR1400 EQ 1404 OR
  PTRLNG EQ 100
ERROPNG PARAMETER INCORRECTLY SPECIFIED
FETCH PARAMETER INCORRECTLY SPECIFIED
GENERATION TERMINATED
HALTS PARAMETER INCORRECTLY SPECIFIED
IOCDATE PARAMETER INCORRECTLY SPECIFIED
MPGMBLK PARAMETER INCORRECTLY SPECIFIED
OSADDR PARAMETER INCORRECTLY SPECIFIED
OSALTER PARAMETER INCORRECTLY SPECIFIED
OSDISK PARAMETER INCORRECTLY SPECIFIED
OSDSPLY PARAMETER INCORRECTLY SPECIFIED
OSDSPLY SPECIFIED GREATER THAN 100, 100
  ASSUMED
OSDUMP NOT SUPPORTED IF PTR1400 EQ 1404 OR
  PTRLNG EQ 100
OSDUMP PARAMETER INCORRECTLY SPECIFIED
OSENTER PARAMETER INCORRECTLY SPECIFIED
OSINQRY PARAMETER INCORRECTLY SPECIFIED
OSTAPE PARAMETER INCORRECTLY SPECIFIED
PCH1400 AND PTR1400 PARAMETERS INCORRECTLY
  SPECIFIED
PCH1400 PARAMETER INCORRECTLY SPECIFIED
PCH360 PARAMETER INCORRECTLY SPECIFIED
PFR PARAMETER INCORRECTLY SPECIFIED
PROGRAM NAME INCORRECTLY SPECIFIED
PTRASGN PARAMETER INCORRECTLY SPECIFIED
PTRLNG PARAMETER INCORRECTLY SPECIFIED
PTR1400 PARAMETER INCORRECTLY SPECIFIED
PTR360 PARAMETER INCORRECTLY SPECIFIED
PUNCHSS PARAMETER INCORRECTLY SPECIFIED
RDR1400 PARAMETER INCORRECTLY SPECIFIED
RDR360 MUST BE 2540 IF COL51=YES

RDR360 PARAMETER INCORRECTLY SPECIFIED
READRSS PARAMETER INCORRECTLY SPECIFIED
RELOC PARAMETER INCORRECTLY SPECIFIED
SCAN OR SCAN360 INCORRECTLY SPECIFIED
SCAN PARAMETER INCORRECTLY SPECIFIED
SCAN360 PARAMETER INCORRECTLY SPECIFIED
SECTORS PARAMETER INCORRECTLY SPECIFIED
SEND PARAMETER INCORRECTLY SPECIFIED
SIZ1400 PARAMETER INCORRECTLY SPECIFIED
SIZ360 PARAMETER INCORRECTLY SPECIFIED
SSQUANT PARAMETER INCORRECTLY SPECIFIED
SYSIO PARAMETER INCORRECTLY SPECIFIED
SYSROPT PARAMETER INCORRECTLY SPECIFIED
TAPE PARAMETERS INCORRECTLY SPECIFIED
TAPEDR PARAMETER INCORRECTLY SPECIFIED

TAPEMOD PARAMETER INCORRECTLY SPECIFIED
TAPERRS DISPLAY NOT SUPPORTED IF PTR1400 EQ
   1404
TAPERRS PARAMETER INCORRECTLY SPECIFIED
TAPE1 PARAMETER INCORRECTLY SPECIFIED
TAPE2 PARAMETER INCORRECTLY SPECIFIED
TAPE3 PARAMETER INCORRECTLY SPECIFIED
TAPE4 PARAMETER INCORRECTLY SPECIFIED
TAPE5 PARAMETER INCORRECTLY SPECIFIED
TAPE6 PARAMETER INCORRECTLY SPECIFIED
TAPLDMD PARAMETER INCORRECTLY SPECIFIED
TRACKOP PARAMETER INCORRECTLY SPECIFIED
TIMER PARAMETER INCORRECTLY SPECIFIED
USRPROG PARAMETER INCORRECTLY SPECIFIED
VERIFY PARAMETER INCORRECTLY SPECIFIED

STORAGE LAYOUT

The Emulator Program under DOS for the Model 30 is designed to reside in main storage at the location determined by the SEND parameter. The Emulator Program consists of an initialization phase and a main phase. The initialization phase initializes the interphase communication region, and remains in main storage only until the first Programmed Mode Switch (PMS) supervisor call (SVC). It then fetches the main phase, which overlays all but the interphase communication region. The main phase is made up of individual modules that simulate the various 1400 processes and an area for transient routines. The System/360 tape and disk buffer area begins immediately after the main phase and may extend to the beginning of the 1400 simulated storage area.

Figure 3 shows the storage allocation for a Model 30 Emulator Program with SEND=0 and 4K of 1400 storage. (The algorithm for estimating the total storage requirement for a Model 30 Emulator Program, as a function of the parameters specified at generation time, is presented in Appendix G.)

The Model 40 Emulator Program consists of an initialization phase and a main phase. The initialization phase is loaded at the same location as the starting location of simulated 1400 storage which is determined by the RELOC parameter. The end of the DOS supervisor area must not exceed this location. The main phase is loaded immediately above 1400 simulated storage.
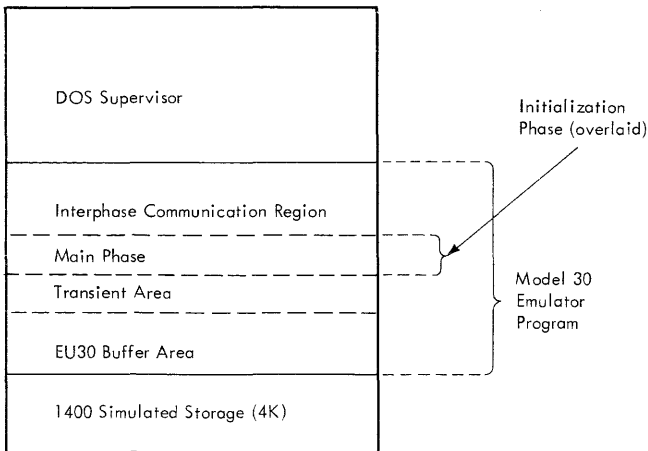
Figure 3. Typical Storage Map of Model 30 Emulator Program With 4K of 1400 Storage
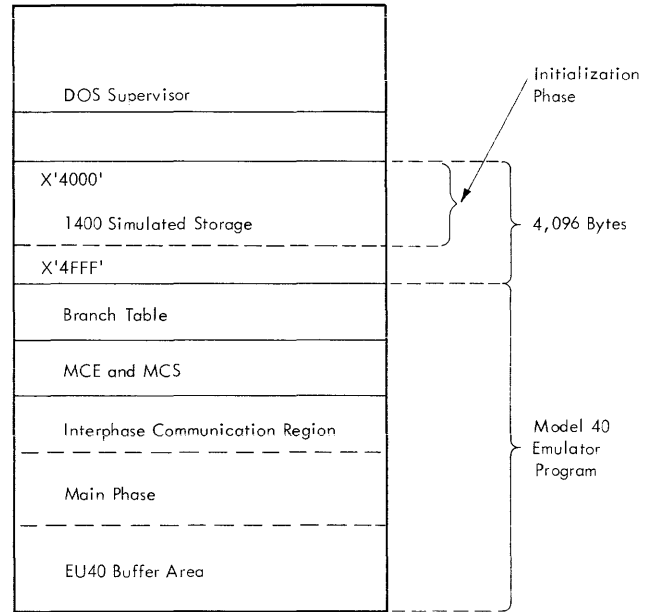
Figure 4. Typical Storage Map of Model 40 Emulator Program With 4K of 1400 Storage

The initialization phase fetches the main phase which copies the branch table and the interphase communication region from the initialization phase into the storage locations above 1400 simulated storage. The main phase, which is made up of individual modules that simulate the various 1400 processes, then clears 1400 simulated storage. The System/360 disk and tape buffer areas begin immediately after the main phase.

Figure 4 shows the storage allocation for a Model 40 Emulator Program with RELOC= 0 and 4K of 1400 storage. (The algorithm for estimating the total storage requirement for a Model 40 Emulator Program, as a function of the parameters specified at generation time, is presented in Appendix H.)

REGISTER USAGE

The utilization of the general purpose registers by the Model 30 Emulator Program is illustrated in Table 4. Usage for the Model 40 is shown in Table 5. All general purpose registers may be used by user routines if registers 0 through 14 are saved and restored.

Table 4. Use of Registers by Model 30
Emulator Program

Register	Use by Model 30 Emulator Program
0 and 1	Temporary computations.
2, 3, 4, 11, 12, & 15	Base registers.
5	Temporary computations.
6	Holds address of 1400 instruction that caused the program-mode switch when the Emulator Program branched to a simulation routine.
7, 8, & 10	Used within individual routines.
9	Holds 1400 offset address throughout execution.
13	Holds address of Emulator Communications Region.
14	Used for Branch and Link.

Table 5. Use of Registers by Model 40
Emulator Program

Register	Use by Model 40 Emulator Program
0	1400 Instruction Address Register.
1	1400 A-Address and B-Address Registers.
2, 3, & 4	Base registers.
4	Used for Edit Get/Put Diagnose instructions.
5 & 6	Temporary computations.
7	Used by Compatibility Feature to store sense-switch settings.
8, 9, & 11	Used by Compatibility Feature.
10	Branch Table Pointer.
12 & 13	Temporary computations.
14 & 15	Subroutine linkage.

PROGRAMMING RESTRICTIONS AND CONSIDERATIONS

RESTRICTIONS

Before an installation utilizes the Model 30 or Model 40 Emulator Programs under DOS, the user must consider the following programming restrictions:

1. Time-dependent programs may not yield results identical to those obtained on a 1400 system.

2. The Model 30 and Model 40 Emulator Programs do not check for an effective address greater than the main storage capacity of the 1400 system. The Model 40 hardware always assumes a 16K 1400 main storage, except for 1400 Clear Storage, Set Wordmark, and Clear Wordmark instructions. Therefore, for the Model 40 Emulator and for a 16K 1400 memory simulated on a Model 30 Emulator, addresses between 0 and 15,999 are valid; addresses greater than 15,999 cause a wraparound.

3. Simulated 1400 locations 0000 and 0100 are not used by the Model 30 and Model 40 Emulator Programs for timing control of read and punch operations as they are on a 1400 system. The contents of these locations are undisturbed by the Model 30 and Model 40 Emulator Programs.

4. Programs cataloged under the Model 30 Emulator Program may not be executed on the Model 40 Emulator Program, and vice versa.

5. 1050 control codes are not supported.

6. The Selective Tape Listing Feature is not emulated for printers.

7. Reassignment of SYSIO to magnetic devices restricts I/O operations. (See Item 10 under "Considerations.")

8. Stacker selection to the RP3 pocket is not supported when SYSPCH is assigned to tape or disk.

9. Catastrophic 1400 processing errors can result in System/360 program checks, which may occur in lieu of 1400 "process errors."

10. When a Divide instruction is executed by the Model 40 Emulator Program, high-order blanks in the dividend field are converted to zeros.

11. The cataloging of overlay programs on the Model 40 Emulator Program is restricted because of the non-contiguous layout of simulated 1400 storage.

12. Read release operations on the card reader are not supported.

13. When the System/360 punch unit is not a 1442, the 1442 Punch-Column-Skip instruction cannot be used in conjunction with the Card-Image-Punch instruction for the same card, nor can both BCD and Card Image data be punched into the same card.

14. Multiple readers, punches, or printers are not supported (such as the second 1442 on the 1440), nor is concurrent punching on both a 1442 and 1444 supported.

15. Stacker select operations are limited by the System/360 card devices. (See Table 8, Note 5.)

16. Since the 2540 has an additional pre-stacker station on the read side, operations involving merging into the RP3 pocket of punched and read cards may not be consistent with the original 1400 program.

17. While simulating the 1442 on the 2540, the Punch-Feed-Read Feature will not support card image reading or punching, or the catalog facilities.

18. Load-mode, file-scan operations using System/360 File Scan Feature are not supported. Simulation support is provided but, due to the difference in scan arguments, accurate results are not always guaranteed.

19. The SIZ1400 parameter must be specified as one of the actual 1400 storage sizes for programs whose coding is dependent upon actual machine size (e.g., AUTOCODER programs).

20. On the Model 40 invalid disk seeks with no d-modifier will not be emulated as seeks, but rather as move operations. Therefore, modifications to programs with such instructions will be required.

21. When executing more than one Model 40 Emulator Program, each specifying RELOC≠0, the EDITINV parameters for the concurrently executing Emulator Programs should be the same. If the EDITINV parameters are not the same for the concurrently executing Emulator Programs, the character editing is determined by the last initiated Emulator Program.

22. If an attempt is made to execute an Emulator Program in a DOS/SPI mode of operation, the Emulator Program issues message EC21I and is terminated. The DOS/SPI mode of operation is not supported.

CONSIDERATIONS

Before an installation utilizes the Model 30 or Model 40 Emulator Program, the user must take into account the following programming considerations:

1. The Model 30 and Model 40 Emulator Programs clear 1400 storage between catalog runs. Therefore, multiphase 1400 programs that require the presence of data or instructions from a previous phase may not be executed correctly after cataloging.

2. Programs with undetected programming errors may not yield results identical to those obtained on a 1400 system.

3. Data prepared for input to the Emulator Programs by System/360 programs must be restricted to the 64-character BCD set.

4. The Emulator Programs move the date ("yyddd") from the DOS communication region into 1400 locations 82-86 and/or 195-199 and set wordmarks if the parameter "IOCDATE=x" is specified. These are the locations where the disk and tape 1400 input/output control system (IOCS) routines expect the current date. If the 1400 program is loaded from cards, this move occurs before the program is loaded; therefore, the user should remove the clear-storage cards from his 1400 object decks except for 1400 cataloging. (When the 1400 program is loaded from the Core-Image Library, the date is moved after the program has been fetched.)

5. The 1400 tests for unit-record and disk errors are not effective since the DOS supervisor performs error checking.

6. Magnetic ink character reader (MICR) devices in foreground partitions may not operate correctly when the Model 30 or Model 40 Emulator Program is in operation. In the execution of 1400 instructions, it is possible to stay in execution time in excess of safe time for stacker selection on MICR devices, although the probability of this occurring is low. The problem is caused by extremely long data fields. Examples of this condition are shown in Table 6. An example of the use of the table is as follows: If a user is on a Model 30 with a 1.5 microsecond memory, and is executing a 1400 opera-

tion of Load Character to A-Field Wordmark having a field length of 314 characters, the operation is executed with less than a millisecond delay. (An initial assessment of the problem can be obtained from Table 7, "Performance Ratios.") These timings should be evaluated together with the timings shown for MICR devices in IBM System/ 360 Disk Operating System, Performance Estimates, Form GC24-5032, for any potential timing conflict.

7. When READRSS=YES is specified, and when either stacker selection or 1442 read-punch updating is being performed, the // LC control card should be placed just prior to the last card of the 1400 data file.

8. Since tape errors are handled by DOS, user-written 1400 error recovery procedures are not executed unless mixed parity is specified for tape in the // TAPE control card.

9. It is possible to saturate a disk pack when SYSLST or SYSPCH is assigned to a disk extent. DOS issues a warning when the residual capacity of the extent is reached if the SYSFIL parameters of "n_1" and "n_2" in the FOPT macro are properly assigned at DOS system generation.

10. Reassignment of SYSIO is not available for Column Binary, or Card Image Read, or Punch operations, or 1442 Read Punch updating. (Refer to Table 8.)

11. A /* card must appear in the job stream for every 1400 program, whether or not the program has any card input. This is because the Emulator Programs read ahead on the card reader, or the device assigned to SYSIPT, before they know if the 1400 program contains a Read instruction.

12. 1400 disk files written on either stacked or unstacked packs under the Model 30 Emulator Program are compatible with files written under the Model 40 Emulator Program, and vice versa. In addition, disk files created by the stand-alone compatibility on Models 25 and 30 are accepted by the Model 30 and the Model 40 Emulator programs as unstacked packs. (Disk files created by the Emulator

Table 6. Example of Field Lengths Affecting MICR Devices

| 1400 Instructions | DELAY | | | | | |
| | 1.5 uSEC MODEL 30 | | 2.0 uSEC MODEL 30 | | 2.5 uSEC MODEL 40 | |
	<1MSEC	<4MSEC	<1MSEC	<4MSEC	<1MSEC	<4MSEC
Load Characters (LCA)	La=314	La=1314	La=231	La=981	La=312	La=1274
Move Characters (MLC)	La=251	La=1051	La=184	La=784	La=260	La=1060
Move Record (MRCM)	La=252	La=1052	La=185	La=785	La=131	La=531
Move & Binary Encode (MBC)	La=178	La=750	La=131	La=559	La=115	La=468
Move & Binary Decode (MBD)	La=220	La=926	La=153	La=653	La=115	La=468
Multiply	La=5; Lb=11	La=13; Lb=27	La=4; Lb=9	La=11; Lb=23	La=6; Lb=13	La=16; Lb=33
Divide	La=2; Lb=5	La=7; Lb=15	See Note 7	La=7; Lb=9	La=4; Lb=9	La=9; Lb=19
Edit	La=23; Lb=36	La=131; Lb=150	La=2; Lb=26	La=65; Lb=100	Emulator Program edit No MICR Delays	

Notes:
1. La=Length of A-Field.
2. Lb=Length of B-Field.
3. Instructions listed are those most likely to have large data fields.
4. All Model 30 1401 Addresses are assumed to be over 4K.
5. All Model 30 1401 A and B Addresses are assumed to be indexed.
6. No special characters are assumed to be in any data field.
7. Unable to execute this instruction in less than 1 millisecond.

Table 7. Performance Ratios

Under DOS		Original Computer	IBM 1401	IBM 1460
Model 30		Processing (1.5 microsecond storage)	Approx. 3.5 times as fast.	Approx. 1.8 times as fast.
		I/O	Depends on specific units involved.	Depends on specific units involved.
Model 40		Processing (except for MCE instruction)	Approx. 4.5 times as fast.	Approx. 2.3 times as fast.
		MCE instruction	Approx. 5 times slower.	Approx. 10 times slower.
		I/O	Depends on specific units involved.	Depends on specific units involved.

programs are not accepted by the Model 25 or 30 stand-alone compatibility if 1400 labels are being processed.) However, only Move-mode files written under the stand-alone emulation on the Model 40 are compatible with unstacked packs produced under the Model 40 Emulator Program.

If the user desires to take advantage of the stacked pack capabilities of the Emulator Programs under DOS, the user can perform a 1400 disk-to-tape operation under stand-alone emulation. Then, perform a tape-to-disk operation with the Emulator Programs under DOS to recreate the files on stacked packs. This technique can also be used to convert Load-mode files written under the stand-alone emulation on the Model 40 to either stacked or unstacked packs.

13. A Scan Disk operation is not stopped by cylinder overflow, but only by a match or the sector count going to zero.

14. The Write Disk Check operation, a disk-file-to-main-storage compare, is a System/360 cyclic check of the data on the 2311/2314.

15. A check is not made to determine if all records written on a specific track are written in the same mode.

16. 1400 programs that depend on wrong-length-record checks or cylinder overflow may not run correctly. These conditions, as well as other disk error conditions, are not passed to the 1400 program.

17. If SYSLST is assigned to disk, the maximum actual data length is 120

characters (121 including the control character). If SYSLST is assigned to tape, the maximum actual data length is 144 characters (145 including the control character). The first character of each record corresponds to the Carriage-Control command that is the System/360 Channel Command Word (CCW) command byte (known as type A in the Multiprogramming Support (MPS) utility macro instructions). For this reason, the magnetic-tape unit must be either a 9-track unit, or a 7-track unit with the Data Conversion Feature. DOS job control writes 121-character records with an ASA control character (known as type D in the MPS utility macro instructions). See the publication IBM System/360 Disk and Tape Operating Systems: Utility Programs Specifications, Form GC24-3465.

18. The higher-order position of the address portion of the disk control field is assumed to be 0. File-protection techniques using the high-order position of this address may not be effective. (Example: Normal address and normal address plus x00, 000 are treated as the same address.)

19. 1400 programs that depend on the absence of a feature may not be emulated properly (see "Additional Features" in the "Introduction" section). For example, because the Emulator Program under DOS appears as a 16,000-position system to the 1400 program, programs written for use on 1400 systems with lesser storage capacity may require modification. The SIZ1400 parameter must be specified as one of the actual 1400 memory sizes for programs generating coding dependent upon actual machine size (e.g., 1400 autocoder program).

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Table 8. Unit-Record Operation Correspondence

1400 Unit and Operation / System/360 Unit	2540	1442 Model #1	1442 Model #2	2501 Model B1,B2	2520 Model B1	2520 Model B2,B3	Magnetic Devices (SYSIO)
1402							
Reading only	YES	YES	N/A	YES	YES	N/A	YES
Punching only	YES	YES[1]	YES[1]	N/A	YES[1]	YES[1]	YES
Reading & Punching	YES	NO[2]	N/A	N/A	NO[2]	N/A	YES[1,2]
Punch Feed Read	YES[3]	NO	N/A	N/A	NO	N/A	NO
Reader Stacker Select	YES	YES[4]	N/A	N/A	YES[4]	N/A	N/A
Punch Stacker Select	YES	YES[4]	N/A	N/A	YES[4]	YES[4]	YES
PFR Stacker Select	YES[5]	NO	N/A	N/A	NO	N/A	NO
Read 51-Col Cards	YES[6]	N/A	N/A	N/A	N/A	N/A	NO
1442							
Reading only	YES	YES	N/A	YES	YES	N/A	YES
Punching only	YES[7]	YES[8]	YES	N/A	YES[8]	YES	YES
Read data cards, then Punch into blank cards	YES[7]	YES[8]	N/A	N/A	YES[8]	N/A	NO
Read & Punch same card[9]	YES[10]	YES[8]	N/A	N/A	YES[8]	N/A	NO
Reader Stacker Select	YES	YES	N/A	N/A	YES	YES	N/A
Punch Stacker Select	YES	YES	N/A	N/A	YES	YES	YES
1444							
Punching	YES	YES	YES[11]	N/A	YES	YES[11]	YES
Stacker Select	YES	YES	N/A	N/A	YES	YES	YES

Note: N/A=not applicable because of hardware limitations.

[1] EU executes one additional feed before the first Punch command is executed.

[2] Permissible if punching follows all reading; i.e., data to be read followed by blank cards. EU executes one additional feed before the first Punch command is executed.

[3] If the PFR features are installed on the 2540 (#5890) and the 2821 Control Unit (#5895).

[4] Cards selected to the 1 or 4 pocket go into stacker 2; cards selected to the 2 or 8, and NR and NP cards go into stacker 1.

[5] If the 2540 Compatibility Attachment (#8065) is installed on the 2821 Control Unit.

[6] If the 51-Column Interchangeable Read Feed (#4151) is installed on the 2540.

[7] This applies only when punching into blank cards. 1440 Read instructions require a blank data card in the read unit to simulate initial movement to the punch station of a 1442. Punch-and-Stop and Punch-and-Skip instructions are not simulated on the 2540 without the PFR feature.

[8] If punching is required in the program, the // 1400 card must indicate this by the omission of operand "d".

[9] Punching the same card on a 1442 (1400) allows the simulation of Punch-and-Stop, Punch-and-Skip, Punch-and-Feed, and Read Card instuctions.

[10] Permissible only if the PFR feature is installed. PFR=YES and PCH1400=1442 must be specified and a // PR card must be used as the last card in the reader to switch reading from the reader to the punch side. Card-image reading or punching cannot be simulated in this way.

[11] EU executes one additional feed before punching begins to accomodate the devices with reading capability. Therefore the first card will be a blank card.

[12] Two tape drives needed, one for SYSIPT and one for SYSPCH.

20. The Emulator Program operator service functions may be requested through the INTERRUPT key only when OC=YES is specified in the FOPT macro parameter during DOS Supervisor generation.

21. On nine-track tapes, a substitute blank character (1401/1440/1460 A-bit only) is never converted to a blank.

22. The DOS copy and restore disk utility programs cannot be used for stacked disk packs. When these operations are required, 1400 disk-to-tape and 1400 tape-to-disk operations must be performed for each half of the stacked pack using the Emulator Programs under DOS.

23. When executing a 1440 program that issues a read command to eject the last card during 1442 file closing, one blank card must be placed after the last data card if not reading ahead, or two blank cards after the /* card if reading ahead.

24. The Model 30 and Model 40 Emulator Programs do not provide System/360 disk or tape _file_ label creation, verification, or protection. If a user's 1400 program does not perform these functions, a 1400 or System/360 tape or disk file could be destroyed without operator notification.

    Disk file protection can be attained only through 1400 programming. However, if user label checking is not used in the 1400 program, then the following techniques should be used to afford _volume_ protection.

    • Use the DOS Clear Disk Utility Program to format all 1400 files and specify an unexpired date in the DLBL or DLAB statement. This creates a VTOC entry for the file, and thus, protects the file from other System/360 programs.

    • Use the // DVOL control card and specify DVOL=YES when generating the user's Emulator Program. By initializing all user disk volumes with different and unique volume serial numbers, the DVOL facility insures that the correct volume is being used.

25. When simulating a 1442 on the 2540, the user must clear the previous read information before issuing punch and stop instruction. Otherwise, repunching the same data read causes a 2540 hole count error, and message EC51D PFR PUNCH ERROR is issued.

26. Programs which rely on tape to be initially positioned at other than load point may not execute properly. CS30/40 assumes all tapes to be rewound and at load point.

TIMING INFORMATION

Throughput under emulation is not dictated so much by the Emulator as it is by the 1400 program being executed. It is the mix of CPU operations (executed by Read Only Storage), I/O operations (executed by program support), and the amount of interference from higher-priority partitions that determines total throughput. Assuming a normal distribution of the above considerations, a minimum throughput of one to one with the original equipment can be expected. However, this will vary by application.

A comparison of processing times using a representative sample of 1400 instructions under the Model 30 and Model 40 Emulator Programs with the 1401/1460 is presented in Table 7. The estimated processing times are based on the assumptions that the timer is off and that there is no multiprogramming.

GENERAL COMMENTS ON I/O SIMULATION

In general, all I/O error recovery is attempted in System/360 mode. The 1400 program is not notified of I/O errors and need not include error tests. The exception to this situation is when mixed-parity 7-track tapes have been specified. Either standard DOS operator intervention messages from the physical input/output control system (PIOCS) or Emulator Program initiated error-recovery messages are displayed when necessary.

In effect, all I/O is double-buffered since the Emulator Program reads and writes from its own I/O areas in System/360 main storage. Hence, the Emulator Program usually is a card read ahead, a punch or print behind, a tape read ahead, and a tape write behind. Disk read operations are not overlapped nor read ahead, but disk write and verify operations are written behind. Data is always passed between the I/O areas of the Emulator and the I/O areas of the 1400.

I/O device independence is provided for all 1400 unit-record devices. The Emulator Program simulates requests for unit-record I/O (card reader, card punch, and printer) from a comparable unit-record device or magnetic-tape or disk unit. This enables the user to efficiently utilize the System/360 in a multiprogramming environment for both 1400 and System/360 programs, while reducing the total processing time required for most commercial 1400 applications.

USER-WRITTEN SIMULATION ROUTINES

It is possible for the user to include his own System/360 routine to support I/O devices which are not supported by the Emulator Programs. The user-written simulation routine can be used to process 1400 instructions that use any of the unassigned operation codes given in Table 9. These codes are normally considered to be invalid by the Emulator Programs and are treated as 1400 program errors. However, if USRPROG= YES is specified at Emulator Program generation time, control is passed to the user-written simulation routine when the Emulator Program encounters any of these unassigned codes. The user's routine should test for those codes which are supported in his simulation routine. (Note: 1400 instructions which contain emulated operation codes are not passed to the user-written simulation routine unless an error is detected in that instruction.) Desired codes can be processed in any manner. Upon completion of the processing, control can be returned to the Emulator Program for the Model 30 to continue normal processing with the instruction:

```
BR    14          (normal return)
```

or to the Emulator Program for the Model 40 to either the 1400 NSI or to I-Fetch at A-address with the instructions:

```
BR    14          (Back to 1400 NSI)
B     4(14)       (Back to I-Fetch at
                   A-address)
```

For all undesired codes, control should be returned to the Emulator Program for the Model 30 with the instruction:

```
B     4(14)       (Error--Abort job)
```

or to the Emulator Program for the Model 40 with the instruction:

```
B     8(14)       (Error--Abort job)
```

In the Model 30 Emulator Program the address of the 1400 instruction to be executed is contained in register 6. The instruction is in 1400 simulated storage. All 1400 instructions and data are represented in 1400 simulated storage as shown in Table 15. Also, the user must use the special compatibility feature instructions given in Appendix B when moving data between 1400 simulated storage and the user's System/360 routine.

In the Model 40 Emulator Program, 1400 instructions are not directly accessible. Instead, the compatibility feature, when encountering one of the operation codes shown in Table 9, performs the following functions:

Table 9. Unassigned Operation Codes

Unassigned Operation Code		Model 40 Operation Code Number (Hexadecimal)
	No word mark	00
+	Plus	01
(	Left parenthesis	02
<	Less than	03
ǂ	Group mark	04
–	Minus	05
$	Dollar sign	06
*	Asterisk	07
)	Right parenthesis	08
;	Semicolon	09
Δ	Delta	0A
¢	A bit only	0B
ᴧ	Word separator	0C
\	Backward slash	0D
⧥	Segment mark	0E
bl	Blank	0F
:	Colon	10
>	Greater than	11
√	Tape mark	20
ǂ	Record mark	30
I		40
J		44
T		50
X		60
O	Letter O	80
0	Zero	90

- Inserts a hexadecimal "operation code number" into byte 3 of register 0. Table 9 lists the operation codes and the corresponding operation code number for one-, two-, seven-, or eight- position instructions. The operation code number for four- or five-position instructions is the ones complement of the number listed in Table 9.

- Places the A address, if any, into bytes 0 and 1 of register 1.

- Places the B address, if any, into bytes 2 and 3 of register 1.

- Places the d-modifier, if any, into byte 2 of register 0.

- Places the address of the next sequential 1400 instruction into bytes 0 and 1 of register 0.

Data in simulated 1400 storage and the d-modifier in register 0 are represented as indicated in Table 14. The 1400 addresses in registers 1 and 0 are represented in the Emulator "hddd" format, where "h" is a hexadecimal digit and "d" is a packed-decimal digit. (For example: The 1400 address 13,444 (U4D in BCD) is a hexadecimal "D444" in the "hddd" format.) When moving data between 1400 simulated storage and the user's simulation routine, the user

must use the special compatibility feature
instructions given in Appendix D. General
purpose register 15 contains the address of
the simulation routine and can be used as a
base register.

All user-written routines must save and
restore registers 0 through 15, and the
routines must be cataloged in the Assembler
Source Statement Library. To catalog a
program in the Assembler Source Statement
Library, the following sequence of cards
must be used:

```
// JOB    CATALOG
// EXEC   MAINT
   CATALS A.progname
   BKEND
     •)
     •}            User-written routine
     •)
   BKEND
/*
/&
```

To include the user-written routine in
the Emulator Program, the following se-
quence of cards must be used when generat-
ing the Emulator Program:

```
// JOB
// OPTION LIST
// EXEC   ASSEMBLY
         MACRO
         USRPROG
         COPY    progname
         MEND
euname      EU30[EU40]
     •)
     •}            Emulator Program parameters
     •)
   END      ACOMP01
/*
/&
```

The name "progname" is the name used to
catalog the user-written routine in the
Assembler Source Statement Library.

Note: Any CSECTS generated in the user's
routine must be added by means of user-
inserted INCLUDE cards placed after the
'INCLUDE, (ACOMP01)' card (punched by the
emulator) at link-edit time, unless AUTO-
LINKING procedures are employed.

SIMULATION OF I/O DEVICES

CARD READ PUNCH SIMULATION

Reader stacker selection is optionally
supported. Because card read speed is
reduced when such simulation is specified,
the user is advised to employ it only when
essential. Cards are read ahead except
when simulating reader stacker selection,
or 1442 read-punch updating.

Two methods are used to read cards. The
method used depends on whether overlapped
operations are possible. When it is, cards
are preread into buffer areas and the stan-
dard /* DOS data delimiter card is used to
provide a last card indication for the pre-
ceding data card. However, cards are not
preread by the Emulator Program during 1442
read-punch-update simulation or during
read-stacker-select simulation. In the
case of no prereading, the 1400 program
initiates the physical reading of the card.
To inform the Emulator Program of a pending
end-of-file condition, the // LC Emulator
control card must be placed before the last
data card in the deck. Although the // LC
card is required only when preread opera-
tions will not occur, it is suggested that
both the // LC and /* cards be used. This
procedure will relieve the user from having
to distinguish each time whether there is a
preread operation or not. The system makes
this distinction and ignores the // LC card
during preread operations.

When reading ahead and not stacker
selecting, a Reader Stacker Selection in-
struction will be treated as a No-Operation
(No-Op), and a Reader Stacker Selection and
Branch as an unconditional branch. It
should be noted that it is possible to name
a stacker for all input cards in the
// 1400 control card.

Punch stacker selection is optionally
supported. Unless a 1401/1460 program is
known to include stacker selection for all
or most punch instructions, punch stacker
selection should not be simulated. This is
because punch overlapping is lost if the
Emulator Program expects a stacker select
following a punch and does not get one.

A 1402 and/or a 1442 can be simulated on
a card-read-punch or magnetic-tape or disk
unit extent attached to the System/360 sub-
ject to the limitations of Table 8. Eighty
columns will be read and punched into or
from 1400 locations 1 to 80 and 101 to 180,
respectively, if a 1402 is being simulated.
Either 80 columns or the number of columns
preceding a groupmark with a wordmark are
read into or punched from the B-Address of
a 1442 instruction if that device is being
simulated.

If RDR1400=1442, PCH360=2540, and PFR=
YES are specified, the instructions to read
and punch the same card can be emulated if
the PFR feature is installed on the 2540
Card Read Punch. READRSS=YES is required
when simulating stacker selection. A // PF
card conditions the program to read all
following cards from the punch side. Con-
sequently, all data cards should be on the
punch side of the 2540, and a blank card
should be placed in front of the first data
card. The data cards are not read ahead,
and the // LC card and a blank card should

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follow the last data card. After the user
end-of-job routine, DOS controls card read-
ing and thus reinitializes the read func-
tions to normal. Programs with overlays
cannot be cataloged if using this option.

1402 punch-feed-read operations may be simulated on a 2540 with both the Punch-Feed-Read feature and the 2540 Compatibility Feature. The Compatibility Feature is required only when simulating stacker selection (PUNCHSS=YES) of punch-feed-read cards. A blank card should be placed in front of the first data card.

Because standard DOS or Emulator Program initiated operator-intervention messages are given in the case of card errors, 1400 Branch on Punch-Error or Read-Error instructions are normally treated as No-Ops. However, on the Model 40 the Branch on Read Error indication optionally can be returned to the 1400 program. 402/403 MLP code conversion is automatic on the Model 40 and optional on the Model 30. Refer to parameter c of the // 1400 card in the "Control Cards" section.

1400 Card-Read instructions may be simulated on any card reader or magnetic-tape or disk unit assigned to SYSIPT. The Emulator Program checks for the type of device assigned to SYSIPT at execution time and constructs proper I/O commands for that particular device. If the unit assigned to SYSIPT is a magnetic- tape or disk unit, all records must contain 80-byte unblocked records, and disk records must be organized either as a standard sequential file (EXTENT Type 1) or as a split-cylinder sequential file (EXTENT Type 128) with a key length of zero and a data length of 80. All disk records must be contained within one extent, specified in the standard manner; however, multireel magnetic-tape files are supported. The Emulator Program rewinds and unloads a tape unit upon encountering a tapemark.

The 51-Column Interchangeable Read Feed feature is supported by the utilization of a // 51 control card, which is the last 80-column card before the first 51-column card. This card causes the Emulator Program to issue console message EC03D. After the operator has mounted the device on the 2540 Card Read Punch and readied the reader, he enters START in response to message EC03D to continue processing. The // 51 control card conditions the program to move columns 15-65 of the card buffer area into 1400 storage. When the 51-column feature is being utilized, column-binary and punch-feed-read operations are excluded. Stacker selection is limited by the device to the R1 and R2 pockets; therefore, parameter "c" of the // 1400 control card must not be a 2. (See "The // 1400 Control Card" in the "Control Cards" section.) SYSIPT must be the 2540 Card Read Punch.

The Column-Binary or Card-Image feature utilizes a // CB control card to cause all following cards to be read in data mode 2.

If the 1400 program has normal BCD Read instructions, the data is translated to data mode 1 when loaded into 1400 storage. Unrecognized characters are replaced with blanks. This facility could be used for bypassing data checks. The // CB control card must immediately precede the first column-binary data card. When the Column-Binary feature is being utilized, 51-column and PFR operations are excluded for that run. SYSIPT must be on the card reader. Column-Binary or Card-Image-Punch instructions do not require control cards, and are executed in the correct mode when encountered.

Note: These cards are punched in 1400 column binary representations and can only be read by 1400, or simulated 1400 devices or emulators.

1400 Card-Punch instructions may be simulated on any card punch or magnetic-tape or disk unit assigned to SYSPCH within the physical limitations of the device (see Table 8). The Emulator Program checks for the type of device assigned to SYSPCH at execution time and constructs proper I/O commands for that particular device. If SYSPCH is assigned to a magnetic-tape or disk unit, either 80- or 81-character records are written unblocked.

If the symbolic parameter PUNCHSS=NO is specified at assembly time or no punch stacker selection is indicated in the // 1400 control card, 80-character records are written unblocked on the magnetic unit. If the symbolic parameter PUNCHSS=YES for 1444 or 1402 simulation, or if READRSS=YES for 1442 simulation and the // 1400 control card indicates that punch stacker selection is to be simulated, 81-character records are written unblocked on the magnetic unit. The first character of each 81-character record corresponds to the Stacker Select command that is the standard extended American Standard Association (ASA) code (V is pocket 1, W is pocket 2). Since ASA codes provide for only two possible pockets for stacker selection, 1402 Card-Punch instructions directing the output to pocket 8 (read-punch pocket) contain the code V.

When SYSPCH is assigned to a magnetic-tape unit, multireel output files are supported as the Emulator Program writes a single tapemark at the end of the reel, rewinds, and unloads the unit upon detection of an end-of-reel condition. A tapemark is written at the beginning of the next reel. Upon termination of the 1400 program (either normally or abnormally), the Emulator Program writes a /* delimiter followed by a character other than blank in column 4. It then writes a single tapemark to indicate end of file, then backspaces one record (past the tapemark) so that the

next job in the job stream may continue to use the unit for SYSPCH, or the unit may be rewound and unloaded to preserve the integrity of the file. No tape labels are written by, nor are any tape labels required by the Emulator Program. The tape unit is presumed to be properly positioned to write the first record prior to the execution of the 1400 program. If SYSPCH is assigned to a disk unit, 80- or 81-character records are written unblocked within one extent. All disk records have a key length of zero. Proper DLBL and EXTENT cards must be submitted to DOS prior to the assignment of SYSPCH to a disk unit; therefore, no label checking is required by the Emulator Program. File organizations supported include standard sequential (EXTENT Type 1) and split-cylinder sequential (EXTENT Type 128). If end of extent is reached prior to the termination of the 1400 program, console message EC74I is displayed followed by message EC83I, and the 1400 program is abnormally terminated. The Emulator Program does not close a disk file assigned to SYSPCH upon termination of a 1400 program; therefore, the operator must issue a standard CLOSE command to SYSPCH upon completion of the job stream. The number of records written on each disk track is 25 for the 2311 and 39 for the 2314. The user should calculate his file requirements to ensure that the assigned extent contains sufficient space to hold the file prior to the execution of the program.

PRINTER SIMULATION

All printer operations are supported except selective tape listing. This operation may be added by the user if desired. 1401 and 1460 combination I/O instructions are supported.

As in the case of reader punches, a 1403 and/or a 1443 may be supported on either device (or a magnetic-tape or disk unit) attached to a System/360.

If a 1403 is to be simulated, 132 positions are printed from 1400 locations 201 to 332, unless otherwise indicated by the PTRLNG parameter. If a 1443 is being simulated, 120 or 144 positions or the characters preceding a groupmark are printed from the B-Address of a 1443 instruction, whichever is specified in the PTRLNG parameter.

To achieve maximum overlap, Branch-On-Carriage-Overflow instructions do not cause the Emulator Program to wait for printer device end. Therefore, the 1400 program does not know of a channel-overflow condition until it has executed the Print command (or Space command) after the command that caused the overflow. This requires

that the channel-12 hole be moved up one line in the carriage tape from its 1400 position. The channel-overflow latch remains set until the 1400 program executes a Skip command or, if a 1440 is being emulated, a Branch-On-Overflow instruction.

When the CARRCTL=YES parameter option is specified, the Emulator Program maintains a carriage-control-tape image area in main storage. As printer operations are performed, a pointer in this area indicates the position of the print line on the page. This area is checked for overflow and channel indications rather than interrogating the printer indicators. When the user wishes to utilize the carriage-control-tape image option, he uses the // CCTL control cards at 1400-program execution time (see "The // CCTL Control Cards" in the "Control Cards" section). The proper carriage-control tape still must be placed in the printer to provide the skip to channel punches. The // CCTL control card 9 and 12 punches must correspond to those on the System/360 carriage control tape (i.e., the channel 9 and 12 holes must be moved up one line in either case from its 1400 position).

Since all I/O error recovery is done in System/360 mode, a 1400 branch on printer error or branch on printer busy is treated as a No-Op.

1404 cut-card operations are simulated only on a 1404. Thus, both PTR1400 and PTR360 must specify a 1404 and PTRASGN must specify a programmer logical unit other than the default value SYSLST. A bill-feed-read operation, as well as any valid combination instruction, causes 30 bytes to be transferred to 1400 storage. During bill-feed-read operations, the carriage-control-tape-image option provided by the // CCTL card is discontinued and the bill-feed-read operations are not overlapped. If continuous forms operations are to be simulated, parameters PTR1400 and PTR360 must specify a 1403, therefore, a different generation of the Emulator Program must be used.

1400 printer instructions (excluding 1404 bill-feed operations) may be simulated on any printer or magnetic-tape or disk unit assigned to SYSLST. The Emulator Program checks for the type of device assigned to SYSLST at execution time and constructs proper I/O commands for that particular device. If SYSLST is assigned to a magnetic-tape unit, records are written unblocked, and have a length dependent on the line length specified in the PTRLNG parameter. The record length is equal to PTRLNG + 1. (Exception: when PTRLNG=100, the record length is 121 characters.) The first character of each record corresponds

to the Carriage-Control command that is the
System/360 Channel Command Word (CCW) com-
mand byte (known as type A in the multipro-

gramming support (MPS) utility macro
instructions). For this reason, the
magnetic-tape unit must be either a 9-track
unit or a 7-track unit with the Data Con-
version Feature. DOS Job Control writes
121-character records with an ASA control
character (known as type D in the MPS util-
ity macro instructions).

The Emulator Program uses the type-A
forms control character for throughput
efficiency. Since most 1400 forms-control
commands are of the form "write a line and
space" or "skip after printing," the use of
ASA codes causes two records to be written
for each 1400 command (one for the line of
print, the other for the forms movement
after printing). Type -A control charac-
ters provide the print-and-space-after
facility in one record. Multireel output
files are supported since the Emulator Pro-
gram writes a single tapemark at the end of
the reel, rewinds, and unloads the unit
upon detection of an end-of-reel condition.
A tapemark is written on the beginning of
the next reel. Upon termination of the
1400 program (either normally or abnormal-
ly), the Emulator Program writes a single
tapemark to indicate end of file, then
backspaces one record (past the tapemark)
so that the next job in the job stream may
continue to use the unit for SYSLST, or the
unit may be rewound and unloaded to pre-
serve the integrity of the file. No tape
labels are written by, nor are any tape
labels required by the Emulator Program.
The tape unit is presumed to be properly
positioned to write the first record prior
to the execution of the 1400 program.

If SYSLST is assigned to a disk unit,
121-character records are written unblocked
within one extent (key length zero, data
length 121). The first character of each
record corresponds to the Carriage-Control
command, followed by the first 120 print
positions. The remaining 12 print posi-
tions are truncated. DOS Job Control mes-
sages may be bypassed, except that all rec-
ords are 121 bytes in length; therefore,
the user must separate the records in some
other manner, such as testing the first
character of each record (forms-control
character). Proper DLBL and EXTENT cards
must be submitted to DOS prior to the
assignment of SYSLST to a disk unit; there-
fore, no label checking is required by the
Emulator Program. File organization sup-
ported includes standard sequential (EXTENT
Type 1) and split-cylinder sequential
(EXTENT Type 128). If end of extent is
reached prior to the termination of the
1400 program, console message EC73I is dis-
played, and the 1400 program is abnormally
terminated. The Emulator Program does not
close a disk file assigned to SYSLST upon
termination of the 1400 program; therefore,
the operator must issue a standard CLOSE

command to SYSLST upon completion of the
job stream. The number of records written
on each disk track is 19 for the 2311 and
32 for the 2314. The user should calculate
his file requirement to ensure that the
assigned extent contains sufficient space
to hold the file prior to the execution of
the 1400 program. It should be noted that
the 1400 Printer commands, which cause
immediate spacing or skipping without writ-
ing a line, cause a record to be written.

If SYSLST is assigned to either tape or
disk, and the CARRCTL=YES parameter option
is not specified, the standard DOS line-
count facility (initialized for each job to
the value of the "LINECT=nn" parameter of
the SET card, or to the standard value) is
used to simulate end-of-form conditions
(channel 9 or channel 12 in the carriage-
control tape, but not both). As each line
is written, the count is decremented by the
number of lines spaced (e.g., a write and
space two lines after print decrements the
count by two). Since the number of lines
skipped when simulating a skip to channels
2 through 11 cannot be predicted, the count
is decremented by one. It is not desirable
to assign SYSLST to a magnetic unit when
the 1400 program prints a variable number
of lines between form skips and a pre-
printed form is being used. To calculate
the value to be used in the DOS "LINECT=nn"
parameter, the number of lines written from
the channel-1 punch in the carriage-control
tape to the channel-12 punch are counted,
and to this are added the number of lines
spaced between the two punches plus one for
each immediate skip to channels 2 through
11.

MAGNETIC-TAPE SIMULATION

All magnetic-tape operation codes for
the 1400 programs are supported. Process
overlap is treated in the same manner as
described in the publication IBM System/360
Model 30 1401/1440/1460 Compatibility Fea-
ture, Form GA24-3255.

7-track tapes should be specified to run
the appropriate parity with the translator
on and the converter off. Mixed even- and
odd-parity tapes can be simulated only with
a loss of read ahead capability.

The following specifications, which are
made in the DOS ASSGN card for assigning a
logical I/O unit to a physical device, are
used to specify mode settings for 7-track
and 9-track tapes. The first six entries
are valid only for 7-track tape. The last
four entries are valid only for 9-track
tape. If the mode setting is not specified
in the ASSGN card, the system assumes odd
parity at 800 bpi with the translator off
and the converter on for 7-track tapes

which can cause invalid recording of data for emulation. X'C0' is the normal reset mode for a 9-track tape unit and specifies the maximum byte density for that device. X'C8' is an Alternate-mode setting for 9-track dual-density tapes only. The specifications are:

Setting	BPI	Parity
X'28'	200	even
X'38'	200	odd
X'68'	556	even
X'78'	556	odd
X'A8'	800	even
X'B8'	800	odd
X'C0'	800	single-density 9-track
X'C0'	1600	single-density 9-track (phase-encoded)
X'C0'	1600	dual-density 9-track (phase-encoded)
X'C8'	800	dual-density 9-track (phase-encoded)

The operations performed by the Emulator Program are read, write, and control operations. Therefore, all logical IOCS functions (i.e., label checking, blocking/deblocking, etc.) remain the responsibility of the 1400 program with one exception. This exception is that the Emulator Program provides error recovery if mixed parity has not been specified for the given drive. A Tape Error Recovery routine is provided to simulate an operator-initiated diagnostic read and storage scan.

Load-mode operations are supported, but they are not overlapped with processing or other tape operations. This is because Load-mode operations must support checkpoint records, which require the combining of all tape I/O buffers. A 16K 1400 checkpoint, as written by SORT 7, requires a System/360 I/O area in excess of 16,000 bytes. Checkpoint is, therefore, not feasible on a System/360 with less than 64K.

The Emulator Program does not support read-ahead operations if the tape being read contains mixed even- and odd-parity records. When the Emulator Program recognizes a Read in the wrong mode, it sets the 1400 error indicator and returns to the 1400 program; thus, read-ahead operations on tape are impractical with mixed-parity tapes. Tape error recovery is performed by the 1400 program and not by the Disk Operating System. If the user wants the 1400 program to handle tape error recovery on a particular tape drive, he should specify mixed parity even though mixed-parity records are not on the tape.

1400 tapes written or read by the Emulator Program are completely compatible with those written under machine compatibility or on a 1400 system (provided 7-track tapes are used). System/360 volume and header labels are not supported by the Emulator Program.

Tape Error Recovery

A Tape Error Recovery routine is provided as an option and is used in conjunction with an IGNORE response to a standard DOS data-check message. This routine is available only if "TAPERRS=xxx" is specified when the Emulator Program is generated ("xxx" may be LST, LOG, LSTCHAR, or LOGCHAR in order to define where and in what format the display is to take place).

The Tape Error Recovery routine provides a simulation of the diagnostic read and storage scan operations used on 1400 systems. These operations are simulated using the System/360 I/O area, so changes are not made by the operator to 1400 storage.

When a data-check condition is detected (after the DOS supervisor has tried to reread the tape block), a standard DOS error message is displayed by the operating system on the console. The only valid responses to this DOS message are CANCEL or IGNORE. The IGNORE response returns control to the Emulator Program, since it is the System/360 problem program that issued the I/O request.

When the operator enters IGNORE, the tape block is displayed on SYSLST or SYSLOG by the Emulator Program. The first four characters of each line indicate the System/360 storage address of the first byte displayed (in hexadecimal). This address is followed by ten 8-byte fields of data. Nonprintable characters are translated to an asterisk (*), except the 1400 groupmark, which is translated as a dollar sign($).

After printing the entire error block, the following messages are typed on SYSLOG:

either
    EC60I MESSAGE RESPONSES ARE B=BYPASS,
        P=PROCESS
or
    EC61I MESSAGE RESPONSES ARE B=BYPASS,
        P=PROCESS, H=HEX-DISPLAY
followed by
    EC62D TAPE BLOCK IN ERROR

The output of message EC60I or EC61I is determined by the options specified at Emulator system generation.

A response of B causes the tape block in error to be bypassed and not given to the 1400. Processing continues with the next block. The 1400 is not informed that a block has been bypassed.

A response of P causes the tape block to be passed to the 1400 as is. Control then is returned to the 1400 program.

A response of H causes the error block to be displayed in hexadecimal format exactly as it was read into System/360 main storage. Parity is, of course, corrected by the channel. After the hexadecimal display, the operator again has the option of responding with a B or P.

Magnetic-Tape Data Representation

Nine-Track Tape Data: The 9-track magnetic-tape output of 1400 compatibility applications is similar to the 9-track tape format used with normal System/360 operations, except that parity is represented by bit 1 of the byte. This allows for the processing of mixed-parity data on 9-track tape. With even parity, each 6-bit Binary Coded Decimal (BCD) character is represented by its corresponding BCDIC-8 bit configuration. (See Table 16.) Bit 1 of the BCDIC-8 character is always on (1). With odd parity, each 6-bit BCD character is represented by its corresponding BCDIC-8 character representation as shown in Table 15. Bit 1 of the 8-bit BCDIC-8 byte is off (0).

Example:

Even parity: x1xxxxxx

Odd parity: x0xxxxxx

where "x" may be either 1 or 0.

A tape error is recognized during even-parity operations when bit 1 is a 0 and during odd-parity operations when bit 1 is a 1. The 9-track, Normal-mode, odd-parity tape format is not compatible with conventional EBCDIC System/360 tape. Its sole purpose is to preserve character compatibility between Emulators; for example, when card-to-tape operations are being performed on a 1401 Emulator and the output is to be input to a 1410 Emulator.

Alternate mode provides for the recording of either 6-bit binary or BCD data in standard EBCDIC format on 9-track tape operating in Compatibility mode. Use of Alternate mode is desirable when processing 6-bit binary information with System/360 programs.

If specified at Emulator system generation, the Alternate tape mode of operation sets bit 1 to 1 (see Table 16, note 1). The input/output (external storage) EBCDIC should not be confused with the internal code used with the Compatibility Features.

Seven-Track Tape Data: Seven-track tape data is represented exactly as it is on 1400-series systems. Seven-track tape requires that the appropriate 7-Track Compatibility Feature be installed on the tape control unit to convert BCD data to EBCDIC, and that the 7-Track Read/Write Head be installed on the magnetic-tape unit.

DIRECT-ACCESS SIMULATION

The Emulator Programs support up to five 1311 Disk Storage Drives or one module of 1301 Disk Storage on 2311 Disk Storage Drives or, alternately, five 1311 drives and/or one module of a 1301 drive on 2314 Direct Access Storage Facilities. Alternately, a Model 1 or Model 2 1405 Disk Storage may be simulated. Simulation of the 1405, however, excludes simulation of 1301/1311. The five 1311 drives may be simulated on as few as two-and-a-half or as many as five disk packs on 2311s. // ASSGN cards may be used at object time to assign each 1311 to a 2311 or a 2314, and a parameter in the // 1400 control card specifies which half of the 2311 or which quadrant of a 2314 is to be used for the 1311 file(s). Hence, any 1311 can be simulated on either half of any installed 2311 or on any quadrant of a 2314, with the necessary assignments made at object time.

One module of 1301 Disk Storage requires five complete 2311 Disk Storage Drives or two-and-a-half disk packs on 2314 modules. These 2311 drives and 2314 modules must be separate and distinct from any 2311 drives and 2314 modules used to simulate 1311 Disk Storage Drives.

The programmer logical units to be used for 1311 and 1301 simulation are assigned according to assembly parameter cards. Unless changed by the user, the following assignments for 1301 simulation on a 2311 are assumed:

1301 Sector Address	Programmer Logical Unit
000000-039999	SYS001
040000-079999	SYS002
080000-119999	SYS003
120000-159999	SYS004
160000-199999	SYS005

Unless changed by the user, the following assignments are assumed for 1301 simulation on a 2314:

1301 Sector Address	Programmer Logical Unit
000000-079999	SYS001 (Module 1)
080000-159999	SYS002 (Module 2)
160000-199999	SYS003 (Module 3)

The assignment of these logical units to physical units is accomplished with the // ASSGN card used by DOS Job Control.)

Both 1311 and 1301 are simulated by writing 100-character records without keys, 20 to the track. (Track record uses one 2980-character record without a key.) (See "Disk-Pack Initialization" in this section.

A 1405 may be simulated in lieu of 1311 or 1301. In this instance, two 2311 drives or one module of a 2314 facility are required for a Model 1 and four 2311 drives or two modules of a 2314 facility for a Model 2. As with 1311 simulation, the programmer logical units are assigned in the macro generation. Each 2311 contains twenty-five thousand and each 2314 module contains fifty thousand 200-character records.

All disk operations are supported, including Load mode, track record, sector count overlay, and scan disk. Disk errors are handled in System/360 mode, so the 1400 is never informed of disk error conditions. Therefore, those programs that depend on error conditions from disk in order to run may not run correctly (e.g., cylinder overflow). Seek operations are overlapped with subsequent processing or other I/O operations, as are write operations. Read operations are not overlapped, since the assumption is made that processing is random in most cases. Write-check operations may be optionally accomplished by specifying VERIFY=YES at assembly time. In order to provide maximum overlap, this write check is not performed when requested by the 1400 program, but is done on a delayed basis. If VERIFY=YES is not specified at assembly time, the 1400 program Write-Check instruction is treated as a No-Operation. However, when specified, the time for performing disk write operations may be increased by as much as 50 percent. The 1311/1301 disk control field is updated by a write-check operation.

Disk-Pack Initialization

Emulator/DOS 1311 and/or 1301 disk routines are designed to operate with formatted 1316 (on the 2311) and 2316 (on the 2314) disk packs. That is, <u>each track must be written with either 100-character or 2980-character records without keys prior to accessing it under the Emulator Programs</u>. This may be done using the DOS Initialize Disk and Clear Disk utility programs, with or without the option for assigning cylinder 200 as a prime data cylinder, and specifying the appropriate parameters for clearing or initializing tracks or sectors. The only times that the option for assigning cylinder 200 as a prime data cylinder is selected is when the user wishes to simulate: (1) two 1311 drives on one 2311, (2) four 1311 drives on one 2314 module, or (3) one module of the 1301 on either a 2311 or 2314.

The Emulator Program reads and writes 100-character records when the 1400 program requests sector operations (either Move or Load mode) and 2980-character records when the 1400 program requests track-record operations (either Move or Load mode). When Load-mode operations are performed, the 1400 program either gets or puts the first 90 characters of the 100-character records or the first 2682 characters of the 2980-character records.

The reason the Emulator Programs do not read and write 90- or 2682- character records is that such an approach makes it impossible for the Emulator Programs to alternately use a track for both Move- and Load-mode operations, such as is done in 1400 disk sort programs. The Model 30 stand-alone Compatibility Feature and the Model 40 stand-alone Emulator Program write compatible move-mode records on the first half of a 1316 (i.e., cylinders 1 through 100). However, Model 40 stand-alone emulator load-mode records on the first half of a 1316 are not compatible with the Emulator Programs under DOS because these load-mode records are 90 or 2682 characters in length.

1311 Disk Initialization: the Emulator Programs under DOS use cylinders 1 through 100 to simulate a 1311 on the first half of a 2311, just as straight compatibility does. (Tracks 0 and 1 of cylinder 0 are reserved for the volume label and VTOC and are not used by the Emulator Programs.) In addition, the Emulator Programs under DOS use cylinders 101 through 200 to simulate a 1311 on the second half of a 2311. On a 2314, the Emulator Programs use cylinders 1 through 50 and heads 0 through 19 to simulate a 1311 on the first quadrant, cylinders 51 through 100 and heads 0 through 19 to simulate a 1311 on the second quadrant, cylinders 101 through 150 and heads 0 through 19 to simulate a 1311 on the third quadrant, and cylinders 151 through 200 and heads 0 through 19 to simulate a 1311 on the fourth quadrant.

Users who run their programs under 1400 emulation under DOS first must initialize their disk packs using the DOS Initialize Disk utility program. If the user desires to simulate two 1311 drives on a 2311 or four 1311 drives on a 2314, he must use the stacked-disk option in the DOS Initialize Disk program. Normally, the user then runs the DOS Clear Disk utility program for clearing and formatting unstacked packs. For stacked packs, he uses the stacked-disk option in the DOS Clear Disk utility program.

In using the stacked-disk option in the DOS Clear Disk utility program, the user should specify a high expiration date of

99365 to reserve an extent in the VTOC, thus preventing Emulator-allocated space from being allocated to another file.

Since cylinder 200 normally is used for alternate tracks, users desiring to simulate two 1311 drives on a 2311 (four on a 2314) or a 1301 on a 2311 or 2314 must use the stacked-disk option in the DOS Initialize Disk utility program to initialize the 1316 or 2316 packs for use by the Emulator Programs. Normally, the DOS Initialize Disk program assigns defective tracks to alternate tracks beginning on cylinder 200 and indicates the correct number of unassigned alternate tracks in the Format 4 label. Optionally, tracks 2 to 9 of cylinder 0 and cylinders 201 and 202 are assigned as alternate tracks, with cylinder 200 assigned as a prime data track. If the entire disk pack is dedicated to emulation under DOS (stacked), cylinder 200 is used as a data track. If the entire disk pack is not dedicated (unstacked), cylinder 200 is used as an alternate track. If a pack that formerly used cylinder 200 as a data track is released for open-shop use, the pack should be reformatted with the normal option of the DOS Initialize Disk utility program prior to release.

AUTOCODER/COBOL assemblies can be accomplished under the Emulator Programs with generally improved timings. The AUTOCODER system pack can be simulated on either half of a 2311 or either quadrant of a 2314 and should be preformatted to all 100-character records. It can be built under the Emulator Programs from standard card input, using normal 1400 system generation procedures.

1301 Disk Initialization: Users of a 1301 drive on the 2311/2314 should initialize the 2311/2314 drives with the DOS Initialize Disk utility program, using the option for cylinder 200. The 2311/2314 drives should be cleared with the DOS Clear Disk utility program, using the option for cylinder 200 and specifying a key length of 0 and a data length of 100 for sector operations and a key length of 0 and a data length of 2980 for full-track operations.

1405 Disk Initialization: 1405 disk routines are designed to operate with formatted 1316 or 2316 disk packs; however, all operations (sector and track) require 200-character records. Load-mode operations are accomplished in the same manner as described for the 1311. The disk packs should be initialized normally with the DOS Initialize Disk utility program. The user must clear the 1316 and 2316 disk packs to 200-character records (key length of zero) with the DOS Clear Disk utility program from cylinder 1, head 0 to cylinder 193, head 9 for the 2311, and cylinder 1, head 0

to cylinder 110, head 19 for the 2314. Cylinders 111 to 199 of the 2314 module are available to the user, as are cylinders 194 to 199 of the 2311.

CONSOLE INQUIRY SIMULATION

Read and Write Console Printer instructions in Move or Load mode are supported when OSINQRY=1400 or YES. A single console Read instruction transfers up to 50 characters including wordmarks entered from the console and places a groupmark with a wordmark after the last character entered. A single console Write instruction types 200 characters or those characters preceding a groupmark with a wordmark. Wordmarks in Load mode count as a character. Read Console Printer instructions in Load mode can be executed. However, a groupmark/wordmark in 1400 storage does not lock the Printer-Keyboard, and the operator may continue to type data. When the Emulator Program encounters a groupmark/wordmark in 1400 storage while transferring data, data transfer is stopped. In order to determine if a groupmark/wordmark has stopped data transfer, the DISPLAY operator service function can be used. The Emulator Program does not support the functional control character tabulate (C). The console inquiry Q latch function is also supported when OSINQRY=1400 or YES.

The 1052 Printer-Keyboard emulates the 1407 or 1447 Console Inquiry Station. The correlation of the functions of the 1407/1447 with those of the 1052 are shown in Table 10.

There are certain differences between the 1407/1447 graphics and those of the 1052. The 1407/1447 record mark (≠), exclamation mark (!), and question mark (?) are not produced by the 1052. Substituted for these special characters are the lowercase alphabetics "x", "p", and "g", respectively. A wordmark is represented on the 1052 by an underscore (_) preceding the character associated with the wordmark. A word separator character is represented as a lower-case w. The graphics of the 1052 that are dissimilar to those produced by the 1407/1447 are listed in Table 11.

DIFFERENCES IN PRINTER GRAPHICS

Wherever possible the Emulator Program attempts to translate 1400 BCD graphic symbols to corresponding EBCDIC graphic symbols. On the other hand, a number of the 1400 BCD graphic symbols are not on the standard System/360 printer chains. The Emulator Program, therefore, translates these BCD symbols to EBCDIC symbols that can be printed.

Table 10. Correspondence of 1407/1447 Functions With 1052 Functions

1407 Function	1447 Function	1052 Function
REQUEST key	TYPE key	Console INTERRUPT key "EC40D TYPE IN FUNCTION" "INQUIRY 1400" reply ALTN CODING KEY AND "5" key (EOB)
ENTER light	PROCEED light	PROCEED light
RESPOND key	RELEASE key	ALTN CODING key and "5" key (EOB)
CLEAR key-light	CANCEL key-light	For Read Operation: ALTN CODING key and "0" key (CANCEL)

Table 11. Dissimilar Graphics: 1407/1447 vs. 1052

1407/1447 Character	Corresponding 1052 Character
:	'
✓	"
>	=
ƀ	:
⧻	?
¤	<
Δ	⌐
[	(
⧻	|
<	+
\	>
]	)
?	g
!	p
b	space
⌐	w
⧻	x

Table 12. Translated Codes and Graphic Symbol Differences

Card Code	BCD Graphic Symbol	System/360 8-Bit Code Sent to the Printer	EBCDIC Graphic Symbol
12-8-5	[	0100 0000	blank
12-8-6	<	0100 0000	blank
12-8-7	⧻	0100 0000	blank
12	& +	0101 0000	&
11-8-5	]	0100 0000	blank
11-8-6	;	0100 0000	blank
11-8-7	Δ	0100 0000	blank
0-8-5	⌐	0100 0000	blank
0-8-6	\	0100 0000	blank
0-8-7	⧻	0100 0000	blank
8-2	ƀ	0100 0000	blank
8-5	:	0100 0000	blank
8-6	>	0100 0000	blank
8-7	✓	0100 0000	blank
12-0	?	0101 0000	&
11-0	!	0110 0000	-
0-8-2	⧻	0100 1110	+

Table 12 lists these "unprintable" BCD symbols and indicates the EBCDIC translation for each.

The Emulator Program uses a translation table (ALSTABLE) to translate these special BCD symbols. ALSTABLE can be modified to enable the Emulator Program to print any of the special BCD symbols that may be on a non-standard System/360 printer chain.

The Print Word Mark instruction is emulated as in the 1460 system. A groupmark character is printed in the wordmark line as "2"; a groupmark with wordmark as "3".

EMULATOR JOB CONTROL CARDS

The job control cards for 1400 programs appearing in a job stream should be as follows:

// JOB jobname

// ASSGN

If 1400 devices are reassigned.

// UPSI

The User Program Switch Indicator (UPSI) card is used to set 1400 sense switches. UPSI bits 0-6 coincide with sense switches A-G. A 1 in the appropriate bit position indicates that the sense switch should be initially set on for this run; a 0 indicates off. All sense switches are initialized off when a // JOB card is encountered. Sense switch A should not normally be set on for a run unless the user wants the first 1400 test for last card to be successful. The Emulator Program sets sense switch A on when it encounters a /* card.

// EXEC euname

"euname" is the name given by the user to his Emulator Program. It is the same name as that punched into the name field of the EU30/EU40 macro when it was generated.

// 1400

Always required. See "The // 1400 Control Card" in this section.

// TAPE

If nonstandard block sizes, mixed parity on 7-track, or 9-track compatibility is desired. See "The // TAPE Control Card" in this section.

// DVOL

Verification of a given volume serial number(s) for a disk pack(s) accessed by the Emulator Program is desired. See "The // DVOL Control Card" in this section.

// CCTL

If the carriage-control-tape image option is desired. See "The // CCTL Control Cards" in this section.

1400 object deck
    or

// FETCH card
    and/or

1400 data cards

/*

Always required.

/&

If end of job stream.

If DOS is logging job control statements (// OPTION LOG card before the // EXEC card), the Emulator control cards are printed on SYSLOG in card-image format. It is possible to correct Emulator Control card errors (on // 1400, // TAPE, // DVOL, and // CCTL cards) by typing a correct response on the console typewriter. If LOG is specified, the control card in error will be the last card printed on the console output. Information on an invalid control card is not accepted by the Emulator program. (See Operator Message EC29D.)

THE // 1400 CONTROL CARD

Each 1400 program to be executed under the Emulator Program requires, immediately following the // EXEC card, an Emulator control card of the following format:

// 1400 name,a,b,c,d,e,$f_0f_2f_4f_6f_8$,g,hhhhh

There can be only one // 1400 control card per job step. Until a valid // 1400 control card is read or the job is cancelled, any other card read is considered a control card error.

The card is free form in the same manner as all other job control cards. At least one blank must separate the "//" from the operation code (1400) and at least one blank must separate the operation code from the operands. The operands are positional and conform to the standard rules for writing positional parameters; that is, any or all operands may be omitted, but if one operand is omitted and a following operand

is included, the comma following the first operand must be included. Embedded blanks are not allowed.

For example:

// 1400
     All operands have default values.

// 1400 PAYROL,,b,,,e

     Operands "a", "c", "d", "$f_0f_2f_4f_6f_8$", "g", and "hhhhh" have default values.

// 1400 ,a,b

     The name is blank and all operands after "b" have default values.

The meaning of the operands and their default values are:

name
     specifies the name of the 1400 program to be executed. This name is used in logging the start and end of job messages, and is the name under which the 1400 program is cataloged in the Core-Image Library if cataloging is requested. This operand may consist of from 1 to 6 characters or may be omitted. If used in the catalog function, it should be 6 characters. Names less than 6 characters in length are left-justified and filled with blanks when they appear in the start and end messages. If "name" is greater than 6 characters, only the first 6 bytes are used.

a
     specifies the 1400 load device. This parameter may be a 1, 2, C, D, or it may be omitted. Omitting this parameter is equivalent to making it a 1. The meanings of the values of "a" are:

1
     specifies that the 1400 program is to be loaded from cards, or from SYSRDR if SYSROPT=YES was specified, or from the unit assigned to SYSIPT, and immediately follows the // 1400 control card, and // TAPE, // DVOL, and // CCTL control cards if included. If the user wishes to have the Emulator Program move the input/output control system (IOCS) date ("yyddd") into those positions in which 1400 logical IOCS expects it (82-86 and 195-199), he should remove the two clear-storage cards from his 1400 object program. The Emulator Program clears 1400 storage to blanks.

2
     specifies that the 1400 program is to be loaded from the logical tape drive

corresponding to 1400 tape drive 1, just as if the operator had pressed the TAPE LOAD key on a 1400. In this case, data cards or, if no card input, a /* card immediately follows the // 1400 control card and any other associated control cards.

C
     specifies that the 1400 program is to be loaded from cards, but is not to be executed. Instead, the Emulator Program punches a System/360 object module from the 1400 program that can be cataloged by the user into his Core-Image Library. The 1400 object deck (or overlay) must immediately follow the // 1400 control card. Overlay programs may not be cataloged on the Model 40.

D
     specifies that the 1400 program is to be loaded from the Core-Image Library and executed. In this case, the // FETCH card, punched by the Emulator Program as a part of the catalog function, must immediately follow the // 1400 control card, or // TAPE, // DVOL, and // CCTL control cards if included. Otherwise, the job is cancelled.

b
     when cataloging is not being done, this parameter is used to specify a 1400 storage dump on an abnormal job termination. If this parameter is omitted or if it is other than a 1, a 1400-style main storage dump accompanies abnormal job termination. In addition a System/360 main storage dump is provided if the test-mode option in the // 1400 control card is specified as "S". If "b" is a 1, no dump occurs. Parameter may be coded a 1 if preprinted forms are in SYSLST or SYSLST is assigned to a magnetic unit. This parameter takes on special meaning when the catalog option is being executed. By coding this parameter with a 1 (scan for 1728 blanks), the catalog routine will interpret this to mean that either a non-overlaying 1400 program, or the first (root) section of an overlaying 1400 program is being cataloged. This will conserve library space and improve retrieval time. Subsequent sections of overlaying 1400 programs must <u>not</u> specify a 1 in this parameter when cataloging. This parameter has its normal meaning when the 1400 program is actually executed.

c
     specifies an input card stacker option for 1402 simulation or both the input and output stacker options for 1442

simulation. This parameter can be used to specify simulation of Read Stacker Select instructions or to specify a stacker for all input cards following the // 1400 control card up to and including the /* card. On the Model 40, the parameter is also used to specify a 1400 branch-on-reader-error option. In addition, this parameter is used on the Model 30 to request 402/403 MLP code conversion.

The proper values for "c" are 1, 2, 3, 4, 5, 6, 7, or omitted. If this parameter is omitted, all cards go into stacker 1.

If "c" is coded as a 1 or 2, all input cards are read ahead and directed to the R2 or RP3 stackers, respectively. This is the recommended coding, since card-read speed is maximized and full overlap occurs.

If "c" is coded as a 3, input cards are not read ahead, but are stacker-selected according to the 1400 program. (READRSS=YES must be specified when the Emulator Program is generated.) A // LC card must be placed just ahead of the last data card the 1400 program is to read. The card, which is not passed to the 1400, is directed to the R1 stacker. A /* card should be included following the last data card. It should be noted that a reduction in card throughput results if stacker selection is simulated. This parameter, if specified as 3, is ignored for a catalog operation.

If "c" is coded as a 4, 5, 6, or 7, the same stacker select options are provided as when the parameter is omitted, or coded as a 1, 2, or 3, respectively. In addition, on the Model 40, the 1400 branch-on-reader-error option is activated. When an invalid BCD character is encountered by the reader, control is returned to the 1400 program to process the reader error, and message EC49 is suppressed. On the Model 30, the 402/403 MLP codes are converted to numeric as they are encountered by the reader.

d   specifies either a punch stacker select option or a punch option depending on the 1400 device to be simulated. The meanings for the value of "d" are:

When simulating a 1402, "d" specifies a punch stacker select option for 1402 simulation. If "d" is a 1 and PUNCHSS=YES is specified when the Emu-

lator Program is generated, punch stacker selection is simulated. If "d" is other than a 1, or if it is omitted, all punched cards are directed to the normal punch stacker. Using this parameter for a program in which Punch Stacker Select commands are not issued results in a loss of punch overlap. If SYSPCH is assigned to a tape or disk device, 80- (no stacker selection) or 81-character (with stacker selection) records are written based on this parameter. In the latter case, the first character is the DOS code for stacker selection.

When simulating a 1442 card read punch, "d" specifies whether or not punching into the same card is required when a 1442 Card Read Punch is being simulated by a 1442 or 2520 Card Read Punch. If "d" is a 1, read punch update is desired and input cards are not read ahead. If "d" is omitted or specified as other than a 1, input cards are read ahead.

e   specifies a 1400 halt option. If "e" is a 1, operator restart is possible after 1400 halts other than end of job. (See "Operator Messages" in the "Console Messages" section.) If "e" is other than a 1, or if it is omitted, 1400 halts other than end of job are considered abnormal termination and result in the termination of the 1400 job. If OSDUMP=YES is specified at Emulator Program generation, a 1400-style main storage dump is provided.

$f_0f_2f_4f_6f_8$
specifies a disk part option. The five characters in the parameter correspond to 1311 disk drives 0, 2, 4, 6, and 8, respectively. A disk part option may be specified for each of the five drives starting with drive 0. If less than five are specified, the high-numbered drives are defaulted to 0. Each character of the parameter may be coded as either a 0 or a 1 for simulation on a 2311, and a 0, 1, 2, or 3 for simulation on a 2314.

For simulation on a 2311, a 0 indicates that the respective 1311 drive is to be simulated on the first 100 cylinders of the 2311 to which this file is assigned; that is, cylinders 1 through 100. A 1 indicates that the respective 1311 drive is to be simulated on cylinders 101 through 200 of its assigned 2311 unit. For simulation on a 2314, a 0 indicates that the respective 1311 drive is to be simulated on cylinders 1-50, using heads

0-19, of the <u>first</u> quadrant of the
2314 to which this file is assigned.

A 1 indicates that the respective 1311 drive is to be simulated on cylinders 51-100, using heads 0-19, of the second quadrant of the 2314 to which this file is assigned. A 2 indicates that the respective 1311 drive is to be simulated on cylinders 101-150, using heads 0-19, of the third quadrant of the 2314 to which this file is assigned. A 3 indicates that the respective 1311 drive is to be simulated on cylinders 151-200, using heads 0-19, of the fourth quadrant of the 2314 to which this file is assigned.

Examples:

01010 - 1311 disk drives 0, 4, and 8 are to be simulated on the first 100 cylinders of their assigned 2311 units, which must be different 2311 units. 1311 disk drives 2 and 6 are to be simulated on the second 100 cylinders of their assigned 2311 units, which must be different units.

01230 - 1311 disk drive 0 is to be simulated on cylinders 1-50, using heads 0-19, of the first quadrant of the assigned 2314. 1311 disk drive 2 is to be simulated on cylinders 51-100, using heads 0-19, of the second quadrant of the assigned 2314. 1311 disk drive 4 is to be simulated on cylinders 101-150, using heads 0-19, of the third quadrant of the assigned 2314. 1311 disk drive 6 is to be simulated on cylinders 151-200, using heads 0-19, of the fourth quadrant of the assigned 2314. 1311 disk drive 8 is to be simulated on cylinders 1-50, using heads 0-19, of the first quadrant of the assigned 2314, which must be a different 2314 than the unit to which drives 0, 2, 4, and 6 are assigned.

Note: Stacking of disk packs can reduce disk throughput to the 1400 program if sequential access organization is being used.

g
    specifies a test-mode option. This parameter is coded either S or T (or TEST). The meanings for the values are:

    T
    specifies that the 1400 program is to be executed in the "Test Mode" which causes 1400 program errors to be trapped automatically to the Operator

Services routine in the Emulator Program. This permits the operator to attempt to restart the 1400 program using the operator service functions. A 1400 style storage dump is provided automatically if OSDUMP=YES is specified at Emulator Program generation.

S
    provides all of the "Test Mode" functions provided by "T". Additionally, provides a System/360 main storage dump following 1400-style storage dumps.

If "g" is coded other than an S or T, or if it is omitted, 1400 program errors result in an abnormal job termination.

hhhhh
    End-of-job instruction address (I-STAR) option. When the Emulator Program is generated, standard end-of-job halt indications can be specified through the EOJAADR and EOJBADR parameters. If the user has standard end-of-job halts, the Emulator Program will automatically transfer control to DOS Job Control upon encountering a halt instruction whose A and/or B address equaled the values specified by the EOJAADR and EOJBADR parameters. The "hhhhh" parameter, issued at execution time, enables the user to supply the instruction address of the end-of-job halt unique to the particular 1400 program. The EOJ halt instruction address is always compared first to the contents of the A- and/or B-address registers (if the parameters were specified) and then is compared with the value supplied in this parameter. All comparisons are made upon encountering a 1400 halt instruction but before its execution is completed. This parameter is specified as a five-digit decimal number with leading zeros and having a maximum value of 15999.

THE // TAPE CONTROL CARD

Standard tape I/O buffer assignments are made when the Emulator Program is generated through the "BLKSIZu=nnnn" parameters, where "u" refers to the 1400 tape unit number. These standard buffer assignments may be changed at execution time through the use of the // TAPE control card. The general format of the // TAPE control card is as follows:

// TAPE u_1=nnnnn,y,u_2=nnnnn,y,...

The card is free form in the same manner as all other job control cards. At least one

blank must separate the "//" from the operation code (TAPE) and at least one blank must separate the operation code from the operand(s). The operands are positional and must be separated from each other by a comma; the first blank encountered terminates the operands. The remainder of the card may be used for comments. As many // TAPE control cards as desired may be used. However, cards that decrease buffer size from the standard values must precede cards that increase buffer size. Continuation cards are not allowed. The tape buffers are reset to the standard values upon termination of each 1400 program. The meaning of the operands are as follows:

u
    specifies the number (from 1 to 6) of the 1400 tape unit to be assigned to the I/O buffer area.

nnnnn
    specifies the amount of storage to be allocated for the tape I/O buffer. This value must exceed by at least one byte the physical block size of all records read or written from this unit in the Move mode.

y
    specifies the mode of 7- or 9-track tape that is being used. "y" may be either an A or B. The meanings for these values are:

  A
    For 7-track tape; either even, odd, or mixed parity as determined by the mode specified in the 1400 program instruction.

    For 9-track tape; either even, odd, or mixed parity as determined by the mode specified in the 1400 program instruction. Parity is indicated by the setting of bit 1. For example:

        even parity: X1XXXXXX
        odd parity: X0XXXXXX

    where X may be either a 0 or 1.

  B
    For 7-track tape; the mode specified in the DOS // ASSGN card.

    For 9-track tape; alternate mode (Bit 1 = 1). For example:

        even parity: X1XXXXXX
        odd parity: X1XXXXXX

    where X may be either a 0 or 1.

"A" may be specified only when TAPEMOD= MXEDPAR is specified at Emulator Program generation. When "A" and "MXEDPAR" are

specified, tape errors are passed to the 1400 program for processing.

If parameter "y" is omitted, "B" is assumed. Even though the "y" parameter is positional, if the "y" parameter is omitted, the comma must be omitted.

Examples:

// TAPE 3=1000,A

    1400 tape drive 3 is allotted 1000 bytes of the tape buffer area, which allow a maximum of 999 characters to be read or written as one physical block on 1400 tape unit 3 in the Move mode. In addition, 1400 tape unit 3 is assigned to a tape to be written in mixed, odd or even parity.

// TAPE 1=0,2=580

    1400 tape drive 1 is not used in this program, freeing the standard block size for unit 1 for use by any other unit. 1400 tape drive 2 is allotted 579 bytes of the tape buffer area.

THE // DVOL CONTROL CARD

    The optional // DVOL control card identifies the volume serial numbers of disk packs for which volume serial number verification is to be performed by the Emulator Program at initialization time. To use this option, the DVOL=YES parameter must be specified at Emulator Program generation time. Verification is performed between the data specified in the control card and the unique volume serial number in the Standard Volume Label. The general format of the // DVOL control card is as follows:

    // DVOLyyyy DISKn=xxxxxx,...

Where "yyyy" is the 1400 DASD device type for which verification of volume serial number is to be performed. "yyyy" must be specified as either a type 1301, 1311, or 1405.

    The card is free form in the same manner as all other job control cards. At least one blank must separate the "//" from the operation code (DVOL) and at least one blank must separate the operation code from the operand(s). As many // DVOL control cards as desired may be used; continuation cards, however, are not allowed. The meaning of the operand is as follows:

DISKn
    specifies the 1400 disk drive on which the disk pack is mounted. "n" is the 1400 disk drive number (0, 2, 4, 6, or 8). See the "DISKu=SYSnnn and D1301u= SYSnnn" parameters under "Description

of Disk Parameters" in the "Program
Generation" section.

xxxxxx
    specifies the volume serial number
    (six alphameric characters).

Although the use of the // DVOL control
card is optional, it is recommended that
the volume serial number verification capa-
bility be used to avoid the possibility of
the 1400 program accessing the wrong disk
pack in the DOS multiprogramming environ-
ment. Additional verification may be per-
formed at the operator's option for 1311
direct-access storage devices assigned
through the DVOL DISKn and DVOL DISKn=
xxxxxx operator service functions. (See
"Available Functions" in the Operator Ser-
vice Functions section.) The operator
initiated option is not available for 1301
and 1405 direct-access storage devices
because they are considered fixed devices
that are not changeable during execution of
a 1400 program.

THE // CCTL CONTROL CARDS

The // CCTL control cards provide the
Emulator Program with the carriage-control-
tape image. The CARRCTL=YES parameter
option must be specified at Emulator-
Program generation time to use this option.
If only one card is needed to define the
carriage-control-tape image, the // CCTL
control card should be used. If two cards
are needed, the // CCTL1 and // CCTL2 con-
trol cards should be used. A CCTL1 card
must be read before a CCTL2 card is consi-
dered valid. If a CCTL1 card is read,
there must be a CCTL2 card or the job will
be cancelled. The formats of the // CCTL
control cards are as follows:

```
┌─────────┬───────────────────────────┐
│1 3 4   9│10                       80│
├─────────┼───────────────────────────┤
│// CCTL  │'Lines 1-69 of the         │
│         │     carriage tape image'  │
│         │     (up to 69 lines)      │
└─────────┴───────────────────────────┘
```

```
┌─────────┬───────────────────────────┐
│1 3 4   9│10                       80│
├─────────┼───────────────────────────┤
│// CCTL1 │'Lines 1-69 of the         │
│         │     carriage tape image'  │
│         │     (up to 69 lines)      │
└─────────┴───────────────────────────┘
```

```
┌─────────┬───────────────────────┬────┐
│1 3 4   9│10                   74│ 80│
├─────────┼───────────────────────┼────┤
│// CCTL2 │'Lines 70-132 of the   │    │
│         │  carriage tape image' │    │
│         │  (up to 63 lines)     │    │
└─────────┴───────────────────────┴────┘
```

Note: 132 lines is the maximum form size
for the 1403 or 1443 printer.

The card is free form in the manner of
other job control cards. At least one
blank must separate the "//" from the
operation CCTL (or CCTLn) and at least one
blank must separate the operation from the
carriage tape image. An apostrophe is used
to delimit the image in each card.
Although the card is free form, it is sug-
gested that the apostrophe be in column 10
of the first card to simplify the positio-
ning of the control punches. If this is
done, adding 10 to the line number of the
control tape will determine the line loca-
tion on the card. Thus, tape line 4 would
be positioned in column 14 (see Figure 5).
Frequently, carriage-control tapes are made
with the form image repeated several times.
One image in the // CCTL card(s) is all
that the Emulator Program requires, howev-
er, the form image may be repeated exactly
as on the carriage-control tape. Each
column in the card represents a line on the
carriage-control tape, and the rows of the
card correspond to the channels of the
tape. The punches are as follows:

Card Punch   12 11 0 1 2 3 4 5 6 7 8 9
Channel Punch 12 11 10 1 2 3 4 5 6 7 8 9

A maximum of two punches is allowed in each
card column; if there are two punches, one
must be a 12 or 9 punch.

At 1400-program execution time, the Emu-
lator Program automatically initializes the
carriage-control tape on the printer to
channel 1.

A carriage-control tape and a // CCTL
control card for an 11-inch form to be
printed at 6 lines per inch is illustrated
in Figure 5. A carriage control tape and
// CCTL control cards for a 14-inch form to
be printed at 6 lines per inch is illus-
trated in Figure 6.

READ OPERATION CONTROL CARDS

Six read operation control cards are
used by the Emulator Programs to control
1400 program read operations. These cards,
when required, must be placed at appropri-
ate positions in the 1400 program data
cards.

The read operation control cards (with
the exception of the // FETCH card) are
prepared by the user in a standard format.
All cards are punched with a // in columns
1 and 2, a blank in column 3, and the
operation code in columns 4 and 5. The
// FETCH card is punched in the proper
format by the Emulator Program during cata-
loging operations. The functions of the
control cards are as follows:

Figure 5. Carriage-Control Tape and // CCTL Control Card for 11-Inch Form

// CB - This card is required only when performing column-binary operations. The control card must be placed following the // 1400, // TAPE, // CCTL, and // DVOL emulator job control cards, and prior to the first column-binary data card. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

// FETCH - This card is automatically produced by the Emulator Programs during a catalog run of a 1400 program. The card is required only when executing a cataloged 1400 program. (For more details, see "Fetching" in the section on "Programming Considerations.")

// LC - This card is used as a data delimiter card, and is required by the Emulator Program when performing either 1442 read-punch-update simulation, or read-stacker-select simulation. This card is placed just prior to the last data card in the deck. Although this card is not required for other opera-

tions, it is suggested that both the // LC and the conventional /* cards be used. (For more details, see "Card Read Punch Simulation" in the section on "Simulation of I/O Devices.")

// IP - This card is required when the user desires to read Emulator job control cards from SYSRDR and 1400 programs or data from SYSIPT. If the SYSROPT parameter is specified YES, the // IP control card is optional, but must be in the customer's deck if he wishes the job stream transferred from input on SYSRDR to SYSIPT during 1400 program execution. However, if the // IP control card is used, the SYSROPT parameter must be specified YES. Upon encountering the // IP control card, reading operations are transferred from SYSRDR to SYSIPT. Thus, when this card is used, SYSRDR and SYSIPT should be assigned to separate devices. The SYSIO parameter must specify SYSIPT on the desired type of device (SYSIO= i00). The // IP control card is placed in the SYSRDR job stream
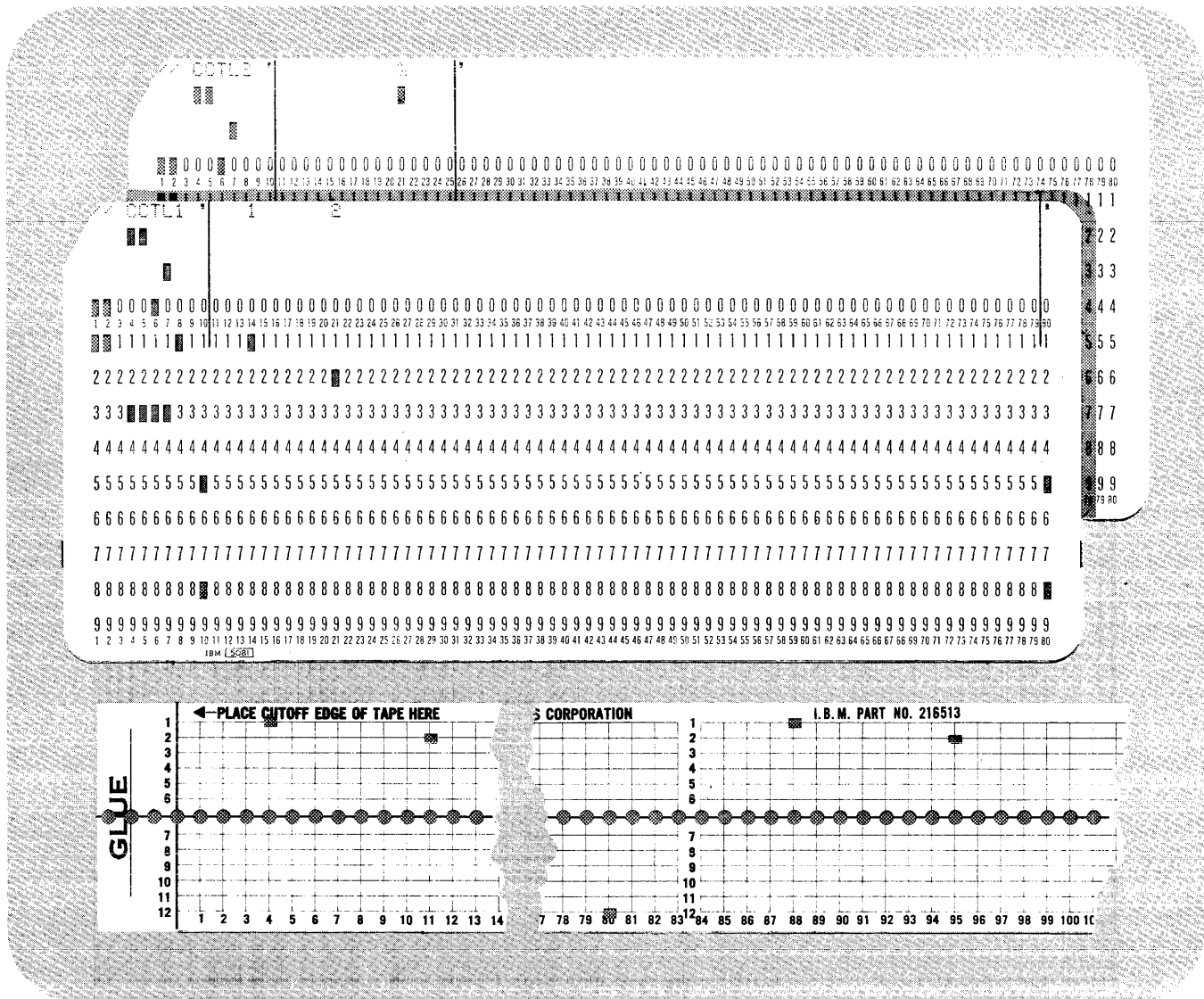
Figure 6. Carriage-Control Tape and // CCTL Control Cards for 14-Inch Form

following the // 1400, // TAPE, // CCTL, and // DVOL emulator job control cards. The only read operation control card that may be included in the same program as this control card is the // FETCH card. The // FETCH card may either precede or follow the // IP card. Reading operations are returned to SYSRDR by the DOS Supervisor following 1400 end of job.

// PR - This card is required only when simulating 1442 punch-feed-read operations on a System/360 2540 Card Read Punch. Since cards are not preread during punch-feed-read operations, a // LC card must also be included. The // PR card conditions the Emulator Program, to read all of the following cards from the punch side of the 2540. Thus, all data

cards, including the // LC control card and the conventional /* card must be on the 2540. For proper operation a blank card must be placed in front of the first data card.

// 51 - This card is required only when performing 51-column cut card operations. The control card must be placed just prior to the first 51-column data card. The control card causes an operator message to be issued requesting the operator to mount the 51-Column Interchangeable Read Feed Feature.

The control cards // CB, // IP, // PR, and // 51 are mutually exclusive and combinations of these cards in the same 1400 program are not supported.

INQUIRY

Standard System/360 inquiry programs can be called from the Core-Image Library and executed while under control of the Emulator Program if OSINQRY is specified at Emulator system generation. This should not be confused with the multiprogramming facilities of DOS, since the inquiry program is called as a background program phase. All 1400 program processing is stopped while an inquiry program is being executed. Inquiry programs that have already been written in Assembly Language require minor modifications to be linkage-edited and called under the Emulator Program because certain programming considerations must be met:

- The inquiry program must be linkage-edited with the generated Emulator Program. The PHASE card required for the inquiry program is as follows:

        PHASE progname,INQPROG

    where INQPROG is a label defined in the Emulator Program as an ENTRY. The "progname" must adhere to standard phase name restrictions and is the name used by the operator when requesting an INQUIRY.

- The program must not exceed 2,980 bytes of storage; it may, however, contain multiple overlay phases.

- Upon completion of the inquiry program, when the user would normally code the EOJ macro, control is passed back to the Emulator Program, and in turn back to the 1400 program, by executing the following instructions:

        L 1,=V(INQEXIT)
        BR 1

- Any I/O device may be used except the card reader and the magnetic-tape units used by the 1400 program. Disk-storage drives may be referenced by the inquiry program without interfering with the 1400 program. The user is cautioned against altering data on disk that is being referenced by the 1400 program because the result of the 1400 program may not agree with expected control totals.

CATALOGING

CATALOGING 1400 PROGRAMS INTO THE CORE-IMAGE LIBRARY

One of the major benefits of System/360 operating systems is the ability to catalog and fetch programs from the Core-Image Library rather than having to load each program from the card reader. Emulation under DOS provides this function for the compatibility user. Through the use of the Emulator Program, 1400 programs may be converted into System/360 object modules. These object modules are then cataloged in the Core-Image Library in the normal DOS manner. Thereafter, the Emulator Program is able to fetch 1400 programs as they are needed in the job stream. The 1400 programs may be in any form of object deck that is loadable from the card reader. However, only 1400 programs for the Model 30 may consist of overlays.

Briefly, the method for converting a 1400 object deck into a System/360 object module is as follows. The 1400 program (or overlay section) is allowed to load itself into System/360 main storage in the normal manner under control of the Emulator Program. Immediately following the 1400 END or XFR card is a /* card. This /* card signals to the Emulator Program that the 1400 program or overlay has been loaded. Because the Emulator Program is a card read ahead of the 1400, the situation at that point is that the END or XFR card has been passed to 1400 storage, but control has not yet been returned to the 1400 Compatibility Feature. Hence, the 1400 program has been effectively cut off just at the point at which it was to execute the program.

The Emulator Program can therefore save the current 1400 address registers and, providing the 1400 storage area can be restored to the way it now looks and the address registers returned, 1400 processing may be restarted at any time in the future. 1400 storage may be saved easily if it is punched out in the form of an object module. The Emulator Program translates what it finds in the 1400 storage area into ESD, TXT, END, and ENTRY cards.

There are two methods of representing 1400 storage as an object module. The method chosen by the user is indicated to the Emulator Program at execution time by use of the // 1400 control card parameters "a" and "b". (Refer to the section on

// 1400 Control Card for a description of these parameters.)

Method 1 - Scan for 1728 Blanks: This method should be used for 1400 programs which do not contain overlays. This method punches an object module from 1400 storage as a series of non-contiguous phases. Any area of 1728 or more consecutive blanks is not cataloged in the DOS Core-Image Library. Since the Emulator Program initializes all of 1400 storage to blanks prior to loading the 1400 program, this should present no problems to the user. This method offers:

- Conservation of space in the DOS Core-Image Library

- Fast retrieval due to the low number of phases to be loaded

Method 2 - Scan for 100 Blanks: This method should be used when 1400 overlay programs are to be cataloged on the Model 30. (1400 overlay programs on the Model 40 are restricted due to the non-contiguous layout of simulated 1400 storage.) This method also punches an object module from 1400 storage as a series of non-contiguous phases. Any area of 100 or more consecutive blanks is not cataloged in the DOS Core-Image Library. This approach yields a greater number of phases than Method 1, and the Emulator Program will abort cataloging if the number of internal phases exceeds 27. However, this method offers the ability to catalog most 1400 overlay programs on the Model 30.

For both methods, scanning of 1400 storage is contiguous from the start of 1400 storage to the end. As soon as a character other than a blank with no word-mark is discovered, a phase is assumed to begin, and the scan of main storage continues. Eventually, another blank with no wordmark is found. At that point, the address of the last nonblank is saved as being the tentative phase end, and the scan continues. If 100 (or 1728) consecutive blanks are found, the phase is considered to have ended at the last nonblank. If less than 100 (or 1728) consecutive blanks are found, the tentative phase end address is updated, and the phase is assumed to include embedded blanks. This causes no problems for the Model 30 Emulator Program since 1400 storage addresses run contiguously. For the Model 40 Emulator Program, however, all of the storage area is cleared to 1400 blanks and, even though 1400 addresses are noncontiguous, memory is scanned sequentially on the assumption that some blank areas can be eliminated.

In short, a 1400 storage load is punched by the Emulator Program as one or more

internal phases. Each phase is considered to be terminated by either 100 (or 1728) consecutive blanks or the highest 1400 storage address.

The user should keep two important facts in mind. First, that a 1400 storage load may be either an entire program or merely an overlay. An Emulator-Program catalog run is required for _each_ overlay in a program and is done using Method 2. Second, that a nonblank (such as a record mark or blank with a wordmark) that is preceded and followed by at least 100 blanks is cataloged as a separate phase. This could lead to inefficient use of the Core-Image Library and should be avoided where possible.

The Emulator Program used to catalog a 1400 program need not be the same that fetches it. Nor is it necessary for 1400 storage to occupy the same absolute System/ 360 addresses in the Model 30 Emulator Program since Model 30 1400 storage is relocatable. Programs cataloged by the Model 30 Emulator Program, however, cannot be fetched and executed by the Model 40 Emulator Program, and vice versa.

OVERLAY PROGRAM CONSIDERATIONS

Normally, each 1400 program overlay section must be cataloged in a separate run of the Model 30 Emulator Program. This requires that the user know his 1400 object decks well enough to determine where overlay transfer cards are located. The user should have little difficulty, however, since the overlays were planned in the writing of the 1400 program.

In at least two instances, overlay programs occur when the user does not plan for them. The 1400 input/output control system (IOCS) on disk, when assembling disk IOCS (DIOCS) entries for a program using magnetic tape, causes an overlay in order to create a character in the program that is not readable from a card (substitute blank). Similarly, all 1400 COBOL programs in which constants are defined in the Working Storage or Constants Sections, include an overlay. In this instance, the overlay is used to move the values of the constants to the main storage positions that they occupy during execution of the program. Neither of these cases require separate cataloging, even though an overlay is involved, nor does the overlay restriction apply for the Model 40. In effect, the overlay may be ignored. The reason for this is evident from a consideration of the purpose of the overlay. The sole purpose of the overlay is to arrange 1400 storage prior to beginning execution of the program. Therefore, if it is feasible or possible to load main

storage directly as desired, no overlay is necessary. Hence, COBOL programs in which the user has not entered AUTOCODER in order to cause a deliberate overlay may be considered to be non-overlaying. Similarly, tape or disk AUTOCODER problems in which the user has not specifically programmed an overlay may also be considered non-overlaying.

The method described for cataloging overlay programs will work for all overlays on the Model 30 except when:

1. An overlay segment attempts to selectively alter (through the use of ORG statements or patching) coding that existed in a previous segment unless at least 100 bytes of blanks exist between segments.

2. The programming practice of initializing counters set up in a previous overlay through the technique of "loading" zeroes is employed.

3. The index register area is overlaid by subsequent phases. (The Model 30 Emulator Program solves this problem during actual execution by saving and restoring the 1400 index registers before and after loading subsequent segments of overlaying programs.) The saving and restoring of 1400 index registers by the Emulator Program causes the user problems if reinitialization of the 1400 index registers is actually desired.

Therefore, programs in the above categories will not execute correctly, and thus, should not be cataloged.

In summary, programs cataloged with the Model 30 Emulator Program cannot be executed with the Model 40 Emulator Program, and vice versa. In addition, since 1400 storage is cleared between catalog runs, those multiphase 1400 programs that require 1400 data or instructions to be resident in 1400 storage as a result of a previous phase cause difficulty to the user and are, therefore, restricted. Also, overlay programs on the Model 40 are restricted from cataloging due to the non-contiguous nature of simulated 1400 storage.

PROCEDURES FOR CATALOGING 1400 PROGRAMS

If the 1400 program to be emulated on the Model 30 has one or more deliberately programmed overlays, the program must be separated into its overlay sections. Each

section must be cataloged as a separate run of the Emulator Program. Therefore, clear storage, bootstrap and loader (if AUTOCODER on disk) cards must be supplied for overlay sections. Overlay programs on the Model 40 should not be cataloged due to the non-contiguous layout of simulated 1400 storage.

The // 1400 card must include, at a minimum, a program name and a C for the load device, as follows:

    // 1400 myname,C

The remaining parameters may be included if desired. The program name may be from 1 to 6 characters in length. It is used as the first six characters of the phase name under which the phases that go to make it up are cataloged in the Core-Image Library. If the program name is less than six characters in length, it is padded with the letter X. This name must be unique for each catalog run, even though separate runs are required for overlay programs. Immediately following the last card of the object deck (or an XFR card in the case of an overlay) must be a /* card. The makeup of a deck for a 1400 catalog run is illustrated in Figure 7. SYSPCH must be assigned to a punch unit for the 1400 catalog function.

As illustrated in Figure 8, the output of a catalog run consists of one or more Linkage Editor job steps. If the program or overlay is contiguous, there is only one Linkage Editor job step. If there are at least 100 (or 1728) consecutive blanks embedded in the coding, there is more than one step. Each step consists of a PHASE card, an INCLUDE card, an ESD card, one or more TXT cards, an END card, an ENTRY card, a /* card, and a // EXEC LNKEDT card. Following the cards making up the last step are a /& card and // FETCH card. The // FETCH card is used by the Emulator Program when the program is to be fetched from the Core-Image Library and executed after the cataloging run is completed.

The // FETCH card should be removed and held aside. The remaining cards may then be preceded by standard DOS Job Control cards and processed as normal input by the DOS Linkage Editor. This results in the 1400 program being cataloged in the Core-Image Library.

The following error message is issued during a 1400 catalog run if the number of phases to catalog exceeds 27:

    EC84I   TOO MANY PHASES TO CATALOG

The 1400 catalog run produces punched output of
System/360 main storage (in DOS Object format)
and is used as input to a normal DOS catalog run.

/&

/*

End Card (1400 L/C)

Object Deck of
Overlay Section

Program 2
(Overlay)

Clear Storage,
Bootstrap, etc.

// 1400 prgnm2, C

// EXEC euname

/*

1400 XFR Card

1400 Object Deck
of Overlaid Section

Program 1

1400 Clear Strg.,
Bootstrap, (& Loader
if Disk Autocoder)

// 1400 prgnml, C

// EXEC euname

// JOB jobname
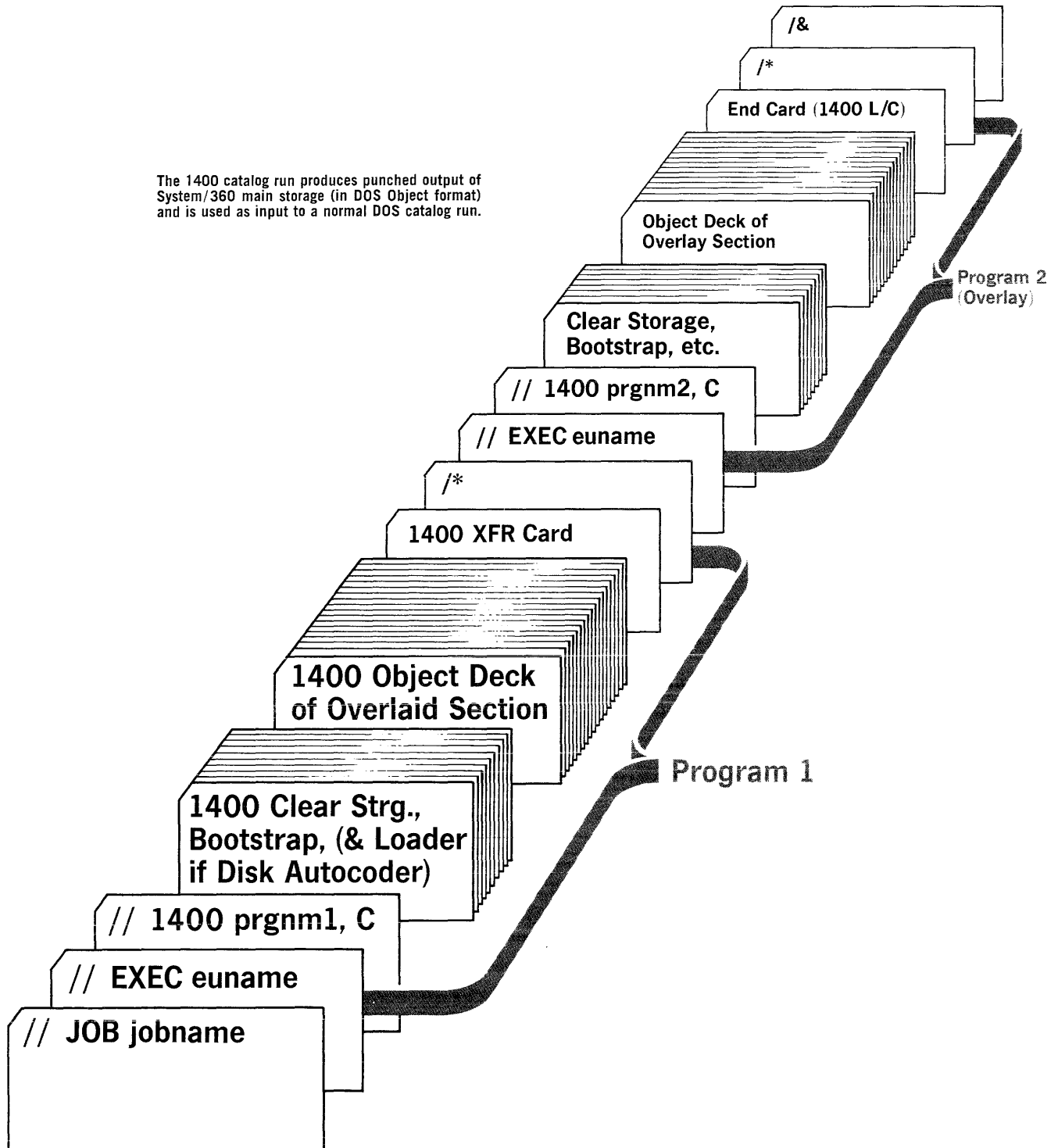
Figure 7. 1400 Catalog Run for a 1400 Program With One Overlay

FETCHING

FETCHING 1400 PROGRAMS FROM THE CORE-IMAGE
LIBRARY

   The // FETCH card produced by the 1400
catalog run and used in the fetch run pro-
vides the Emulator Program with the phase

names that make up the phases in the 1400
program or overlay section. It also car-
ries the 1400 I-, B-, and A-Storage Address
Registers for restarting the 1400 program,
and the origin address of each phase in the
program or overlay. With this information,
the Emulator Program can do a series of
loads (using the LOAD macro instruction)

NOTE 1 ────────► // FETCH prgnm2

/&

// EXEC LNKEDT

/*

ENTRY

END

TXT

ESD

INCLUDE

NOTE 2

PHASE prgnm201

NOTE 1

(blank)

// FETCH prgnm1

/&

// EXEC LNKEDT

/*

ENTRY

END

TXT

ESD

INCLUDE

PHASE prgnm101

Set 1
Program 2
(Overlay)

Set 1
Program 1
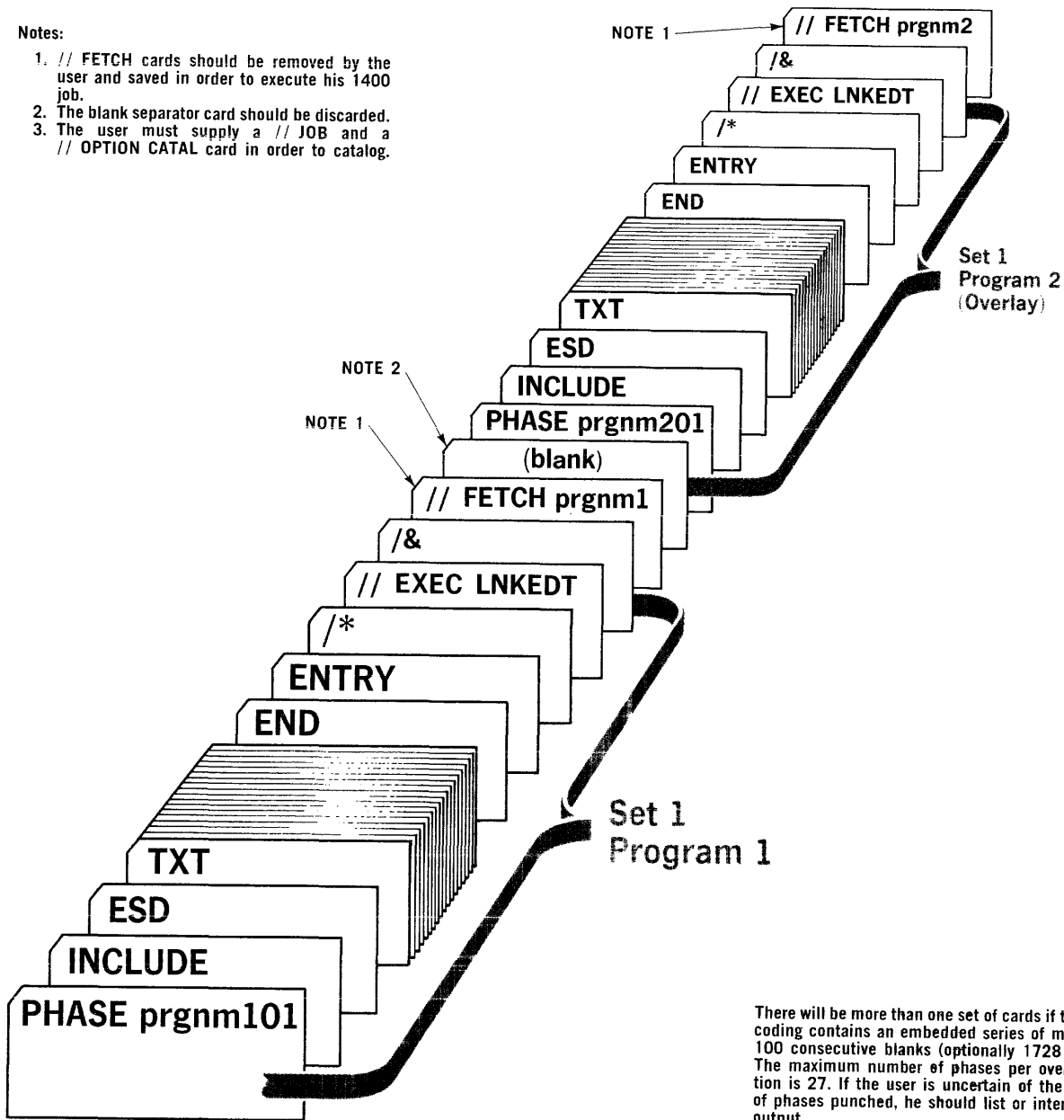
There will be more than one set of cards if the 1400 coding contains an embedded series of more than 100 consecutive blanks (optionally 1728 blanks). The maximum number of phases per overlay section is 27. If the user is uncertain of the number of phases punched, he should list or interpret the output.

Figure 8. Output of the 1400 Catalog Run in Figure 7

until all phases are in main storage. The address registers can then be loaded and a switch made to Compatibility mode.

PROCEDURES FOR FETCHING 1400 PROGRAMS

If the 1400 program to be fetched consists of one or more overlays, two or more // FETCH cards are required. Otherwise, only one // FETCH card is needed. The sequence of cards for a fetch run is illustrated in Figure 9. The // 1400 card must include a D for the load device. The other parameters may be included as required.

(Note: The name in the // 1400 card is used only to log the starting and ending messages on the console or in a 1400 storage dump if one occurs. It is not used in fetching the program.)

A standard method of coding in an overlay program in which the section of code to be overlayed reads a variable number of data cards is to test for a comma in column 1 of each card. When the test is successful, all data cards have been read, and the card in the read area is the first card of the overlay. The first card of the overlay is always some form of bootstrap card.

If the 1400 reads cards while executing its first overlay section, it must be able to recognize an "end-of-data" condition. (See example in text for one method of accomplishing this.)

```
/&
  /*
    Data Cards
    (if required)
      // FETCH prgnm2
        Data Cards
        (if required)
          // FETCH prgnm1
            // 1400
               anynam, D
              // EXEC euname
                // JOB name
```
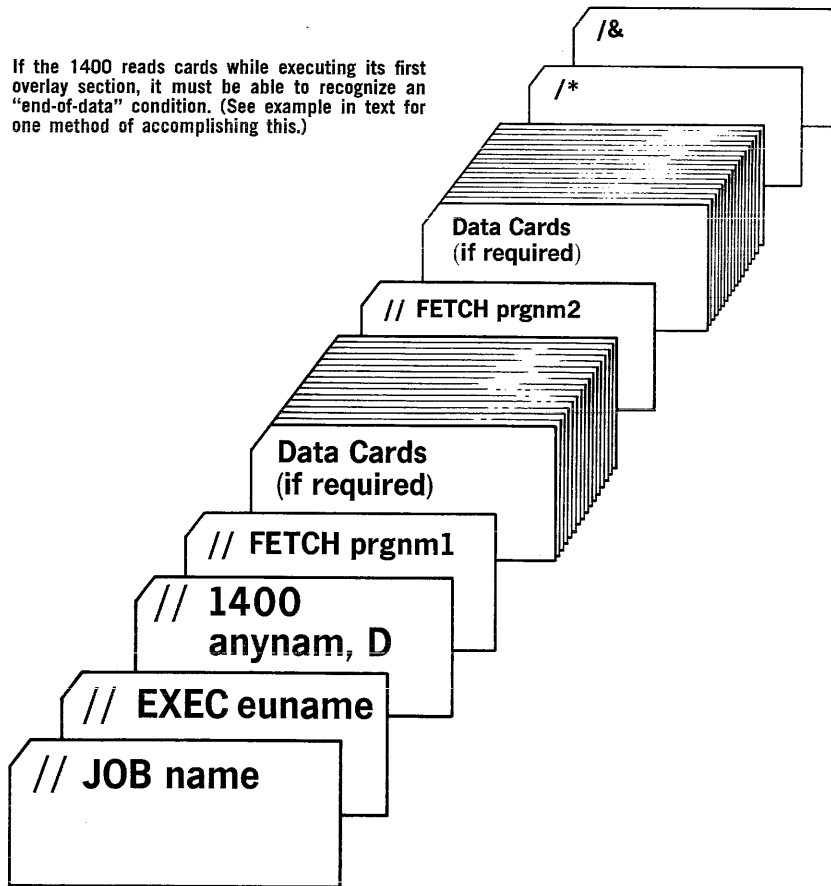
Figure 9. Executing a 1400 Program From the Core-Image Library

This method may be simulated when 1400 programs are being fetched by including the bootstrap card between the end of the data cards and the next // FETCH card, as follows:

```
// JOB jobname
// EXEC euname
// 1400 prgnam,D,...
// CCTL (optional)
// DVOL (optional)
// FETCH .....     (Fetch card for first
                    section)
data cards
   .
   .
   .
last data card
bootstrap card
// FETCH .....     (Fetch card for second
                    section)
```

It should be emphasized again that the bootstrap card indicated in the example is only required when an overlay recognizes its "end-of-data" condition by having read the first card of the next overlay.

A /* card should not normally be included following a group of data cards read by other then the last overlay section of a program. This is because it has the effect of setting the 1400 last-card latch on, a situation that is impossible if an overlay section of the object deck follows the data cards.

Note that, when IOCDATE is 82 or 195 or both, the Emulator Program loads the date in 1400 addresses 82 through 86 or addresses 195 through 199 or both. This is done after the 1400 program has been fetched and will cause what is already in those positions to be overlaid.

AVAILABLE FUNCTIONS

Many of the Operator Service Functions
are optional features of the 1401/1440/1460
Emulator Programs under the Disk Operating
System (DOS) and are included in the
generated program if specified in the sym-
bolic parameters. During the execution of
a 1400 program under the Model 30 Emulator,
dial F on the operator's panel of the 2030
Central Processing Unit (CPU) should be
positioned to CI. This allows external
interrupts (INTERRUPT key) to be handled
while the system is in Compatibility mode
(COMP MODE light on). For the Model 40, no
special dial F considerations are neces-
sary. The Operator Service routine is
entered by pressing the external INTERRUPT
key when the Emulator Program is running in
the background partition or by pressing the
console REQUEST key (MSG F1 or MSG F2) when
the Emulator Program is running in the
foreground partition. OC=YES must be spec-
ified in the FOPT macro at DOS Supervisor
generation. In addition, the Operator Ser-
vice routine is entered through recognition
of a 1400 halt if parameter 'e' on the
// 1400 card is specified as '1' and the
halt is not specified as either an EOJAADR,
EOJBADR, or the EOJ I-address in the
// 1400 card. When operator services fol-
lowing a halt message are not specified,
the 1400 program is canceled on recognition
of any halt other than a specified end-of-
job halt. Additionally, when the 1400 pro-
gram is being executed in "Test mode"
(described in the "Control Cards" section
under "The // 1400 Control Card") and the
Emulator Program recognizes any error con-
dition, the Operator Service Function rou-
tine is entered automatically. Alphabetic
characters may be entered in either upper
or lower case except characters g, p, x and
w. These characters, when entered in lower
case, represent a question mark (?), excla-
mation mark (!), the 1407/1447 record mark
( ), and a word separator ( ), respec-
tively.

When the Operator Service Functions have
been entered, the following message is
displayed:

    EC40D TYPE IN FUNCTION

The operator then types in the function
he wants. Five functions are always
included with the Operator Service routine
macro (EU30S/EU40S); these are: CANCEL,
END, RESET, START, and STATUS. An end-of-
block (EOB) entry (alternate coding key and
numeric 5 key) will perform the same func-

tion as the response START. RESET is
available only when the Operator Service
routine is entered as a result of a 1400
halt. CANCEL and END are valid responses
to any Emulator Program message requesting
a reply.

The following Operator Service Functions
are available with the typed responses
below:

ADDRESS

This is included only if OSADDR=YES is
specified. The ADDRESS function converts a
decimal 1400 address into its corresponding
System/360 hexadecimal address (including
offset), and can be used to determine where
to alter main storage via the console or
where to set the dials when the SAR STOP
switch is used to address-stop 1400 pro-
grams. The operator types in ADDRESS fol-
lowed by at least one blank and a valid
1400 address in the range 1 to 15999. The
Operator Service Function responds with the
converted hexadecimal address. For exam-
ple:

(System)   EC40D TYPE IN FUNCTION

(Operator) ADDRESS 1579

(System)   EC41I HEX ADDRESS = 47AA

ALTER

This function is included if the parameter
OSALTER=YES is specified. The ALTER func-
tion causes the 1400 I-, A-, and B-Storage
Address Registers to be altered to the
address that follows the word ALTER. This
may be used to alter the instruction
address of a 1400 program, to effect a
branch, or to place a valid address in a
register destroyed by a 1400 process error.
At least one blank must precede the
address. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) ALTER 632

(System)   EC80I 1400 STATUS: I=00632;
            A=00632;B=00632.
            INSTN BLOCK=xxxxxxxx

(System)   EC40D TYPE IN FUNCTION

Since all storage address registers are set to the same value, the alter address should not be the address of a 1400 Store B-Register (SBR) instruction or to an address where 1400 chaining is being used.

CANCEL

This response to any Emulator Program message causes the 1400 program to be terminated with an end of job. If OSDUMP=YES was specified at Emulator Program generation, a 1400-style storage dump is provided on SYSLST unless a no-dump option (a "1") is specified in parameter "b" of the // 1400 control card. When a 1400-style storage dump is provided, a System/360 main storage dump also is provided if the test-mode option in the // 1400 control card is specified as "S".

DELETE

The operator wishes to discontinue volume serial number checking on a specific 1400 drive identified as DISKn in messages EC75I and EC76I, and allow the 1400 program to process any 1311 disk pack mounted on that 1400 drive. In order to use the DELETE function, the operator must first reply DSPLYV to message EC75I. For example:

(System)   EC75I WRONG PACK, MOUNT 134A21
            DISK 0 ON DR 192

(Operator) DSPLYV

(System)   EC76I DISK 0 ON DR 192 SERIAL
            NO.=111222

(System)   EC40D TYPE IN FUNCTION

(Operator) DELETE

Volume serial number checking will be discontinued on 1400 drive DISK 0 until re-initiated using the DVOL DISKn=xxxxxx operator service function. The DELETE function should be used with caution when performing write operations.

DISK

This function is included if the parameter OSDISK=YES is specified. Two separate functions of DISK may be requested depending on the operator responses:

(System)   EC40D TYPE IN FUNCTION

(Operator) DISK
            or
            DISK n (where n=0,2,4,6, or 8)

The response DISK causes a display only of message DISK n ON SYSxxx, PART n for each drive on the system, and then message EC40D is reissued. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) DISK

(System)   EC44I DISK 0 ON SYSxxx, PART n
                  DR 190
            EC44I DISK 2 ON SYSxxx, PART n
                  DR 191
            EC44I DISK 4 ON SYSxxx, PART n
                  DR 191
            EC44I DISK 6 ON SYSxxx, PART n
                  DR 192
            EC44I DISK 8 ON SYSxxx, PART n
                  DR 192

The response DISK n, where n is the drive number, displays one specific disk assignment (DISK n) and allows the operator to retain or change the assignment. When the assignment is changed, disk verification is automatically performed. It then displays the new assignment, if it was changed. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) DISK 0

(System)   EC44D DISK 0 ON SYS003,
                  PART 0 DR 191

The operator may then change the assignment or leave it as it is. If he wishes to change the assignment, he types in the programmer logical unit ("SYSnnn") to which he wants the 1400 disk drive assigned, followed by a 0 or 1 (2311) or 0, 1, 2, or 3 (2314) to indicate which half (2311) or quadrant (2314) of the new device is to be used for the file. For example:

(Operator) SYS021,1

(System)   EC44I DISK 0 ON SYS021, PART 1

This operator response causes 1400 disk drive 0 to be assigned to the second half or quadrant of SYS021. However, if the operator was satisfied with the current assignment, he could respond with START (or EOB). This causes the drive assignment to remain as listed. The assignment is again displayed if the disk drive assignment was changed, and the system reissues message EC40D.

If verification of the volume serial number for a disk pack accessed by the Emulator Program is specified through utilization of a // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) or initiated through operator entry of DVOL DISKn=xxxxxx, the disk

verification (see message EC75I in the
"Console Messages" section) is included in
the DISK function. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) DISK 0

(System)   EC44D DISK 0 ON SYS003, PART 0
            DR 191

(Operator) SYS022,1

(System)   EC44I DISK 0 ON SYS022, PART 1
            DR 191

(System)   EC75I WRONG PACK, MOUNT ABCDEF
            DISK 0 ON DR 191

(Operator) DVOL DISK0=123456

DISPLAY

    This function is included only if the
parameter OSDSPLY=YES or "OSDSPLY=nn" is
specified when the Emulator Program is
generated. The display function prints 100
or "nn" positions of 1400 storage on the
console typewriter. The address is entered
by the operator at least one space beyond
the word DISPLAY. The 1400 zoned zeros are
typed as follows:

" " is typed as "x", "?" is typed as "g",
and "!" is typed as "p". (See Table 11
for additional graphic differences.) For
example:

(System)   EC40D TYPE IN FUNCTION

(Operator) DISPLAY 2347

(System)   _M%U3500R_B60gL_Bp50K_.123456_|

DSPLYV

The operator wishes to display the volume
serial number of the disk pack referenced
in message EC75I (see "Operator Messages"
in the "Console Messages" section). This
response is valid only if preceded by mes-
sage EC75I. For example:

(System)   EC75I WRONG PACK, MOUNT 134A21
            DISK 0 ON DR 191

(System)   EC40D TYPE IN FUNCTION

(Operator) DSPLYV

(System)   EC76I DISK 0 ON DR 191 SERIAL
            NO.=111222

DUMP

This function is included only if the para-
meter OSDUMP=YES is specified when the Emu-
lator Program is generated. The dump func-
tion provides a formatted storage printout
of the 1400 program on the printer assigned
to SYSLST. The 1400 program name, taken
from the // 1400 control card, is printed
along with the date on the top of the dump.
The entire 1400 storage is printed in bands
of 100 except when the band consists of all
blanks without wordmarks. Additionally, a
System/360 main storage dump is provided if
the test-mode option in the // 1400 control
card is specified as "S". For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) DUMP

    A wordmark is shown as a 1 below the
character with which it is associated. A
groupmark in 1400 storage appears as a
blank character in the upper portion of the
band, with a 2 below. A wordmark with
groupmark appears as a blank character in
the upper portion of the band, with a 3
below.

DVOL DISKn

The operator wishes to initiate verifica-
tion of the volume serial number of the
disk pack mounted on 1400 disk drive "n"
(0, 2, 4, 6, or 8) with the volume serial
number specified by the // DVOL control
card (see "The // DVOL Control Card" in the
"Control Cards" section) or as modified by
operator entry.

DVOL DISKn=xxxxxx

The operator wishes to initiate verifica-
tion of the volume serial number of the
disk pack just mounted, where "n" is the
1400 disk drive (0, 2, 4, 6, or 8) on which
the pack is mounted and "xxxxxx" is the
volume serial number (six alphameric char-
acters). "xxxxxx" supersedes the volume
serial number specified in the // DVOL con-
trol card (see "The // DVOL Control Card"
in the "Control Cards" section) or in the
previous operator entry for that disk
drive.

END

This response to any Emulator Program mes-
sage causes the 1400 program to be ter-
minated with an end of job. No storage
dump occurs.

ENTER

This function is included only if the parameter OSENTER=YES is included when the Emulator Program is generated. The ENTER function allows the operator to change the contents of 1400 storage beginning at the 1400 address specified in the response. Entered data or instructions replace any groupmarks/wordmarks which may be present in affected 1400 storage. The first position typed is entered by the operator at least one space beyond the word ENTER. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) ENTER 653

(System)   EC42D DATA

The operator can now enter up to 50 characters. The data to be entered is typed using the special character "_" to indicate that a wordmark is associated with the next character typed. The special character "_" is included in the 50 character count, but when entered at the specified main storage address, it is associated with the next character so that the two characters enter a single-byte location. Alphabetic characters G, P, X, and W must be entered in upper case. Special characters must be entered as indicated in Table 11. The form is similar to the condensed loader format of 1400 disk assembler output. For example, if the operator wishes to enter a branch to 1400 location 3101 at 1400 location 653:

(System)   EC40D TYPE IN FUNCTION

(Operator) ENTER 653

(System)   EC42D TYPE DATA

(Operator) _BA01

INQUIRY

Two separate functions of INQUIRY may be specified at Emulator system generation: INQUIRY and INQUIRY phasename. If OSINQRY=1400 is specified, then the INQUIRY function is available. If OSINQRY=YES is specified, both INQUIRY and INQUIRY phasename are available. INQUIRY: To inform the 1400 program that the operator has performed the function equivalent to pressing the TYPE or REQUEST key on a 1400; that is, the 1400 Q latch is set on for testing by the 1400 program with a BIN xxx, Q. This function must be selected in order to support a 1400 program that is testing for operator inquiry. In this instance, the operator types in INQUIRY (with no operand)

and is thus able to set on the 1400 Q latch. INQUIRY phasename: To call a System/360 program from the Core-Image Library, execute this program, and then return to the 1400 program. If a System/360 program is to be fetched and executed, the response INQUIRY is followed by the name of the System/360 phase to be executed. For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) INQUIRY
                 or
            INQUIRY phasename

See "Inquiry" in the "Programming Considerations" section for further details.

NEWPAC

In response to messages EC75I or EC78D (see "Operator Messages" in the "Console Messages" section), the operator wishes to change disk packs. After mounting the correct disk pack and entering this response, verification of the volume serial number of the newly mounted disk pack with the volume serial number of the 1400 disk drive specified in the // DVOL control card (see "The // DVOL Control Card" in the "Control Cards" section) is performed. This response is valid only if preceded by messages EC75I or EC78D.

RESET

This function is equivalent to pressing the START-RESET and then START keys on the 1400. RESET is available only when the Operator Service routine is entered as a result of a 1400 halt. To reread an error card after a 1400 program error halt, see the RETRY function.

RETRY

This function is used to reread an error card. If input cards are being edited by the 1400 program, and normal operating procedure calls for invalid 1400 cards to cause a halt, at which time the operator is to run out the reader, the operator should correct the card and reinsert it; this response must be made. This special halt response is necessary because the Emulator Program is a card read ahead of the 1400 and already has the next card that the 1400 is to read in its buffer. The buffer, therefore, must be emptied and reloaded in order to reread a card. RETRY is available only when the Operator Service routine is entered as a result of a 1400 halt. The

procedure for using this response is as
follows:

1. The error card is the third card in a
   2540 stacker or the last card in a
   1442 stacker before the operator per-
   forms a nonprocess runout. The opera-
   tor should then nonprocess run out the
   cards in the reader transport.

2. The operator should then correct the
   error card and place it, as well as
   all cards behind it, into the reader
   for processing.

3. The operator then responds with RETRY
   to continue the program. Sense switch
   A is reset off at this time.

If the 1400 program is simulating reader
stacker selection, the operating procedures
are the same, except that the error card is
the first card run out when the operator
performs a nonprocess runout.

START

This function is included if any Operator
Service Functions have been specified, and
is the method used to exit from the service
routines unless EOJ is desired. An end-of-
block (EOB) entry (alternate coding key and
numeric 5 key) will provide the same func-
tion as the response START. Control is
returned to the next sequential 1400
instruction in the interrupted program.

STATUS

This response to message EC40D causes the
display of message EC80I, which displays
the status of the 1400 storage address
registers.

SWITCH

This function is used to set sense
switches. This reply is valid only if
HALTS=YES is specified when the Emulator
Program is generated. Upon selection of
this function, sense switches B through G
are turned off. The desired switches are
turned on by entering their alphabetic
representations. An entry of a blank by
means of typewriter spacebar results in
sense switches B through G remaining off.
The following example shows how this func-
tion may be used.

(System)	EC82I HALT
(System)	EC40D TYPE IN FUNCTION
(Operator)	SWITCH
(System)	EC46I S-SW ON = C EF
(System)	EC45D TYPE S-SW
(Operator)	BDF
(System)	EC46I S-SW ON = B D F

Message EC40D is then retyped, and the
operator may respond with any of the valid
Operator Service Function responses.

TAPE

This function is included only if the pa-
rameter OSTAPE=YES is included when the
Emulator Program is generated. Two sepa-
rate functions of TAPE may be requested
depending on the operator response:

(System)	EC40D TYPE IN FUNCTION
(Operator)	TAPE
	or
	TAPE n (where n=1,2,3,4,5 or 6)

The response TAPE causes a display of
message EC43I TAPE n ON SYSxxx, MAX BLK=
xxxxx DR cuu, n TR, yyy BPI which provides
the current programmer logical unit assign-
ment (SYSnnn), the maximum block size (MAX
BLK=xxxxx), the device address (DR cuu),
the designation for 7- or 9-track tapes (n
TR), and the tape density (yyy BPI) for
each drive (TAPE n). For example:

(System)	EC40D TYPE IN FUNCTION
(Operator)	TAPE
(System)	EC43I TAPE 1 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
	EC43I TAPE 2 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
	EC43I TAPE 3 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
	EC43I TAPE 4 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
	EC43I TAPE 5 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI
	EC43I TAPE 6 ON SYSxxx, MAX BLK=xxxxx DR cuu, n TR, yyy BPI

The response TAPE n, where n is the drive number to be changed (a digit from 1 to 6), displays one specific tape assignment, and then, awaits a response from the operator as to whether he is satisfied with the current assignment or desires to change it. The operator may change the assignment by typing the programmer logical unit ("SYSnnn") to which he wants the 1400 tape drive assigned, or leave the current assignment by entering START (or EOB). For example:

(System)   EC40D TYPE IN FUNCTION

(Operator) TAPE 1

(System)   EC43D TAPE 1 ON SYS011, MAX
                  BLK=00725   DR 191, 7 TR,
                  556 BPI

(Operator) SYS022

(System)   EC43I TAPE 1 ON SYS022, MAX
                  BLK=00725   DR 191, 7 TR,
                  556 BPI

In this example, the operator desired to change the assignment for 1400 tape drive 1 from SYS011 to SYS022. It is important that SYS022 is previously assigned to the proper _physical_ unit. It should be noted that the maximum block size cannot be increased at this time.

GENERAL COMMENTS

Except for data entered under the ENTER option, and responses to the 1400 Read Console Printer command (M%TOxxxR or L%TOxxxR), both of which must be specified in upper case (except special characters), all operator input in the Operator Service Function routines may be typed in either upper or lower case (except special characters). The end-of-block (ALTN CODING key and 5 key) terminates the operator input and releases it to the CPU in the normal manner. Operator errors not yet released by an end of block may be canceled by the CANCEL function (ALTN CODING key and numeric 0 key). The entire input message must then be retyped. The use of the BACKSPACE key is _not_ supported by the Emulator Programs under DOS.

Parameter	Required By	Remarks
BLKSIZu={nnnn / 0000}		Indicates standard block size (plus one byte) for 1400 tape units. "u" is 1400 unit number (1-6). "nnnn" is one larger than the normal block length associated with the unit. Default is 0000.
BUFSIZE={nnnnn / 00000}	1400 magnetic tape	Indicates total storage area to be reserved by the Emulator Program for tape buffers. Default is 0000.
CARRCTL={YES / NO}	Carriage-control pointer option	Indicates carriage-control tape pointer option. Default is NO.
CATALOG={YES / NO}		Indicates 1400 programs to be cataloged in the Core-Image Library. Default is cataloging not available.
COLBINP={YES / NO}	1400 Column-Binary or Card-Image Punch instructions	Indicates that 1400 Column-Binary/Card-Image Punch instructions are to be emulated. Default is NO.
COLBINR={YES / NO}	1400 Column-Binary or Card-Image Read instructions	Indicates the 1400 Column-Binary/Card-Image Read instructions are to be emulated. Default is NO.
COL51={YES / NO}	51-column cards	Indicates 51-Column Interchangeable Read Feed feature support. Default is NO.
DVOL={YES / NO}	1400 DASD	Indicates verification of volume serial number of disk pack accessed by the Emulator Program. Default is NO.
DISKDR={n / 130n / 1405 / 0}	1400 DASD	"n" is number of 1311 drives to be simulated. "130n" indicates one module of 1301 storage in addition to "n" 1311 drives to be simulated. 1405 indicates Model 1 or 2 (mutually exclusive of 1301 and 1311). Default is "n"=0 (no disk).
DISKTYP={2314 / 2311}	1400 DASD	Indicates type of System/360 disk unit. Default is 2311.
DISKu=SYSnnn	1400 DASD	"u" is 1-5 for 1311 and 1-4 for 1405. "nnn" is the programmer logical unit for device "u". Default is SYS001-SYS005 for the respective values of "u" from 1-5.
D1301u=SYSnnn	1400 DASD	"u" is 1-5 for 1301 on a 2311 and 1-3 for 1301 on a 2314. "nnn" is the programmer logical unit for device "u". Default is SYS001-SYS005 for 2311 and SYS001-SYS003 for 2314.

Parameter	Required By	Remarks
EDITINV=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Indicates support of Inverted Print Edit. Default is NO.
EOJAADR=nnnnn		Indicates A-address (5 digits) of standard 1400 end-of-job halt. No default, not generated if not specified.
EOJBADR=nnnnn		Indicates B-address (5 digits) of standard 1400 end-of-job halt. No default, not generated if not specified.
ERROPNG=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Indicates 1400 storage dump when 1400 op code $\underline{G}$ is detected. Default $\underline{G}$ is treated as invalid op code.
FETCH=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Allows 1400 programs to be called from Core-Image Library. Default is no fetch routine is generated.
HALTS=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Changes sense switches on 1400 halts or operator service. Default is change of switches not performed.
IOCDATE=$\begin{Bmatrix} 82 \\ 195 \\ BOTH \\ \underline{NO} \end{Bmatrix}$		Moves required date to 1400 storage from DOS communication region. Default is movement of date not performed.
MPGMBLK=$\begin{Bmatrix} nn \\ \underline{0} \end{Bmatrix}$		Indicates number of 2K (2048) blocks of storage reserved for foreground programs. "nn" must be less than or equal to 20 for the Model 30 Emulator Program Default is 0.
OSADDR=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Converts 1400 addresses to hexadecimal. Default is conversion not performed.
OSALTER=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Changes 1400 address registers. Default is register change not performed.
OSDISK=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Changes 1400 disk-drive assignments. Default is assignment changes not performed.
OSDSPLY=$\begin{Bmatrix} YES \\ nn \\ \underline{NO} \end{Bmatrix}$		Displays 1400 storage. "nn" is number of bytes per display. Default is display not performed.
OSDUMP=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Dumps 1400 storage onto SYSLST. Default is dump not performed.
OSENTER=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Alters 1400 storage from console. Default is alteration of storage not performed.

Parameter	Required By	Remarks
OSINQRY=(1400) {YES} (NO)	1407/1447 Console Inquiry Station	Performs 1400 Read and Write Console Printer instructions, and simulates the Q latch when "1400" is specified. Performs the preceding and executes System/360 inquiry programs when "YES" is specified. Default is none of the above functions performed.
OSTAPE={YES} {NO}		Changes 1400 tape-drive assignments. Default is tape assignment changes not performed.
PCH1400=(1444) {1442} (1402)	Other than 1402	Indicates type of 1400 card punch. Default is 1402.
PCH360=(1442) {2520} (2540)	Other than 2540	Indicates type of System/360 card punch. Default is 2540.
PFR=(YES) {COM} (NO)		Indicates if the punch-feed-read feature is to be implemented. Default is NO.
PTRASGN=SYSnnn	1404	1404 cut-card operations and indicates reassignment of printer from SYSLST. Default is SYSLST.
PTRLNG=(nnn) {132}		Indicates length of 1400 print line. "nnn" is 100, 120, or 132 for the 1403, 120 or 144 for the 1443, or 132 for the 1404. Default is 132.
PTR1400=(1443) {1404} (1403)	Other than 1403	Indicates type of 1400 printer. Default is 1403.
PTR360=(1443) {1404} (1403)	Other than 1403	Indicates type of System/360 printer. Default is 1403.
PUNCHSS=(YES) {NO}		Indicates 1402 punch stacker selection support. Default is NO.
READRSS=(YES) {NO}		Indicates reader stacker selection or 1442 reader-punch-stacker selection. Default is NO.
RDR1400=(1442) {1402}	1442	Indicates type of 1400 card reader. Default is 1402.
RDR360=(1442 2501 2520 2540)	Other than 2540	Indicates type of System/360 card reader. Default is 2540.
RELOC=(0) {nnn}		Indicates the location of the first byte of 1400 simulated storage on the Model 40. Also used to calculate the Emulator's load point.
SCAN=(YES) {NO}	1400 Scan Disk	Indicates 1311 Scan Disk instructions in 1400 program. Default is Scan Disk not performed.

Parameter	Required By	Remarks
SCAN360=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$	1400 Scan Disk	If File Scan feature is installed, used in conjunction with SCAN=YES to implement 1400 Scan Disk feature. Default is a software simulation of Scan Disk function.
SECTORS=$\begin{Bmatrix} nnn \\ \underline{020} \end{Bmatrix}$	Less than 20	Indicates number of sectors the Emulator Program may read per revolution, where "nnn" is 001-020 for the Model 30 Emulator Program and 001-100 for the Model 40 Emulator Program. Default is 020.
SEND=$\begin{Bmatrix} 0 \\ nnnnn \end{Bmatrix}$		Indicates load point for the Model 30 Emulator Program. Used to generate assembly listing addresses identical to those at object program execution time. Not used on the Model 40.
SIZ1400=$\begin{Bmatrix} nn \\ \underline{16} \end{Bmatrix}$	Other than 16K	Indicates 1400 main storage size, where "nn" is any even number between 2 and 16. Default is 16.
SIZ360=$\begin{Bmatrix} nnn \\ \underline{64} \end{Bmatrix}$	Other than 64K	Indicates System/360 main storage size, where "nn" is 24, 32, or 64 for the Model 30 Emulator Program and 32, 48, 64, 128, or 256 for the Model 40 Emulator Program. Default is 64.
SSQUANT=$\begin{Bmatrix} ONE \\ \underline{MANY} \end{Bmatrix}$		Applies only when reader stacker selection is desired. The default is MANY.
SYSIO=$\begin{Bmatrix} ipl \\ \underline{000} \end{Bmatrix}$	Other than 000	Indicates assignment of 1400 unit-record devices to tape or disk, where "i", is SYSIPT, "p" is SYSPCH, and "l" is SYSLST. 0 indicates unit-record device only. 1 indicates unit-record or tape device, 2 indicates unit-record, tape, or disk device, and 3 indicates unit-record or disk device. Default is 000.
SYSROPT=$\begin{Bmatrix} YES \\ \underline{NO} \end{Bmatrix}$		Indicates that job stream can be transferred from card input on SYSRDR to tape or disk on SYSIPT during 1400 program execution. If the SYSROPT parameter is specified YES, the // IP control card is optional, but must be in the customer's deck if he wishes the job stream transferred from card input on SYSRDR to tape or disk on SYSIPT during 1400 program execution. However, if the // IP control card is used, the SYSROPT parameter must be specified YES. Default is all input from SYSIPT.
TAPEDR=$\begin{Bmatrix} n \\ \underline{0} \end{Bmatrix}$	1400 magnetic tape	Indicates number (1-6) of 1400 tape units. Default is 0.
TAPEMOD=MXEDPAR		Indicates mode of 9- or 7- track tape. Default is even parity, Normal mode.

Parameter	Required By	Remarks
TAPERRS=$\begin{Bmatrix} \text{LST} \\ \text{LOG} \\ \text{LSTCHAR} \\ \text{LOGCHAR} \\ \underline{\text{NO}} \end{Bmatrix}$		Indicates simulation of 1400 diagnostic tape read and storage scan. (CHAR indicates display in character mode only.) Default is simulation not performed.
TAPEu=SYSnnn	1400 magnetic tape	"u" is 1-6. A programmer logical unit must be assigned to all six 1400 tape units. The same logical unit may be assigned to more than one tape unit. "nnn" is the programmer logical unit for device "u". Default is SYS011-SYS016 for the respective values of "u" from 1-6.
TAPLDMD=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$	1400 magnetic tape in Load mode	Indicates tape Load-mode operations. Default is Load-mode operations not performed.
TIMER=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$		Indicates availability of timer on System/360 and time of day to log for 1400 jobs. Default is timer not available.
TRACKOP=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$	1311, 1301, or 1405 track operations	Indicates track operations on 1311, 1301, or 1405. Default is track operations not performed.
USRPROG=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$	User-written routine	Indicates block of user code to be inserted for non-standard Emulator Program functions. Default is entry to user program not generated.
VERIFY=$\begin{Bmatrix} \text{YES} \\ \underline{\text{NO}} \end{Bmatrix}$		Verifies disk records written. Default is disk verification not performed.

Six specialized System/360 instructions are provided for use with the 1401/1440/1460 Basic Compatibility Feature. These are:

- Compatibility Feature Initialize Mode (CFIM)

- Compatibility Feature Mode Set (CFMS)

- Compatibility Feature Store Variables (CFSV)

- Compatibility Feature Load Variables (CFLV)

- Compatibility Feature Store Constants (CFSC)

- Compatibility Feature Load Constants (CFLC)

An attempt to use these instructions should not be made unless the Basic Compatibility Feature is installed on the system.

The System/360 Diagnose instructions (see the publication IBM System/360 Principles of Operations, GA22-6821) provide a means to enable and disable these specialized instructions. Thus, operation-exception protection is assured when compatibility is not being used on the system. The Diagnose instruction as used for the Compatibility Feature has the following format:

```
        SI
   r----T--------------------T----T-----------1
   |    |                    | B₁ |    D₁     |
   | 83 |        I₂          +----+-----------+
   |    |                    | 0  | 3   C   C |
   L----+--------------------+----+-----------J
   0   7 8                15 16 19 20         31
```
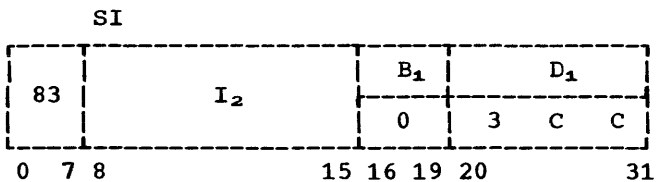
When the Diagnose instruction is used to enable or disable the special compatibility instructions, the displacement contains the hexadecimal address 3CC. Bits 16-19 (B_1) must be zero. When the I_2 byte of the Diagnose instruction is 80, special 1400 compatibility instructions are allowed to function. When the I_2 byte is 00, these special instructions are disabled and cause a program interruption if used. It should be noted that the Diagnose instruction is a privileged operation.

Condition Code:
    Unpredictable

Program Interruptions:
    Privileged operation
    Specification
    Addressing

Timing:
    19 microseconds

The six special System/360 instructions provided with the Basic Compatibility Feature have the SI format and are similar to the Diagnose instruction. The operation code for all instructions is the same (99). The six special compatibility instructions have the following format:

```
        SI
   r----T--------------------T----T-----------1
   |    |         I₂         |    |           |
   | 99 +-----------T--------+ B₁ |    D₁     |
   |    |    W₁     |   W₂   |    |           |
   L----+-----------+--------+----+-----------J
   0   7 8        11 12    15 16 19 20        31
```
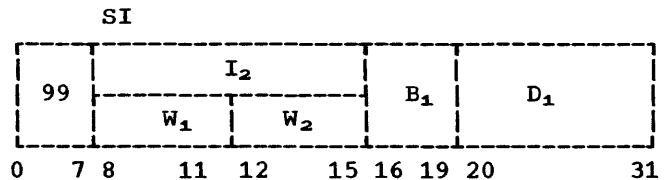
Bits 8-11 (W_1) are used to define the six special instructions. Mnemonics are not provided for these instructions in the assembler language. When the assembler language is used, these instructions must be coded as hexadecimal constants, using the DC assembler statement.

Condition Code:
    Remains unchanged

Program Interruptions:
    Addressing

Compatibility Feature Initialize Mode (CFIM)

This compatibility instruction is defined by W_1 being equal to zero. Bits 12-15 (W_2) are interpreted as follows:

W_2	Interpreted As
0	No initialization required
1	Initialize for 1402 card load
2	Initialize for 1401 tape load
9	Initialize for 1442 card load

This instruction loads auxiliary storage consecutively with 512 bytes, starting at the main storage address specified by the effective address (B_1 + D_1). If W_2 = 1 or 9, positions 0001 through 0080 of compatibility storage are cleared to blanks and a wordmark is inserted in location 0001. In

addition, if $W_2 = 9$, a groupmark with word-mark (GMWM) is inserted in position 0081 of compatibility storage. If $W_2 = 2$, the first tape instruction performed ignores GMWMs in storage. This instruction also performs the following functions after aux-iliary storage loading is completed:

• Tests the allow-I/O-traps bit (Pro-grammed Mode Switch control) in auxil-iary storage. If the bit is off, the multiplexor channel is inhibited from byte interleaving, all I/O interrup-tions are prohibited, and external interruptions are enabled.

Note: The allow-I/O-traps bit should always be off unless the Programmed Mode Switch (PMS) subfeature is installed.

• Generates a unique character (8F) in the main storage location that is one less than that corresponding to compatibility-storage location 0000. This character serves to detect a low-main-storage wraparound condition when operating in Compatibility mode.

• Switches to 1400 Read Only Storage (ROS) control and initiates a 1400 instruction read-out at the address specified in the auxiliary-storage A backup locations for the I and J regis-ters (1400 instruction counter). This initial address need not be in the 1400 portion of main storage, but it may not be in main-storage hexadecimal address 0000.

• Scans 1400 storage and sets all invalid 1400 characters to blank (hexadecimal 40).

The Compatibility Feature Initialize Mode instruction has the following Format:

SI

99	W_1	W_2	B_1	D_1
	0	0,1,2,9		

0   7 8   11 12   15 16 19 20   31
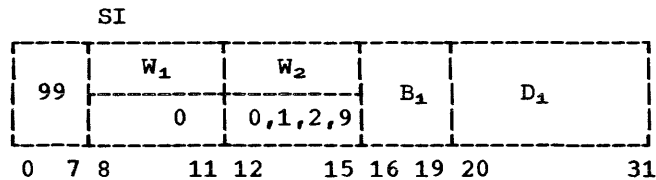
Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    65 + (4 x 512) + (6 times number of 1400 characters) microseconds + 3 microseconds for tape load, or + 238 microseconds for 1402 card load (80 column), or + 240 microseconds for

1402 card load (51 column), or + 240 microseconds for 1442 card load.

Compatibility Feature Mode Set (CFMS)

This compatibility instruction is defined by the contents of W_1 being equal to 1. W_2 is interpreted as follows:

W_2 Interpreted As

0   No initialization required

1   Initialize for 1402 card load

2   Initialize for 1401 tape load

9   Initialize for 1442 card load

If $W_2 = 1$ or 9, positions 0001 through 0080 of compatibility storage are cleared to blanks and a wordmark is inserted in location 0001. In addition, if $W_2 = 9$, a groupmark with wordmark (GMWM) is inserted in position 0081 of compatibility storage. If $W_2 = 2$, the first tape instruction per-formed ignores GMWMs in storage. This instruction performs the same functions as the CFIM instruction, except that auxiliary storage is not initialized and no storage scan is performed. In brief, the CFMS instruction does the following (see the CFIM instruction for details):

• Tests the allow-I/O-traps bit.

• Allows detection of any low-order 1400-mode storage wraparound conditions.

• Switches control to 1400-mode.

Therefore, the CFMS instruction is used when auxiliary storage has been previously initialized and no changes are required to begin another Emulator Program. The CFMS instruction also may be used to return sys-tem control to the 1400 ROS after a system interruption when the PMS subfeature is used. In this latter case, W_2 would be equal to 0.

The Compatibility Feature Mode Set instruction has the following format:

SI

99	W_1	W_2	B_1	D_1
	0	0,1,2,9		

0   7 8   11 12   15 16 19 20   31
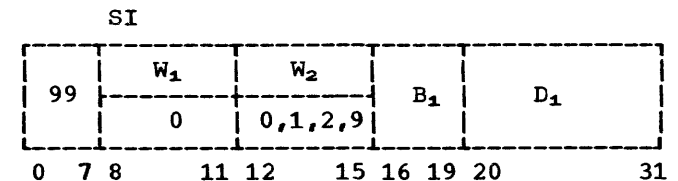
Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    63 microseconds

Compatibility Feature Store Variables (CFSV)

This instruction can be used to alter any of the 64 bytes of 1400 auxiliary storage. It transfers four bytes from main storage, beginning with the effective address specified by B_1 and D_1, to four contiguous 1400 auxiliary-storage locations specified by W_2 (see Table 13). For this instruction, W_1 contains a hexadecimal value of 3.

Most variables contained in 1400 auxiliary storage, such as 1400 instruction address, tape densities, and unit address assignments, can be changed with this instruction.

The Compatibility Feature Store Variables instruction has the following format:
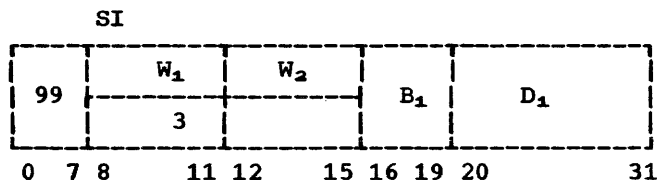
SI

99	W_1 3	W_2	B_1	D_1

0   7 8   11 12   15 16 19 20   31

Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    44 microseconds

Table 13. 1400 Auxiliary Storage Bytes Defined by W_2

Bytes Defined	W_2 for 1400 Auxiliary Storage A	W_2 for 1400 Auxiliary Storage B
80 through 83	0000 (0)	1000 (8)
84 through 87	0001 (1)	1001 (9)
88 through 8B	0010 (2)	1010 (A)
8C through 8F	0011 (3)	1011 (B)
90 through 93	0100 (4)	1100 (C)
94 through 97	0101 (5)	1101 (D)
98 through 9B	0110 (6)	1110 (E)
9C through 9F	0111 (7)	1111 (F)

Although no specification checking is performed, a 256-byte boundary in main storage must not be crossed during instruction execution.

Compatibility Feature Load Variables (CFLV)

This Compatibility-mode instruction is defined by W_1 being equal to a hexadecimal value of 2. The CFLV instruction loads main storage, beginning with the effective address specified by B_1 and D_1, from the four contiguous bytes of 1400 auxiliary storage specified by W_2. The specifications of W_2 for this instruction are shown in Table 13.

The Compatibility Feature Load Variables instruction has the following format:

SI

99	W_1 2	W_2	B_1	D_1

0   7 8   11 12   15 16 19 20   31

Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    44 microseconds

A main-storage 256-byte boundary must not be crossed during execution of this instruction.

Compatibility Feature Store Constants (CFSC)

This instruction transfers the contents of main storage locations beginning with the effective address specified by B_1 and D_1 to the 16 contiguous 1400 auxiliary-storage locations specified by W_1 and W_2. W_1 is used to define the instruction function and must contain the hexadecimal value 9 or D. If W_1 contains a 9, W_2 refers to a starting address in 1400 auxiliary storage A. If W_1 contains a D, W_2 refers to a starting address in 1400 auxiliary storage B. W_2 provides the high-order hexadecimal digit of the starting address in 1400 auxiliary storage. The low-order hexadecimal digit of the starting address is always zero. If W_2 contains the value 7, the starting address in 1400 auxiliary storage is 70, and the locations 70 through 7F are loaded with the information starting at the main storage location defined by B_1 and D_1.

The Compatibility Feature Store Constants instruction has the following format:

```
       SI
 ┌─────┬─────────┬─────────┬─────┬──────────────┐
 │     │    W₁   │   W₂    │     │              │
 │  99 ├─────────┼─────────┤  B₁ │     D₁       │
 │     │  9 or D │         │     │              │
 └─────┴─────────┴─────────┴─────┴──────────────┘
 0   7 8      11 12     15 16 19 20            31
```

Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    106 microseconds

Compatibility Feature Load Constants (CFLC)

   This instruction loads the main storage
locations beginning with the effective
address specified by B_1 and D_1 from the 16
contiguous bytes of 1400 auxiliary storage
specified by W_1 and W_2. W_2 is used to
define the instruction function and must
contain the hexadecimal value 8 or C. If
W_1 contains an 8, data is fetched from 1400
auxiliary storage A. If W_1 contains a C,
data is fetched from 1400 auxiliary storage

B. W_2 provides the high-order hexadecimal
digit of the starting address in 1400 aux-
iliary storage. The low-order hexadecimal
digit of the starting address is always
zero. If W_2 contains the value 7, the
starting address in 1400 auxiliary storage
is 70, and the locations 70 through 7F are
loaded with the information starting at the
main storage location defined by B_1 and D_1.

   The Compatibility Feature Load Constants
instruction has the following format:
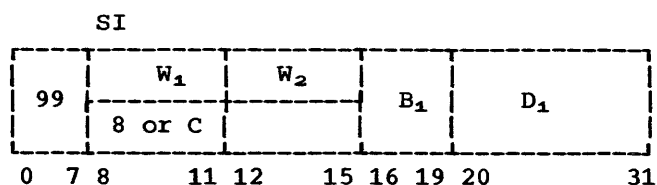
```
       SI
 ┌─────┬─────────┬─────────┬─────┬──────────────┐
 │     │    W₁   │   W₂    │     │              │
 │  99 ├─────────┼─────────┤  B₁ │     D₁       │
 │     │  8 or C │         │     │              │
 └─────┴─────────┴─────────┴─────┴──────────────┘
 0   7 8      11 12     15 16 19 20            31
```

Condition Code:
    Unchanged

Program Interruption:
    Addressing

Timing:
    106 microseconds

The Programmed Mode Switch (PMS) subfeature allows 2030 programs and Model 30 Emulator Programs to reside in storage coincidentally and to be executed in an interleaved manner by providing the capability to switch the processor between Compatibility mode and 2030 mode under control of the 2030 program.

Special System/360 instructions are provided to control and facilitate communication between the 2030 program and the 1400 programs. These special System/360 instructions are enabled and disabled as in the Basic Compatibility Feature by way of the System/360 Diagnose instruction. Mnemonics are not included in the assembler language.

If the system is not equipped with the PMS subfeature, the Model 30 1400 Emulator Program under DOS cannot be used.

The PMS subfeature includes the following instructions, which facilitate the transfer of data between 2030-program data areas:

- Compatibility Feature Move To Compatibility (CFMT)

- Compatibility Feature Move From Compatibility (CFMF)

- Compatibility Feature Load To Compatibility (CFLT)

- Compatibility Feature Load From Compatibility (CFLF)

The four special System/360 instructions have the RR format, which is illustrated as follows:

```
                 RR
        r--------T--------T------1
        |  Op    |        |      |
        | Code   |  R₁    |  R₂  |
        L_____i_____i_____J
        0       7 8      11 12  15
```
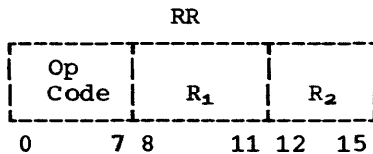
The general register specified by R_1 contains the destination address. The source address is specified by R_2.

Compatibility Feature Move to Compatibility (CFMT)

This instruction moves data from the source address (2030 storage) to the destination address (compatibility storage). Wordmarks in the source field are not moved; wordmarks in the destination field remain undisturbed.

The move to compatibility is similar to a tape-move operation in the 1400, except that information is moved from the 2030 storage area to the area reserved for the 1400 portion of the program. The binary address specified by general register R_2 is the source address in the 2030 storage area. The binary address specified by general register R_1 is the destination address in the 1400 main-storage area. The low-order 16 bits of the general register specified by $R_1 + 1$ is the count and is decremented for each byte transferred from the 2030 main-storage area.

The two addresses are incremented by 1 and the count is decremented by 1 in the specified general purpose register after each byte is moved.

The count is checked for zero before each byte transfer. If it is zero, the operation is terminated and a groupmark (GM) is inserted in the destination field. The operation is also terminated on detection of a groupmark with wordmark (GMWM) in the destination field, in which case no character is moved.

The destination address is always updated to 1 beyond the GMWM or GM address at the end of the move. The effective 1400 B-Storage Address Register is set to this address.

The Compatibility Feature Move to Compatibility instruction has the following format:

```
                 RR
        r------T--------T------1
        |      |        |      |
        |  0E  |  R₁    |  R₂  |
        L_____i_____i_____J
        0     7 8      11 12  15
```
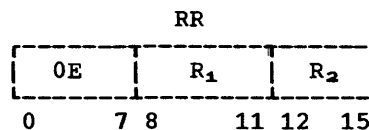
Condition Code:
   00 - Operation terminated by count zero
   01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
   Addressing
   Program

Timing:
   65 + (5 times number of characters transferred) microseconds. Add 3

microseconds for each wordmark in the destination field.

Compatibility Feature Move From Compatibility (CFMF)

This instruction is identical to the CFMT instruction, with the following exceptions:

- The movement of data is reversed.

- GMWM detection is done on the source field.

- When a GMWM terminates the instruction, the source address is incremented to 1 beyond the GMWM address, and the destination address remains unchanged. The effective 1400 B-Storage Address Register is set to this (source) address.

- No groupmark is inserted in the destination field on termination by count.

The Compatibility Feature Move From Compatibility instruction has the following format:

RR
```
,-------T-------T-------,
|  OF   |  R₁   |  R₂   |
'-------^-------^-------'
0       7 8     11 12   15
```
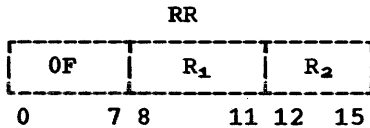
Condition Code:
    00 - Operation terminated by count zero
    01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
    Addressing
    Program

Timing:
    62 + (5 times number of characters transferred) microseconds. Add 3 microseconds for each wordmark in the destination field.

Compatibility Feature Load to Compatibility (CFLT)

This instruction moves data from the source address (2030 storage) to the destination address (compatibility storage).

This function is similar to a tape-load operation from 2030 storage to 1400 storage. The binary address specified by general register R_2 is the source address, and the binary address specified by general register R_1 is the destination address. The low-order 16 bits in general register

R_1 + 1 is a count of the number of bytes to be handled in the source field.

Wordmarks in the source field are not moved. Wordmarks in the destination field are cleared. When a word separator character is detected in the source field, however, the count is decremented by 1, the source address is incremented by 1, no character transfer takes place, and a wordmark is inserted with the first character following in the source field that is not also a word separator.

Termination on GMWM detection or count and setting of the condition register is identical to that of the CFMT instruction. The effective 1400 B-Storage Address Register is set to the final destination address.

The Compatibility Feature Load to Compatibility instruction has the following format:

RR
```
,-------T-------T-------,
|  0C   |  R₁   |  R₂   |
'-------^-------^-------'
0       7 8     11 12   15
```
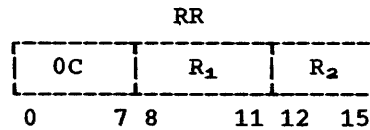
Condition Code:
    00 - Operation terminated by count zero
    01 - Operation terminated by a GMWM in 1400 storage

Program Interruptions:
    Addressing
    Program

Timing:
    65 + (4 times number of characters transferred) microseconds. Add 2 microseconds for each wordmark in the source field.

Compatibility Feature Load From Compatibility (CFLF)

This instruction is identical to the CFLT instruction, with the following exceptions:

- The movement of data is from 1400 storage to 2030 storage.

- Wordmarks in the source field cause a word separator character to be inserted in the destination field. The destination address is incremented by 1, the count is decremented by 1, and the source address remains unchanged.

- GMWM detection is done on the source field.

- When a GMWM terminates the operation, the source address is incremented to 1 beyond the GMWM, and the destination address remains unchanged. The effective 1400 B-Storage Address Register is set to this source address.

- No groupmark is inserted on termination by count.

The Compatibility Feature Load From Compatibility instruction has the following format:

```
                RR
    ┌───────┬─────────┬───────┐
    │  0D   │   R₁    │  R₂   │
    └───────┴─────────┴───────┘
    0     7 8       11 12   15
```
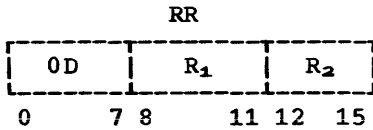
Condition Code:
00 - Operation terminated by count zero
01 - Operation terminated by GMWM in 1400 storage

Program Interruptions:
Addressing
Program

Timing:
61 + (5 times number of characters transferred) microseconds. Add 4 microseconds for each wordmark in the destination field, and add 10 microseconds for each wordmark in the source field.

This appendix contains a brief description of the functions performed by a group of machine instructions that are intended for use by the Model 40 Emulator Program and are available for modifying the Model 40 Emulator Program for specific applications. To use these instructions properly, it is necessary that the user be thoroughly familiar with the internal operation and logic of the Model 40 Emulator Program.

The 1401/1440/1460 DOS Compatibility Feature executes 1400 instructions and performs other functions, such as updating the simulated 1400 registers. If the 1400 instruction to be emulated is not a Move Character and Edit (MCE), a Move Character and Suppress Zeros (MCS), an instruction related to input/output, a Halt, or any of the Branch on I/O Indicator instructions, the 1401/1440/1460 DOS Compatibility Feature executes the instruction without using the Emulator Program. After execution of an instruction, the 1401/1440/1460 DOS Compatibility Feature obtains (fetches) the next 1400 instruction. There are two methods of fetching the 1400 instructions: fetch the next sequential instruction (I-Fetch) and fetch the instruction located at the address of the A operand (I-Fetch at A-Address).

I-FETCH

I-Fetch performs the following operations:

- Gets the contents of the simulated Instruction Address Register (IAR)

- Converts the address in the IAR to the effective address in simulated storage that contains the instruction to be interpreted

- Fetches the instruction

- Updates and restores the simulated IAR

- Performs any indexing required for the instruction

- Converts the effective 1400 addresses of the operands obtained to their System/360 addresses in simulated storage

- Examines the operation code to determine whether the instruction can be

executed by the 1401/1440/1460 DOS Compatibility Feature alone or requires a branch to the Emulator Program

I-FETCH AT A-ADDRESS

I-Fetch at the A-address performs the same operations as I-Fetch, except that the address in the A-Address Register (AAR) is used, instead of the address in the IAR, to obtain the address of the next instruction. After the instruction is fetched, the address of the next instruction is stored in the simulated IAR. This is the process used for executing 1400 Branch instructions.

DIAGNOSE INSTRUCTIONS

The 1401/1440/1460 DOS Compatibility Feature provides special Diagnose instructions for use by the Emulator Program in executing 1400 instructions, converting addresses, providing character translation, inserting groupmarks and tapemarks, and returning control to the 1401/1440/1460 DOS Compatibility Feature. These instructions include the following:

- Multiway Branch

- Scatter/Gather

- Clear Entire 1400 Storage to Blanks

- Clear 1400 Locations 0-80 to Blanks

- Address Modify

- Scatter/Gather Binary Data

- Return to 1401: I-Fetch

- Return to 1401: I-Fetch at A-Address

- Scan for Groupmark with Wordmark in 1400 Storage

- Edit Analyze

- Edit Get, Put

The Diagnose instructions communicate with the 1401/1440/1460 DOS Compatibility Feature through the general purpose registers (GPRs).

The Diagnose instructions have the fol-
lowing format:

- Byte 1 - operation code (hexadecimal
  83)

- Byte 2 - control byte (variable)

- Bytes 3 and 4 - absolute Read-Only-
  Storage address of the link to the
  1401/1440/1460 DOS Compatibility Fea-
  ture (hexadecimal 0741)

A description of each Diagnose instruc-
tion follows.

Multiway Branch

The hexadecimal representation of this
instruction is 83000741. This instruction
causes a branch to a subroutine after
determining the branch address by a table-
lookup operation. A specified character is
compared to the entries in a table in
Emulator-Program storage; the program
branches to the address formed by combining
the table function with a specified base
address when an equal compare is recog-
nized. After each unequal compare of
search and table arguments, the table argu-
ment is tested for zero. A zero table
argument signals the end of the table; the
current search argument is ignored and pro-
gram execution continues at the next
sequential instruction after the Diagnose.
To execute this Diagnose instruction, GPRs
8 and 9 must be initialized as follows:

	Bytes 0 and 1	Bytes 2 and 3
GPR 8	Search Table Address	Search Argument Address
GPR 9		Base Address

Search Table Address: This is the binary
address of the beginning of a table (high
order) consisting of a series of 2-byte
entries, each situated on a halfword bound-
ary. Byte 1 of each entry is the table
argument to be compared to the search argu-
ment. Byte 2 is a binary relative address
that is added to the base address when an
equal compare occurs. The sum of the rela-
tive address and the base address is loaded
into the current program status word (PSW)
as a new instruction counter (IC).

Search Argument Address: This is the
binary address of the search argument in
Emulator-Program storage.

Base Address: This address forms the
address of the next Emulator-Program
instruction when combined with the relative
address found in the table.

Scatter/Gather

The hexadecimal representation of this
instruction is 83100741. Since simulated
1400 storage is not contiguous, and 1400
internal BCD is not represented the same as
in the System/360 buffers, this instruction
is necessary to move data between Emulator-
Program storage and the simulated 1400
storage. This instruction also translates
between BCDIC-8 and the simulated 1400
internal code in which instructions and
data are represented in simulated 1400
storage (see Table 14).

Scatter performs the following:

- Moves characters from contiguous
  Emulator-Program storage to noncontigu-
  ous 1400 storage

- Translates these characters from BCDIC-
  8 to simulated 1400 internal code

- Sets a condition code at termination of
  Scatter operation to indicate results
  of the operation

- Returns to the next Emulator-Program
  instruction if no invalid characters
  are found

- If an invalid character is detected, a
  "+" character (X0000000) is inserted in
  1400 storage for that character, opera-
  tion continues to termination and exits
  to branch table entry 31.

Gather performs the following functions:

- Moves characters from noncontiguous
  1400 storage locations to contiguous
  locations in Emulator-Program storage

- Translates these characters from simu-
  lated 1400 internal code to BCDIC-8

- Sets a condition code at termination of
  Gather operation to indicate results of
  the operation

- Returns to the next instruction of the
  Emulator-Program

Data is represented in buffer areas in
BCDIC-8, as shown in Table 15. When this
data is scattered to 1400 storage, it
remaps into the representation as shown in
Table 14. When it is gathered, into the
buffer from 1400 storage, it remaps into
BCDIC-8 again.

To execute this Diagnose instruction,
GPRs 8 and 9 must be initialized as
follows:
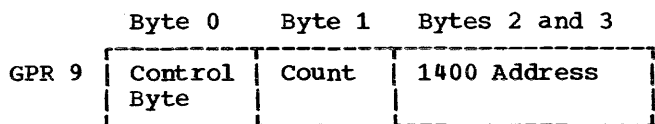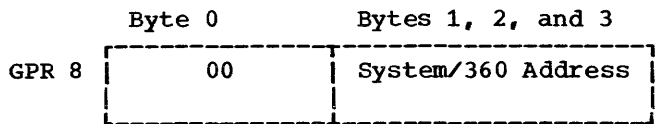
```
               Byte 0        Bytes 1, 2, and 3
         ┌─────────────────┬────────────────────┐
GPR 8    │       00        │ System/360 Address  │
         │                 │                     │
         └─────────────────┴────────────────────┘


               Byte 0     Byte 1    Bytes 2 and 3
         ┌─────────────┬─────────┬─────────────────┐
GPR 9    │ Control     │ Count   │ 1400 Address    │
         │ Byte        │         │                 │
         └─────────────┴─────────┴─────────────────┘
```

System/360 Address: This is the System/360 buffer address from where data is to be taken (scattered) or to where data is to be placed (gathered).

Control Byte: This byte determines the manner of the scatter or gather and the status of the 1400 B-Address Register (BAR), in GPR1 or GPR9. Bits 1, 2, 3, 5, and 6 are always zero. If bit 4 contains a 1, the BAR contains the updated 1400 address used in the scatter or gather operation. GPR 8 (System/360 address) is updated as used. If bit 4 is 0, the BAR remains unchanged, and GPR 9 contains the updated 1400 address used in the scatter or gather operation. Bits 0 and 7 have the following meanings:

```
Bits
0    7              Operation

0    0    Gather characters in Load mode.
          The characters from simulated 1400
          internal code with word- marks are
          translated to BCDIC-8 with
          wordmarks.

0    1    Scatter characters in Move mode.
          The characters are translated from
          BCDIC-8 to simulated 1400 internal
          code. Bit 0 of the 1400 storage
          locations remains unchanged. This
          has the effect of leaving wordmark
          bits unchanged in 1400 storage
          while moving new characters into
          these locations.

1    0    Gather characters in Move mode.
          Simulated 1400 internal code char-
          acters with wordmarks are trans-
          lated to BCDIC-8 without
          wordmarks.

1    1    Scatter characters in Load mode.
          BCDIC-8 characters with wordmarks
          are translated to simulated 1400
          internal code.
```

Count: This field specifies the number of characters to be moved minus 1. For example, a count field containing hexadecimal 0A causes 11 characters to be moved. The scatter/gather operation is restricted to 256 characters per operation. The count field is unchanged by this operation.

1400 Address: This is the address, in "hddd" form, of the lowest 1400 address of the data field, where "h" is a hexadecimal digit and "d" is a decimal digit.

Condition Codes: The following condition codes are set at the termination of a Scatter operation:

00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character scattered plus 1.

01 - The operation has been terminated because a groupmark wordmark (GMWM) has been found in 1400 storage before the internal count has been decremented to zero. The 1400 address points to the GMWM plus 1. GPR8 points to the last System/360 character that was scattered plus 1.

The following condition codes are set for a Gather operation:

00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character gathered plus 1.

01 - The operation has been terminated because a GMWM has been found in 1400 storage before the internal count was decremented to zero. The GMWM has not been gathered to the Emulator Program storage. The 1400 address pointer to the GMWM plus 1. GPR8 points to the last character gathered to the System/360 storage plus 1, i.e., where the GMWM would be if it had been moved.

Scatter/Gather Load Mode Tape

The hexadecimal representation of this instruction is 83100741. Since simulated 1400 storage is not contiguous, this instruction is necessary to move data between Emulator-Program storage and simulated 1400 storage, translating the data between BCDIC-8 and the simulated 1400 internal code in which instructions and data are represented in simulated 1400 storage (see Table 14). The instruction also performs a conversion between word separators and wordmarks.

Scatter Load Mode Tape performs the following:

• Moves characters from contiguous Emulator-Program storage to noncontiguous 1400 storage

- Translates these characters from BCDIC-8 to simulated 1400 internal code

- Converts word separators to wordmarks (only the first of a series of word separators is utilized)

- Tests for invalid characters, setting a condition code of 10 upon detection and inserting a "+" character (X0000000) in 1400 storage for that character

- Returns to the next instruction of the Emulator Program

Gather Load Mode Tape performs the following:

- Moves characters from noncontiguous 1400 storage to contiguous Emulator-Program storage

- Translates these characters from simulated 1400 internal code to BCDIC-8

- Converts wordmarks to word separators

- Returns to the next instruction of the Emulator Program

To execute this Diagnose instruction, GPRs 8 and 9 must be initialized as follows:

```
          Byte 0      Bytes 1, 2, and 3
        r-----------T--------------------------1
GPR 8|  Split      |System/360 Address        |
     |  Operation  |                           |
        L-----------+--------------------------J

          Byte 0   Byte 1    Bytes 2 and 3
        r---------T--------T--------------------1
GPR 9|  Control  |Count   |1400 Address       |
     |  Byte     |        |                    |
        L---------+--------+--------------------J
```
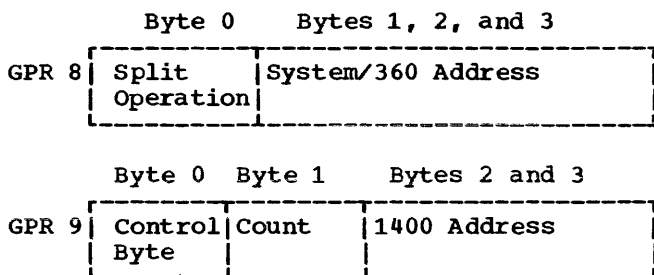
Split Operation: This byte (byte 0 of GPR 8) is used to indicate a split operation, where the last character read from Emulator-Program storage was a word separator. If bit 4 of byte 0 of GPR 8 is not a zero when Scatter Load Mode Tape is entered, a wordmark is placed at the first character in simulated 1400 storage. This byte of GPR 8 must be initialized at 0, and hardware will automatically set this byte for split operation.

System/360 Address: This is the System/360 buffer address from where data is to be taken (scattered) or to where data is to be placed (gathered).

Control Byte: This byte determines whether the operation is a scatter or a gather, the scatter/gather is a load-mode tape operation, and the status of the B-Address Register (BAR), GPR 8 (System/360 address), and GPR 9 (1400 address). Bits 0, 1, 2, 5, and 6 are always zero. If bit 3 contains a 1, Scatter/Gather Load Mode Tape is indicated. If bit 4 contains a 1, the BAR contains the updated 1400 address used in the scatter or gather operation. GPR 8 (System/360 address) is updated as used. If bit 4 contains a 0, the BAR remains unchanged, and GPR 9 contains the updated 1400 address used in the scatter or gather operation. If bit 7 contains a 0, the operation is a gather; if bit 7 contains a 1, the operation is a scatter.

Count: This field specifies the number of characters to be moved minus 1. For example, a count field containing hexadecimal 0A causes 11 characters to be moved. The scatter/gather operation is restricted to 256 characters per operation. The count field is unchanged by this operation.

1400 Address: This is the address, in "hddd" form, of the lowest 1400 address of the data field.

Condition Codes: The following condition codes are set at the termination of a Scatter operation:

00 - The operation has been terminated because an internal count, derived from the count byte in GPR9, has been decremented to zero. The 1400 address points to the last character scattered plus 1.

01 - The operation has been terminated because a groupmark wordmark (GMWM) has been found in 1400 storage before the internal count was decremented to zero. The 1400 address points to the GMWM plus 1. GPR8 points to the last System/360 character that was scattered plus 1.

10 - An invalid 1400 character has been detected during the scatter and the internal count has been decremented to zero. The 1400 address in GPR1 or GPR9 points to the last character scattered plus 1.

11 - An invalid 1400 character has been detected during the scatter and the scatter has been terminated by a GMWM in 1400 storage before the internal count was decremented to zero. The 1400 address in GPR1 or GPR9 points to the GMWM plus 1.

GPR8 points to the last System/360
character scattered plus 1.

Clear Entire 1400 Storage to Blanks

The hexadecimal representation of this
instruction is 83300741. This Diagnose
instruction uses the 1401/1440/1460 DOS
Compatibility Feature to clear the entire
simulated 1400 storage to blanks. No
register initialization is necessary.

Clear 1400 Locations 0-80 to Blanks

The hexadecimal representation of this
instruction is 83400741. This Diagnose
instruction uses the 1401/1440/1460 DOS
Compatibility Feature to clear the simu-
lated 1400 card read area to blanks. No
register initialization is necessary.

Address Modify

The hexadecimal representation of this
instruction is 839x0741, where "x" (bits
12-15) is set to one of eight possible con-
figurations for specific address modifica-
tion. This Diagnose instruction uses the
1401/1440/1460 DOS Compatibility Features
to increment or decrement by one or under
count a 1401-type address in the form
"hddd" or a six-digit decimal address in
the form "dddddd" in GPR 9 where "h" is a
hexadecimal digit and "d" is a decimal
digit. In order for this instruction to be
executed, GPR 9 must be initialized as
follows:

```
         Bytes 0 and 1    Bytes 2 and 3
       r------------------T------------------1
GPR 9  |                  |      hddd        |
       L------------------+------------------J
```

or

```
         Bytes 0 and 1    Bytes 2 and 3
       r------------------T------------------1
GPR 9  |       dd         |      dddd        |
       L------------------+------------------J
```
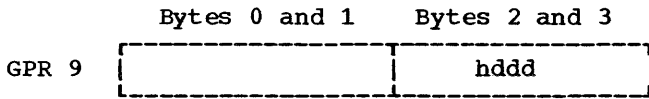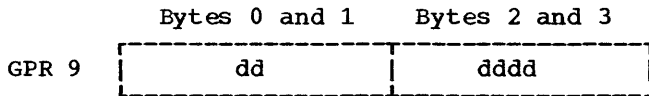
The count, if required, is in binary
form in bytes 2 and 3 of GPR 8 and should
be one less than the number desired to be
incremented or decremented.

The possible configurations for bits
12-15, with the resulting format and
address modification, are:

Bits 12-15	Format	Modification
0000	hddd	Increment by one
0001	hddd	Increment under count
0010	dddddd	Increment by one
0011	dddddd	Increment under count
1000	hddd	Decrement by one
1001	hddd	Decrement under count
1010	dddddd	Decrement by one
1011	dddddd	Decrement under count

Scatter/Gather Binary Data

The hexadecimal representation of this
instruction is 83A00741 for Scatter and
83B00741 for Gather. This Diagnose
instruction transfers 160 bytes of binary
data between Emulator-Program storage and
1400 storage locations 401, 501, 402, 502,
etc. Translation between BCDIC-8 and simu-
lated 1400 internal code representation is
accomplished during the transfer. After
the operation, control is returned to the
1401/1440/1460 DOS Compatibility Feature
through branch table entry 16 for Scatter
or entry 5 for Gather. In order for this
instruction to be executed, GPR 8 must be
initialized as follows:

```
              Byte 0        Bytes 1, 2, and 3
       r-------------T------------------------------1
GPR 8  |             |    System/360 Address        |
       L-------------+------------------------------J
```
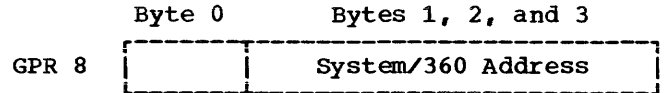
System/360 Address: This is the binary
address of the lowest location of the
binary data in Emulator-Program storage.
After completion of the operation, this
address will have been incremented by 160.

Return to 1400: I-Fetch

The hexadecimal representation of this
instruction is 83D00741. This Diagnose
instruction returns control from the Emula-
tor Program to the 1401/1440/1460 DOS Com-
patibility Feature. The Compatibility Fea-
ture then performs an I-Fetch for the next
1400 instruction. No register initializa-
tion is necessary.

Return to 1400: I-Fetch at A-Address

The hexadecimal representation of this
instruction is 83E00741. This Diagnose
instruction executes a 1400 branch by
returning control from the Emulator Program
to the 1401/1440/1460 DOS Compatibility
Feature. The Compatibility Feature then
performs an I-Fetch at the address in the
AAR for the next 1400 instruction. No
register initialization is necessary.

Scan for Groupmark with Wordmark in 1400 Storage

The hexadecimal representation of this
instruction is 83600741. This Diagnose
instruction uses 1401/1440/1460 DOS Compat-
ibility Feature to scan for a groupmark
with wordmark under count. The scan is
from left to right. In order for this

instruction to be executed, GPRs 8 and 9 must be initialized as follows:

Bytes 0 and 1   Bytes 2 and 3

GPR 8		Count
GPR 9		1400 Address
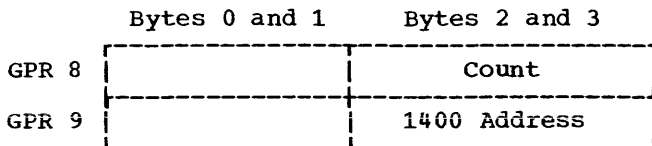
Count: This field specifies, in binary form, the number of positions to be scanned minus 1. This binary value should not exceed the decimal value of 16,000. A starting count of hexadecimal FFFF results in an error. After the operation is completed, the residual count in GPR 8 is the original count minus the number of positions scanned. The scan is stopped when the count is reduced from hexadecimal 0000 to hexadecimal FFFF, unless the groupmark with wordmark is found earlier. The condition code is set as follows:

00   Specifies the groupmark with word-
      mark was found at the count.

01   Specifies the groupmark with word-
      mark was found before the count.

10   Specifies the size of 1400 storage
      (16K) was exceeded.

11   Specifies the groupmark with word-
      mark was not found.

1400 Address: This is the address, in "hddd" format, of the first 1400 location to be scanned. After the operation is completed, GPR 9 contains an address one greater than the last position scanned, whether or not the scan was stopped by an end-of-count or groupmark-with-wordmark-found condition.

Examples: Assuming a starting 1400 address of 0401 in bytes 2 and 3 of GPR 9, and a starting count of hexadecimal 0009 in bytes 2 and 3 of GPR 8, the following results are produced after the operation is completed:

	Residual	Residual Addr.	
GMWM Addr.	Count	in GPR 9	CC
0410	FFFF	0411	00
0409	0000	0410	01
Not in field	FFFF	0411	11

Assuming a starting 1400 address of 15, 996 in bytes 2 and 3 of GPR 9, and the same starting count of hexadecimal 0009 in bytes 2 and 3 of GPR 8, the following results are produced:

	Residual	Residual Addr.	
GMWM Addr.	Count	in GPR 9	CC
Not in field	000	0000	10

Edit Analyze

The hexadecimal representation of this instruction is 83700741. This Diagnose instruction uses the 1401 character in byte 3 of GPR 7 as an action control. This byte of data is called the "control byte" in the following text.

The Edit Analyze instruction has two courses of action, depending on whether or not the control byte has a wordmark.

If the control byte has no wordmark, then its bit 0 is set to a 1, and the resulting character is used as the low-order byte of a table address. The second byte of this address is taken from byte 0 of GPR 7. The remaining high-order positions of the table address are taken from the high-order positions of the current instruction counter (IC). The table address is used to fetch a character from System/360 storage. This character is used as the low-order byte of a branch address. The second byte of the branch address is taken from byte 0 of the current IC. The high-order positions of the branch address are set to a 0. This address is then inserted into the IC of the current PSW, which effects a branch. .

If the control character has a wordmark, then bit 0 remains a 1, and a branch address is formed in the same manner as described in the previous paragraph. However, instead of a branch to this address being executed, the branch address is placed in bytes 0 and 1 of GPR 7. The current IC is then used to fetch the next instruction.

Edit Get, Put

The hexadecimal representation of this instruction is 832x0741, where "x" (bits 12-15) is set to one of four possible configurations for four specific operations. In all four operations, a character is fetched from 1400 storage and put in byte 3 of a GPR. If the character has a wordmark, the condition code is set to 1; otherwise, the condition code is set to 0. The possible configurations for bits 12-15 are:

1011   Specifies GET A, MOD AAR -1. In
        this operation, the 1400-character
        address is in the current 1400 AAR.
        After the character is fetched, the
        AAR is decremented by one. The
        character is placed in byte 3 of
        GPR 4.

0111   Specifies GET B, NO MODIFY. In this operation, the 1400-character address is in the current 1400 BAR. The BAR is unchanged after the operation. The character is placed in byte 3 of GPR 7.

1110   Specifies PUT B, MOD BAR -1, GET NEXT B. In this operation, the character in byte 3 of GPR 7 is transferred to 1400 storage (to the address specified by the BAR). The BAR is then decremented by one (and replaces the current BAR); the character at the resulting address is fetched to byte 3 to GPR 7. The condition code is set to 0 if the fetched character has no wordmark; otherwise, it is set to 1.

1100   Specifies PUT B, MOD BAR +1, GET NEXT B. This operation is identical to PUT B, MOD BAR -1, GET NEXT B, except that the BAR is incremented (instead of decremented) by one.

Table 14.   Eight-Bit Representation of BCD Graphics in Simulated 1400 Storage for the Model 40

4567	WITHOUT WORDMARK								WITH WORDMARK							
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	+	−	b̄	bl	?	!	ǂ	0	+	−	b̄	bl	?	!	ǂ	0
0001					A	J	/	1					A	J	/	1
0010					B	K	S	2					B	K	S	2
0011					C	L	T	3					C	L	T	3
0100					D	M	U	4					D	M	U	4
0101					E	N	V	5					E	N	V	5
0110					F	O	W	6					F	O	W	6
0111					G	P	X	7					G	P	X	7
1000					H	Q	Y	8					H	Q	Y	8
1001					I	R	Z	9					I	R	Z	9
1010																
1011	.	$	,	#					.	$	,	#				
1100	¤	*	%	@					¤	*	%	@				
1101	[	]	⌐	:	.				[	]	⌐	:				
1110	<	;	\	>					<	;	\	>				
1111	ǂ	Δ	⧺	✓					ǂ	Δ	⧺	✓				

Table 15. Eight-Bit Representation of BCD Graphics in Simulated 1400 Storage for the Model 30, and Buffer Areas for Models 30 and 40

4567 / 0123 →	WITH WORDMARK₁				WITHOUT WORDMARK₂				WITH WORDMARK₁				WITHOUT WORDMARK₂			
	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	bl	+	–		bl	+	–		?	!	‡	0	?	!	‡	0
0001			/				/		A	J		1	A	J		1
0010									B	K	S	2	B	K	S	2
0011									C	L	T	3	C	L	T	3
0100									D	M	U	4	D	M	U	4
0101									E	N	V	5	E	N	V	5
0110									F	O	W	6	F	O	W	6
0111									G	P	X	7	G	P	X	7
1000									H	Q	Y	8	H	Q	Y	8
1001									I	R	Z	9	I	R	Z	9
1010				ƀ				ƀ								
1011	.	$	,	#	.	$	,	#								
1100	¤	*	%	@	¤	*	%	@								
1101	[	]	⌐	:	[	]	⌐	:								
1110	<	;	\	>	<	;	\	>								
1111	‡	Δ	⧣	✓	‡	Δ	⧣	✓								

[1] Representation for odd-parity, 9-track tapes.
[2] Representation for even-parity, 9-track tapes.

APPENDIX F: MODEL 40 ADDRESS CONVERSION TABLE

Normally the area of Model 40 Emulator-Program main storage from hexadecimal 4000 to 7FFF is reserved for simulated 1400 storage. This area of 16,384 bytes provides 16 thousand 1400 character positions.

Because of addressing differences between the 1400 and System/360, consecutive 1400 addresses do not necessarily correspond to consecutive System/360 addresses. For example, data in 1400 locations 096, 097, and 098 are actually stored in System/360 bytes 0421E, 0421F, and 04618, respectively. The following address conversion table will aid the user in reading 1400 data and instructions as they appear in a System/360 storage dump. The 1400 addresses in decimal and their equivalent System/360 addresses in hexadecimal are shown in the table. Only even addresses are shown; the equivalent System/360 address of odd 1400 addresses is always one greater than the previous even address.

If RELOC has been specified and the IBM 1401/1440/1460 Relocatable DOS compatibility feature (#4462) is installed, a relocation factor must be added to the S/360 address portion of the conversion table. The following table indicates the possible parameters for RELOC and the corresponding hexadecimal value that must be added to the S/360 address.

RELOC Parameters	Hexadecimal value to be added
16	0000
32	4000
48	8000
64	C000
80	10000
96	14000
112	18000

For example, if RELOC=32, then data at 1400 locations 096, 097, and 098 are actually stored in System/360 bytes 0821E, 0821F, and 08618, respectively.

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
00	04000	02	04002	04	04004	06	04006	08	04008	10	04010	12	04012	14	04014	16	04016	18	04018
20	04020	22	04022	24	04024	26	04026	28	04028	30	04030	32	04032	34	04034	36	04036	38	04038
40	04040	42	04042	44	04044	46	04046	48	04048	50	04050	52	04052	54	04054	56	04056	58	04058
60	04060	62	04062	64	04064	66	04066	68	04068	70	04070	72	04072	74	04074	76	04076	78	04078
80	04208	82	0420A	84	0420C	86	0420E	88	04608	90	04218	92	0421A	94	0421C	96	0421E	98	04618
100	04100	102	04102	104	04104	106	04106	108	04108	110	04110	112	04112	114	04114	116	04116	118	04118
120	04120	122	04122	124	04124	126	04126	128	04128	130	04130	132	04132	134	04134	136	04136	138	04138
140	04140	142	04142	144	04144	146	04146	148	04148	150	04150	152	04152	154	04154	156	04156	158	04158
160	04160	162	04162	164	04164	166	04166	168	04168	170	04170	172	04172	174	04174	176	04176	178	04178
180	04308	182	0430A	184	0430C	186	0430E	188	04708	190	04318	192	0431A	194	0431C	196	0431E	198	04718
200	04200	202	04202	204	04204	206	04206	208	0400A	210	04210	212	04212	214	04214	216	04216	218	0401A
220	04220	222	04222	224	04224	226	04226	228	0402A	230	04230	232	04232	234	04234	236	04236	238	0403A
240	04240	242	04242	244	04244	246	04246	248	0404A	250	04250	252	04252	254	04254	256	04256	258	0405A
260	04260	262	04262	264	04264	266	04266	268	0406A	270	04270	272	04272	274	04274	276	04276	278	0407A
280	04228	282	0422A	284	0422C	286	0422E	288	04628	290	04238	292	0423A	294	0423C	296	0423E	298	04638
300	04300	302	04302	304	04304	306	04306	308	0410A	310	04310	312	04312	314	04314	316	04316	318	0411A
320	04320	322	04322	324	04324	326	04326	328	0412A	330	04330	332	04332	334	04334	336	04336	338	0413A
340	04340	342	04342	344	04344	346	04346	348	0414A	350	04350	352	04352	354	04354	356	04356	358	0415A
360	04360	362	04362	364	04364	366	04366	368	0416A	370	04370	372	04372	374	04374	376	04376	378	0417A
380	04328	382	0432A	384	0432C	386	0432E	388	04728	390	04338	392	0433A	394	0433C	396	0433E	398	04738
400	04400	402	04402	404	04404	406	04406	408	0400C	410	04410	412	04412	414	04414	416	04416	418	0401C
420	04420	422	04422	424	04424	426	04426	428	0402C	430	04430	432	04432	434	04434	436	04436	438	0403C
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460	04460	462	04462	464	04464	466	04466	468	0406C	470	04470	472	04472	474	04474	476	04476	478	0407C
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500	04500	502	04502	504	04504	506	04506	508	0410C	510	04510	512	04512	514	04514	516	04516	518	0411C
520	04520	522	04522	524	04524	526	04526	528	0412C	530	04530	532	04532	534	04534	536	04536	538	0413C
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560	04560	562	04562	564	04564	566	04566	568	0416C	570	04570	572	04572	574	04574	576	04576	578	0417C
580	04348	582	0434A	584	0434C	586	0434E	588	04748	590	04358	592	0435A	594	0435C	596	0435E	598	04758
600	04600	602	04602	604	04604	606	04606	608	0400E	610	04610	612	04612	614	04614	616	04616	618	0401E
620	04620	622	04622	624	04624	626	04626	628	0402E	630	04630	632	04632	634	04634	636	04636	638	0403E
640	04640	642	04642	644	04644	646	04646	648	0404E	650	04650	652	04652	654	04654	656	04656	658	0405E
660	04660	662	04662	664	04664	666	04666	668	0406E	670	04670	672	04672	674	04674	676	04676	678	0407E
680	04268	682	0426A	684	0426C	686	0426E	688	04668	690	04278	692	0427A	694	0427C	696	0427E	698	04678
700	04700	702	04702	704	04704	706	04706	708	0410E	710	04710	712	04712	714	04714	716	04716	718	0411E
720	04720	722	04722	724	04724	726	04726	728	0412E	730	04730	732	04732	734	04734	736	04736	738	0413E
740	04740	742	04742	744	04744	746	04746	748	0414E	750	04750	752	04752	754	04754	756	04756	758	0415E
760	04760	762	04762	764	04764	766	04766	768	0416E	770	04770	772	04772	774	04774	776	04776	778	0417E
780	04368	782	0436A	784	0436C	786	0436E	788	04768	790	04378	792	0437A	794	0437C	796	0437E	798	04778
800	04408	802	0440A	804	0440C	806	0440E	808	0460A	810	04418	812	0441A	814	0441C	816	0441E	818	0461A
820	04428	822	0442A	824	0442C	826	0442E	828	0462A	830	04438	832	0443A	834	0443C	836	0443E	838	0463A
840	04448	842	0444A	844	0444C	846	0444E	848	0464A	850	04458	852	0445A	854	0445C	856	0445E	858	0465A
860	04468	862	0446A	864	0446C	866	0446E	868	0466A	870	04478	872	0447A	874	0447C	876	0447E	878	0467A
880	0460C	882	0462C	884	0464C	886	0466C	888	0460E	890	0461C	892	0463C	894	0465C	896	0467C	898	0461E
900	04508	902	0450A	904	0450C	906	0450E	908	0470A	910	04518	912	0451A	914	0451C	916	0451E	918	0471A
920	04528	922	0452A	924	0452C	926	0452E	928	0472A	930	04538	932	0453A	934	0453C	936	0453E	938	0473A
940	04548	942	0454A	944	0454C	946	0454E	948	0474A	950	04558	952	0455A	954	0455C	956	0455E	958	0475A
960	04568	962	0456A	964	0456C	966	0456E	968	0476A	970	04578	972	0457A	974	0457C	976	0457E	978	0477A
980	0470C	982	0472C	984	0474C	986	0476C	988	0470E	990	0471C	992	0473C	994	0475C	996	0477C	998	0471E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
1000	04080	1002	04082	1004	04084	1006	04086	1008	04088	1010	04090	1012	04092	1014	04094	1016	04096	1018	04098
1020	040A0	1022	040A2	1024	040A4	1026	040A6	1028	040A8	1030	040B0	1032	040B2	1034	040B4	1036	040B6	1038	040B8
1040	040C0	1042	040C2	1044	040C4	1046	040C6	1048	040C8	1050	040D0	1052	040D2	1054	040D4	1056	040D6	1058	040D8
1060	040E0	1062	040E2	1064	040E4	1066	040E6	1068	040E8	1070	040F0	1072	040F2	1074	040F4	1076	040F6	1078	040F8
1080	04288	1082	0428A	1084	0428C	1086	0428E	1088	04688	1090	04298	1092	0429A	1094	0429C	1096	0429E	1098	04698
1100	04180	1102	04182	1104	04184	1106	04186	1108	04188	1110	04190	1112	04192	1114	04194	1116	04196	1118	04198
1120	041A0	1122	041A2	1124	041A4	1126	041A6	1128	041A8	1130	041B0	1132	041B2	1134	041B4	1136	041B6	1138	041B8
1140	041C0	1142	041C2	1144	041C4	1146	041C6	1148	041C8	1150	041D0	1152	041D2	1154	041D4	1156	041D6	1158	041D8
1160	041E0	1162	041E2	1164	041E4	1166	041E6	1168	041E8	1170	041F0	1172	041F2	1174	041F4	1176	041F6	1178	041F8
1180	04388	1182	0438A	1184	0438C	1186	0438E	1188	04788	1190	04398	1192	0439A	1194	0439C	1196	0439E	1198	04798
1200	04280	1202	04282	1204	04284	1206	04286	1208	0408A	1210	04290	1212	04292	1214	04294	1216	04296	1218	0409A
1220	042A0	1222	042A2	1224	042A4	1226	042A6	1228	040AA	1230	042B0	1232	042B2	1234	042B4	1236	042B6	1238	040BA
1240	042C0	1242	042C2	1244	042C4	1246	042C6	1248	040CA	1250	042D0	1252	042D2	1254	042D4	1256	042D6	1258	040DA
1260	042E0	1262	042E2	1264	042E4	1266	042E6	1268	040EA	1270	042F0	1272	042F2	1274	042F4	1276	042F6	1278	040FA
1280	042A8	1282	042AA	1284	042AC	1286	042AE	1288	046A8	1290	042B8	1292	042BA	1294	042BC	1296	042BE	1298	046B8
1300	04380	1302	04382	1304	04384	1306	04386	1308	0418A	1310	04390	1312	04392	1314	04394	1316	04396	1318	0419A
1320	043A0	1322	043A2	1324	043A4	1326	043A6	1328	041AA	1330	043B0	1332	043B2	1334	043B4	1336	043B6	1338	041BA
1340	043C0	1342	043C2	1344	043C4	1346	043C6	1348	041CA	1350	043D0	1352	043D2	1354	043D4	1356	043D6	1358	041DA
1360	043E0	1362	043E2	1364	043E4	1366	043E6	1368	041EA	1370	043F0	1372	043F2	1374	043F4	1376	043F6	1378	041FA
1380	043A8	1382	043AA	1384	043AC	1386	043AE	1388	047A8	1390	043B8	1392	043BA	1394	043BC	1396	043BE	1398	047B8
1400	04480	1402	04482	1404	04484	1406	04486	1408	0408C	1410	04490	1412	04492	1414	04494	1416	04496	1418	0409C
1420	044A0	1422	044A2	1424	044A4	1426	044A6	1428	040AC	1430	044B0	1432	044B2	1434	044B4	1436	044B6	1438	040BC
1440	044C0	1442	044C2	1444	044C4	1446	044C6	1448	040CC	1450	044D0	1452	044D2	1454	044D4	1456	044D6	1458	040DC
1460	044E0	1462	044E2	1464	044E4	1466	044E6	1468	040EC	1470	044F0	1472	044F2	1474	044F4	1476	044F6	1478	040FC
1480	042C8	1482	042CA	1484	042CC	1486	042CE	1488	046C8	1490	042D8	1492	042DA	1494	042DC	1496	042DE	1498	046D8
1500	04580	1502	04582	1504	04584	1506	04586	1508	0418C	1510	04590	1512	04592	1514	04594	1516	04596	1518	0419C
1520	045A0	1522	045A2	1524	045A4	1526	045A6	1528	041AC	1530	045B0	1532	045B2	1534	045B4	1536	045B6	1538	041BC
1540	045C0	1542	045C2	1544	045C4	1546	045C6	1548	041CC	1550	045D0	1552	045D2	1554	045D4	1556	045D6	1558	041DC
1560	045E0	1562	045E2	1564	045E4	1566	045E6	1568	041EC	1570	045F0	1572	045F2	1574	045F4	1576	045F6	1578	041FC
1580	043C8	1582	043CA	1584	043CC	1586	043CE	1588	047C8	1590	043D8	1592	043DA	1594	043DC	1596	043DE	1598	047D8
1600	04680	1602	04682	1604	04684	1606	04686	1608	0408E	1610	04690	1612	04692	1614	04694	1616	04696	1618	0409E
1620	046A0	1622	046A2	1624	046A4	1626	046A6	1628	040AE	1630	046B0	1632	046B2	1634	046B4	1636	046B6	1638	040BE
1640	046C0	1642	046C2	1644	046C4	1646	046C6	1648	040CE	1650	046D0	1652	046D2	1654	046D4	1656	046D6	1658	040DE
1660	046E0	1662	046E2	1664	046E4	1666	046E6	1668	040EE	1670	046F0	1672	046F2	1674	046F4	1676	046F6	1678	040FE
1680	042E8	1682	042EA	1684	042EC	1686	042EE	1688	046E8	1690	042F8	1692	042FA	1694	042FC	1696	042FE	1698	046F8
1700	04780	1702	04782	1704	04784	1706	04786	1708	0418E	1710	04790	1712	04792	1714	04794	1716	04796	1718	0419E
1720	047A0	1722	047A2	1724	047A4	1726	047A6	1728	041AE	1730	047B0	1732	047B2	1734	047B4	1736	047B6	1738	041BE
1740	047C0	1742	047C2	1744	047C4	1746	047C6	1748	041CE	1750	047D0	1752	047D2	1754	047D4	1756	047D6	1758	041DE
1760	047E0	1762	047E2	1764	047E4	1766	047E6	1768	041EE	1770	047F0	1772	047F2	1774	047F4	1776	047F6	1778	041FE
1780	043E8	1782	043EA	1784	043EC	1786	043EE	1788	047E8	1790	043F8	1792	043FA	1794	043FC	1796	043FE	1798	047F8
1800	04488	1802	0448A	1804	0448C	1806	0448E	1808	0468A	1810	04498	1812	0449A	1814	0449C	1816	0449E	1818	0469A
1820	044A8	1822	044AA	1824	044AC	1826	044AE	1828	046AA	1830	044B8	1832	044BA	1834	044BC	1836	044BE	1838	046BA
1840	044C8	1842	044CA	1844	044CC	1846	C44CE	1848	046CA	1850	044D8	1852	044DA	1854	044DC	1856	044DE	1858	046DA
1860	044E8	1862	044EA	1864	044EC	1866	044EE	1868	046EA	1870	044F8	1872	044FA	1874	044FC	1876	044FE	1878	046FA
1880	0468C	1882	046AC	1884	046CC	1886	046EC	1888	0468E	1890	0469C	1892	046BC	1894	046DC	1896	046FC	1898	0469E
1900	04588	1902	0458A	1904	0458C	1906	0458E	1908	0478A	1910	04598	1912	0459A	1914	0459C	1916	0459E	1918	0479A
1920	045A8	1922	045AA	1924	045AC	1926	045AE	1928	047AA	1930	045B8	1932	045BA	1934	045BC	1936	045BE	1938	047BA
1940	045C8	1942	045CA	1944	045CC	1946	045CE	1948	047CA	1950	045D8	1952	045DA	1954	045DC	1956	045DE	1958	047DA
1960	045E8	1962	045EA	1964	045EC	1966	045EE	1968	047EA	1970	045F8	1972	045FA	1974	045FC	1976	045FE	1978	047FA
1980	0478C	1982	047AC	1984	047CC	1986	047EC	1988	0478E	1990	0479C	1992	047BC	1994	047DC	1996	047FC	1998	0479E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
2000	04800	2002	04802	2004	04804	2006	04806	2008	04808	2010	04810	2012	04812	2014	04814	2016	04816	2018	04818
2020	04820	2022	04822	2024	04824	2026	04826	2028	04828	2030	04830	2032	04832	2034	04834	2036	04836	2038	04838
2040	04840	2042	04842	2044	04844	2046	04846	2048	04848	2050	04850	2052	04852	2054	04854	2056	04856	2058	04858
2060	04860	2062	04862	2064	04864	2066	04866	2068	04868	2070	04870	2072	04872	2074	04874	2076	04876	2078	04878
2080	04A08	2082	04A0A	2084	04A0C	2086	04A0E	2088	04E08	2090	04A18	2092	04A1A	2094	04A1C	2096	04A1E	2098	04E18
2100	04900	2102	04902	2104	04904	2106	04906	2108	04908	2110	04910	2112	04912	2114	04914	2116	04916	2118	04918
2120	04920	2122	04922	2124	04924	2126	04926	2128	04928	2130	04930	2132	04932	2134	04934	2136	04936	2138	04938
2140	04940	2142	04942	2144	04944	2146	04946	2148	04948	2150	04950	2152	04952	2154	04954	2156	04956	2158	04958
2160	04960	2162	04962	2164	04964	2166	04966	2168	04968	2170	04970	2172	04972	2174	04974	2176	04976	2178	04978
2180	04B08	2182	04B0A	2184	04B0C	2186	04B0E	2188	04F08	2190	04B18	2192	04B1A	2194	04B1C	2196	04B1E	2198	04F18
2200	04A00	2202	04A02	2204	04A04	2206	04A06	2208	0480A	2210	04A10	2212	04A12	2214	04A14	2216	04A16	2218	0481A
2220	04A20	2222	04A22	2224	04A24	2226	04A26	2228	0482A	2230	04A30	2232	04A32	2234	04A34	2236	04A36	2238	0483A
2240	04A40	2242	04A42	2244	04A44	2246	04A46	2248	0484A	2250	04A50	2252	04A52	2254	04A54	2256	04A56	2258	0485A
2260	04A60	2262	04A62	2264	04A64	2266	04A66	2268	0486A	2270	04A70	2272	04A72	2274	04A74	2276	04A76	2278	0487A
2280	04A28	2282	04A2A	2284	04A2C	2286	04A2E	2288	04E28	2290	04A38	2292	04A3A	2294	04A3C	2296	04A3E	2298	04E38
2300	04B00	2302	04B02	2304	04B04	2306	04B06	2308	0490A	2310	04B10	2312	04B12	2314	04B14	2316	04B16	2318	0491A
2320	04B20	2322	04B22	2324	04B24	2326	04B26	2328	0492A	2330	04B30	2332	04B32	2334	04B34	2336	04B36	2338	0493A
2340	04B40	2342	04B42	2344	04B44	2346	04B46	2348	0494A	2350	04B50	2352	04B52	2354	04B54	2356	04B56	2358	0495A
2360	04B60	2362	04B62	2364	04B64	2366	04B66	2368	0496A	2370	04B70	2372	04B72	2374	04B74	2376	04B76	2378	0497A
2380	04B28	2382	04B2A	2384	04B2C	2386	04B2E	2388	04F28	2390	04B38	2392	04B3A	2394	04B3C	2396	04B3E	2398	04F38
2400	04C00	2402	04C02	2404	04C04	2406	04C06	2408	0480C	2410	04C10	2412	04C12	2414	04C14	2416	04C16	2418	0481C
2420	04C20	2422	04C22	2424	04C24	2426	04C26	2428	0482C	2430	04C30	2432	04C32	2434	04C34	2436	04C36	2438	0483C
2440	04C40	2442	04C42	2444	04C44	2446	04C46	2448	0484C	2450	04C50	2452	04C52	2454	04C54	2456	04C56	2458	0485C
2460	04C60	2462	04C62	2464	04C64	2466	04C66	2468	0486C	2470	04C70	2472	04C72	2474	04C74	2476	04C76	2478	0487C
2480	04A48	2482	04A4A	2484	04A4C	2486	04A4E	2488	04E48	2490	04A58	2492	04A5A	2494	04A5C	2496	04A5E	2498	04E58
2500	04D00	2502	04D02	2504	04D04	2506	04D06	2508	0490C	2510	04D10	2512	04D12	2514	04D14	2516	04D16	2518	0491C
2520	04D20	2522	04D22	2524	04D24	2526	04D26	2528	0492C	2530	04D30	2532	04D32	2534	04D34	2536	04D36	2538	0493C
2540	04D40	2542	04D42	2544	04D44	2546	04D46	2548	0494C	2550	04D50	2552	04D52	2554	04D54	2556	04D56	2558	0495C
2560	04D60	2562	04D62	2564	04D64	2566	04D66	2568	0496C	2570	04D70	2572	04D72	2574	04D74	2576	04D76	2578	0497C
2580	04B48	2582	04B4A	2584	04B4C	2586	04B4E	2588	04F48	2590	04B58	2592	04B5A	2594	04B5C	2596	04B5E	2598	04F58
2600	04E00	2602	04E02	2604	04E04	2606	04E06	2608	0480E	2610	04E10	2612	04E12	2614	04E14	2616	04E16	2618	0481E
2620	04E20	2622	04E22	2624	04E24	2626	04E26	2628	0482E	2630	04E30	2632	04E32	2634	04E34	2636	04E36	2638	0483E
2640	04E40	2642	04E42	2644	04E44	2646	04E46	2648	0484E	2650	04E50	2652	04E52	2654	04E54	2656	04E56	2658	0485E
2660	04E60	2662	04E62	2664	04E64	2666	04E66	2668	0486E	2670	04E70	2672	04E72	2674	04E74	2676	04E76	2678	0487E
2680	04A68	2682	04A6A	2684	04A6C	2686	04A6E	2688	04E68	2690	04A78	2692	04A7A	2694	04A7C	2696	04A7E	2698	04E78
2700	04F00	2702	04F02	2704	04F04	2706	04F06	2708	0490E	2710	04F10	2712	04F12	2714	04F14	2716	04F16	2718	0491E
2720	04F20	2722	04F22	2724	04F24	2726	04F26	2728	0492E	2730	04F30	2732	04F32	2734	04F34	2736	04F36	2738	0493E
2740	04F40	2742	04F42	2744	04F44	2746	04F46	2748	0494E	2750	04F50	2752	04F52	2754	04F54	2756	04F56	2758	0495E
2760	04F60	2762	04F62	2764	04F64	2766	04F66	2768	0496E	2770	04F70	2772	04F72	2774	04F74	2776	04F76	2778	0497E
2780	04B68	2782	04B6A	2784	04B6C	2786	04B6E	2788	04F68	2790	04B78	2792	04B7A	2794	04B7C	2796	04B7E	2798	04F78
2800	04C08	2802	04C0A	2804	04C0C	2806	04C0E	2808	04E0A	2810	04C18	2812	04C1A	2814	04C1C	2816	04C1E	2818	04E1A
2820	04C28	2822	04C2A	2824	04C2C	2826	04C2E	2828	04E2A	2830	04C38	2832	04C3A	2834	04C3C	2836	04C3E	2838	04E3A
2840	04C48	2842	04C4A	2844	04C4C	2846	04C4E	2848	04E4A	2850	04C58	2852	04C5A	2854	04C5C	2856	04C5E	2858	04E5A
2860	04C68	2862	04C6A	2864	04C6C	2866	04C6E	2868	04E6A	2870	04C78	2872	04C7A	2874	04C7C	2876	04C7E	2878	04E7A
2880	04E0C	2882	04E2C	2884	04E4C	2886	04E6C	2888	04E0E	2890	04E1C	2892	04E3C	2894	04E5C	2896	04E7C	2898	04E1A
2900	04D08	2902	04D0A	2904	04D0C	2906	04D0E	2908	04F0A	2910	04D18	2912	04D1A	2914	04D1C	2916	04D1E	2918	04F1A
2920	04D28	2922	04D2A	2924	04D2C	2926	04D2E	2928	04F2A	2930	04D38	2932	04D3A	2934	04D3C	2936	04D3E	2938	04F3A
2940	04D48	2942	04D4A	2944	04D4C	2946	04D4E	2948	04F4A	2950	04D58	2952	04D5A	2954	04D5C	2956	04D5E	2958	04F5A
2960	04D68	2962	04D6A	2964	04D6C	2966	04D6E	2968	04F6A	2970	04D78	2972	04D7A	2974	04D7C	2976	04D7E	2978	04F7A
2980	04F0C	2982	04F2C	2984	04F4C	2986	04F6C	2988	04F0E	2990	04F1C	2992	04F3C	2994	04F5C	2996	04F7C	2998	04F1E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
3000	04880	3002	04882	3004	04884	3006	04886	3008	04888	3010	04890	3012	04892	3014	04894	3016	04896	3018	04898
3020	048A0	3022	048A2	3024	048A4	3026	048A6	3028	048A8	3030	048B0	3032	048B2	3034	048B4	3036	048B6	3038	048B8
3040	048C0	3042	048C2	3044	048C4	3046	048C6	3048	048C8	3050	048D0	3052	048D2	3054	048D4	3056	048D6	3058	048D8
3060	048E0	3062	048E2	3064	048E4	3066	048E6	3068	048E8	3070	048F0	3072	048F2	3074	048F4	3076	048F6	3078	048F8
3080	04A88	3082	04A8A	3084	04A8C	3086	04A8E	3088	04E88	3090	04A98	3092	04A9A	3094	04A9C	3096	04A9E	3098	04E98
3100	04980	3102	04982	3104	04984	3106	04986	3108	04988	3110	04990	3112	04992	3114	04994	3116	04996	3118	04998
3120	049A0	3122	049A2	3124	049A4	3126	049A6	3128	049A8	3130	049B0	3132	049B2	3134	049B4	3136	049B6	3138	049B8
3140	049C0	3142	049C2	3144	049C4	3146	049C6	3148	049C8	3150	049D0	3152	049D2	3154	049D4	3156	049D6	3158	049D8
3160	049E0	3162	049E2	3164	049E4	3166	049E6	3168	049E8	3170	049F0	3172	049F2	3174	049F4	3176	049F6	3178	049F8
3180	04B88	3182	04B8A	3184	04B8C	3186	04B8E	3188	04F88	3190	04B98	3192	04B9A	3194	04B9C	3196	04B9E	3198	04F98
3200	04A80	3202	04A82	3204	04A84	3206	04A86	3208	0488A	3210	04A90	3212	04A92	3214	04A94	3216	04A96	3218	0489A
3220	04AA0	3222	04AA2	3224	04AA4	3226	04AA6	3228	048AA	3230	04AB0	3232	04AB2	3234	04AB4	3236	04AB6	3238	048BA
3240	04AC0	3242	04AC2	3244	04AC4	3246	04AC6	3248	048CA	3250	04AD0	3252	04AD2	3254	04AD4	3256	04AD6	3258	048DA
3260	04AE0	3262	04AE2	3264	04AE4	3266	04AE6	3268	048EA	3270	04AF0	3272	04AF2	3274	04AF4	3276	04AF6	3278	048FA
3280	04AA8	3282	04AAA	3284	04AAC	3286	04AAE	3288	04EA8	3290	04AB8	3292	04ABA	3294	04ABC	3296	04ABE	3298	04EB8
3300	04B80	3302	04B82	3304	04B84	3306	04B86	3308	0498A	3310	04B90	3312	04B92	3314	04B94	3316	04B96	3318	0499A
3320	04BA0	3322	04BA2	3324	04BA4	3326	04BA6	3328	049AA	3330	04BB0	3332	04BB2	3334	04BB4	3336	04BB6	3338	049BA
3340	04BC0	3342	04BC2	3344	04BC4	3346	04BC6	3348	049CA	3350	04BD0	3352	04BD2	3354	04BD4	3356	04BD6	3358	049DA
3360	04BE0	3362	04BE2	3364	04BE4	3366	04BE6	3368	049EA	3370	04BF0	3372	04BF2	3374	04BF4	3376	04BF6	3378	049FA
3380	04BA8	3382	04BAA	3384	04BAC	3386	04BAE	3388	04FA8	3390	04BB8	3392	04BBA	3394	04BBC	3396	04BBE	3398	04FB8
3400	04C80	3402	04C82	3404	04C84	3406	04C86	3408	0488C	3410	04C90	3412	04C92	3414	04C94	3416	04C96	3418	0489C
3420	04CA0	3422	04CA2	3424	04CA4	3426	04CA6	3428	048AC	3430	04CB0	3432	04CB2	3434	04CB4	3436	04CB6	3438	048BC
3440	04CC0	3442	04CC2	3444	04CC4	3446	04CC6	3448	048CC	3450	04CD0	3452	04CD2	3454	04CD4	3456	04CD6	3458	048DC
3460	04CE0	3462	04CE2	3464	04CE4	3466	04CE6	3468	048EC	3470	04CF0	3472	04CF2	3474	04CF4	3476	04CF6	3478	048FC
3480	04AC8	3482	04ACA	3484	04ACC	3486	04ACE	3488	04EC8	3490	04AD8	3492	04ADA	3494	04ADC	3496	04ADE	3498	04ED8
3500	04D80	3502	04D82	3504	04D84	3506	04D86	3508	0498C	3510	04D90	3512	04D92	3514	04D94	3516	04D96	3518	0499C
3520	04DA0	3522	04DA2	3524	04DA4	3526	04DA6	3528	049AC	3530	04DB0	3532	04DB2	3534	04DB4	3536	04DB6	3538	049BC
3540	04DC0	3542	04DC2	3544	04DC4	3546	04DC6	3548	049CC	3550	04DD0	3552	04DD2	3554	04DD4	3556	04DD6	3558	049DC
3560	04DE0	3562	04DE2	3564	04DE4	3566	04DE6	3568	049EC	3570	04DF0	3572	04DF2	3574	04DF4	3576	04DF6	3578	049FC
3580	04BC8	3582	04BCA	3584	04BCC	3586	04BCE	3588	04FC8	3590	04BD8	3592	04BDA	3594	04BDC	3596	04BDE	3598	04FD8
3600	04E80	3602	04E82	3604	04E84	3606	04E86	3608	0488E	3610	04E90	3612	04E92	3614	04E94	3616	04E96	3618	0489E
3620	04EA0	3622	04EA2	3624	04EA4	3626	04EA6	3628	048AE	3630	04EB0	3632	04EB2	3634	04EB4	3636	04EB6	3638	048BE
3640	04EC0	3642	04EC2	3644	04EC4	3646	04EC6	3648	048CE	3650	04ED0	3652	04ED2	3654	04ED4	3656	04ED6	3658	048DE
3660	04EE0	3662	04EE2	3664	04EE4	3666	04EE6	3668	048EE	3670	04EF0	3672	04EF2	3674	04EF4	3676	04EF6	3678	048FE
3680	04AE8	3682	04AEA	3684	04AEC	3686	04AEE	3688	04EE8	3690	04AF8	3692	04AFA	3694	04AFC	3696	04AFE	3698	04EF8
3700	04F80	3702	04F82	3704	04F84	3706	04F86	3708	0498E	3710	04F90	3712	04F92	3714	04F94	3716	04F96	3718	0499E
3720	04FA0	3722	04FA2	3724	04FA4	3726	04FA6	3728	049AE	3730	04FB0	3732	04FB2	3734	04FB4	3736	04FB6	3738	049BE
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3760	04FE0	3762	04FE2	3764	04FE4	3766	04FE6	3768	049EE	3770	04FF0	3772	04FF2	3774	04FF4	3776	04FF6	3778	049FE
3780	04BE8	3782	04BEA	3784	04BEC	3786	04BEE	3788	04FE8	3790	04BF8	3792	04BFA	3794	04BFC	3796	04BFE	3798	04FF8
3800	04C88	3802	04C8A	3804	04C8C	3806	04C8E	3808	04E8A	3810	04C98	3812	04C9A	3814	04C9C	3816	04C9E	3818	04E9A
3820	04CA8	3822	04CAA	3824	04CAC	3826	04CAE	3828	04EAA	3830	04CB8	3832	04CBA	3834	04CBC	3836	04CBE	3838	04EBA
3840	04CC8	3842	04CCA	3844	04CCC	3846	04CCE	3848	04ECA	3850	04CD8	3852	04CDA	3854	04CDC	3856	04CDE	3858	04EDA
3860	04CE8	3862	04CEA	3864	04CEC	3866	04CEE	3868	04EEA	3870	04CF8	3872	04CFA	3874	04CFC	3876	04CFE	3878	04EFA
3880	04E8C	3882	04EAC	3884	04ECC	3886	04EEC	3888	04E8E	3890	04E9C	3892	04EBC	3894	04EDC	3896	04EFC	3898	04E9E
3900	04D88	3902	04D8A	3904	04D8C	3906	04D8E	3908	04F8A	3910	04D98	3912	04D9A	3914	04D9C	3916	04D9E	3918	04F9A
3920	04DA8	3922	04DAA	3924	04DAC	3926	04DAE	3928	04FAA	3930	04DB8	3932	04DBA	3934	04DBC	3936	04DBE	3938	04FBA
3940	04DC8	3942	04DCA	3944	04DCC	3946	04DCE	3948	04FCA	3950	04DD8	3952	04DDA	3954	04DDC	3956	04DDE	3958	04FDA
3960	04DE8	3962	04DEA	3964	04DEC	3966	04DEE	3968	04FEA	3970	04DF8	3972	04DFA	3974	04DFC	3976	04DFE	3978	04FFA
3980	04F8C	3982	04FAC	3984	04FCC	3986	04FEC	3988	04F8E	3990	04F9C	3992	04FBC	3994	04FDC	3996	04FFC	3998	04F9E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
4000	05000	4002	05002	4004	05004	4006	05006	4008	05008	4010	05010	4012	05012	4014	05014	4016	05016	4018	05018
4020	05020	4022	05022	4024	05024	4026	05026	4028	05028	4030	05030	4032	05032	4034	05034	4036	05036	4038	05038
4040	05040	4042	05042	4044	05044	4046	05046	4048	05048	4050	05050	4052	05052	4054	05054	4056	05056	4058	05058
4060	05060	4062	05062	4064	05064	4066	05066	4068	05068	4070	05070	4072	05072	4074	05074	4076	05076	4078	05078
4080	05208	4082	0520A	4084	0520C	4086	0520E	4088	05608	4090	05218	4092	0521A	4094	0521C	4096	0521E	4098	05618
4100	05100	4102	05102	4104	05104	4106	05106	4108	05108	4110	05110	4112	05112	4114	05114	4116	05116	4118	05118
4120	05120	4122	05122	4124	05124	4126	05126	4128	05128	4130	05130	4132	05132	4134	05134	4136	05136	4138	05138
4140	05140	4142	05142	4144	05144	4146	05146	4148	05148	4150	05150	4152	05152	4154	05154	4156	05156	4158	05158
4160	05160	4162	05162	4164	05164	4166	05166	4168	05168	4170	05170	4172	05172	4174	05174	4176	05176	4178	05178
4180	05308	4182	0530A	4184	0530C	4186	0530E	4188	05708	4190	05318	4192	0531A	4194	0531C	4196	0531E	4198	05718
4200	05200	4202	05202	4204	05204	4206	05206	4208	0500A	4210	05210	4212	05212	4214	05214	4216	05216	4218	0501A
4220	05220	4222	05222	4224	05224	4226	05226	4228	0502A	4230	05230	4232	05232	4234	05234	4236	05236	4238	0503A
4240	05240	4242	05242	4244	05244	4246	05246	4248	0504A	4250	05250	4252	05252	4254	05254	4256	05256	4258	0505A
4260	05260	4262	05262	4264	05264	4266	05266	4268	0506A	4270	05270	4272	05272	4274	05274	4276	05276	4278	0507A
4280	05228	4282	0522A	4284	0522C	4286	0522E	4288	05628	4290	05238	4292	0523A	4294	0523C	4296	0523E	4298	05638
4300	05300	4302	05302	4304	05304	4306	05306	4308	0510A	4310	05310	4312	05312	4314	05314	4316	05316	4318	0511A
4320	05320	4322	05322	4324	05324	4326	05326	4328	0512A	4330	05330	4332	05332	4334	05334	4336	05336	4338	0513A
4340	05340	4342	05342	4344	05344	4346	05346	4348	0514A	4350	05350	4352	05352	4354	05354	4356	05356	4358	0515A
4360	05360	4362	05362	4364	05364	4366	05366	4368	0516A	4370	05370	4372	05372	4374	05374	4376	05376	4378	0517A
4380	05328	4382	0532A	4384	0532C	4386	0532E	4388	05728	4390	05338	4392	0533A	4394	0533C	4396	0533E	4398	05738
4400	05400	4402	05402	4404	05404	4406	05406	4408	0500C	4410	05410	4412	05412	4414	05414	4416	05416	4418	0501C
4420	05420	4422	05422	4424	05424	4426	05426	4428	0502C	4430	05430	4432	05432	4434	05434	4436	05436	4438	0503C
4440	05440	4442	05442	4444	05444	4446	05446	4448	0504C	4450	05450	4452	05452	4454	05454	4456	05456	4458	0505C
4460	05460	4462	05462	4464	05464	4466	05466	4468	0506C	4470	05470	4472	05472	4474	05474	4476	05476	4478	0507C
4480	05248	4482	0524A	4484	0524C	4486	0524E	4488	05648	4490	05258	4492	0525A	4494	0525C	4496	0525E	4498	05658
4500	05500	4502	05502	4504	05504	4506	05506	4508	0510C	4510	05510	4512	05512	4514	05514	4516	05516	4518	0511C
4520	05520	4522	05522	4524	05524	4526	05526	4528	0512C	4530	05530	4532	05532	4534	05534	4536	05536	4538	0513C
4540	05540	4542	05542	4544	05544	4546	05546	4548	0514C	4550	05550	4552	05552	4554	05554	4556	05556	4558	0515C
4560	05560	4562	05562	4564	05564	4566	05566	4568	0516C	4570	05570	4572	05572	4574	05574	4576	05576	4578	0517C
4580	05348	4582	0534A	4584	0534C	4586	0534E	4588	05748	4590	05358	4592	0535A	4594	0535C	4596	0535E	4598	05758
4600	05600	4602	05602	4604	05604	4606	05606	4608	0500E	4610	05610	4612	05612	4614	05614	4616	05616	4618	0501E
4620	05620	4622	05622	4624	05624	4626	05626	4628	0502E	4630	05630	4632	05632	4634	05634	4636	05636	4638	0503E
4640	05640	4642	05642	4644	05644	4646	05646	4648	0504E	4650	05650	4652	05652	4654	05654	4656	05656	4658	0505E
4660	05660	4662	05662	4664	05664	4666	05666	4668	0506E	4670	05670	4672	05672	4674	05674	4676	05676	4678	0507E
4680	05268	4682	0526A	4684	0526C	4686	0526E	4688	05668	4690	05278	4692	0527A	4694	0527C	4696	0527E	4698	05678
4700	05700	4702	05702	4704	05704	4706	05706	4708	0510E	4710	05710	4712	05712	4714	05714	4716	05716	4718	0511E
4720	05720	4722	05722	4724	05724	4726	05726	4728	0512E	4730	05730	4732	05732	4734	05734	4736	05736	4738	0513E
4740	05740	4742	05742	4744	05744	4746	05746	4748	0514E	4750	05750	4752	05752	4754	05754	4756	05756	4758	0515E
4760	05760	4762	05762	4764	05764	4766	05766	4768	0516E	4770	05770	4772	05772	4774	05774	4776	05776	4778	0517E
4780	05368	4782	0536A	4784	0536C	4786	0536E	4788	05768	4790	05378	4792	0537A	4794	0537C	4796	0537E	4798	05778
4800	05408	4802	0540A	4804	0540C	4806	0540E	4808	0560A	4810	05418	4812	0541A	4814	0541C	4816	0541E	4818	0561A
4820	05428	4822	0542A	4824	0542C	4826	0542E	4828	0562A	4830	05438	4832	0543A	4834	0543C	4836	0543E	4838	0563A
4840	05448	4842	0544A	4844	0544C	4846	0544E	4848	0564A	4850	05458	4852	0545A	4854	0545C	4856	0545E	4858	0565A
4860	05468	4862	0546A	4864	0546C	4866	0546E	4868	0566A	4870	05478	4872	0547A	4874	0547C	4876	0547E	4878	0567A
4880	0560C	4882	0562C	4884	0564C	4886	0566C	4888	0560E	4890	0561C	4892	0563C	4894	0565C	4896	0567C	4898	0561E
4900	05508	4902	0550A	4904	0550C	4906	0550E	4908	0570A	4910	05518	4912	0551A	4914	0551C	4916	0551E	4918	0571A
4920	05528	4922	0552A	4924	0552C	4926	0552E	4928	0572A	4930	05538	4932	0553A	4934	0553C	4936	0553E	4938	0573A
4940	05548	4942	0554A	4944	0554C	4946	0554E	4948	0574A	4950	05558	4952	0555A	4954	0555C	4956	0555E	4958	0575A
4960	05568	4962	0556A	4964	0556C	4966	0556E	4968	0576A	4970	05578	4972	0557A	4974	0557C	4976	0557E	4978	0577A
4980	0570C	4982	0572C	4984	0574C	4986	0576C	4988	0570E	4990	0571C	4992	0573C	4994	0575C	4996	0577C	4998	0571E

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5000	05080	5002	05082	5004	05084	5006	05086	5008	05088	5010	05090	5012	05092	5014	05094	5016	05096	5018	05098
5020	050A0	5022	050A2	5024	050A4	5026	050A6	5028	050A8	5030	050B0	5032	050B2	5034	050B4	5036	050B6	5038	050B8
5040	050C0	5042	050C2	5044	050C4	5046	050C6	5048	050C8	5050	050D0	5052	050D2	5054	050D4	5056	050D6	5058	050D8
5060	050E0	5062	050E2	5064	050E4	5066	050E6	5068	050E8	5070	050F0	5072	050F2	5074	050F4	5076	050F6	5078	050F8
5080	05288	5082	0528A	5084	0528C	5086	0528E	5088	05688	5090	05298	5092	0529A	5094	0529C	5096	0529E	5098	05698
5100	05180	5102	05182	5104	05184	5106	05186	5108	05188	5110	05190	5112	05192	5114	05194	5116	05196	5118	05198
5120	051A0	5122	051A2	5124	051A4	5126	051A6	5128	051A8	5130	051B0	5132	051B2	5134	051B4	5136	051B6	5138	051B8
5140	051C0	5142	051C2	5144	051C4	5146	051C6	5148	051C8	5150	051D0	5152	051D2	5154	051D4	5156	051D6	5158	051D8
5160	051E0	5162	051E2	5164	051E4	5166	051E6	5168	051E8	5170	051F0	5172	051F2	5174	051F4	5176	051F6	5178	051F8
5180	05388	5182	0538A	5184	0538C	5186	0538E	5188	05788	5190	05398	5192	0539A	5194	0539C	5196	0539E	5198	05798
5200	05280	5202	05282	5204	05284	5206	05286	5208	0508A	5210	05290	5212	05292	5214	05294	5216	05296	5218	0509A
5220	052A0	5222	052A2	5224	052A4	5226	052A6	5228	050AA	5230	052B0	5232	052B2	5234	052B4	5236	052B6	5238	050BA
5240	052C0	5242	052C2	5244	052C4	5246	052C6	5248	050CA	5250	052D0	5252	052D2	5254	052D4	5256	052D6	5258	050DA
5260	052E0	5262	052E2	5264	052E4	5266	052E6	5268	050EA	5270	052F0	5272	052F2	5274	052F4	5276	052F6	5278	050FA
5280	052A8	5282	052AA	5284	052AC	5286	052AE	5288	056A8	5290	052B8	5292	052BA	5294	052BC	5296	052BE	5298	056B8
5300	05380	5302	05382	5304	05384	5306	05386	5308	0518A	5310	05390	5312	05392	5314	05394	5316	05396	5318	0519A
5320	053A0	5322	053A2	5324	053A4	5326	053A6	5328	051AA	5330	053B0	5332	053B2	5334	053B4	5336	053B6	5338	051BA
5340	053C0	5342	053C2	5344	053C4	5346	053C6	5348	051CA	5350	053D0	5352	053D2	5354	053D4	5356	053D6	5358	051DA
5360	053E0	5362	053E2	5364	053E4	5366	053E6	5368	051EA	5370	053F0	5372	053F2	5374	053F4	5376	053F6	5378	051FA
5380	053A8	5382	053AA	5384	053AC	5386	053AE	5388	057A8	5390	053B8	5392	053BA	5394	053BC	5396	053BE	5398	057B8
5400	05480	5402	05482	5404	05484	5406	05486	5408	0508C	5410	05490	5412	05492	5414	05494	5416	05496	5418	0509C
5420	054A0	5422	054A2	5424	054A4	5426	054A6	5428	050AC	5430	054B0	5432	054B2	5434	054B4	5436	054B6	5438	050BC
5440	054C0	5442	054C2	5444	054C4	5446	054C6	5448	050CC	5450	054D0	5452	054D2	5454	054D4	5456	054D6	5458	050DC
5460	054E0	5462	054E2	5464	054E4	5466	054E6	5468	050EC	5470	054F0	5472	054F2	5474	054F4	5476	054F6	5478	050FC
5480	052C8	5482	052CA	5484	052CC	5486	052CE	5488	056C8	5490	052D8	5492	052DA	5494	052DC	5496	052DE	5498	056D8
5500	05580	5502	05582	5504	05584	5506	05586	5508	0518C	5510	05590	5512	05592	5514	05594	5516	05596	5518	0519C
5520	055A0	5522	055A2	5524	055A4	5526	055A6	5528	051AC	5530	055B0	5532	055B2	5534	055B4	5536	055B6	5538	051BC
5540	055C0	5542	055C2	5544	055C4	5546	055C6	5548	051CC	5550	055D0	5552	055D2	5554	055D4	5556	055D6	5558	051DC
5560	055E0	5562	055E2	5564	055E4	5566	055E6	5568	051EC	5570	055F0	5572	055F2	5574	055F4	5576	055F6	5578	051FC
5580	053C8	5582	053CA	5584	053CC	5586	053CE	5588	057C8	5590	053D8	5592	053DA	5594	053DC	5596	053DE	5598	057D8
5600	05680	5602	05682	5604	05684	5606	05686	5608	0508E	5610	05690	5612	05692	5614	05694	5616	05696	5618	0509E
5620	056A0	5622	056A2	5624	056A4	5626	056A6	5628	050AE	5630	056B0	5632	056B2	5634	056B4	5636	056B6	5638	050BE
5640	056C0	5642	056C2	5644	056C4	5646	056C6	5648	050CE	5650	056D0	5652	056D2	6554	056D4	5656	056D6	5658	050DE
5660	056E0	5662	056E2	5664	056E4	5666	056E6	5668	050EE	5670	056F0	5672	056F2	5674	056F4	5676	056F6	5678	050FE
5680	052E8	5682	052EA	5684	052EC	5686	052EE	5688	056E8	5690	052F8	5692	052FA	5694	052FC	5696	052FE	5698	056F8
5700	05780	5702	05782	5704	05784	5706	05786	5708	0518E	5710	05790	5712	05792	5714	05794	5716	05796	5718	0519E
5720	057A0	5722	057A2	5724	057A4	5726	057A6	5728	051AE	5730	057B0	5732	057B2	5734	057B4	5736	057B6	5738	051BE
5740	057C0	5742	057C2	5744	057C4	5746	057C6	5748	051CE	5750	057D0	5752	057D2	5754	057D4	5756	057D6	5758	051DE
5760	057E0	5762	057E2	5764	057E4	5766	057E6	5768	051EE	5770	057F0	5772	057F2	5774	057F4	5776	057F6	5778	051FE
5780	053E8	5782	053EA	5784	053EC	5786	053EE	5788	057E8	5790	053F8	5792	053FA	5794	053FC	5796	053FE	5798	057F8
5800	05488	5802	0548A	5804	0548C	5806	0548E	5808	0568A	5810	05498	5812	0549A	5814	0549C	5816	0549E	5818	0569A
5820	054A8	5822	054AA	5824	054AC	5826	054AE	5828	056AA	5830	054B8	5832	054BA	5834	054BC	5836	054BE	5838	056BA
5840	054C8	5842	054CA	5844	054CC	5846	054CE	5848	056CA	5850	054D8	5852	054DA	5854	054DC	5856	054DE	5858	056DA
5860	054E8	5862	054EA	5864	054EC	5866	054EE	5868	056EA	5870	054F8	5872	054FA	5874	054FC	5876	054FE	5878	056FA
5880	0568C	5882	056AC	5884	056CC	5886	056EC	5888	0568E	5890	0569C	5892	056BC	5894	056DC	5896	056FC	5898	0569E
5900	05588	5902	0558A	5904	0558C	5906	0558E	5908	0578A	5910	05598	5912	0559A	5914	0559C	5916	0559E	5918	0579A
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5960	055E8	5962	055EA	5964	055EC	5966	055EE	5968	057EA	5970	055F8	5972	055FA	5974	055FC	5976	055FE	5978	057FA
5980	0578C	5982	057AC	5984	057CC	5986	057EC	5988	0578E	5990	0579C	5992	057BC	5994	057DC	5996	057FC	5998	0579E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
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6020	05820	6022	05822	6024	05824	6026	05826	6028	05828	6030	05830	6032	05832	6034	05834	6036	05836	6038	05838
6040	05840	6042	05842	6044	05844	6046	05846	6048	05848	6050	05850	6052	05852	6054	05854	6056	05856	6058	05858
6060	05860	6062	05862	6064	05864	6066	05866	6068	05868	6070	05870	6072	05872	6074	05874	6076	05876	6078	05878
6080	05A08	6082	05A0A	6084	05A0C	6086	05A0E	6088	05E08	6090	05A18	6092	05A1A	6094	05A1C	6096	05A1E	6098	05E18
6100	05900	6102	05902	6104	05904	6106	05906	6108	05908	6110	05910	6112	05912	6114	05914	6116	05916	6118	05918
6120	05920	6122	05922	6124	05924	6126	05926	6128	05928	6130	05930	6132	05932	6134	05934	6136	05936	6138	05938
6140	05940	6142	05942	6144	05944	6146	05946	6148	05948	6150	05950	6152	05952	6154	05954	6156	05956	6158	05958
6160	05960	6162	05962	6164	05964	6166	05966	6168	05968	6170	05970	6172	05972	6174	05974	6176	05976	6178	05978
6180	05B08	6182	05B0A	6184	05B0C	6186	05B0E	6188	05F08	6190	05B18	6192	05B1A	6194	05B1C	6196	05B1E	6198	05F18
6200	05A00	6202	05A02	6204	05A04	6206	05A06	6208	0580A	6210	05A10	6212	05A12	6214	05A14	6216	05A16	6218	0581A
6220	05A20	6222	05A22	6224	05A24	6226	05A26	6228	0582A	6230	05A30	6232	05A32	6234	05A34	6236	05A36	6238	0583A
6240	05A40	6242	05A42	6244	05A44	6246	05A46	6248	0584A	6250	05A50	6252	05A52	6254	05A54	6256	05A56	6258	0585A
6260	05A60	6262	05A62	6264	05A64	6266	05A66	6268	0586A	6270	05A70	6272	05A72	6274	05A74	6276	05A76	6278	0587A
6280	05A28	6282	05A2A	6284	05A2C	6286	05A2E	6288	05E28	6290	05A38	6292	05A3A	6294	05A3C	6296	05A3E	6298	05E38
6300	05B00	6302	05B02	6304	05B04	6306	05B06	6308	0590A	6310	05B10	6312	05B12	6314	05B14	6316	05B16	6318	0591A
6320	05B20	6322	05B22	6324	05B24	6326	05B26	6328	0592A	6330	05B30	6332	05B32	6334	05B34	6336	05B36	6338	0593A
6340	05B40	6342	05B42	6344	05B44	6346	05B46	6348	0594A	6350	05B50	6352	05B52	6354	05B54	6356	05B56	6358	0595A
6360	05B60	6362	05B62	6364	05B64	6366	05B66	6368	0596A	6370	05B70	6372	05B72	6374	05B74	6376	05B76	6378	0597A
6380	05B28	6382	05B2A	6384	05B2C	6386	05B2E	6388	05F28	6390	05B38	6392	05B3A	6394	05B3C	6396	05B3E	6398	05F38
6400	05C00	6402	05C02	6404	05C04	6406	05C06	6408	0580C	6410	05C10	6412	05C12	6414	05C14	6416	05C16	6418	0581C
6420	05C20	6422	05C22	6424	05C24	6426	05C26	6428	0582C	6430	05C30	6432	05C32	6434	05C34	6436	05C36	6438	0583C
6440	05C40	6442	05C42	6444	05C44	6446	05C46	6448	0584C	6450	05C50	6452	05C52	6454	05C54	6456	05C56	6458	0585C
6460	05C60	6462	05C62	6464	05C64	6466	05C66	6468	0586C	6470	05C70	6472	05C72	6474	05C74	6476	05C76	6478	0587C
6480	05A48	6482	05A4A	6484	05A4C	6486	05A4E	6488	05E48	6490	05A58	6492	05A5A	6494	05A5C	6496	05A5E	6498	05E58
6500	05D00	6502	05D02	6504	05D04	6506	05D06	6508	0590C	6510	05D10	6512	05D12	6514	05D14	6516	05D16	6518	0591C
6520	05D20	6522	05D22	6524	05D24	6526	05D26	6528	0592C	6530	05D30	6532	05D32	6534	05D34	6536	05D36	6538	0593C
6540	05D40	6542	05D42	6544	05D44	6546	05D46	6548	0594C	6550	05D50	6552	05D52	6554	05D54	6556	05D56	6558	0595C
6560	05D60	6562	05D62	6564	05D64	6566	05D66	6568	0596C	6570	05D70	6572	05D72	6574	05D74	6576	05D76	6578	0597C
6580	05B48	6582	05B4A	6584	05B4C	6586	05B4E	6588	05F48	6590	05B58	6592	05B5A	6594	05B5C	6596	05B5E	6598	05F58
6600	05E00	6602	05E02	6604	05E04	6606	05E06	6608	0580E	6610	05E10	6612	05E12	6614	05E14	6616	05E16	6618	0581E
6620	05E20	6622	05E22	6624	05E24	6626	05E26	6628	0582E	6630	05E30	6632	05E32	6634	05E34	6636	05E36	6638	0583E
6640	05E40	6642	05E42	6644	05E44	6646	05E46	6648	0584E	6650	05E50	6652	05E52	6654	05E54	6656	05E56	6658	0585E
6660	05E60	6662	05E62	6664	05E64	6666	05E66	6668	0586E	6670	05E70	6672	05E72	6674	05E74	6676	05E76	6678	0587E
6680	05A68	6682	05A6A	6684	05A6C	6686	05A6E	6688	05E68	6690	05A78	6692	05A7A	6694	05A7C	6696	05A7E	6698	05E78
6700	05F00	6702	05F02	6704	05F04	6706	05F06	6708	0590E	6710	05F10	6712	05F12	6714	05F14	6716	05F16	6718	0591E
6720	05F20	6722	05F22	6724	05F24	6726	05F26	6728	0592E	6730	05F30	6732	05F32	6734	05F34	6736	05F36	6738	0593E
6740	05F40	6742	05F42	6744	05F44	6746	05F46	6748	0594E	6750	05F50	6752	05F52	6754	05F54	6756	05F56	6758	0595E
6760	05F60	6762	05F62	6764	05F64	6766	05F66	6768	0596E	6770	05F70	6772	05F72	6774	05F74	6776	05F76	6778	0597E
6780	05B68	6782	05B6A	6784	05B6C	6786	05B6E	6788	05F68	6790	05B78	6792	05B7A	6794	05B7C	6796	05B7E	6798	05F78
6800	05C08	6802	05C0A	6804	05C0C	6806	05C0E	6808	05E0A	6810	05C18	6812	05C1A	6814	05C1C	6816	05C1E	6818	05E1A
6820	05C28	6822	05C2A	6824	05C2C	6826	05C2E	6828	05E2A	6830	05C38	6832	05C3A	6834	05C3C	6836	05C3E	6838	05E3A
6840	05C48	6842	05C4A	6844	05C4C	6846	05C4E	6848	05E4A	6850	05C58	6852	05C5A	6854	05C5C	6856	05C5E	6858	05E5A
6860	05C68	6862	05C6A	6864	05C6C	6866	05C6E	6868	05E6A	6870	05C78	6872	05C7A	6874	05C7C	6876	05C7E	6878	05E7A
6880	05E0C	6882	05E2C	6884	05E4C	6886	05E6C	6888	05E0E	6890	05E1C	6892	05E3C	6894	05E5C	6896	05E7C	6898	05E1E
6900	05D08	6902	05D0A	6904	05D0C	6906	05D0E	6908	05F0A	6910	05D18	6912	05D1A	6914	05D1C	6916	05D1E	6918	05F1A
6920	05D28	6922	05D2A	6924	05D2C	6926	05D2E	6928	05F2A	6930	05D38	6932	05D3A	6934	05D3C	6936	05D3E	6938	05F3A
6940	05D48	6942	05D4A	6944	05D4C	6946	05D4E	6948	05F4A	6950	05D58	6952	05D5A	6954	05D5C	6956	05D5E	6958	05F5A
6960	05D68	6962	05D6A	6964	05D6C	6966	05D6E	6968	05F6A	6970	05D78	6972	05D7A	6974	05D7C	6976	05D7E	6978	05F7A
6980	05F0C	6982	05F2C	6984	05F4C	6986	05F6C	6988	05F0E	6990	05F1C	6992	05F3C	6994	05F5C	6996	05F7C	6998	05F1E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
7000	05880	7002	05882	7004	05884	7006	05886	7008	05888	7010	05890	7012	05892	7014	05894	7016	05896	7018	05898
7020	058A0	7022	058A2	7024	058A4	7026	058A6	7028	058A8	7030	058B0	7032	058B2	7034	058B4	7036	058B6	7038	058B8
7040	058C0	7042	058C2	7044	058C4	7046	058C6	7048	058C8	7050	058D0	7052	058D2	7054	058D4	7056	058D6	7058	058D8
7060	058E0	7062	058E2	7064	058E4	7066	058E6	7068	058E8	7070	058F0	7072	058F2	7074	058F4	7076	058F6	7078	058F8
7080	05A88	7082	05A8A	7084	05A8C	7086	05A8E	7088	05E88	7090	05A98	7092	05A9A	7094	05A9C	7096	05A9E	7098	05E98
7100	05980	7102	05982	7104	05984	7106	05986	7108	05988	7110	05990	7112	05992	7114	05994	7116	05996	7118	05998
7120	059A0	7122	059A2	7124	059A4	7126	059A6	7128	059A8	7130	059B0	7132	059B2	7134	059B4	7136	059B6	7138	059B8
7140	059C0	7142	059C2	7144	059C4	7146	059C6	7148	059C8	7150	059D0	7152	059D2	7154	059D4	7156	059D6	7158	059D8
7160	059E0	7162	059E2	7164	059E4	7166	059E6	7168	059E8	7170	059F0	7172	059F2	7174	059F4	7176	059F6	7178	059F8
7180	05B88	7182	05B8A	7184	05B8C	7186	05B8E	7188	05F88	7190	05B98	7192	05B9A	7194	05B9C	7196	05B9E	7198	05F98
7200	05A80	7202	05A82	7204	05A84	7206	05A86	7208	0588A	7210	05A90	7212	05A92	7214	05A94	7216	05A96	7218	0589A
7220	05AA0	7222	05AA2	7224	05AA4	7226	05AA6	7228	058AA	7230	05AB0	7232	05AB2	7234	05AB4	7236	05AB6	7238	058BA
7240	05AC0	7242	05AC2	7244	05AC4	7246	05AC6	7248	058CA	7250	05AD0	7252	05AD2	7254	05AD4	7256	05AD6	7258	058DA
7260	05AE0	7262	05AE2	7264	05AE4	7266	05AE6	7268	058EA	7270	05AF0	7272	05AF2	7274	05AF4	7276	05AF6	7278	058FA
7280	05AA8	7282	05AAA	7284	05AAC	7286	05AAE	7288	05EA8	7290	05AB8	7292	05ABA	7294	05ABC	7296	05ABE	7298	05EB8
7300	05B80	7302	05B82	7304	05B84	7306	05B86	7308	0598A	7310	05B90	7312	05B92	7314	05B94	7316	05B96	7318	0599A
7320	05BA0	7322	05BA2	7324	05BA4	7326	05BA6	7328	059AA	7330	05BB0	7332	05BB2	7334	05BB4	7336	05BB6	7338	059BA
7340	05BC0	7342	05BC2	7344	05BC4	7346	05BC6	7348	059CA	7350	05BD0	7352	05BD2	7354	05BD4	7356	05BD6	7358	059DA
7360	05BE0	7362	05BE2	7364	05BE4	7366	05BE6	7368	059EA	7370	05BF0	7372	05BF2	7374	05BF4	7376	05BF6	7378	059FA
7380	05BA8	7382	05BAA	7384	05BAC	7386	05BAE	7388	05FA8	7390	05BB8	7392	05BBA	7394	05BBC	7396	05BBE	7398	05FB8
7400	05C80	7402	05C82	7404	05C84	7406	05C86	7408	0588C	7410	05C90	7412	05C92	7414	05C94	7416	05C96	7418	0589C
7420	05CA0	7422	05CA2	7424	05CA4	7426	05CA6	7428	058AC	7430	05CB0	7432	05CB2	7434	05CB4	7436	05CB6	7438	058BC
7440	05CC0	7442	05CC2	7444	05CC4	7446	05CC6	7448	058CC	7450	05CD0	7452	05CD2	7454	05CD4	7456	05CD6	7458	058DC
7460	05CE0	7462	05CE2	7464	05CE4	7466	05CE6	7468	058EC	7470	05CF0	7472	05CF2	7474	05CF4	7476	05CF6	7478	058FC
7480	05AC8	7482	05ACA	7484	05ACC	7486	05ACE	7488	05EC8	7490	05AD8	7492	05ADA	7494	05ADC	7496	05ADE	7498	05ED8
7500	05D80	7502	05D82	7504	05D84	7506	05D86	7508	0598C	7510	05D90	7512	05D92	7514	05D94	7516	05D96	7518	0599C
7520	05DA0	7522	05DA2	7524	05DA4	7526	05DA6	7528	059AC	7530	05DB0	7532	05DB2	7534	05DB4	7536	05DB6	7538	059BC
7540	05DC0	7542	05DC2	7544	05DC4	7546	05DC6	7548	059CC	7550	05DD0	7552	05DD2	7554	05DD4	7556	05DD6	7558	059DC
7560	05DE0	7562	05DE2	7564	05DE4	7566	05DE6	7568	059EC	7570	05DF0	7572	05DF2	7574	05DF4	7576	05DF6	7578	059FC
7580	05BC8	7582	05BCA	7584	05BCC	7586	05BCE	7588	05FC8	7590	05BD8	7592	05BDA	7594	05BDC	7596	05BDE	7598	05FD8
7600	05E80	7602	05E82	7604	05E84	7606	05E86	7608	0588E	7610	05E90	7612	05E92	7614	05E94	7616	05E96	7618	0589E
7620	05EA0	7622	05EA2	7624	05EA4	7626	05EA6	7628	058AE	7630	05EB0	7632	05EB2	7634	05EB4	7636	05EB6	7638	058BE
7640	05EC0	7642	05EC2	7644	05EC4	7646	05EC6	7648	058CE	7650	05ED0	7652	05ED2	7654	05ED4	7656	05ED6	7658	058DE
7660	05EE0	7662	05EE2	7664	05EE4	7666	05EE6	7668	058EE	7670	05EF0	7672	05EF2	7674	05EF4	7676	05EF6	7678	058FE
7680	05AE8	7682	05AEA	7684	05AEC	7686	05AEE	7688	05EE8	7690	05AF8	7692	05AFA	7694	05AFC	7696	05AFE	7698	05EF8
7700	05F80	7702	05F82	7704	05F84	7706	05F86	7708	0598E	7710	05F90	7712	05F92	7714	05F94	7716	05F96	7718	0599E
7720	05FA0	7722	05FA2	7724	05FA4	7726	05FA6	7728	059AE	7730	05FB0	7732	05FB2	7734	05FB4	7736	05FB6	7738	059BE
7740	05FC0	7742	05FC2	7744	05FC4	7746	05FC6	7748	059CE	7750	05FD0	7752	05FD2	7754	05FD4	7756	05FD6	7758	059DE
7760	05FE0	7762	05FE2	7764	05FE4	7766	05FE6	7768	059EE	7770	05FF0	7772	05FF2	7774	05FF4	7776	05FF6	7778	059FE
7780	05BE8	7782	05BEA	7784	05BEC	7786	05BEE	7788	05FE8	7790	05BF8	7792	05BFA	7794	05BFC	7796	05BFE	7798	05FF8
7800	05C88	7802	05C8A	7804	05C8C	7806	05C8E	7808	05E8A	7810	05C98	7812	05C9A	7814	05C9C	7816	05C9E	7818	05E9A
7820	05CA8	7822	05CAA	7824	05CAC	7826	05CAE	7828	05EAA	7830	05CB8	7832	05CBA	7834	05CBC	7836	05CBE	7838	05EBA
7840	05CC8	7842	05CCA	7844	05CCC	7846	05CCE	7848	05ECA	7850	05CD8	7852	05CDA	7854	05CDC	7856	05CDE	7858	05EDA
7860	05CE8	7862	05CEA	7864	05CEC	7866	05CEE	7868	05EEA	7870	05CF8	7872	05CFA	7874	05CFC	7876	05CFE	7878	05EFA
7880	05E8C	7882	05EAC	7884	05ECC	7886	05EEC	7888	05E8E	7890	05E9C	7892	05EBC	7894	05EDC	7896	05EFC	7898	05E9E
7900	05D88	7902	05D8A	7904	05D8C	7906	05D8E	7908	05F8A	7910	05D98	7912	05D9A	7914	05D9C	7916	05D9E	7918	05F9A
7920	05DA8	7922	05DAA	7924	05DAC	7926	05DAE	7928	05FAA	7930	05DB8	7932	05DBA	7934	05DBC	7936	05DBE	7938	05FBA
7940	05DC8	7942	05DCA	7944	05DCC	7946	05DCE	7948	05FCA	7950	05DD8	7952	05DDA	7954	05DDC	7956	05DDE	7958	05FDA
7960	05DE8	7962	05DEA	7964	05DEC	7966	05DEE	7968	05FEA	7970	05DF8	7972	05DFA	7974	05DFC	7976	05DFE	7978	05FFA
7980	05F8C	7982	05FAC	7984	05FCC	7986	05FEC	7988	05F8E	7990	05F9C	7992	05FBC	7994	05FDC	7996	05FFC	7998	05F9E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
8000	06000	8002	06002	8004	06004	8006	06006	8008	06008	8010	06010	8012	06012	8014	06014	8016	06016	8018	06018
8020	06020	8022	06022	8024	06024	8026	06026	8028	06028	8030	06030	8032	06032	8034	06034	8036	06036	8038	06038
8040	06040	8042	06042	8044	06044	8046	06046	8048	06050	8050	06050	8052	06052	8054	06054	8056	06056	8058	06058
8060	06060	8062	06062	8064	06064	8066	06066	8068	06068	8070	06070	8072	06072	8074	06074	8076	06076	8078	06078
8080	06208	8082	0620A	8084	0620C	8086	0620E	8088	06608	8090	06218	8092	0621A	8094	0621C	8096	0621E	8098	06618
8100	06100	8102	06102	8104	06104	8106	06106	8108	06108	8110	06110	8112	06112	8114	06114	8116	06116	8118	06118
8120	06120	8122	06122	8124	06124	8126	06126	8128	06128	8130	06130	8132	06132	8134	06134	8136	06136	8138	06138
8140	06140	8142	06142	8144	06144	8146	06146	8148	06148	8150	06150	8152	06152	8154	06154	8156	06156	8158	06158
8160	06160	8162	06162	8164	06164	8166	06166	8168	06168	8170	06170	8172	06172	8174	06174	8176	06176	8178	06178
8180	06308	8182	0630A	8184	0630C	8186	0630E	8188	06708	8190	06318	8192	0631A	8194	0631C	8196	0631E	8198	06718
8200	06200	8202	06202	8204	06204	8206	06206	8208	0600A	8210	06210	8212	06212	8214	06214	8216	06216	8218	0601A
8220	06220	8222	06222	8224	06224	8226	06226	8228	0602A	8230	06230	8232	06232	8234	06234	8236	06236	8238	0603A
8240	06240	8242	06242	8244	06244	8246	06246	8248	0604A	8250	06250	8252	06252	8254	06254	8256	06256	8258	0605A
8260	06260	8262	06262	8264	06264	8266	06266	8268	0606A	8270	06270	8272	06272	8274	06274	8276	06276	8278	0607A
8280	06228	8282	0622A	8284	0622C	8286	0622E	8288	06628	8290	06238	8292	0623A	8294	0623C	8296	0623E	8298	06638
8300	06300	8302	06302	8304	06304	8306	06306	8308	0610A	8310	06310	8312	06312	8314	06314	8316	06316	8318	0611A
8320	06320	8322	06322	8324	06324	8326	06326	8328	0612A	8330	06330	8332	06332	8334	06334	8336	06336	8338	0613A
8340	06340	8342	06342	8344	06304	8346	06346	8348	0614A	8350	06350	8352	06352	8354	06354	8356	06356	8358	0615A
8360	06360	8362	06362	8364	06364	8366	06366	8368	0616A	8370	06370	8372	06372	8374	06374	8376	06376	8378	0617A
8380	06328	8382	0632A	8384	0632C	8386	0632E	8388	06728	8390	06338	8392	0633A	8394	0633C	8396	0633E	8398	06738
8400	06400	8402	06402	8404	06404	8406	06406	8408	0600C	8410	06410	8412	06412	8414	06414	8416	06416	8418	0601C
8420	06420	8422	06422	8424	06424	8426	06426	8428	0602C	8430	06430	8432	06432	8434	06434	8436	06436	8438	0603C
8440	06440	8442	06442	8444	06444	8446	06446	8448	0604C	8450	06450	8452	06452	8454	06454	8456	06456	8458	0605C
8460	06460	8462	06462	8464	06464	8466	06466	8468	0606C	8470	06470	8472	06472	8474	06474	8476	06476	8478	0607C
8480	06248	8482	0624A	8484	0624C	8486	0624E	8488	06648	8490	06258	8492	0625A	8494	0625C	8496	0625E	8498	06658
8500	06500	8502	06502	8504	06504	8506	06506	8508	0610C	8510	06510	8512	06512	8514	06514	8516	06516	8518	0611C
8520	06520	8522	06522	8524	06524	6526	06526	8528	0612C	8530	06530	8532	06532	8534	06534	8536	06536	8538	0613C
8540	06540	8542	06542	8544	06544	8546	06546	8548	0614C	8550	06550	8552	06552	8554	06554	8556	06556	8558	0615C
8560	06560	8562	06562	8564	06564	8566	06566	8568	0616C	8570	06570	8572	06575	8574	06574	8576	06576	8578	0617C
8580	06348	8582	0634A	8584	0634C	8586	0634E	8588	06748	8590	06358	8592	0635A	8594	0635C	8596	0635E	8598	06758
8600	06600	8602	06602	8604	06604	8606	06606	8608	0600E	8610	06610	8612	06612	8614	06614	8616	06616	8618	0601E
8620	06620	8622	06622	8624	06624	8626	06626	8628	0602E	8630	06630	8632	06632	8634	06634	8636	06636	8638	0603E
8640	06640	8642	06642	8644	06644	8646	06646	8648	0604E	8650	06650	8652	06652	8654	06654	8656	06656	8658	0605E
8660	06660	8662	06662	8664	06664	8666	06666	8668	0606E	8670	06670	8672	06672	8674	06674	8676	06676	8678	0607E
8680	06268	8682	0626A	8684	0626C	8686	0626E	8688	06668	8690	06278	8692	0627A	8694	0627C	8696	0627E	8698	06678
8700	06700	8702	06702	8704	06704	8706	06706	8708	0610E	8710	06710	8712	06712	8714	06714	8716	06716	8718	0611E
8720	06720	8722	06722	8724	06724	8726	06726	8728	0612E	8730	06730	8732	06732	8734	06734	8736	06736	8738	0613E
8740	06740	8742	06742	8744	06744	8746	06746	8748	0614E	8750	06750	8752	06752	8754	06754	8756	06756	8758	0615E
8760	06760	8762	06762	8764	06764	8766	06766	8768	0616E	8770	06770	8772	06772	8774	06774	8776	06776	8778	0617E
8780	06368	8782	0636A	8784	0636C	8786	0636E	8788	06768	8790	06378	8792	0637A	8794	0637C	8796	0637E	8798	06778
8800	06408	8802	0640A	8804	0640C	8806	0640E	8808	0660A	8810	06418	8812	0641A	8814	0641C	8816	0641E	8818	0661A
8820	06428	8822	0642A	8824	0642C	8826	0642E	8828	0662A	8830	06438	8832	0643A	8834	0643C	8836	0643E	8838	0663A
8840	06448	8842	0644A	8844	0644C	8846	0644E	8848	0664A	8850	06458	8852	0645A	8854	0645C	8856	0645E	8858	0665A
8860	06468	8862	0646A	8864	0646C	8866	0646E	8868	0666A	8870	06478	8872	0647A	8874	0647C	8876	0647E	8878	0667A
8880	0660C	8882	0662C	8884	0664C	8886	0666C	8888	0660E	8890	0661C	8892	0663C	8894	0665C	8896	0667C	8898	0661E
8900	06508	8902	0650A	8904	0650C	8906	0650E	8908	0670A	8910	06518	8912	0651A	8914	0651C	8916	0651E	8918	0671A
8920	06528	8922	0652A	8924	0652C	8926	0652E	8928	0672A	8930	06538	8932	0653A	8934	0653C	8936	0653E	8938	0673A
8940	06548	8942	0654A	8944	0654C	8946	0654E	8948	0674A	8950	06558	8952	0655A	8954	0655C	8956	0655E	8958	0675A
8960	06568	8962	0556A	8964	0656C	8966	0656E	8968	0676A	8970	06578	8972	0657A	8974	0657C	8976	0657E	8978	0677A
8980	0670C	8982	0672C	8984	0674C	8986	0676C	8988	0670E	8990	0671C	8992	0673C	8994	0675C	8996	0677C	8998	0671E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
9000	06080	9002	06082	9004	06084	9006	06086	9008	06088	9010	06090	9012	06092	9014	06094	9016	06096	9018	06098
9020	060A0	9022	060A2	9024	060A4	9026	060A6	9028	060A8	9030	060B0	9032	060B2	9034	060B4	9036	060B6	9038	060B8
9040	060C0	9042	060C2	9044	060C4	9046	060C6	9048	060C8	9050	060D0	9052	060D2	9054	060D4	9056	060D6	9058	060D8
9060	060E0	9062	060E2	9064	060E4	9066	060E6	9068	060E8	9070	060F0	9072	060F2	9074	060F4	9076	060F6	9078	060F8
9080	06288	9082	0628A	9084	0628C	9086	0628E	9088	06688	9090	06298	9092	0629A	9094	0629C	9096	0629E	9098	06698
9100	06180	9102	06182	9104	06184	9106	06186	9108	06188	9110	06190	9112	06192	9114	06194	9116	06196	9118	06198
9120	061A0	9122	061A2	9124	061A4	9126	061A6	9128	061A8	9130	061B0	9132	061B2	9134	061B4	9136	061B6	9138	061B8
9140	061C0	9142	061C2	9144	061C4	0146	061C6	9148	061C8	0150	061D0	9152	061D2	9154	061D4	9156	061D6	9158	061D8
9160	061E0	9162	061E2	9164	061E4	9166	061E6	9168	061E8	9170	061F0	9172	061F2	9174	061F4	9176	061F6	9178	061F8
9180	06388	9182	0638A	9184	0638C	9186	0638E	9188	06788	9190	06398	9192	0639A	9194	0639C	9196	0639E	9198	06798
9200	06280	9202	06282	9204	06284	9206	06286	9208	0608A	9210	06290	9212	06292	9214	06294	9216	06296	9218	0609A
9220	062A0	9222	062A2	9224	062A4	9226	062A6	9228	060AA	9230	062B0	9232	062B2	9234	062B4	9236	062B6	9238	060BA
9240	062C0	9242	062C2	9244	062C4	9246	062C6	9248	060CA	9250	062D0	9252	062D2	9254	062D4	9256	062D6	9258	060DA
9260	062E0	9262	062E2	9264	062E4	9266	062E6	9268	060EA	9270	062F0	9272	062F2	9274	062F4	9276	062F6	9278	060FA
9280	062A8	9282	062AA	9284	062AC	9286	062AE	9288	066A8	9290	062B8	9292	062BA	9294	062BC	9296	062BE	9298	066B8
9300	06380	9302	06382	9304	06384	9306	06386	9308	0618A	9310	06390	9312	06392	9314	06394	9316	06396	9318	0619A
9320	063A0	9322	063A2	9324	063A4	9326	063A6	9328	061AA	9330	063B0	9332	063B2	9334	063B4	9336	063B6	9338	061BA
9340	063C0	9342	063C2	9344	063C4	9346	063C6	9348	061CA	9359	063D0	9352	063D2	9354	063D4	9356	063D6	9358	061DA
9360	063E0	9362	063E2	9364	063E4	9366	063E6	9368	061EA	9370	063B8	9372	063F2	9374	063F4	9376	063F6	9378	061FA
9380	063A8	9382	063AA	9384	063AC	9386	063AE	9388	067A8	9390	063F0	9392	063BA	9394	063BC	9396	063BE	9398	067B8
9400	06480	9402	06482	9404	06484	9406	06486	9408	0608C	9410	06490	9412	06492	9414	06494	9416	06496	9418	0609C
9420	064A0	9422	064A2	9424	064A4	9426	064A6	9428	060AC	9430	064B0	9432	064B2	9434	064B4	9436	064B6	9438	060BC
9440	064C0	9442	064C2	9444	064C4	9446	064C6	9448	060CC	9450	064D0	9452	064D2	9454	064D4	9456	064D6	9458	060DC
9460	064E0	9462	064E2	9464	064E4	9466	064E6	9468	060EC	9470	064F0	9472	064F2	9474	064F4	9476	064F6	9478	060FC
9480	062C8	9482	062CA	9484	062CC	9486	062CE	9488	066C8	9490	062D8	9492	062DA	9494	062DC	9496	062DE	9498	066D8
9500	06580	9502	06582	9504	06584	9506	06586	9508	0618C	9510	06590	9512	06592	9514	06594	9516	06596	9518	0619C
9520	065A0	9522	065A2	9524	065A4	9526	065A6	9528	061AC	9530	065B0	9532	065B2	9534	065B4	9536	065B6	9538	061BC
9540	065C0	9542	065C2	9544	065C4	9546	065C6	9548	061CC	9550	065D0	9552	065D2	9554	065D4	9556	065D6	9558	061DC
9560	065E0	9562	065E2	9564	065E4	9566	065E6	9568	061EC	9570	065F0	9572	065F2	9574	065F4	9576	065F6	9578	061FC
9580	063C8	9582	063CA	9584	063CC	9586	063CE	9588	067C8	9590	063D8	9592	063DA	9594	063DC	9596	063DE	9598	067D8
9600	06680	9602	06682	9604	06684	9606	06686	9608	0608E	9610	06690	9612	06692	9614	06694	9616	06696	9618	0609E
9620	066A0	9622	066A2	9624	066A4	9626	066A6	9628	060AE	9630	066B0	9632	066B2	9634	066B4	9636	066B6	9638	060BE
9640	066C0	9642	066C2	9644	066C4	9646	066C6	9648	060CE	9650	066D0	9652	066D2	9654	066D4	9656	066D6	9658	060DE
9660	066E0	9662	066E2	9664	066E4	9666	066E6	9668	060EE	9670	066F0	9672	066F2	9674	066F4	9676	066F6	9678	060FE
9680	062E8	9682	062EA	9684	062EC	9686	062EE	9688	066E8	9690	062F8	9692	062FA	9694	062FC	9696	062FE	9698	066F8
9700	06780	9702	06782	9704	06784	9706	06786	9708	0618E	9710	06790	9712	06792	9714	06794	9716	06796	9718	0619E
9720	067A0	9722	067A2	9724	067A4	9726	067A6	9728	061AE	9730	067B0	9732	067B2	9734	067B4	9736	067B6	9738	061BE
9740	067C0	9742	067C2	9744	067C4	9746	067C6	9748	061CE	9750	067D0	9752	067D2	9754	067D4	9756	067D6	9758	061DE
9760	067E0	9762	067E2	9764	067E4	9766	067E6	9768	061EE	9770	067F0	9772	067F2	9774	067F4	9776	067F6	9778	061FE
9780	063E8	9782	063EA	9784	063EC	9786	063EE	9788	067E8	9790	063F8	9792	063FA	9794	063FC	9796	063FE	9798	067F8
9800	06488	9802	0648A	9804	0648C	9806	0648E	9808	0668A	9810	06498	9812	0649A	9814	0649C	9816	0649E	9818	0669A
9820	064A8	9822	064AA	9824	064AC	9826	064AE	9828	066AA	9830	064B8	9832	064BA	9834	064BC	9836	064BE	9838	066BA
9840	064C8	9842	064CA	9844	064CC	9846	064CE	9848	066CA	9850	064D8	9852	064DA	9854	064DC	9856	064DE	9858	066DA
9860	064E8	9862	064EA	9864	064EC	8966	064EE	9868	066EA	9870	064F8	9872	064FA	9874	064FC	9876	064FE	9878	066FA
9880	0668C	9882	066AC	9884	066CC	9886	066EC	9888	0668E	9890	0669C	9892	066BC	9894	066DC	9896	066FC	9898	0669E
9900	06588	9902	0658A	9904	0658C	9906	0658E	9908	0678A	9910	06598	9912	0659A	9914	0659C	9916	0659E	9918	0679A
9920	065A8	9922	065AA	9924	065AC	9926	065AE	9928	067AA	9930	065B8	9932	065BA	9934	065BC	9936	065BE	9938	067BA
9940	065C8	9942	065CA	9944	065CC	9946	065CE	9948	067CA	9950	065D8	9952	065DA	9954	065DC	9956	065DE	9958	067DA
9960	065E8	9962	065EA	9964	065EC	9966	065EE	9968	067EA	9970	065F8	9972	065FA	9974	065FC	9976	065FE	9978	067FA
9980	0678C	9982	067AC	9984	067CC	9986	067EC	9988	0678E	9990	0679C	9992	067BC	9994	067DC	9996	067FC	9998	0679E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
10000	06800	10002	06802	10004	06804	10006	06806	10008	06808	10010	06810	10012	06812	10014	06814	10016	06816	10018	06818
10020	06820	10022	06822	10024	06824	10026	06826	10028	06828	10030	06830	10032	06832	10034	06834	10036	06836	10038	06838
10040	06840	10042	06842	10044	06844	10046	06846	10048	06848	10050	06850	10052	06852	10054	06854	10056	06856	10058	06858
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10080	06A08	10082	06A0A	10084	06A0C	10086	06A0E	10088	06E08	10090	06A18	10092	06A1A	10094	06A1C	10096	06A1E	10098	06E18
10100	06900	10102	06902	10104	06904	10106	06906	10108	06908	10110	06910	10112	06912	10114	06914	10116	06916	10118	06918
10120	06920	10122	06922	10124	06924	10126	06926	10128	06928	10130	06930	10132	06932	10134	06934	10136	06936	10138	06938
10140	06940	10142	06942	10144	06944	10146	06946	10148	06948	10150	06950	10152	06952	10154	06954	10156	06956	10158	06958
10160	06960	10162	06962	10164	06964	10166	06966	10168	06968	10170	06970	10172	06972	10174	06974	10176	06976	10178	06978
10180	06B08	10182	06B0A	10184	06B0C	10186	06B0E	10188	06F08	10190	06B18	10192	06B1A	10194	06B1C	10196	06B1E	10198	06F18
10200	06A00	10202	06A02	10204	06A04	10206	06A06	10208	0680A	10210	06A10	10212	06A12	10214	06A14	10216	06A16	10218	0681A
10220	06A20	10222	06A22	10224	06A24	10226	06A26	10228	0682A	10230	06A30	10232	06A32	10234	06A34	10236	06A36	10238	0683A
10240	06A40	10242	06A42	10244	06A44	10246	06A46	10248	0684A	10250	06A50	10252	06A52	10254	06A54	10256	06A56	10258	0685A
10260	06A60	10262	06A62	10264	06A64	10266	06A66	10268	0686A	10270	06A70	10272	06A72	10274	06A74	10276	06A76	10278	0687A
10280	06A28	10282	06A2A	10284	06A2C	10286	06A2E	10288	06E28	10290	06A38	10292	06A3A	10294	06A3C	10296	06A3E	10298	06E38
10300	06B00	10302	06B02	10304	06B04	10306	06B06	10308	0690A	10310	06B10	10312	06B12	10314	06B14	10316	06B16	10318	0691A
10320	06B20	10322	06B22	10324	06B24	10326	06B26	10328	0692A	10330	06B30	10332	06B32	10334	06B34	10336	06B36	10338	0693A
10340	06B40	10342	06B42	10344	06B44	10346	06B46	10348	0694A	10350	06B50	10352	06B52	10354	06B54	10356	06B56	10358	0695A
10360	06B60	10362	06B62	10364	06B64	10366	06B66	10368	0696A	10370	06B70	10372	06B72	10374	06B74	10376	06B76	10378	0697A
10380	06B28	10382	06B2A	10384	06B2C	10386	06B2E	10388	06F28	10390	06B38	10392	06B3A	10394	06B3C	10396	06B3E	10398	06F38
10400	06C00	10402	06C02	10404	06C04	10406	06C06	10408	0680C	10410	06C10	10412	06C12	10414	06C14	10416	06C16	10418	0681C
10420	06C20	10422	06C22	10424	06C24	10426	06C26	10428	0682C	10430	06C30	10432	06C32	10434	06C34	10436	06C36	10438	0683C
10440	06C40	10442	06C42	10444	06C44	10446	06C46	10448	0684C	10450	06C50	10452	06C52	10454	06C54	10456	06C56	10458	0685C
10460	06C60	10462	06C62	10464	06C64	10466	06C66	10468	0686C	10470	06C70	10472	06C72	10474	06C74	10476	06C76	10478	0687C
10480	06A48	10482	06A4A	10484	06A4C	10486	06A4E	10488	06E48	10490	06A58	10492	06A5A	10494	06A5C	10496	06A5E	10498	06E58
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10560	06D60	10562	06D62	10564	06D64	10566	06D66	10568	0696C	10570	06D70	10572	06D72	10574	06D74	10576	06D76	10578	0697C
10580	06B48	10582	06B4A	10584	06B4C	10586	06B4E	10588	06F48	10590	06B58	10592	06B5A	10594	06B5C	10596	06B5E	10598	06F58
10600	06E00	10602	06E02	10604	06E04	10606	06E06	10608	0680E	10610	06E10	10612	06E12	10614	06E14	10616	06E16	10618	0681E
10620	06E20	10622	06E22	10624	06E24	10626	06E26	10628	0682E	10630	06E30	10632	06E32	10634	06E34	10636	06E36	10638	0683E
10640	06E40	10642	06E42	10644	06E44	10646	06E46	10648	0684E	10650	06E50	10652	06E52	10654	06E54	10656	06E56	10658	0685E
10660	06E60	10662	06E62	10664	06E64	10666	06E66	10668	0686E	10670	06E70	10672	06E72	10674	06E74	10676	06E76	10678	0687E
10680	06A68	10682	06A6A	10684	06A6C	10686	06A6E	10688	06E68	10690	06A78	10692	06A7A	10694	06A7C	10696	06A7E	10698	06E78
10700	06F00	10702	06F02	10704	06F04	10706	06F06	10708	0690E	10710	06F10	10712	06F12	10714	06F14	10716	06F16	10718	0691E
10720	06F20	10722	06F22	10724	06F24	10726	06F26	10728	0692E	10730	06F30	10732	06F32	10734	06F34	10736	06F36	10738	0693E
10740	06F40	10742	06F42	10744	06F44	10746	06F46	10748	0694E	10750	06F50	10752	06F52	10754	06F54	10756	06F56	10758	0695E
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10780	06B68	10782	06B6A	10784	06B6C	10786	06B6E	10788	06F68	10790	06B78	10792	06B7A	10794	06B7C	10796	06B7E	10798	06F78
10800	06C08	10802	06C0A	10804	06C0C	10806	06C0E	10808	06E0A	10810	06C18	10812	06C1A	10814	06C1C	10816	06C1E	10818	06E1A
10820	06C28	10822	06C2A	10824	06C2C	10826	06C2E	10828	06E2A	10830	06C38	10832	06C3A	10834	06C3C	10836	06C3E	10838	06E3A
10840	06C48	10842	06C4A	10844	06C4C	10846	06C4E	10848	06E4A	10850	06C58	10852	06C5A	10854	06C5C	10856	06C5E	10858	06E5A
10860	06C68	10862	06C6A	10864	06C6C	10866	06C6E	10868	06E6A	10870	06C78	10872	06C7A	10874	06C7C	10876	06C7E	10878	06E7A
10880	06E0C	10882	06E2C	10884	06E4C	10886	06E6C	10888	06E0E	10890	06E1C	10892	06E3C	10894	06E5C	10896	06E7C	10898	06E1E
10900	06D08	10902	06D0A	10904	06D0C	10906	06D0E	10908	06F0A	10910	06D18	10912	06D1A	10914	06D1C	10916	06D1E	10918	06F1A
10920	06D28	10922	06D2A	10924	06D2C	10926	06D2E	10928	06F2A	10930	06D38	10932	06D3A	10934	06D3C	10936	06D3E	10938	06F3A
10940	06D48	10942	06D4A	10944	06D4C	10946	06D4E	10948	06F4A	10950	06D58	10952	06D5A	10954	06D5C	10956	06D5E	10958	06F5A
10960	06D68	10962	06D6A	10964	06D6C	10966	06D6E	10968	06F6A	10970	06D78	10972	06D7A	10974	06D7C	10976	06D7E	10978	06F7A
10980	06F0C	10982	06F2C	10984	06F4C	10986	06F6C	10988	06F0E	10990	06F1C	10992	06F3C	10994	06F5C	10996	06F7C	10998	06F1E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
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11020	068A0	11022	068A2	11024	068A4	11026	068A6	11028	068A8	11030	068B0	11032	068B2	11034	068B4	11036	068B6	11038	068B8
11040	068C0	11042	068C2	11044	068C4	11046	068C6	11048	068C8	11050	068D0	11052	068D2	11054	068D4	11056	068D6	11058	068D8
11060	068E0	11062	068E2	11064	068E4	11066	068E6	11068	068E8	11070	068F0	11072	068F2	11074	068F4	11076	068F6	11078	068F8
11080	06A88	11082	06A8A	11084	06A8C	11086	06A8E	11088	06E88	11090	06A98	11092	06A9A	11094	06A9C	11096	06A9E	11098	06E98
11100	06980	11102	06982	11104	06984	11106	06986	11108	06988	11110	06990	11112	06992	11114	06994	11116	06996	11118	06998
11120	069A0	11122	069A2	11124	069A4	11126	069A6	11128	069A8	11130	069B0	11132	069B2	11134	069B4	11136	069B6	11138	069B8
11140	069C0	11142	069C2	11144	069C4	11146	069C6	11148	069C8	11150	069D0	11152	069D2	11154	069D4	11156	069D6	11158	069D8
11160	069E0	11162	069E2	11164	069E4	11166	069E6	11168	069E8	11170	069F0	11172	069F2	11174	069F4	11176	069F6	11178	069F8
11180	06B88	11182	06B8A	11184	06B8C	11186	06B8E	11188	06F88	11190	06B98	11192	06B9A	11194	06B9C	11196	06B9E	11198	06F98
11200	06A80	11202	06A82	11204	06A84	11206	06A86	11208	0688A	11210	06A90	11212	06A92	11214	06A94	11216	06A96	11218	0689A
11220	06AA0	11222	06AA2	11224	06AA4	11226	06AA6	11228	068AA	11230	06AB0	11232	06AB2	11234	06AB4	11236	06AB6	11238	068BA
11240	06AC0	11242	06AC2	11244	06AC4	11246	06AC6	11248	068CA	11250	06AD0	11252	06AD2	11254	06AD4	11256	06AD6	11258	068DA
11260	06AE0	11262	06AE2	11264	06AE4	11266	06AE6	11268	068EA	11270	06AF0	11272	06AF2	11274	06AF4	11276	06AF6	11278	068FA
11280	06AA8	11282	06AAA	11284	06AAC	11286	06AAE	11288	06EA8	11290	06AB8	11292	06ABA	11294	06ABC	11296	06ABE	11298	06EB8
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11320	06BA0	11322	06BA2	11324	06BA4	11326	06BA6	11328	069AA	11330	06BB0	11332	06BB2	11334	06BB4	11336	06BB6	11338	069BA
11340	06BC0	11342	06BC2	11344	06BC4	11346	06BC6	11348	069CA	11350	06BD0	11352	06BD2	11354	06BD4	11356	06BD6	11358	069DA
11360	06BE0	11362	06BE2	11364	06BE4	11366	06BE6	11368	069EA	11370	06BF0	11372	06BF2	11374	06BF4	11376	06BF6	11378	069FA
11380	06BA8	11382	06BAA	11384	06BAC	11386	06BAE	11388	06FA8	11390	06BB8	11392	06BBA	11394	06BBC	11396	06BBE	11398	06FB8
11400	06C80	11402	06C82	11404	06C84	11406	06C86	11408	0688C	11410	06C90	11412	06C92	11414	06C94	11416	06C96	11418	0689C
11420	06CA0	11422	06CA2	11424	06CA4	11426	06CA6	11428	068AC	11430	06CB0	11432	06CB2	11434	06CB4	11436	06CB6	11438	068BC
11440	06CC0	11442	06CC2	11444	06CC4	11446	06CC6	11448	068CC	11450	06CD0	11452	06CD2	11454	06CD4	11456	06CD6	11458	068DC
11460	06CE0	11462	06CE2	11464	06CE4	11466	06CE6	11468	068EC	11470	06CF0	11472	06CF2	11474	06CF4	11476	06CF6	11478	068FC
11480	06AC8	11482	06ACA	11484	06ACC	11486	06ACE	11488	06EC8	11490	06AD8	11492	06ADA	11494	06ADC	11496	06ADE	11498	06ED8
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11520	06DA0	11522	06DA2	11524	06DA4	11526	06DA6	11528	069AC	11530	06DB0	11532	06DB2	11534	06DB4	11536	06DB6	11538	069BC
11540	06DC0	11542	06DC2	11544	06DC4	11546	06DC6	11548	069CC	11550	06DD0	11552	06DD2	11554	06DD4	11556	06DD6	11558	069DC
11560	06DE0	11562	06DE2	11564	06DE4	11566	06DE6	11568	069EC	11570	06DF0	11572	06DF2	11574	06DF4	11576	06DF6	11578	069FC
11580	06BC8	11582	06BCA	11584	06BCC	11586	06BCE	11588	06FC8	11590	06BD8	11592	06BDA	11594	06BDC	11596	06BDE	11598	06FD8
11600	06E80	11602	06E82	11604	06E84	11606	06E86	11608	0688E	11610	06E90	11612	06E92	11614	06E94	11616	06E96	11618	0689E
11620	06EA0	11622	06EA2	11624	06EA4	11626	06EA6	11628	068AE	11630	06EB0	11632	06EB2	11634	06EB4	11636	06EB6	11638	068BE
11640	06EC0	11642	06EC2	11644	06EC4	11646	06EC6	11648	068CE	11650	06ED0	11652	06ED2	11654	06ED4	11656	06ED6	11658	068DE
11660	06EE0	11662	06EE2	11664	06EE4	11666	06EE6	11668	068EE	11670	06EF0	11672	06EF2	11674	06EF4	11676	06EF6	11678	068FE
11680	06AE8	11682	06AEA	11684	06AEC	11686	06AEE	11688	06EE8	11690	06AF8	11692	06AFA	11694	06AFC	11696	06AFE	11698	06EF8
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11720	06FA0	11722	06FA2	11724	06FA4	11726	06FA6	11728	069AE	11730	06FB0	11732	06FB2	11734	06FB4	11736	06FB6	11738	069BE
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11780	06BE8	11782	06BEA	11784	06BEC	11786	06BEE	11788	06FE8	11790	06BF8	11792	06BFA	11794	06BFC	11796	06BFE	11798	06FF8
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11980	06F8C	11982	06FAC	11984	06FCC	11986	06FEC	11988	06F8E	11990	06F9C	11992	06FBC	11994	06FDC	11996	06FFC	11998	06F9E

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12660	07660	12662	07662	12664	07664	12666	07666	12668	0706E	12670	07670	12672	07672	12674	07674	12676	07676	12678	0707E
12680	07268	12682	0726A	12684	0726C	12686	0726E	12688	07668	12690	07278	12692	0727A	12694	0727C	12696	0727E	12698	07678
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13260	072E0	13262	072E2	13264	072E4	13266	072E6	13268	070EA	13270	072F0	13272	072F2	13274	072F4	13276	072F6	13278	070FA
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13340	073C0	13342	073C2	13344	073C4	13346	073C6	13348	071CA	13350	073D0	13352	073D2	13354	073D4	13356	073D6	13358	071DA
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14060	07860	14062	07862	14064	07864	14066	07866	14068	07868	14070	07870	14072	07872	14074	07874	14076	07876	14078	07878
14080	07A08	14082	07A0A	14084	07A0C	14086	07A0E	14088	07E08	14090	07A18	14092	07A1A	14094	07A1C	14096	07A1E	14098	07E18
14100	07900	14102	07902	14104	07904	14106	07906	14108	07908	14110	07910	14112	07912	14114	07914	14116	07916	14118	07918
14120	07920	14122	07922	14124	07924	14126	07926	14128	07928	14130	07930	14132	07932	14134	07934	14136	07936	14138	07938
14140	07940	14142	07942	14144	07944	14146	07946	14148	07948	14150	07950	14152	07952	14154	07954	14156	07956	14158	07958
14160	07960	14162	07962	14164	07964	14166	07966	14168	07968	14170	07970	14172	07972	14174	07974	14176	07976	14178	07978
14180	07B08	14182	07B0A	14184	07B0C	14186	07B0E	14188	07F08	14190	07B18	14192	07B1A	14194	07B1C	14196	07B1E	14198	07F18
14200	07A00	14202	07A02	14204	07A04	14206	07A06	14208	0780A	14210	07A10	14212	07A12	14214	07A14	14216	07A16	14218	0781A
14220	07A20	14222	07A22	14224	07A24	14226	07A26	14228	0782A	14230	07A30	14232	07A32	14234	07A34	14236	07A36	14238	0783A
14240	07A40	14242	07A42	14244	07A44	14246	07A46	14248	0784A	14250	07A50	14252	07A52	14254	07A54	14256	07A56	14258	0785A
14260	07A60	14262	07A62	14264	07A64	14266	07A66	14268	0786A	14270	07A70	14272	07A72	14274	07A74	14276	07A76	14278	0787A
14280	07A28	14282	07A2A	14284	07A2C	14286	07A2E	14288	07E28	14290	07A38	14292	07A3A	14294	07A3C	14296	07A3E	14298	07E38
14300	07B00	14302	07B02	14304	07B04	14306	07B06	14308	0790A	14310	07B10	14312	07B12	14314	07B14	14316	07B16	14318	0791A
14320	07B20	14322	07B22	14324	07B24	14326	07B26	14328	0792A	14330	07B30	14332	07B32	14334	07B34	14336	07B36	14338	0793A
14340	07B40	14342	07B42	14344	07B44	14346	07B46	14348	0794A	14350	07B50	14352	07B52	14354	07B54	14356	07B56	14358	0795A
14360	07B60	14362	07B62	14364	07B64	14366	07B66	14368	0796A	14370	07B70	14372	07B72	14374	07B74	14376	07B76	14378	0797A
14380	07B28	14382	07B2A	14384	07B2C	14386	07B2E	14388	07F28	14390	07B38	14392	07B3A	14394	07B3C	14396	07B3E	14398	07F38
14400	07C00	14402	07C02	14404	07C04	14406	07C06	14408	0780C	14410	07C10	14412	07C12	14414	07C14	14416	07C16	14418	0781C
14420	07C20	14422	07C22	14424	07C24	14426	07C26	14428	0782C	14430	07C30	14432	07C32	14434	07C34	14436	07C36	14438	0783C
14440	07C40	14442	07C42	14444	07C44	14446	07C46	14448	0784C	14450	07C50	14452	07C52	14454	07C54	14456	07C56	14458	0785C
14460	07C60	14462	07C62	14464	07C64	14466	07C66	14468	0786C	14470	07C70	14472	07C72	14474	07C74	14476	07C76	14478	0787C
14480	07A48	14482	07A4A	14484	07A4C	14486	07A4E	14488	07E48	14490	07A58	14492	07A5A	14494	07A5C	14496	07A5E	14498	07E58
14500	07D00	14502	07D02	14504	07D04	14506	07D06	14508	0790C	14510	07D10	14512	07D12	14514	07D14	14516	07D16	14518	0791C
14520	07D20	14522	07D22	14524	07D24	14526	07D26	14528	0792C	14530	07D30	14532	07D32	14534	07D34	14536	07D36	14538	0793C
14540	07D40	14542	07D42	14544	07D44	14546	07D46	14548	0794C	14550	07D50	14552	07D52	14554	07D54	14556	07D56	14558	0795C
14560	07D60	14562	07D62	14564	07D64	14566	07D66	14568	0796C	14570	07D70	14572	07D72	14574	07D74	14576	07D76	14578	0797C
14580	07B48	14582	07B4A	14584	07B4C	14586	07B4E	14588	07F48	14590	07B58	14592	07B5A	14594	07B5C	14596	07B5E	14598	07F58
14600	07E00	14602	07E02	14604	07E04	14606	07E06	14608	0780E	14610	07E10	14612	07E12	14614	07E14	14616	07E16	14618	0781E
14620	07E20	14622	07E22	14624	07E24	14626	07E26	14628	0782E	14630	07E30	14632	07E32	14634	07E34	14636	07E36	14638	0783E
14640	07E40	14642	07E42	14644	07E44	14646	07E46	14648	0784E	14650	07E50	14652	07E52	14654	07E54	14656	07E56	14658	0785E
14660	07E60	14662	07E62	14664	07E64	14666	07E66	14668	0786E	14670	07E70	14672	07E72	14674	07E74	14676	07E76	14678	0787E
14680	07A68	14682	07A6A	14684	07A6C	14686	07A6E	14688	07E68	14690	07A78	14692	07A7A	14694	07A7C	14696	07A7E	14698	07E78
14700	07F00	14702	07F02	14704	07F04	14706	07F06	14708	0790E	14710	07F10	14712	07F12	14714	07F14	14716	07F16	14718	0791E
14720	07F20	14722	07F22	14724	07F24	14726	07F26	14728	0792E	14730	07F30	14732	07F32	14734	07F34	14736	07F36	14738	0793E
14740	07F40	14742	07F42	14744	07F44	14746	07F46	14748	0794E	14750	07F50	14752	07F52	14754	07F54	14756	07F56	14758	0795E
14760	07F60	14762	07F62	14764	07F64	14766	07F66	14768	0796E	14770	07F70	14772	07F72	14774	07F74	14776	07F76	14778	0797E
14780	07B68	14782	07B6A	14784	07B6C	14786	07B6E	14788	07F68	14790	07B78	14792	07B7A	14794	07B7C	14796	07B7E	14798	07F78
14800	07C08	14802	07C0A	14804	07C0C	14806	07C0E	14808	07E0A	14810	07C18	14812	07C1A	14814	07C1C	14816	07C1E	14818	07E1A
14820	07C28	14822	07C2A	14824	07C2C	14826	07C2E	14828	07E2A	14830	07C38	14832	07C3A	14834	07C3C	14836	07C3E	14838	07E3A
14840	07C48	14841	07C4A	14844	07C4C	14846	07C4E	14848	07E4A	14850	07C58	14852	07C5A	14854	07C5C	14856	07C5E	14858	07E5A
14860	07C68	14862	07C6A	14864	07C6C	14866	07C6E	14868	07E6A	14870	07C78	14872	07C7A	14874	07C7C	14876	07C7E	14878	07E7A
14880	07E0C	14882	07E2C	14884	07E4C	14886	07E6C	14888	07E0E	14890	07E1C	14892	07E3C	14894	07E5C	14896	07E7C	14898	07E1E
14900	07D08	14902	07D0A	14904	07D0C	14906	07D0E	14908	07F0A	14910	07D18	14912	07D1A	14914	07D1C	14916	07D1E	14918	07F1A
14920	07D28	14922	07D2A	14924	07D2C	14926	07D2E	14928	07F2A	14930	07D38	14932	07D3A	14934	07D3C	14936	07D3E	14938	07F3A
14940	07D48	14942	07D4A	14944	07D4C	14946	07D4E	14948	07F4A	14950	07D58	14952	07D5A	14954	07D5C	14956	07D5E	14958	07F5A
14960	07D68	14962	07D6A	14964	07D6C	14966	07D6E	14968	07F6A	14970	07D78	14972	07D7A	14974	07D7C	14976	07D7E	14978	07F7A
14980	07F0C	14982	07F2C	14984	07F4C	14986	07F6C	14988	07F0E	14990	07F1C	14992	07F3C	14994	07F5C	14996	07F7C	14998	07F1E

1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360	1401	S/360
15000	07880	15002	07882	15004	07884	15006	07886	15008	07888	15010	07890	15012	07892	15014	07894	15016	07896	15018	07898
15020	078A0	15022	078A2	15024	078A4	15026	078A6	15028	078A8	15030	078B0	15032	078B2	15034	078B4	15036	078B6	15038	078B8
15040	078C0	15042	078C2	15044	078C4	15046	078C6	15048	078C8	15050	078D0	15052	078D2	15054	078D4	15056	078D6	15058	078D8
15060	078E0	15062	078E2	15064	078E4	15066	078E6	15068	078E8	15070	078F0	15072	078F2	15074	078F4	15076	078F6	15078	078F8
15080	07A88	15082	07A8A	15084	07A8C	15086	07A8E	15088	07E88	15090	07A98	15092	07A9A	15094	07A9C	15096	07A9E	15098	07E98
15100	07980	15102	07982	15104	07984	15106	07986	15108	07988	15110	07990	15112	07992	15114	07994	15116	07996	15118	07998
15120	079A0	15122	079A2	15124	079A4	15126	079A6	15128	079A8	15130	079B0	15132	079B2	15134	079B4	15136	079B6	15138	079B8
15140	079C0	15142	079C2	15144	079C4	15146	079C6	15148	079C8	15150	079D0	15152	079D2	15154	079D4	15156	079D6	15156	079D8
15160	079E0	15162	079E2	15164	079E4	15166	079E6	15168	079E8	15170	079F0	15172	079F2	15174	079F4	15176	079F6	15178	079F8
15180	07B88	15182	07B8A	15184	07B8C	15186	07B8E	15188	07F88	15190	07B98	15192	07B9A	15194	07B9C	15196	07B9E	15198	07F98
15200	07A80	15202	07A82	15204	07A84	15206	07A86	15208	0788A	15210	07A90	15212	07A92	15214	07A94	15216	07A96	15218	0789A
15220	07AA0	15222	07AA2	15224	07AA4	15226	07AA6	15228	078AA	15230	07AB0	15232	07AB2	15234	07AB4	15236	07AB6	15238	078BA
15240	07AC0	15242	07AC2	15244	07AC4	15246	07AC6	15248	078CA	15250	07AD0	15252	07AD2	15254	07AD4	15256	07AD6	15258	078DA
15260	07AE0	15262	07AE2	15264	07AE4	15266	07AE6	15268	078EA	15270	07AF0	15272	07AF2	15274	07AF4	15276	07AF6	15278	078FA
15280	07AA8	15282	07AAA	15284	07AAC	15286	07AAE	15288	07EA8	15290	07AB8	15292	07ABA	15294	07ABC	15296	07ABE	15298	07EB8
15300	07B80	15302	07B82	15304	07B84	15306	07B86	15308	0798A	15310	07B90	15312	07B92	15314	07B94	15316	07B96	15318	0799A
15320	07BA0	15322	07BA2	15324	07BA4	15326	07BA6	15328	079AA	15330	07BB0	15332	07BB2	15334	07BB4	15336	07BB6	15338	079BA
15340	07BC0	15342	07BC2	15344	07BC4	15346	07BC6	15348	079CA	15350	07BD0	15352	07BD2	15354	07BD4	15356	07BD6	15358	079DA
15360	07BE0	15362	07BE2	15364	07BE4	15366	07BE6	15368	079EA	15370	07BF0	15372	07BF2	15374	07BF4	15376	07BF6	15378	079FA
15380	07BA8	15382	07BAA	15384	07BAC	15386	07BAE	15388	07FA8	15390	07BB8	15392	07BBA	15394	07BBC	15396	07BBE	15398	07FB8
15400	07C80	15402	07C82	15404	07C84	15406	07C86	15408	0788C	15410	07C90	15412	07C92	15414	07C94	15416	07C96	15418	0789C
15420	07CA0	15422	07CA2	15424	07CA4	15426	07CA6	15428	078AC	15430	07CB0	15432	07CB2	15434	07CB4	15436	07CB6	15438	078BC
15440	07CC0	15442	07CC2	15444	07CC4	15446	07CC6	15448	078CC	15450	07CD0	15452	07CD2	15454	07CD4	15456	07CD6	15458	078DC
15460	07CE0	15462	07CE2	15464	07CE4	15466	07CE6	15468	078EC	15470	07CF0	15472	07CF2	15474	07CF4	15476	07CF6	15478	078FC
15480	07AC8	15482	07ACA	15484	07ACC	15486	07ACE	15488	07EC8	15490	07AD8	15492	07ADA	15494	07ADC	15496	07ADE	15498	07ED8
15500	07D80	15502	07D82	15504	07D84	15506	07D86	15508	0798C	15510	07D90	15512	07D92	15514	07D94	15516	07D96	15518	0799C
15520	07DA0	15522	07DA2	15524	07DA4	15526	07DA6	15528	079AC	15530	07DB0	15532	07DB2	15534	07DB4	15536	07DB6	15538	079BC
15540	07DC0	15542	07DC2	15544	07DC4	15546	07DC6	15548	079CC	15550	07DD0	15552	07DD2	15554	07DD4	15556	07DD6	15558	079DC
15560	07DE0	15562	07DE2	15564	07DE4	15566	07DE6	15568	079EC	15570	07DF0	15572	07DF2	15574	07DF4	15576	07DF6	15578	079FC
15580	07BC8	15582	07BCA	15584	07BCC	15586	07BCE	15588	07FC8	15590	07BD8	15592	07BDA	15594	07BDC	15596	07BDE	15598	07FD8
15600	07E80	15602	07E82	15604	07E84	15606	07E86	15608	0788E	15610	07E90	15612	07E92	15614	07E94	15616	07E96	15618	0789E
15620	07EA0	15622	07EA2	15624	07EA4	15626	07EA6	15628	078AE	15630	07EB0	15632	07EB2	15634	07EB4	15636	07EB6	15638	078BE
15640	07EC0	15642	07EC2	15644	07EC4	15646	07EC6	15648	078CE	15650	07ED0	15652	07ED2	15654	07ED4	15656	07ED6	15658	078DE
15660	07EE0	15662	07EE2	15664	07EE4	15666	07EE6	15668	078EE	15670	07EF0	15672	07EF2	15674	07EF4	15676	07EF6	15678	078FE
15680	07AE8	15682	07AEA	15684	07AEC	15686	07AEE	15688	07EE8	15690	07AF8	15692	07AFA	15694	07AFC	15696	07AFE	15698	07EF8
15700	07F80	15702	07F82	15704	07F84	15706	07F86	15708	0798E	15710	07F90	15712	07F92	15714	07F94	15716	07F96	15718	0799E
15720	07FA0	15722	07FA2	15724	07FA4	15726	07FA6	15728	079AE	15730	07FB0	15732	07FB2	15734	07FB4	15736	07FB6	15738	079BE
15740	07FC0	15742	07FC2	15744	07FC4	15746	07FC6	15748	079CE	15750	07FD0	15752	07FD2	15754	07FD4	15756	07FD6	15758	079DE
15760	07FE0	15762	07FE2	15764	07FE4	15766	07FE6	15768	079EE	15770	07FF0	15772	07FF2	15774	07FF4	15776	07FF6	15778	079FE
15780	07BE8	15782	07BEA	15784	07BEC	15786	07BEE	15788	07FE8	15790	07BF8	15792	07BFA	15794	07BFC	15796	07BFE	15798	07FF8
15800	07C88	15802	07C8A	15804	07C8C	15806	07C8E	15808	07E8A	15810	07C98	15812	07C9A	15814	07C9C	15816	07C9E	15818	07E9A
15820	07CA8	15822	07CAA	15824	07CAC	15826	07CAE	15828	07EAA	15830	07CB8	15832	07CBA	15834	07CBC	15836	07CBE	15838	07EBA
15840	07CC8	15842	07CCA	15844	07CCC	15846	07CCE	15848	07ECA	15850	07CD8	15852	07CDA	15854	07CDC	15856	07CDE	15858	07EDA
15860	07CE8	15862	07CEA	15864	07CEC	15866	07CEE	15868	07EEA	15870	07CF8	15872	07CFA	15874	07CFC	15876	07CFE	15878	07EFA
15880	07E8C	15882	07EAC	15884	07ECC	15886	07EEC	15888	07E8E	15890	07E9C	15892	07EBC	15894	07EDC	15896	07EFC	15898	07E9E
15900	07D88	15902	07D8A	15904	07D8C	15906	07D8E	15908	07F8A	15910	07D98	15912	07D9A	15914	07D9C	15916	07D9E	15918	07F9A
15920	07DA8	15922	07DAA	15924	07DAC	15926	07DAE	15928	07FAA	15930	07DB8	15932	07DBA	15934	07DBC	15936	07DBE	15938	07FBA
15940	07DC8	15942	07DCA	15944	07DCC	15946	07DCE	15948	07FCA	15950	07DD8	15952	07DDA	15954	07DDC	15956	07DDE	15958	07FDA
15960	07DE8	15962	07DEA	15964	07DEC	15966	07DEE	15968	07FEA	15970	07DF8	15972	07DFA	15974	07DFC	15976	07DFE	15978	07FFA
15980	07F8C	15982	07FAC	15984	07FCC	15986	07FEC	15988	07F8E	15990	07F9C	15992	07FBC	15994	07FDC	15996	07FFC	15998	07F9E

The total storage requirement of the Model 30 is the sum of the following:

1. Size of the user's DOS/360 supervisor

2. Size of the 1400 system to be simulated

3. Amount of storage reserved for partitions other than the one in which the Emulator Program is resident.

4. Amount of storage reserved for magnetic-tape I/O buffers (value assigned to the symbolic parameter BUFSIZE)

5. Size of the generated Emulator Program

Requirements (1) through (4) can be easily determined. The size of the generated Emulator Program, requirement (5), can be estimated by using the list of storage estimates in this appendix.

The storage estimates for parameters listed more than once should be included for each statement that is true. Parameters that do not appear in the list do not generate additional coding or have been included in the fixed overhead figure. Due to the vast number of possible ways to generate the Emulator Program, and since certain parameters share routines or constants with other parameters, the values obtained from the list should be used only as a guide. A "trial" generation is the only method of determining the exact amount of storage required. The following list contains the estimates of bytes required for the Emulator-Program generation:

Parameter	Bytes
Fixed Overhead	3400
CATALOG=YES	270
FETCH=YES	100
SYSIO=ipl (use Table 16)	

Example: If 1402 is to be simulated on a 2540 directly for card read and punch and the 1403 output to disk is to be simulated by assigning SYSLST to a 2311 extent, then SYSIO=003, or a storage requirement of 330 bytes as shown in Table 16.

Table 16. Model 30 SYSIO Storage Estimates

i p	l = 0	l = 1	l = 2	l = 3
00	0	260	490	330
01	260	520	750	600
02	550	800	1030	880
03	400	660	890	730
10	140	400	630	470
11	400	660	890	740
12	690	940	1170	1020
13	550	800	1030	880
20	300	520	720	600
21	530	730	1010	890
22	840	1090	1330	1170
23	700	950	1180	1030
30	180	440	670	520
31	450	700	930	780
32	730	990	1210	1060
33	580	840	1090	920

Parameter (con't)	Bytes
DISKDR=n (n≠0)	1770
DISKDR=130n	1770
DISKDR=1405	1405
DVOL=YES	700
SCAN=YES and SCAN360=NO	630
SCAN=YES and SCAN360=YES	880
TRACKOP=YES	300
TRACKOP=YES (1405) and OSINQRY≠YES	800
TRACKOP=YES (not 1405) and OSINQRY≠YES	2980-100n
(where n = no. of sectors)	
VERIFY=YES	300
SECTORS=n (not 1405)	124n
SECTORS=n (1405) and OSINQRY≠YES	200
TAPEDR=n (n≠0)	1150
TAPEMOD=MXEDPAR	600
TAPLDMD=YES	240
TAPERRS=LOG or LST	830
TAPERRS=LOGCHAR or LSTCHAR	700
RDR1400=1402	550
READRSS=YES	200

```
   COLBINR=YES                                   1230
RDR1400=1442                                       450
   READRSS=YES                                     100
   COLBINR=YES                                    1530

PCH1400=1402 and PCH360=2540                       640
   PUNCHSS=YES                                     100
   COLBINP=YES                                     840
PCH1400=1402 and PCH360=2520 or 1442               500
   PUNCHSS=YES                                     100
   COLBINP=YES                                     740
PCH1400=1442 and PCH360=2540                       660
   PUNCHSS=YES                                     100
   COLBINP=YES                                     480
PCH1400=1442 and PCH360=2520 or 1442               490
   PUNCHSS=YES                                      50
   COLBINP=YES                                     400
PCH1400=1444 and PCH360=2540                       490
   PUNCHSS=YES                                      50
   COLBINP=YES                                     480
PCH1400=1444 and PCH360=2520 or 1442               350
   PUNCHSS=YES                                      50
   COLBINP=YES                                     380

PTR1400=1403                                       580
PTR1400=1404                                      1100
PTR1400=1443                                       450
CARRCTL=YES                                        510
PPR=YES or COM                                     270
COL51=YES                                          100

ERROPNG=YES and OSDUMP=NO                           100
OSDUMP=YES and ERROPNG=NO                           130
OSDUMP=YES and ERROPNG=YES                          160
OSADDR=YES                                          50
OSALTER=YES                                         50
OSINQRY=YES                                        120
OSINQRY=YES and DISKDR=0                           2980
OSINQRY=YES and DISKDR≠0 (not 1405) 2980-100n
                  (where n = no. of sectors
                         and is less than 30)
OSINQRY=YES and DISKDR≠0(1405)                     2980
```

If any of the following are true add only the value which is largest for any of the true statements. If none are true, add nothing.

```
OSDISK=YES                        600
OSDUMP or ERROPNG=YES             570
OSTAPE=YES                        570
OSINQRY≠NO                        560
CATALOG=YES                       400
OSENTER=YES                       270
OSDSPLY≠NO                        180
HALTS=YES                         150
DVOL=YES                          100
FETCH=YES                         100
TIMER=YES                         150
```

Sample Worksheet for Computing Model 30 Storage Requirements

1. DOS supervisor size   _____

2. Size of 1400 system being
   simulated (1000 bytes per
   K)   _____

3. Amount of storage
   reserved for partitions
   other than the one in
   which the Emulator Pro-
   gram is resident.   _____

4. Tape I/O area (same as
   BUFSIZE value)   _____

5. Emulator-Program size   _____

Total main storage required   _____

The total storage requirement of the Model 40 is the sum of the following:

1. The constant 16,384 or the value assigned to RELOC times 1024, whichever is greater (beginning of 1400 memory)

2. Size of the 1400 system to be simulated

3. Amount of storage reserved for magnetic tape and disk I/O buffers (value of symbolic parameter BUFSIZE)

4. Amount of storage reserved for partitions above the partition for which this calculation is being done.

5. Size of the generated Emulator Program

Requirements (1) through (4) can easily be determined. The size of the generated Emulator Program, requirement (5), can be estimated by using the list of storage estimates in this appendix.

The storage estimates for parameters listed more than once in the list should be included for each statement that is true. Parameters that do not appear in the list do not generate additional coding or have been included in the fixed overhead figure. Due to the vast number of possible ways to generate the Emulator Program, and since certain parameters may share routines or constants with other parameters, the values obtained from the tables should be used only as a guide. A "trial" generation is the only method of determining the exact amount of storage required. The following list contains the estimates of bytes required for the Emulator-Program generation:

Parameter	Bytes
Fixed Overhead	6850
CATALOG=YES	790
FETCH=YES	200
EOJAADR=nnnnn	20
EOJBADR=nnnnn	20
HALTS=YES	600
TIMER=YES	150
SYSIO=ipl (use Table 17)	

Example: If 1402 is to be simulated on a 2540 directly for card read and punch and the 1403 output to disk is to be simulated by assigning SYSLST to a 2311 extent, then SYSIO=003, or a storage requirement of 330 bytes as shown in Table 17.

Table 17.   Model 40 SYSIO Storage Estimates

i p	l = 0	l = 1	l = 2	l = 3
00	0	260	490	330
01	260	520	750	600
02	550	800	1030	880
03	400	660	890	730
10	140	400	630	470
11	400	660	890	740
12	690	940	1170	1020
13	550	800	1030	880
20	300	520	720	600
21	530	780	1010	890
22	840	1090	1330	1170
23	700	950	1180	1030
30	180	440	670	520
31	450	700	930	780
32	730	990	1210	1060
33	580	840	1090	920

Parameters (con't)	Bytes
DISKDR=n (n≠0)	2360
DISKDR=130n	2360
DISKDR=1405	1045
DVOL=YES (for 1311 support)	1100
DVOL=YES (for 1405 or 1301 support)	860
SCAN=YES and SCAN360=NO	685
SCAN=YES and SCAN360=YES	1200
TRACKOP=YES	350
TRACKOP=YES(1405) and OSINQRY≠YES	800
TRACKOP=YES (not 1405)	
and OSINQRY≠YES	2980-100n
(where n = no. of sectors)	
VERIFY=YES	455
SECTORS=n (not 1405)	148n
SECTORS=n (1405) and OSINQRY≠YES	200
TAPEDR=n (n≠0)	1830
TAPEMOD=MXEDPAR	920
TAPLDMD=YES	250
TAPERRS=LOG	940
TAPERRS=LST	990
TAPERRS=LOGCHAR	700

```
TAPERRS=LSTCHAR                                    725        OSDISK=YES and/or OSTAPE=YES                    100
TAPEDR≠0 and/or DISKDR≠0                            350        OSADDR=YES                                      645
                                                              OSALTER=YES                                      35
RDR1400=1402                                        680        OSDSPLY=YES or nn                                80
  READRSS=YES                                       200        OSENTER=YES                                     125
  COLBINR=YES                                      1160        OSINQRY=YES                                     935
RDR1400=1442                                        630        OSINQRY=1400                                    815
  READRSS=YES                                       100        OSINQRY=YES and DISKDR=0                       2980
  COLBINR=YES                                      1440        OSINQRY=YES and DISKDR≠0 (not 1405) 2980-100n
                                                                               (where n = no. of sectors
PCH1400=1402 and PCH360=2540                        700                             and is less than 30)
  PUNCHSS=YES                                       100        OSINQRY=YES and DISKDR≠0 (1405)               2980
  COLBINP=YES                                       730        OSENTER=YES and/or OSINQRY≠NO                  505
PCH1400=1402 and PCH360=2520 or 1442                630        OSENTER=YES and/or OSALTER=YES and/or          515
  PUNCHSS=YES                                       130          OSADDR=YES and/or OSDSPLY=YES
  COLBINP=YES                                       630        RELOC≠0                                        300
PCH1400=1442 and PCH360=2540                        780
  PUNCHSS=YES                                       130
  COLBINP=YES                                       550        Sample Worksheet for Computing Model 40
PCH1400=1442 and PCH360=2520 or 1442                600        Storage Requirements
  PUNCHSS=YES                                        50
  COLBINP=YES                                       450        1.  Use the constant 16,384
PCH1400=1444 and PCH360=2540                        630            or the value assigned to
  PUNCHSS=YES                                        70            RELOC times 1024, which-
  COLBINP=YES                                       550            ever is greater            _____
PCH1400=1444 and PCH360=2520 or 1442                480
  PUNCHSS=YES                                        50        2.  Size of 1400 system being
  COLBINP=YES                                       420            simulated (1024 bytes per
                                                                  K)                          _____
PTR1400=1403                                        580
PTR1400=1443                                        480        3.  Tape I/O area (same as
PTR1400=1404                                       1200            BUFSIZE) value             _____
CARRCTL=YES                                         550
PFR=YES or COM                                      270        4.  Size of partitions above
COL51=YES                                           100            the partition for which
                                                                  this calculation is being
OSDUMP=YES and ERROPNG=NO                          1120            done                       _____
OSDUMP=YES and ERROPNG=YES                         1150
ERROPNG=YES and OSDUMP=NO                           1170        5.  Emulator-Program size       _____
OSDISK=YES                                          770
OSTAPE=YES                                          665        Total main storage required    _____
```

Two sample programs are provided with the 1401/1440/1460 Emulator Program for the Models 30 and 40.   One sample program is used with an Emulator Program generated for either a 1401 or a 1460 program.   The other sample program is used with an Emulator Program generated for a 1440 program.   The name used to catalog the sample programs in the Source Statement Library is EU3SPRGM for the Model 30, and EU4SPRGM for the Model 40.

The sample programs are designed to:

• Read data from the card reader.

• Print the data on the printer.

• Punch the data into cards on the card punch.

• Read the punched cards on the card reader.

• Print the data from the punched cards on the printer.

If the System/360 configuration includes a tape unit, the sample program also reads and writes on tape.

The sample programs consist of 1400 object programs and the source statements as well as the necessary DOS and Emulator Program control cards for execution. Execution may be accomplished either with a user-generated Emulator Program that has been cataloged in the Core-Image Library, or with the Emulator Program generated and cataloged as described in this appendix. The sample programs require a minimum system configuration of at least one 2311 disk

drive (the system residence volume), a card reader/punch, a printer, and a 1052 Printer-Keyboard.   Optionally, the configuration may include a tape unit.   The minimum storage capacity required for the sample program, using the Emulator Program generated as described in this section, is 24K for the Model 30, and 32K for the Model 40.

GENERATING THE SAMPLE EMULATOR PROGRAM

The input required to generate the sample Emulator Program for use with either the 1401 or 1460 sample program is shown in Figure 10.   In card 004, the user must specify EU30 for the Model 30, or EU40 for the Model 40.   All underscored parameters in control cards 004 through 008 must be tailored to the user's System/360 configuration.   Table 8 can be used to select model numbers for the punch, printer and reader in control cards 004 and 005.   Control cards 006, 007, and 008 should be omitted if the system configuration does not include a tape drive.   If the configuration includes a tape drive, "SYSnnn" in control cards 007 and 008 must specify valid DOS assigned programmer logical units.   If other than standard assignments are desired, a // ASSGN control card must be provided for TAPE1.   See paragraph on "Execution of Sample Program."

The input required to generate the sample Emulator Program for use with the 1440 sample program is shown in Figure 11. In card 004, the user must specify EU30 for the Model 30, or EU40 for the Model 40. All underscored parameters in control cards

```
┌─────────────────────────────────────────────────────────────────────────────────┐
│ // JOB    EUJOB1                                                           001    │
│ // OPTION LIST,DECK,XREF                                                   002    │
│ // EXEC   ASSEMBLY                                                         003    │
│ EUSAMPL  {EU30}  PCH1400=1402,PCH360=nnnn,PTR1400=1403,PTR360=nnnn,    X   004    │
│          {EU40}  RDR1400=1402,RDR360=nnnn,SIZ1400=4,OSINQRY=1400,      X   005    │
│                  BLKSIZ1=0081,BUFSIZE=0081,HALTS=YES,                  X   006    │
│                  TAPEDR=1,TAPE1=SYSnnn,TAPE2=SYSnnn,TAPE3=SYSnnn,      X   007    │
│                  TAPE4=SYSnnn,TAPE5=SYSnnn,TAPE6=SYSnnn                    008    │
│          END ACOMP01                                                       009    │
│ /*                                                                         010    │
│ /&                                                                         011    │
└─────────────────────────────────────────────────────────────────────────────────┘
```

•Figure 10.   Emulator Program Generation for 1401/1460 Sample Program

```
r----------------------------------------------------------------------------------------------1
| // JOB    EUJOB2                                                              001              |
| // OPTION LIST,DECK,XREF                                                      002              |
| // EXEC   ASSEMBLY                                                            003              |
|  EUSAMP2 {EU30}  PCH1400=1442,PCH360=nnnn,PTR1400=1443,PTR360=nnnn,      X    004              |
|          {EU40}  RDR1400=1442,RDR360=nnnn,SIZ1400=4,OSINQRY=1400,        X    005              |
|                  BLKSIZ1=0081,BUFSIZE=0081,HALTS=YES,                    X    006              |
|                  TAPEDR=1,TAPE1=SYSnnn,TAPE2=SYSnnn,TAPE3=SYSnnn,        X    007              |
|                  TAPE4=SYSnnn,TAPE5=SYSnnn,TAPE6=SYSnnn                        008             |
|              END ACOMP01                                                      009              |
|  /*                                                                           010             |
|  /&                                                                           011             |
L----------------------------------------------------------------------------------------------J
```

•Figure 11.   Emulator Program Generation for 1440 Sample Program

004 through 008 must be tailored to the
user's System/360 configuration. Table 8
can be used to select model numbers for the
punch, printer, and reader in control cards
004 and 005. Control cards 006, 007, and
008 should be omitted if the system config-
uration does not include a tape drive. If
the configuration includes a tape drive,
"SYSnnn" in control cards 007, and 008 must
specify valid DOS assigned programmer log-
ical units. If other than standard assign-
ments are desired, a // ASSGN control card
must be provided for TAPE1. See paragraph
on "Execution of the Sample Program."

GENERATING A USER-WRITTEN EMULATOR PROGRAM

If the sample programs are to be
executed with user-written Emulator Pro-
grams, several parameters must be included
in the users' Emulator Program generation.
For the 1401/1460 sample program, the pa-
rameters SIZ1400=4 (or larger) and OSINQRY=
1400 or YES must be included. For the 1440
sample program, the parameters SIZ1400=4
(or larger), PCH1400=1442, RDR1400=1442,
PTR1400=1443, and OSINQRY=1400 or YES must
be included. Optionally, if tape support
is desired, the necessary tape simulation
parameters must be included.

CATALOGING THE EMULATOR PROGRAM

The output of the Emulator-Program
generation is a punched card deck which
includes the necessary DOS control cards
and System/360 emulator object module to
catalog the Emulator Program in the Core-
Image Library. The emulator object module,
which is punched out following the /& DOS
control card, must be repositioned within
the card deck. The proper position for the
object module is marked by a punched card
"***REPLACE WITH OBJECT MODULE***". Be
sure to remove this card when repositioning
the object deck. (Refer to Figure 2 for an
example of the cards for the catalog run.)

EXECUTION OF THE SAMPLE PROGRAM

Because the Emulator Program is executed
using a 1400 object deck, it is necessary
to retrieve the sample 1400 object programs
and the DOS and Emulator Program control
cards contained in the source statement
library. Both an object deck and a source
statement deck are punched out for both
sample programs. Only that object deck for
which the Emulator Program was generated
should be retained (either the 1401/1460
object program or the 1440 object program).
The following control cards are required to
punch out and display the sample programs.

```
// JOB PUNCH AND DISPLAY SAMPLE PROGRAMS
// EXEC SSERV
   DSPCH Z.EU3SPRGM (for Model 30)
        or
   DSPCH Z.EU4SPRGM (for Model 40)
/*
/&
```

After obtaining the punch card output of
the sample programs, select the object deck
and control cards to be used with the
generated Emulator Program. The correct
card deck for the 1401/1460 sample program
is shown in Figure 12, while the correct
card deck for the 1440 sample program is
shown in Figure 13.

The DOS control cards provided with the
sample program are for use with either the
sample Emulator Program or with a user-
prepared Emulator Program. If the sample
program is for use with the sample Emulator
Program, perform the following operations.

• Discard the // ASSGN card if system
  configuration does not include tape, or
  if standard tape drive assignments were
  made during DOS system generation. If
  standard tape drive assignments were
  not made, complete the // ASSGN card as
  follows:

  // ASSGN SYSnnn,X'cuu'

where "nnn" is the programmer logical
unit assigned to the TAPE1=SYSnnn pa-
rameter during Emulator Program genera-
tion, and "cuu" is the device address
of the tape drive.

- Discard the // UPSI card.

- Key punch the name of the sample Emula-
tor Program, (EUSAMPL for the 1401/1460
program and EUSAMP2 for the 1440 pro-
gram) in the operand field of the
// EXEC card.

If the sample program is for use with a
user-prepared Emulator Program, perform the
following operations:

- Discard the // ASSGN card if the system
configuration does not include tape, or
if standard tape drive assignments were
made during DOS generation. If stan-
dard tape drive assignments were not
made, complete the // ASSGN card as
follows:

// ASSGN SYSnnn,X'cuu'

where "nnn" is the programmer logical
unit assigned to the TAPE1=SYSnnn pa-

rameter during Emulator Program genera-
tion, and "cuu" is the device address
of the tape drive.

- Discard the // UPSI card if the system
configuration does not include tape, or
if the user's Emulator Program includes
the parameter HALTS=YES.

- Key punch the user's Emulator Program
name in the operand field of the
// EXEC card.

Complete the preparations for executing the
sample program by placing a /* card at the
end of the sample program data cards. Do
not include a /& card since the /* card
only indicates the end of a data file and
not the end of job. The sample program
provides a /& card for end of job.

During execution, the operator must per-
form several operator service functions. A
copy of SYSLOG, which includes operator
responses to the operator service func-
tions, is shown in Figure 14. A copy of
the output data printed on SYSLST is shown
in Figure 15.

```
*                                                                              0001
*                                                                              0002
// JOB SAMPLE PROGRAM FOR THE EMULATOR PROGRAM   1401/1460                      0003
// ASSGN SYSNNN,X'CUU'        SPECIFY 1400 TAPE 1 IF SYSTEM HAS TAPE            0004
// UPSI 01                                                                      0005
// EXEC            INSERT NAME OF EMULATOR PROGRAM                              0006
// 1400 S1401,1,1,,,1,,T,00730                                                 0007
,008015,022026,030034,041,045,053L0721001026              /0991,001/001116I0 1 0008
L096116,105106,110110B101/I99,027A099029<027B001100 B026                       0009
,008015,022029,036040L071131,1041081001/080,001V00600611M217159,004174M BOOT0010
L070162,116117,124131,136140,1471481001M218M003S224005AV108005KM007220   LOAD0011
L069192,156170,174181,189001,0010011001M219000<000A223159B193219_B124    LOAD0012
L071224,197205,212216,218219,221224B100S219B174220_M124170B15607<   0011 LOAD0013
33353_/332_/_/_,001101_B680_M%T0913W_M%T0996W_.001001_B483B_B437A_1_M0 000410014
3865580280_2_C/08/04_B378U_M080W80_,408_A/11410_<408_A/13/04_B378_MW80 001510015
44154180_4_,438_A/11440_<438_A/13/06_C/04/06_B437/_B598_U%U1R_B540A_1_M002610016
49555080280_2_M080813_M%U1734W_B526L_B488_U%U1B_U%U1E_B502_U%U1M_U%U1R 003910017
55054_M%U1734R_B572L_B593K_B581_U%U1B_B550_M813180_4_B550_U%U1U_M/1418 004910018
604550_M180179_M/16102_4_M/18102_4_M/14180_M180179_4_M%T0_22W_.002002_B006010019
65951680_1_M080280_2_B709A_B662_H708_F1_/280_M912307_FT_2_/307_/_B000_F007110020
71024K_/280_M/02224_2_.999999_B723                                      008610021
81401_|                                                                 009210022
81564_ SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DO 009310023
87964S                            _IF SYSTEM HAS A TAPE MOUNT SCR 009410024
94363ATCH ON TAPE UNIT 1, TURN ON SSW B AND RESPOND START_|_IF NO TAPE 009610025
 0663, RESPOND START_|_PLACE CARDS THAT WERE PUNCHED IN READER AND RES 009810026
 6950POND START_|_SAMPLE PROGRAM COMPLETE_00_00_20_080_01_ _/*_/&      010010027
00608_/333080                                                          011110028
001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0029
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0030
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0031
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0032
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0033
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0034
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0035
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0036
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0037
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0038
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0039
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0040
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0041
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0042
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0043
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0044
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0045
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0046
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0047
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM     0048
*                                                                         0049
*                                                                         0050
*    USER MUST SUPPLY /*   CARD                                           0051
```

Figure 12. Control Cards, 1400 Object Deck, and Data for 1401/1460 Sample Program

```
*                                                                      0052
*                                                                      0053
// JOB 1440 SAMPLE PROGRAM FOR THE EMULATOR PROGRAM                    0054
// ASSGN SYSNNN,X'CUU'      SPECIFY 1400 TAPE 1 IF SYSTEM HAS TAPE     0055
// UPSI 01                                                             0056
// EXEC            INSERT NAME OF EMULATOR PROGRAM                      0057
// 1400 S1440,1.1,,1,1,,T,01222                                        0058
,008015,022029,036058L070086,043087,050075,083054S058B075|M%G1001RB001  BOOT0061
<054050<058043L071231,231040B075    B131S226B181227_M131177B16307<  0011 LOAD0062
L072195,188181,177170,200204,212219B075M007227M226000<000A230166B200226_LOAD0063
L071162,155154,147143,139138,223225B075,004181MM225M003S231005AV100005K_LOAD0064
L070130,124120,112108,226226,228228B108V0060061/073M%G1001R,001M224166 LOAD0065
41301_|                                                                000410066
00609_,333_B108                                                        000610067
49401_|                                                                000610068
00609_,414_B108                                                        000810069
57501_|                                                                000810070
00609_,495_B108                                                        000810071
72101_|                                                                001110072
72256_B/41_M%T0T24W_M%T0U08W_.001001_B892B_B827A_M%G1333R_M412680_M%Y1 001210073
77855601W_CV12V08_B754U_M412W80_,798_AV15800_<798_AV17V08_B754_B/72_M% 002010074
83356G1414G_MW80493_M%G1414G_,840_AV15842_<840_AV17V10_CV08V10_B839/_B 003110075
88957_40_U%U1R_B963A_M%G1333R_M412680_M%Y1601W_M412574_M%U1495W_B949L_B004110076
94655897_U%U1B_U%U1E_B925_U%U1M_U%U1R_B/72_M%G1414G_M%U1495R_B_07L_B_3 005010077
 01555K_B_16_U%U1B_B985_M574493_M%G1414G_B985_U%U1R_B/72_MV19415_M%G14 006010078
 565614G_B/72_MV21415_M%G1414G_B/72_M%G1414G_M%T0U56W_.002002_B/41_M%G 007010079
/12551333R_M412680_M%Y1601W_B/94A_B/09_H/71_F1_MT23691_FT_M%Y1601W_/69 007910080
/67551_B000_H/93_MV22493_M493492_B000_FK_/680_MU55624_M%Y1601W_.999999 008910081
S2263_BS15_    SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UN 009910082
S8564DER DOS                          _IF SYSTEM HAS A TAPE, MOU 010210083
T4962NT SCRATCH ON TAPE_ UNIT 1, TURN ON SSW B AND RESPOND START_|_IF 010410084
U1162NO TAPE RESPOND START_|_SAMPLE PROGRAM COMPLETE_PLACE CARDS JUST 010610085
U7350PCHED IN READER AND RESPOND START_|_00_00_20_080_01_/*_/&_      010810086
00605_B722                                                            011910087
001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0088
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0089
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0090
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0091
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0092
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0093
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0094
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0095
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0096
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0097
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0098
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0099
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0100
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0101
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0102
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0103
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0104
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0105
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0106
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM  0107
*                                                                      0108
*    USER MUST SUPPLY /* CARD                                          0109
```

Figure 13. Control Cards, 1400 Object Deck, and Data for 1440 Sample Program

```
BG // JOB   EUJOB1
BG // OPTION LIST,DECK,XREF
BG // EXEC   ASSEMBLY
BG EOJ EUJOB1
```

(a)   Generating the Emulator Program

```
BG // JOB CATALOG EUSAMPL
BF // OPTION CATAL
BG     PHASE EUSAMPL,+16384
BG     INCLUDE,(ACOMP00)
BG     PHASE EUSAMPLX,+20480
BG     INCLUDE,(ACOMP01)
BG     PHASE $$BEU4M1
BG     INCLUDE,($$BEU4M1)
BG     PHASE $$BEU4M2
BG     INCLUDE,($$BEU4M2)
BG     INCLUDE
BG     ENTRY EUENTRY
BG // EXEC   LNKEDT
BG EOJ CATALOG
```

(b)   Cataloging the Emulator Program

```
BG // JOB PUNCH AND DISPLAY SAMPLE PROGRAMS
BG // EXEC SSERV
BG EOJ PUNCH
```

(c)   Retrieving the Sample Program

```
BG // JOB SAMPLE PROGRAM FOR THE EMULATOR PROGRAM   1401/1460
BG // EXEC EUSAMPL
BG // 1400 S1401,1,1,,,1,,T,00730
BG EC30I   BEGIN S1401
BG IF SYSTEM HAS A TAPE MOUNT SCRATCH ON TAPE UNIT 1, TURN ON SSW B
AND RESPOND START
BG IF NO TAPE, RESPOND START
BG EC80I 1400 STATUS:  I=00373; A=00001; B=00001 INSTN BLOCK=.001001B
BG EC82I HALT
BG EC40D TYPE IN FUNCTION
BG switch
BG EC46I S-SW ON =
BG EC45D TYPE S-SW
BG b
BG EC46I S-SW ON = B
BG EC40D TYPE IN FUNCTION
BG start
BG PLACE CARDS THAT WERE PUNCHED IN READER AND RESPOND START
BG EC80I 1400 STATUS:  I=00658; A=00002; B=00002 INSTN BLOCK=.002002B
BG EC82I HALT
BG EC40D TYPE IN FUNCTION
BG start
BG EC31I EOJ      S1401
BG EOJ SAMPLE
```

(d)   Executing the Sample Program

Figure 14.   SYSLOG Output for EU40 Sample Program Running in the Background

```
                    SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DOS


001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
```


```
                    SAMPLE PROGRAM FOR THE 1401/1440/1460 EMULATOR PROGRAM UNDER DOS


001 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
002 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
003 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
004 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
005 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
006 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
007 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
008 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
009 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
010 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
011 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
012 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
013 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
014 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
015 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
016 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
017 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
018 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
019 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM
020 ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 1401/1440/1460 SAMPLE PROGRAM

SAMPLE PROGRAM COMPLETE
```

Figure 15.   SYSLST Output for Sample Program

APPENDIX J: EMULATOR PROGRAM CONSIDERATIONS FOR MODEL 25

This appendix describes the programming restrictions and considerations applicable to Model 25 users utilizing the 1401/1440/1460 Emulator Program for Compatibility Support/30 to execute 1401, 1440, or 1460 object programs under control of the Disk Operating System (DOS). Unless otherwise noted in this appendix, discussions throughout this publication of the 1401/1440/1460 Emulator Program for the Model 30 apply to the Model 25.

MINIMUM SYSTEM CONFIGURATION

The following features are required for a minimum Model 25 configuration for the 1401/1440/1460 Emulator Program under DOS:

- System/360 Model 25 with a 2025 Processing Unit containing at least 24,576 (24K) bytes of program storage.

- 1400 Series Compatibility Feature (#4440) and 1401/1440/1460 DOS Compatibility Feature (#4470).

- Storage Protection Feature (#7520) for Multiprogramming.

- One card reader (1442, 2501, 2520, or 2540) (see Note)

- One card punch (1442, 2520, 2540, or 2560 with 2540 Emulation or Control Feature) (see Note)

- One printer (1403, 1404, or 1443) (see Note)

- One 1052 Printer-Keyboard

- Integrated 2311 Attachment (#4598) for attaching up to four 2311 Model 1 Disk Storage Drives,... includes File Scan capability.

- One 2311 Model 1 Disk Storage Drive for DOS System Residence.

- Whatever system configuration is required for operation of the user's Disk Operating System.

Note: One 2400- or 3400-Series Magnetic Tape Unit (7- or 9-track) may be substituted for this device. (If SYSIPT, SYSPCH, and/or SYSLST are assigned to 7-track tape units, the Data Conversion Feature is required.)

INPUT/OUTPUT DEVICES

The Emulator Program under DOS can request I/O operations on the following System/360 devices:

- 1442 Card Read Punch
- 2501 Card Reader
- 2520 or 2540 Card Read Punches
- 1403 Printer
- 1404 Printer (for continuous-forms or cut-card operations)
- 1443 Printer
- 1052 Printer Keyboard (for operator communications)
- 2311 Model 1 Disk Storage Drive
- 2401, 2415, or 3420 Magnetic Tape Units

The input/output device correspondence between a 1401, 1440, or 1460, and a System/360 Model 25 is as shown in Table 1 with the differences shown in Table 18.

Table 18. Differences in Input/Output Device Correspondence for Model 25

1401/1440/1460 I/O Device	System/360 I/O Device
IBM 729, 7330, or 7335 Magnetic Tape Unit	IBM 2401 or 3420 (Model 3 or 5) Magnetic Tape Unit, or 2415 Magnetic Tape Unit and Control
IBM 1311 Disk Storage Drive or 1405 Model 1 Disk Storage*	IBM 2311 Model 1 Disk Storage Drive
*IBM 1301 Disk Storages, and 1405 Model 2 Disk Storages are not supported	

Table 19. Input/Output Feature Correspondence for Model 25

1401/1440/1460 I/O Feature	Model 25 I/O Feature
IBM 1402 Punch Feed Read and Control Unit (#5890 and #5895)	IBM Punch Feed Read (#5890); and Punch Feed Read Control (#5895) on Integrated 2540 Attachment (#4595) on the 2025, or on the 2821 Control Unit

IBM Column Binary Feature (#1990), or
 	
IBM Binary Transfer Feature (#1468), or IBM Card Image Features (#1531 and #9035)
	Standard for 2540 on Integrated 2540 Attachment (#4595)
	On Multiplexor Channel (#5248) or Selector Channel (#6960):
	  IBM Column Binary Feature (#1990 on the 2821 Control Unit if 2540, or
	  IBM Card Image Feature (#1531) if 2501 or 2520, or
	  IBM Card Image Feature (#1532) if 1442

IBM 1402 51-Column Interchangeable Read Feed (#4150) and Feed Adapter (#1013)	IBM 2540 51-Column Interchangeable Read Feed (#4151)*
IBM 1403 Preferred Character Set (#5523) and Adapter (#5524) IBM 1416 Interchangeable Train Cartridge equipped with Preferred Character Set Print Chain	IBM 1403 Multiple Character Set Feature** (#5110) on Model 2, Model 25 Adapter (#9725), and Interchangeable Chain Cartridge Adapter (#4740) when attached via Integrated 1403 Attachment (#4590) with Multiple Character Set Adapter (#5100) on the 2025; or IBM 1403 Universal Character Set** for Model 2 (#8641) or Model N1 (#8640) with prerequisite Interchangeable Train Cartridge Adapter or Interchangeable Train Cartridge, and appropriate Universal Character Set Adapter for the 2821 Control Unit
IBM Scan Disk (#6396)	Standard for 2311 on Integrated 2311 Attachment (#4595)

*When this feature is installed, reading speed is permanently reduced from 1000 cpm to 800 cpm.

**With this feature, printing speed is dependent upon the number of characters in the character set and whether unprintable characters are included in the print line.

ADDITIONAL FEATURES SUPPORTED

Additional System/360 features supported by the Emulator Program under DOS are:

• Timer Feature

• Either Multiplexor Channel (#5248), or Selector Channel (#6960). The two are mutually exclusive.

• Tape Switching Unit (2816)

• Universal Character Set

• Multiple Character Set

The input/output feature correspondence between a 1401, 1440, or 1460 system and a System/360 Model 25 is given in Table 19.

The Model 30 Emulator Program under DOS when run on the Model 25 provides support for all 1401, 1440, and 1460 standard operations and instructions, plus the following special features (for those items followed by an asterisk, refer to the Input/Output Feature Correspondence List):

Advanced Programming for the 1401
Bit Test
Column Binary*
Expanded Print Edit
51-Column Interchangeable Read Feed*
High-Low-Equal Compare
Multiply-Divide
Print Storage
Additional Print Control
Punch Feed Read
Space Suppression
Sense Switches

Scan Disk*
Direct Seek for the 1311
Track Record for the 1311
Binary Transfer for the 1460*
Indexing and Store Address Register for
  the 1460

RESTRICTIONS

In addition to those restrictions speci-
fied for the Model 30, the following pro-
gramming restrictions must be considered:

1. IBM 1301 Disk Storages, and IBM 1405
    Model 2 Disk Storages are not sup-
    ported due to Model 25 machine
    limitiations.

2. Floating Point Arithmetic, Sterling
    Arithmetic, and the Integrated Com-
    munications Attachment are mutually
    exclusive with the Emulator Program.

3. Long data fields in emulated 1400-
    program instructions impose the same
    restriction on the use of magnetic ink
    character (MICR) devices attached to
    the Model 25 as those attached to the
    Model 30. Examples of the delays
    involved with field lengths of various
    1400 instructions are given in Table
    20.

CONSIDERATIONS

In addition to those considerations
specified for the Model 30, the user must
take into account the following programming
considerations:

1. The channel configuration is limited
    to either one multiplexor or one sele-
    ctor channel.

2. Disk operations are limited to four
    2311 Disk Storages, and one of these
    must be reserved for DOS.

3. Column Binary and File Scan are stan-
    dard features on the Model 25.

4. The allowable values for the SIZ360
    parameter are 24, 32, and 48. This
    parameter always must be included in
    the Emulator Program generation for
    the Model 25 because the default value
    of 64 exceeds the maximum storage size
    of a Model 25.

5. The inverted print edit function is
    supported by the parameter EDITINV.
    The function and use of this parameter
    is identical to its use by the Model
    40 Emulator Program. (Refer to the
    section on "Description of Printer

Table 20. Example of Field Lengths Affect-
           ing MICR Devices on Model 25

1400 Instructions	Delay	
	<1MSEC	<4MSEC
Load Characters (LCA)	La=147	La=322
Move Characters (MLC)	La=127	La=544
Move Record (MRCM)	La=85	La=362
Move & Binary Encode (MBC)	La=80	La=346
Move & Binary Decode (MBD)	La=80	La=346
Zero & Add/Subtract	La=68	La=290
Move Right Characters to Wordmark or Group-mark (MRCWG)	La=85	La=362
Add/Subtract	La=73	La=311
Compare	Lb=93	Lb=396
Multiply	La=3 Lb=7	La=7 Lb=15
Divide	La=3 Lb=7	La=9 Lb=19
Move Characters & Suppress Zeros (MCS)	Ls=12 La=97	Ls=22 La=493
Edit	La=20 Lb=25	La=104 Lb=109

Notes:
1. La=Length of A-Field
2. Lb=Length of B-Field
3. Ls=Number of zeros to the left of
       the first significant digit.

Parameters" for a discussion of this
parameter.)

Note: While this parameter is not
required by the Model 30 Emulator Pro-
gram, an Emulator Program generated
for use on the Model 25 with this
parameter, may be executed on the
Model 30 without modification.

PERFORMANCE

The Model 30 Emulator Program, when
executed on the Model 25 with System/360
input/output devices having speeds equiva-
lent to 1400-series devices, performs
approximately one to one with 1401
equipment.

The Emulator Programs under DOS for the Models 30 and 40 provide a comprehensive set of messages that inform the operator of the status of the 1400-series programs, the status of the Emulator Programs, and the occurrence of errors or other conditions that require the operator's attention. Each message is prefixed by a message code in the form "ECnnx" where:

EC

 identifies the message as one issued by the Emulator Program.

nn

 is the message number.

x

 indicates the message type and is either a D or I, as follows:

D

 indicates that the operator must make a <u>decision</u> among the actions specified.

I

 designates a message issued for <u>information</u> or diagnostic purposes.

A number of the following messages indicate error conditions. In most cases, the error condition can be alleviated by following the proper corrective measure indicated by the "Operator Action" or "Programmer Action" associated with the message. If, after attempting all specified operator actions and programmer actions for the message, the problem still persists, the "problem determination action" should be performed. Upon completion of the "problem determination action", IBM can be called for assistance.

The Emulator program messages, their meaning, and the action required when they are issued follow. The operator should note that DOS also issues messages which should be dealt with according to current DOS System Reference Library publications.

The following group of messages, prefixed by the message code ECOnx, pertains to user-initiated procedures:

ECOID ENTER DATA

 Cause: The user has patched the invalid 1400 operation code wordmark R into the 1400 program being executed, and it has just been

encountered. This may be used as a branch indicator for 1400 programs.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator types a one-character, user-supplied code on the console. This response is placed into 1400 storage location 96. (Lower-case letters g, p, x and w are invalid responses). If there is a wordmark associated with the character, it must be preceded by an underscore ("_").

EC02I INTERIM STORAGE DUMP

Cause: A 1400 operation code of G with a wordmark has been encountered in the 1400 program and the user has specified ERROPNG=YES to request a 1400-style storage dump. If the user has specified an "S" for the test-mode option in the // 1400 control card, a System/360 main storage dump is also provided.

System Action: Storage is automatically dumped on SYSLST. At the completion of the dump, processing continues.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC03D MOUNT 51 COL READ FEED

Cause: The program has encountered a // 51 control card, which conditions it to read 51-column cards.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action:

 (1) Clear the reader.

 (2) Mount the 51-column Interchangeable Read Feed device on the 2540 Card Read Punch.

 (3) Load 51-column cards and ready the reader.

(4) Reply START or EOB.

The following messages, prefixed by the message code EC1nx, pertain to errors in operator responses:

EC10I INVALID RESPONSE

Cause: The format or content of the operator's reply to the previous message issued by the Emulator program is invalid.

Probable errors are:

- Misspelled or miskeyed response, or

- Incorrect sequence of responses, or

- An invalid response.

This is probably a user error.

System Action: Reissues previous message.

Programmer Action: Not applicable.

Operator Action: The operator must reply with a valid response to the reissued message.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.

2. Have the system log, printer output, and job stream available.

EC11I INVALID ADDRESS

Cause: An invalid address was entered for the ADDRESS, ALTER, DISPLAY, or ENTER operator service function.

Probable errors are:

- A non-decimal address, or

- The address exceeds the value specified in the SIZ1400 parameter of the emulator program, or

- The address exceeds five characters in length, or

- The operator reply is too long - the address field must begin

before position thirty of the reply.

This is probably a user error.

System Action: Message EC40D is reissued.

Programmer Action: The programmer should supply the operator with a valid 1400 address within the range specified by the SIZ1400 parameter of the emulator program.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.

2. Have the system log, printer output, and the job stream available.

Operator Action: The operator must reply with a valid 1400 decimal address.

EC12I INVALID DEVICE TYPE

Cause: If the previous message issued by the emulator program is:

1. EC43D - the operator attempted to assign a 1400 device to a programmer logical unit that is not a System/360 tape device.

2. EC44D - the operator attempted to assign a 1400 device to a programmer logical unit that is not a System/360 disk device.

Probable errors are:

- The programmer logical unit previously entered was the wrong unit (keying error on 1052), or

- Missing, misplaced, or incorrect ASSGN statements or cards in the job stream.

This is probably a user error.

System Action: Previous message is reissued.

Programmer Action: The programmer must be certain that the operator has the correct ASSGNs in the job stream and has the correct 1400 device-to-System/360 device assignments.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the Emulator assembly
   listing and the linkage editor
   output available.

2. Have the system log, printer
   output, and job stream
   available.

Operator Action: The operator must
reply with a programmer logical unit
that is assigned to a compatible
device type. After a valid
response, an information message
(type I) will be issued to confirm
the assignment, followed by the mes-
sage EC40D.

If the correct programmer logical
unit is not known:

1. Cancel the job.

2. Press the attention key and
   enter PAUSE BG F2 F1 to halt
   job control at end-of-job.

3. When '1I00A Ready For Communi-
   cations' appears on SYSLOG,
   respond with LISTIO
   {PROG|F1|F2} if output is
   desired on SYSLOG, or //LISTIO
   {PROG|F1|F2} if output is
   desired on SYSLST.

Submit the LISTIO listing to the
programmer and let him supply the
correct assignments.

EC13I   INVALID LOGICAL UNIT NUMBER

Cause: The operator's reply,
assigning a programmer logical unit
in response to the previous message
issued by the Emulator program, is
invalid. The assignment of pro-
grammer logical units must be within
the range of the programmer logical
units specified during system
generation of the Disk Operating
System.

This is probably a user error.

Programmer Action: Resubmit the job
with correct device assignments.

System Action: Previous message is
reissued.

Operator Action: Issue LISTIO to
check the assignment; then reply
with the valid programmer logical

unit. After a valid response, an
information message (type I) is
issued to confirm the assignment,
followed by the message EC40D.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
   listing and the linkage editor
   output available.

2. Have the system log, printer
   output, and job stream
   available.

EC14I   CONFLICTING LOGICAL UNIT ASSIGNMENT

Cause: The operator's reply,
assigning a 1400 device to a pro-
grammer logical unit in response to
the previous message issued by the
Emulator program, conflicts with a
previous assignment. For example,
an assignment of TAPE 2 to SYS011
cannot be made if TAPE 1 is current-
ly assigned to SYS011. In the case
of disk assignments, two 1400 disk
drives cannot be assigned to the
same part of quadrant of a System/
360 direct access storage device.
For example, SYS011, PART 1 cannot
be specified for DISK 0 if SYS011,
PART 1 is already specified for DISK
2.

This is probably a user error.

System Action: Previous message is
reissued.

Programmer Action: Execute LISTIO
and verify assignments. Correct
assignments and resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
   listing, and the linkage editor
   output available.

2. Have the system log, printer
   output, and job stream
   available.

Operator Action: The operator must
reply with a non-conflicting assign-
ment, or unassign the conflicting
1400 device using the "TAPE n" or
"DISK n" operator service function.
After a valid response, an informa-
tion message (type I) is issued to
confirm the assignment, followed by
message EC40D.

EC15I LOGICAL UNIT NOT ASSIGNED

Cause: The operator's reply, to assign a 1400 device to a programmer logical unit in response to the previous message issued by the Emulator program, is invalid. The reply attempted to assign a 1400 device to a programmer logical unit that is not assigned to a System/360 device or DVOL checking was attempted on a system unit not assigned to a System/360 device.

This is probably a user error.

System Action: If the message is not the result of DVOL checking, the previous message is reissued, or

If the message is the result of DVOL checking, message EC40D is issued.

Programmer Action: Execute LISTVTOC and check assignments. Then resubmit the job with the correct assignments, or

Insure that the assignments are correct before checking DVOL.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.

2. Have the system log, printer output, and job stream available.

Operator Action: If this message is not the result of DVOL checking, respond to the associated reissued message, or

If the message is the result of DVOL checking, respond to the associated EC40D message.

EC19I DVOL SERIAL NUMBER NEEDED

Cause: The operator used the DVOL DISKn operator service function to verify the volume serial number of a disk drive for which no volume serial number has been supplied, either on a // DVOL control card or by the DVOL DISKn=xxxxxx operator service function.

This is probably a user error.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: Supply the DVOL DISK=xxxxxx operator service function to initiate serial number checking when the volume serial number has not been previously supplied.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing, and the linkage editor output available.

2. Have the system log, printer output, and job stream available.

The following group of messages, prefixed by the message code EC2nx, pertains to errors detected during Emulator program initialization.

EC20I PARAMETER ERROR

Cause: The sum of the values specified for tape I/O buffers on all // TAPE control cards (parameter "nnnnn" exceeds the amount allocated by the BUFSIZE parameter at Emulator program generation.

This is probably a user error.

System Action: The value specified at program generation by the BLKSIZu parameter for each drive is assumed as a default and message EC29D is issued.

Programmer Action: Analyze the // TAPE control card(s) and the standard values (from the emulator program listing) and perform one of the following actions:

1. Provide a new // TAPE control card. The sum of this card's block size ('nnnnn') operand(s) plus the block size value(s) (either the standard value or a new value supplied by a previous // TAPE control card) of any 1400 tape drive not altered by this card must not exceed the amount allocated by the BUFSIZE parameter.

2. If multiple // TAPE control cards are used, place those cards decreasing tape buffer sizes before those increasing tape buffer sizes. The Emulator program compares the total

block size value against the
BUFSIZE parameter as it com-
pletes each // TAPE control
card, making it possible to
exceed the BUFSIZE value if the
cards are out of order.

3. Reassemble the Emulator program
    with the proper size parameters
    for BLKSIZu and BUFSIZE if they
    are not correct.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
    listing, and the linkage editor
    output available.

2. Have the system log, printer
    output, and job stream
    available.

Operator Action: Not applicable.

EC21I   INITIALIZATION ERROR

Cause: This error has been caused
by one of the following:

* An attempt to execute the Emula-
   tor program in a SPI environment
   has been initiated. SPI opera-
   tion is not supported, or

* Parameter "a" of the // 1400
   card has been specified as a D
   and the // FETCH card did not
   immediately follow the // 1400
   control card, or the // TAPE,
   // DVOL, // CCTL control cards
   if included, or

* A /* card (END OF DATA) has been
   encountered before the // 1400
   card.

This is probably a user error.

System Action: The job is
terminated.

Programmer Action: If the first
cause applies, reassemble the DOS
supervisor to support batched job
processing, or

If the second cause applies, arrange
the control cards so that the
//FETCH card immediately follows the
emulator control cards, or

If the third cause applies, place
the /* card after the //1400 card.

Resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
    listing, and the linkage editor
    output available.

2. Have the system log, printer
    output, and job stream
    available.

Operator Action: Not applicable.

EC29D   CONTROL CARD ERROR

Cause: The previous emulator JOB
control card read is incorrectly
formatted.

This is probably a user error.

System Action: The system waits for
an operator response.

Programmer Action: Correct the card
in error and resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
    listing and the linkage editor
    output available.

2. Have the system log, printer
    output, and job stream
    available.

Operator Action: The operator may
respond with a corrected control
card or with RETRY, START, END, or
CANCEL. RETRY or START will cause
the next card on SYSIPT to be read.
When correcting a CCTL error, two
control cards can be typed in via
the console if the first is a valid
CCTL1 control card.

The following group of messages, pre-
fixed by the message code EC3nx, pertains
to the interval timer:

EC30I   BEGIN name AT hh.mm.ss

Cause: This message is issued just
before 1400 program loading. "name"
is the program name from the // 1400
control card. If the user has spec-
ified TIMER=YES at Emulator system
generation, and the timer has been
turned on by the operator at IPL
time, the time of day ("hh" is the
hour, "mm" is the minute, and "ss"

is the second) is printed as the
second half of this message.

System Action: Processing begins.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC31I   EOJ name AT hh.mm.ss

Cause: A normal 1400 end-of-job
halt has been recognized (the user
specified at Emulator system genera-
tion "EOJAADR=nnnnn" and/or
"EOJBADR=nnnnn" or specified an EOJ
I-address in the // 1400 control
card). "name" is the program name
from the // 1400 control card. If
the user specified TIMER=YES at Emu-
lator program generation, and the
timer has been turned on by the
operator at IPL time, the time of
day ("hh" is the hour, "mm" is the
minute, and "ss" is the second) is
printed as the second half of this
message.

System Action: Control is released
automatically to DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC32I   CANCEL name AT hh.mm.ss

Cause: An abnormal 1400 end-of-job
has been recognized. "name" is the
program name from the // 1400 con-
trol card. If the user specified
TIMER=YES at Emulator program
generation, and the timer has been
turned on by the operator at IPL
time, the time of day ("hh" is the
hour, "mm" is the minute, and "ss"
is the second) is printed as the
second half of the message. If the
user specified OSDUMP=YES at Emula-
tor program generation, a 1400-style
storage dump is provided on SYSLST
unless a nodump option (a "1") is
specified in parameter "b" of the //
1400 control card. When a 1400-
style dump is provided, a System/360
main storage dump is also provided
if the testmode option in the //
1400 control card is specified as
"s".

System Action: Following the
storage dump, control is released to
DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC33I   END name AT hh.mm.ss

Cause: The operator has entered END
to request an end-of-job termination
of the 1400 program. "name" is the
program name from the // 1400 con-
trol card. If the user specified
TIMER=YES at Emulator program
generation and the timer has been
turned on by the operator, the time
of day ("hh" is the hour, "mm" is
the minute, and "ss" is the second)
is printed as the second half of the
message.

System Action: Job is terminated as
if the job had gone to a normal end
of job (no main storage dump); con-
trol is released automatically to
DOS job control.

Programmer Action: Not applicable.

Operator Action: Not applicable.

The following group of messages, pre-
fixed by the message code EC4nx, pertains
to the Operator Service Functions:

EC40D   TYPE IN FUNCTION

Cause: This message is issued when
Operator Service Functions have been
requested.

System Action: The system waits for
an operator response.

Programmer Action: Not applicable.

Operator Action: The operator
replies with one of the following:

ADDRESS
ALTER
CANCEL
DELETE
DISK
DISK n
DISPLAY
DSPLYV
DUMP
DVOL DISKn
DVOL DISKn=xxxxxx
END
ENTER
INQUIRY (or INQUIRY 1400)
INQUIRY phasename
NEWPAC
RESET
RETRY
START (or EOB)
STATUS

SWITCH
TAPE
TAPE n

See "Available Functions" in the "Operator Service Functions" section for a detailed description of response formats and the resulting functions.

EC41I HEX ADDRESS = xxxx

Cause: This message is displayed when the operator enters address "ADDRESS ddddd" (decimal) in response to message EC40D, where "ddddd" is a valid 1400 address for the generated system in the range of 1 to 15999. The "xxxx" is the hexadecimal equivalent of the entered decimal address.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: See message EC40D.

EC42D TYPE DATA

Cause: This message is displayed if the operator types the response ENTER to message EC40D. This allows the operator to change the contents of 1400 storage beginning at the 1400 address specified in the ENTER response.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The data is entered, using the special character "_" to indicate that a wordmark is associated with the next character typed. The data must be typed as uper- or lower-case characters as required. Special characters must be entered as indicated by Table 11. For example, if the operator replies _NNNN, four characters in upper case are entered at the address specified in the ENTER reply, with a wordmark associated with the first character.

EC43D/I TAPES n ON SYSnnn, MAX BLK=xxxxx DR
        cuu, n TR, yyy BPI

EC43D/I TAPE n ON SYSnnn, MAX BLK=xxxxx
        SYSnnn NOT ASSIGNED

EC43D/I TAPE n UNASSIGNED, MAX BLK=xxxxx

Cause: This message is displayed if the operator types the response "TAPE" or "TAPE n" to message EC40D. The response "TAPE" produces a display of all 1400 tape assignments and associated buffer block sizes for each 1400 drive. The response "TAPE n" indicates that the operator wishes to display or alter a 1400 tape assignment as specified by "n" (where "n" is digit from 1 to 6) on a programmer logical unit identified by SYSnnn. Message EC43D is issued to display the present status of the 1400 tape drive and allow the operator to retain or change the current assignment. Tape density (yyy BPI) is displayed only for 7-track tapes. If the tape drive is unassigned, the device address (DR cuu), the designation for 7- or 9-track tapes (n TR) and tape density (yyy BPI) are not displayed.

System Action: Message EC40D is issued following message EC43I. If message EC43D is issued, the system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: Message EC43I requires no response. Message EC43D requires one of the following responses:

• START (or EOB) to retain the present assignment.

• "SYSnnn" to change an assignment, where "SYSnnn" is the programmer logical unit (SYS000-SYS221) to which the simulated 1400 tape drive is to be assigned.

  Note: A programmer logical unit currently assigned to a 1400 tape drive must first be unassigned from that device before reassignment can be made, or message EC14I is issued.

• "UA" to unassign the simulated 1400 tape drive from a programmer logical unit.

EC44D/I DISK n ON SYSnnn, PART n DR cuu

EC44D/I DISK n ON SYSnnn, SYSnnn NOT
        ASSIGNED

EC44D/I DISK n UNASSIGNED

Cause: This message is displayed if the operator types the response "DISK" or "DISK n" to message EC40D. The response "DISK" to message EC40D

indicates that the operator wishes a display of all 1400 disk assignments and associated disk part for each 1400 drive. The response "DISK n" to message EC40D indicates that the operator wishes to display or alter a specific 1400 disk assignment as indicated by the digit 0, 2, 4, 6, or 8 typed after DISK. Message EC44D is issued to display the present status of the 1400 disk drive and allows the operator to retain or change the current assignment.

System Action: Message EC40D is issued following message EC44I. For message EC44D the system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: Message EC44I requires no response. Message EC44D requires that the operator reply with one of the following responses:

- "START (or EOB)" to retain the

- "SYSnnn,x" to change an assignment, where "SYSnnn" is the programmer logical unit (SYS000 - SYS221) to which the simulated 1400 disk drive is to be assigned, and "x" is a 0 or 1 to indicate which half of the new 2311 disk unit, or a 0, 1, 2, or 3 to indicate which quadrant of the new 2314 disk unit is to be used.

    Note: A programmer logical unit currently assigned to a 1400 disk drive must first be unassigned from that device before reassignment can be made, or message EC14I is issued.

- "UA" to unassign the simulated 1400 disk drive from a programmer logical unit.

EC45D TYPE S-SW

Cause: The operator requested the SWITCH operator service function and HALTS=YES was specified at Emulator program generation. A display of the current sense switches, message EC46I, will precede this message. Note that sense switch A is not displayed or altered by this function.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator replies by typing in the desired switch or switches. If all sense switches are to be turned off, a blank (space bar) followed by EOB is entered. To retain present status of sense switches, the operator replies "START" (or EOB). Message EC46I is typed out following the user's response to confirm the sense-switch settings.

EC46I S-SW ON = xxxxxx

Cause: This message displays the current sense-switch status. The message text is followed by a listing ("xxxxxx") of the sense switches that are on. This message follows the reply SWITCH to message EC40D to inform the operator of the current sense-switch status, and then, is issued again to confirm the operator response to EC45D.

System Action: Message EC40D or EC45D is issued.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC47I 1400 ADDRESS LIMIT, FUNCTION ENDED

Cause: This message is displayed only following the use of the ENTER or DISPLAY operator service function. The message indicates that the maximum generated 1400 storage address has been exceeded during execution of the requested function.

System Action: The system will respond with the appropriate action as follows:

- If the message is in response to the ENTER function, the entered data is ignored and message EC40D is displayed.

- If the message is in response to the DISPLAY function, only those positions up to the maximum 1400 storage address are displayed, followed by message EC40D.

Programmer Action: The programmer must ensure that the ENTER or DISPLAY requests do not exceed the maximum 1400 address.

Operator Action: The operator should first verify the previous ENTER or DISPLAY request. If the response was incorrect, the correct command should be entered in response to message EC40D, or

If the request was correct, and is essential for satisfactory job completion, the job can be terminated by replying CANCEL or END to message EC40D, or

If the request was correct but unnecessary for successful job completion, the operator can respond START to message EC40D to resume emulator processing.

EC48I   FUNCTION NOT GENERATED

Cause: This message indicates that the operator requested an operator service function which was not specified for this Emulator program generation.

This is probably a user error.

System Action: Message EC40D is issued.

Programmer Action: If the desired operator service function is not present in the Emulator program, reassemble the Emulator program to generate the desired function and catalog to the core image library, or

Correct any assembly errors, and reassemble and recatalog the Emulator program, or

If any new operator services do not function on a recently cataloged Emulator program, check the linkage editor diagnostics for errors which would have prevented the new program from being cataloged. The old Emulator program may have been used. Correct the diagnostics, reassemble and recatalog the Emulator program.

If the problem recurs, do the following to complete your problem determination action:

1.   Have the emulator assembly listing, and the linkage editor output available.

2.   Have the system log, printer output, and job stream available.

Operator Action: The operator must reply with one of the supported operator service functions.

EC49D   INVALID 1400 CHARACTER DETECTED ON
         xxxxxxxx

Cause: This message is displayed when the Emulator program for the Model 40 encounters an invalid 1400 character. "xxxxxxxx" identifies the source of the error condition (DISK, TAPE, READER, or ENTERING).

If the error occurred while the operator was using the ENTER operator service function or during the execution of a Read Console Printer instruction, messages EC46I and EC42D are issued.

If the source of the error is disk, tape, or card reader, message EC49D is issued.

If the error occurred on the reader, the card in error is typed.

This is probably a user error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: The operator may respond with CANCEL or END and terminate the job regardless of the source of the error.   In addition, the following are valid operator responses:

• For disk -- Enter Process to continue with record that contains the invalid character.

• For tape -- Enter BYPASS to skip the record with the invalid character.

   Enter PROCESS to continue with the record that contains the invalid character.

   Enter DISPLAY to display the record in error (if TAPERRS is not equal to NO).

• For Reader -- Enter PROCESS to continue with the record that contains the invalid character, or

   Perform the RETRY operator service function.

• For ENTERING -- reenter data following message EC42D

The following group of messages, prefixed by the message code EC5nx, pertains to unit-record equipment and are displayed only during 2540 punch operations, or when stacker selection, or when simulating 1442

read punch updating on either a 2520 or 2540. The most common causes for these messages are:

- Card jams

- Double punching

- Multiple punches in rows 2 through 7

EC50D   PUNCH ERROR

Cause: This message indicates that a 2540 or 2520 equipment check has occurred. The last card in the stacker is the card in error. This message is always preceded by a standard DOS operator intervention message.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: If error occurred on a 2520:

1. Remove last card from stacker one:

- If performing punch-only operation, discard card.

- If performing combined read and punch operation, reconstruct prepunching.

2. Remove cards from hopper.

3. Press NPRO key -- two cards enter stacker one.

4. Replace reconstructed card (if performing combined read and punch operation), two cards that were run out, and cards removed from the hopper in the hopper.

5. Ready the 2520.

6. Reply with START or EOB.

If error occurred on a 2540:

1. Remove cards from hopper.

2. Press and hold start key to clear punch feed.

3. Remove last four cards from stacker P1. Last two cards are blank; first two should be discarded.

4. Replace blank cards and cards removed from hopper in hopper.

5. Ready the punch.

6. Reply with START or EOB.

If the problem recurs, do the following to complete your problem determination action:

1. Execute the ROD command and retain the listing.

2. Execute EREP and retain the output.

EC51D   PFR PUNCH ERROR

Cause: A punching error was detected during a PFR operation. The card in error is in stacker P1. The punch-check station may also contain an incorrectly punched card.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action:

1. Remove cards from punch hopper.

2. If the end-of-file light is on, press the stop key to reset the end-of-file circuits.

3. Press and hold the punch start key to clear the punch feed.

4. Remove the last four cards from stacker P1. The last two cards are correct; prepunching in the first two must be reconstructed.

5. Place the two reconstructed cards, the two correct cards, and the cards removed from the hopper, in that sequence, in the hopper.

6. Ready the punch.

7. Reply with START or EOB.

If the problem recurs, execute EREP and retain the listing to complete your problem determination action.

EC52D   PFR READ ERROR

Cause: A reading error was detected during PFR operation. The card in error is at the punch station. The

punch-check station may also contain
an incorrectly punched card.

System Action: The system waits for
an operator response.

Programmer Action: Not applicable.

Operator Action:

1. Remove cards from punch hopper.

2. If end-of-file light is on,
    press stop key to reset end-of-
    file circuits.

3. Press and hold punch start key
    to clear punch feed.

4. Remove last three cards from
    stacker P1.

5. The first of these three cards
    may have to be reconstructed
    because it has been read and
    punched but not punch checked.

6. The second card caused the
    validity check. Correct it as
    necessary.

7. Place these three cards, after
    any necessary corrections, in
    front of the cards removed from
    the hopper. Place this deck in
    the hopper.

8. Ready the punch.

9. Reply with START or EOB.

If the problem recurs, execute EREP
and retain the listing to complete
your problem determination action.

EC58D   1404 aaaaaaaaaa CCSW=yyxxxx SNS=xx

Cause: This message indicates that
a 1404 printer error occurred. The
type of error is identified by
"aaaaaaaaaa", where "aaaaaaaaaa" is
one of the following:

    EQUIP CHK (equipment check)
    INTERV REQ (intervention required)
    BUSOUT CHK (busout check)
    COMM REJCT (command reject)
    DATA CHECK (data check)

The hexadecimal representation of
the channel command word (CCW) com-
mand code is displayed by "yy" in
the CCSW while the hexadecimal
representation of the status bytes
from the CCB is given by "xxxx".
The sense bytes are displayed by
SNS=xx.

System Action: The system waits for
an operator response.

Programmer Action: The programmer
must supply the operator with guide-
lines to handle each of the five
types of error conditions.

Operator Action: The operator must
type in one of the following
replies:

• SKIP 1 -- which causes the
  printer to skip 1 and retry the
  operation.

• IGNORE -- the printer command
  causing the error is ignored and
  processing continues.

• RETRY -- the printer command is
  retried.

• SERVICE -- full operator ser-
  vices are made available, and
  message EC40D is issued.

If the problem recurs, execute EREP
and retain the listing, and have the
system log and printer output avail-
able to complete your problem deter-
mination action.

EC59D   REPLY AGAIN TO 1404 MESSAGE

Cause: This message is displayed
after the operator replied SERVICE
or with an invalid response to mes-
sage EC58D and additional corrective
action is required.

System Action: The system waits for
an operator response.

Programmer Action: Not applicable.

Operator Action: The user must
again reply SKIP 1, RETRY, IGNORE,
or SERVICE.

If the problem recurs, execute EREP
and retain the listing, and have the
system log and printer output avail-
able to complete your problem deter-
mination action.

The following group of messages, pre-
fixed by the message code EC6nx, pertains
to magnetic-tape devices:

EC60I   MESSAGE RESPONSES ARE B=BYPASS,
         P=PROCESS

Cause: This message is displayed to
indicate that a tape error has
occurred and that the 1400 Tape
Error Recovery routine, as specified
at Emulator program generation, has

been entered. This message is dis-
played only if TAPERRS=LST or LOG
was specified during program
generation.

System Action: Message EC62D is
displayed.

Programmer Action: Not applicable.

Operator Action: One of the options
(B=BYPASS or P=PROCESS) indicated in
this message must be given in
response to message EC62D.

EC61I   MESSAGE RESPONSES ARE B=BYPASS, P=
         PROCESS, H=HEX-DISPLAY

Cause: This message is displayed to
indicate that a tape error has
occurred and that the 1400 Tape
Error Recovery routine, as specified
at Emulator Program generation, has
been entered. This message is
issued only if TAPERRS=LSTCHAR or
LOGCHAR was specified during program
generation.

System Action: Message EC62D is
displayed.

Programmer Action: Not applicable.

Operator action: One of the options
(B=BYPASS, H=HEX-DISPLAY, or P=
PROCESS) indicated in this message
must be given in response to message
EC62D.

EC62D   TAPE BLOCK IN ERROR

Cause: This message is displayed to
indicate that a tape error has
occurred, the operator has responded
to the standard DOS-issued error
message with IGNORE, and the Tape
Error Recovery routine has been
entered.

System Action: The tape block in
error is printed on SYSLOG or SYSLST
as specified by the TAPERRS paramet-
er. Non-BCD characters appear as
asterisks (*). If an invalid
response is made, either message
EC60I or EC61I is issued, followed
by a reissued message EC62D. The
system then waits for an operator
response.

Programmer Action: Set up operator
procedures to handle this error.

Operator Action: The available
operator responses to this message
are one-letter options (B, P, or H)
indicated in messages EC60I and
EC61I, one of which is issued just

prior to the display of this mes-
sage. The functions of the one-
letter options are:

B
     The tape block in error is
     bypassed and is not given to
     the 1400 program. Processing
     continues with the next block.
     The 1400 program is not infor-
     med that a block has been
     bypassed.

P
     The tape block in error is
     passed to the 1400 program as
     is.

H
     The tape block in error is dis-
     played in hexadecimal format
     exactly as it was read into
     System/360 main storage, except
     that parity has been corrected
     by the channel. After this
     response, the operator again
     has the option of bypassing or
     processing (B or P).

EC63I   TAPE n BLOCK SIZE EXCEEDED

Cause: A record block, either read
or written on 1400 tape unit "n"
exceeds the maximum block size spec-
ified by the user during Emulator
program generation ("BLKSIZEu=
nnnnn"), as modified by the // TAPE
control card. This message is
always preceded by message EC80I
(status of 1400 registers and cur-
rent instruction). A 1400-style
storage dump is provided on SYSLST
unless a no-dump option (a "1") was
specified in parameter "b" in the
// 1400 control card. If the user
has specified an "S" for the test-
mode option in the // 1400 control
card, a System/360 main storage dump
also is provided.

This is probably a user error.

System Action: The job is
terminated.

Programmer Action: Check the 1400
program for the maximum block size
required for execution. If the
total buffer size exceeds that spec-
ified in the BUFSIZE parameter,
reassemble the Emulator program
increasing the size of the BUFSIZE
parameter, or

If the total buffer size does not
exceed the size indicated by BUF-
SIZE, use a // TAPE card to redis-
tribute the individual buffer space.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
   listing, and the linkage editor
   output available.

2. Have the system log, printer
   output, and job stream
   available.

Operator Action: Not applicable.

EC67I   MOUNT NEW TAPE ON SYSIPT

Cause: An end-of-volume indication
(tape mark) has been detected by the
tape device assigned to SYSIPT
before end of file (/*) was reached.

System Action: A standard DOS
operator intervention message is
issued.

Programmer Action: Not applicable.

Operator Action: Mount the next
tape volume on SYSIPT and reply
START or EOB.

EC68I   MOUNT NEW TAPE ON SYSPCH

Cause: An end-of-volume indication
has been detected by the tape drive
assigned to SYSPCH.

System Action: A standard DOS
operator intervention message is
issued.

Programmer Action: Not applicable.

Operator Action: Mount a new tape
volume on SYSPCH and reply START or
EOB.

EC69I   MOUNT NEW TAPE ON SYSLST

Cause: An end-of-volume indication
has been detected by the tape drive
assigned to SYSLST.

System Action: A standard DOS
operator intervention message is
issued.

Programmer Action: Not applicable.

Operator Action: Mount a new tape
volume on SYSLST and reply START or
EOB.

The following group of messages, pre-
fixed by the message code EC7nx, pertains
to disk devices:

EC70I   DISK PACK NOT FORMATTED

Cause: This message indicates that
the disk pack is not initialized to
the proper 1400 format.

This is probably a user error.

System Action: The job is canceled.

Programmer Action: Initialize the
disk pack using the DOS Initialize
Disk utility program, then run the
Clear Disk utility to format the
tracks. The parameters of the clear
disk utility depend on the device
type being emulated.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the job stream, log sheet,
   and printer output available.

2. Have the control cards for the
   Initialize Disk and Clear Disk
   utility programs.

Operator Action: Check that the
correct pack is mounted.

EC71D   DISK ERROR DETECTED. SECTOR ADDRESS
        = dxxxxx. VALID DATA FOLLOWS:

Cause: This message indicates that
an error has been detected during
disk verification (optionally speci-
fied). The drive number and the
beginning sector address is indi-
cated. This is followed by one or
more lines of 100 characters that
represent the data that should have
been recorded on disk. This data
may be used in a subsequent opera-
tion to rebuild the record affected.
The 1400 program is not informed of
the disk error.

This is probably a hardware error.

System Action: The system waits for
an operator response.

Programmer Action: Reinitialize the
disk pack or execute CLEAR DISK and
resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
   listing, and the linkage editor
   output available.

2. Have the system log, printer
   output, and job stream
   available.

<u>Operator Action</u>: The operator may
type the response START to indicate
that the record in error is to be
accepted as is and that processing
is to continue. The operator may
also type the response END or CANCEL
to cause the job to be terminated.

<u>EC73I</u> <u>SYSLST EXTENT EXHAUSTED</u>

<u>Cause</u>: The extent limit assigned to
SYSLST (disk extent) has been
exhausted.

This is probably a user error.

<u>System Action</u>: Message EC32I is
issued and the job is canceled.

<u>Programmer Action</u>: Increase the
extent for the required system unit
and resubmit the job.

<u>Operator Action</u>: Not applicable.

<u>EC74I</u> <u>SYSPCH EXTENT EXHAUSTED</u>

<u>Cause</u>: The extent limit assigned to
SYSPCH (disk extent) has been
exhausted.

This is probably a user error.

<u>System Action</u>: Message EC32I is
issued and the job is canceled.

<u>Programmer Action</u>: Increase the
extent for the required system unit
and resubmit the job.

<u>Operator Action</u>: Not applicable.

<u>EC75I</u> <u>WRONG PACK, MOUNT xxxxxx DISK n ON</u>
<u>DR cuu</u>

<u>Cause</u>: This message is displayed if
the Emulator program is accessing
the wrong disk pack, where "xxxxxx"

is the volume serial number (EBCDIC
characters) of the correct disk
pack, "n" is the 1400 disk drive
number (0, 2, 4, 6, or 8), and "cuu"
is the hexadecimal channel and
device address of the disk drive on
which the disk pack is mounted. The
volume serial number displayed is
initially established by a // DVOL
control card or by the operator
using the DVOL DISKn=xxxxxx operator
service function.

This is probably a user error.

<u>System Action</u>: Message EC40D is
issued.

<u>Programmer Action</u>: Check that the
assignments are correct and that the
correct packs have been mounted.

<u>Operator Action</u>: This message indi-
cates that the operator must either
take corrective action or terminate
the 1400 program. The operator can
use the DSPLYV operator service
function to display the volume seri-
al number of the pack currently
mounted on this device to assist in
the evaluation of the corrective
action. However, before further
processing can be continued, the
operator must perform one of the
following corrective actions:

- Mount the correct disk pack on
  the specified drive and reply
  with the NEWPAC function, <u>or</u>

- Change the disk drive configura-
  tion using the DISK n function,
  <u>or</u>

- Change the volume serial number
  against which the pack is to be
  verified, with the DVOL DISKn=
  xxxxxx function, where "xxxxxx"
  is the volume serial number of
  the proper pack, <u>or</u>

• Discontinue volume serial number checking for this 1400 drive using the DELETE function. This function must be used with caution when performing write operations.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and the linkage editor output available.

2. Have the log sheet, printer output, and job stream available.

EC76I   DISK n ON cuu SERIAL NO.=xxxxxx

Cause: This message is displayed in response to the operator's selection of the DSPLYV operator service function following the display of message EC75I. "n" is the 1400 disk drive number (0, 2, 4, 6, or 8), "cuu" is the hexadecimal channel and device address of disk drive "n", and "xxxxxx" is the volume serial number (EBCDIC characters) of the disk pack.

System Action: Message EC40D is issued.

Programmer Action: Not applicable.

Operator Action: The operator must respond with one of the valid corrective actions described under message EC75I.

EC77D   SCAN ERROR DETECTED

Cause: A 1400 disk scan was not successfully completed. An end of cylinder condition has not yet been detected.

This is probably a hardware error.

System Action: The system waits for an operator response.

Programmer Action: Not applicable.

Operator Action: If the user wishes to retry the scan operation, he types in the word START. If the user does not wish to retry the operation, he may enter END or CANCEL to terminate the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the log sheet, printer output, and job stream available.

2. Obtain a 1400 dump and a 360 system dump before the job is canceled.

3. Issue the ROD command, execute EREP, and have the output available.

EC78D   WRONG PACK, MOUNT xxxxx DISK n ON DR cuu

EC78I   1301/1405 DRIVE xxx SERIAL NO.=xxxxxx

Cause: These messages are displayed if the Emulator program is accessing the wrong 1301 or 1405 disk pack, where message EC78I displays the volume serial number of the physical pack which is being accessed. Message EC78D always follows and identifies the volume serial number (MOUNT xxxxx) which was requested on the // DVOL control card for this drive. DISK n indicates which part of the 1301 or 1405 drive is being simulated, while DR cuu indicates the hexadecimal channel and device address of the System/360 device being accessed.

This is probably a user error.

System Action: The system waits for an operator response.

Programmer Action: Correct the // DVOL card or supply the correct volumes and resubmit the job.

Operator Action: The operator must perform one of the following corrective actions:

• Mount the correct disk pack on the specified drive and reply with the NEWPAC functions.

• Abnormally terminate the job using the END or CANCEL operator service functions. The job can be resubmitted after correcting the volume serial number entries for the simulated 1301 or 1405 disk pack on the // DVOL control card.

The following group of messages, prefixed by the message code EC8nx or EC9nx, pertains to program messages:

Appendix K: Emulator Program Messages   125

EC80I   1400_STATUS_I=nnnnn_A=nnnnn_B=nnnnn
       INSTN_BLOCK=xxxxxxxx

Cause: A 1400 halt or error has
been encountered or the operator has
requested the STATUS or ALTER opera-
tor service functions. This is a
display of the 1400 storage address
registers and eight characters from
1400 storage within an eight-byte
range of where the I-STAR is point-
ing. Certain 1400 special charac-
ters (such as the record mark) are
not printed on the model 30. When
message EC80I is displayed after a
1400 program error, the A-STAR and
B-STAR values may be invalid because
of storage wraparound.

System Action: Variable, depending
on program status as indicated in
associated message.

Programmer Action: Not applicable.

Operator Action: Reply to asso-
ciated message.

EC81I   HALT

Cause: A 1400 halt other than end
of job (as specified in "EOJAADR=
nnnnn" and/or "EOJBADR=nnnnn" at
Emulator program generation or as
specified for an EOJ I-address in
the // 1400 control card) has
occurred and the user has not speci-
fied operator restart (a "1") in
parameter "e" in the // 1400 control
card. This message is preceded by
the typing out of message EC80I
(status of 1400 registers and cur-
rent instruction). A 1400-style
storage dump is provided on SYSLST
unless a no/dump option (a "1") was
specified in parameter "b" in the //
1400 control card. If the user has
specified an "S" for the test-mode
option in the // 1400 control card,
a System/360 main storage dump is
also provided.

System Action: Storage dump is pro-
vided and job is terminated unless
operating in test mode. In test
mode, message EC40D is issued.

Programmer Action: Resubmit the job
with the // 1400 parameter "e" set
to 1 to permit operator restart, or

Correct the problem causing the halt
and resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
listing and linkage editor out-
put available.

2. Have the job stream, log sheet,
printer output, and program
listing available.

Operator Action: If message EC40D
is issued in conjunction with this
message, respond as indicated in the
EC40D text.

EC82I   HALT

Cause: A 1400 halt other than end
of job (see message EC81I) has
occurred, and the user has specified
operator restart (a "1") in paramet-
er "e" of the // 1400 control card.
This message is preceded by the typ-
ing out of message EC80I.

System Action: Message EC40D is
issued.

Programmer Action: Correct the pro-
blem causing the halt or give
correct operating instructions to
the operator and resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
listing and the linkage editor
output available.

2. Have the log sheet, printer
output, and job stream
available.

Operator Action: Not applicable.

EC83I   1400_PROGRAM_ERROR

Cause: A 1400 program error has
been detected. This message is
always followed by message EC80I
(status of 1400 registers and
instruction block).

A 1400-style storage dump is pro-
vided on SYSLST if OSDUMP=YES was
specified at Emulator Program
generation and unless a no-dump
option (a "1") was specified in
parameter "b" in the // 1400 control
card. If the user has specified an
"s" for the test mode option (para-
meter "q") in the // 1400 control
card, a main storage dump is also
provided, followed by message EC40D.
This message is also issued when the
1400 operation is valid, but emula-
tor support for the function was not
generated.

System Action: The job is ter-
minated unless parameter "q" was
specified on the // 1400 control
card.

Programmer Action: Determine the
operation being attempted from the
1400 program listing, the console
log, and dumps. Verify that support
for the operation was generated by
checking the 1400 program listing.
Reassemble the Emulator program with
the required support.

Check the failing 1400 parameter for
assembly errors and missing or in-
correct object cards. If CS/30,
examine MNOTES to determine if the
Emulator program is overlaying simu-
lated 1400 storage.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
listing and linkage editor out-
put available.

2. Have the job stream, log sheet,
printer output, and program
listing available.

Operator Action: Not applicable.

EC84I   TOO MANY PHASES TO CATALOG

Cause: The 1400 program or overlay
section being cataloged consists of
more than 27 internal phases.

System Action: The job is
terminated.

Programmer Action: If the program
does not have overlays, method 1
cataloging may be used. The "b"
parameter on the // 1400 control
card must be a "1". Method 1 cata-
loging will conserve space and
improve retrieval time, or

If method 1 cannot be used, reor-
ganize the program so that there are
no more than 27 internal phases.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
listing and linkage editor out-
put available.

2. Have the job stream, log sheet,
printer output, and program
listing available.

Operator Action: Not applicable.

EC90I   INVALID OPERATION ON READER

Cause: (1) A 1400 read instruction
has been incorrectly specified; or
(2) a 1400 read instruction which is
not supported by the Emulator pro-
gram (e.g., column binary) has been
specified.

This is probably a user error.

System Action: The job is
terminated.

Programmer Action: If the failing
program specifies any of these read-
er instructions:

• Column binary.

• 51 column interchangeable read
feed.

• Read stacker selection.

Then insure that the parameters to
support the feature are specified in
the Emulator assembly.

If the read instruction is for a
feature not supported by the Emula-
tor, a user-written simulation rou-
tine is required. Correct the error
and resubmit the job.

If the problem recurs, do the fol-
lowing to complete your problem
determination action:

1. Have the emulator assembly
listing and linkage editor out-
put available.

2. Have the job stream, log sheet,
printer output, and program
listing available.

Operator Action: Not applicable.

EC91I   INVALID OPERATION ON PUNCH

Cause: (1) A punch instruction for
an unsupported operation has been
specified in the 1400 program (e.g.,
punch-feed-read, column-binary); or
(2) a punch-feed-read or column-
binary instruction has been speci-
fied in the 1400 program when a mag-
netic device is being used to simul-
ate the unit-record device.

This is probably a user error.

System Action: The job is
terminated.

Programmer Action: If the failing program specifies any of the following punch instructions:

- Column binary

- Punch-feed-read

- Punch stacker selection

Then insure that the parameter to support the feature is specified in the Emulator assembly. If the instruction is for a feature not supported by the 1400 Emulator program, then a user-written simulation routine is required. Correct the parameters and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, printer output, and program listing available.

Operator action: Not applicable.

EC92I   INVALID OPERATION ON PRINTER

Cause: A 1404 print instruction has been specified but is not supported by this particular Emulator program generation.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Check all printer parameters specified in the emulator assembly and the print instructions issued by the failing program. If the 1400 program is issuing print instructions not supported by the emulator, a user simulation routine is required. Make the necessary corrections and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC93I   CONTROL CARD NOT SUPPORTED // yyyy

Cause: The Emulator program has encountered a control card that is not supported. The first four characters of the unsupported control card are identified by "yyyy".

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Check that System/360 control cards do not follow the // 1400 card or that the flagged control card is supported by this assembly of the emulator program. If the 1400 control card is not supported, reassemble the emulator to provide support.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor map available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC94I   NO // LC DATA DELIMITER CARD

Cause: A // LC data delimiter card is required before the last data card, but is not present.

This is probably a user error.

System Action: Last card indicator (sense switch A) is turned on, and message EC40D is issued.

Programmer Action: Before the job is resubmitted, correct the control cards or give the operator instructions so that he can enter the address of your EOJ routine.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: The operator must either enter the address of the user's end-of-job routine using the ALTER operator service function, or terminate the job.

EC95I STACKER 8/2 IGNORED

Cause: A 1402 stacker command has been specified for stacker 8/2 on either a magnetic device when punching, or a unit-record device other than a 2540. This message is displayed only for the first 8/2 stacker command issued.

System Action: 8/2 cards are stacked to normal stacker.

Programmer Action: Not applicable.

Operator Action: Not applicable.

EC96I CARRIAGE CONTROL CARD ERROR

Cause: The 1400 program specified a carriage-control channel punch which is not included in the carriage control card.

This is probably a user error.

System Action: The job is terminated.

Programmer Action: Correct the carriage control card and resubmit the job.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: Not applicable.

EC97I 1400 CONSOLE PRINTER NOT SUPPORTED

Cause: This message is issued if the OSINQRY parameter is not specified as "1400" or "YES", and a 1400 read or write console printer instruction has been encountered.

This is probably a user error.

System Action: Message EC80I is issued, followed by message EC40E.

Programmer Action: Check the emulator assembly listing for OSINQRY= 1400 or YES. If these parameters are not present, and the function is desired, reassemble the emulator with one of these parameters specified.

If the problem recurs, do the following to complete your problem determination action:

1. Have the emulator assembly listing and linkage editor output available.

2. Have the job stream, log sheet, and printer output available.

Operator Action: The parameter "B= nnnnn" in message EC80I is the address of the first storage position of the 1400 message area. The operator can use the DISPLAY operator service function to display the message. To continue processing, enter START or EOB.

IBM SYSTEM/360 DISK OPERATING SYSTEM

1401/1440/1460 EMULATOR PROGRAMS
COMPATIBILITY SUPPORT/30
COMPATIBILITY SUPPORT/40

PROGRAM NUMBER FOR CS/30: 360N-EU-484
PROGRAM NUMBER FOR CS/40: 360N-EU-485

This Technical Newsletter provides replacement pages for your publication.
Pages to be inserted and/or removed are:

Cover, ii	29, 30	123-128
3-6	39, 40	131, 132, 132.1
11, 12	107, 108	135, 136
27, 28, 28.1		

A change to the text is indicated by a vertical line to the left of the
change.

Summary of Amendments

This Technical Newsletter contains information on:
- the addition of the IBM 3420 Magnetic Tape Unit
- adding user routines by means of INCLUDE cards
- the removal of message EC72I

In addition, other minor changes have been made to the text.

Note: Please insert this page in your publication to provide a record of
changes.

IBM / Technical Newsletter

IBM SYSTEM/360 DISK OPERATING SYSTEM

1401/1440/1460 EMULATOR PROGRAMS
COMPATIBILITY SUPPORT/30
COMPATIBILITY SUPPORT/40

PROGRAM NUMBER FOR CS/30: 360N-EU-484
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This Technical Newsletter provides replacement pages for your publication.
Pages to be inserted and/or removed are:

Cover, ii	39, 40, 40.1	61, 62
7-12	43, 44	97, 98
29, 30, 30.1	51, 52	

A change to the text is indicated by a vertical line to the left of the change.

Summary of Amendments

This Technical Newsletter describes minor changes to the Emulator Programs
available with Release 26 of DOS.

Note: Please insert this page in your publication to provide a record of
changes.

READER'S COMMENT FORM

IBM System/360 Disk Operating System: 1401/1440/1460 Emulator Programs:
        Compatibility Support/30, Compatibility Support/40

GC27-6940-4

Please check or fill in the items below, adding explanations and other comments
in the space provided.

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Explanations and other comments:

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