

Systems

**IBM 3287
Printer Models 11 and 12
Component Description**



First Edition (August 1979)

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Preface

This manual describes the IBM 3287 Printer Models 11 and 12, which attach to a distributed processing system communication loop. The manual provides information for executives, system analysts, and system engineers who have knowledge of loop operating procedures and 3287 Printer loop applications.

Chapter 1 describes the 3287 Printer and the system configuration loop. The chapter also provides a description of the 3287 features and user responsibilities.

Chapter 2 outlines the 3287 Printer operating characteristics.

Chapter 3 contains information on the operator panel lights, status indicator, and switches.

Chapter 4 provides both descriptive and reference information to enable the user to program the SNA/SDLC communication procedures for communicating with the 3287.

Chapter 5 describes the power source, character sets, and operator panel nomenclature used by the IBM 3287 Printer in various countries throughout the world.

Prerequisite Publications:

IBM Multiuse Communications Loop Planning Guide, GA23-0038
IBM Multiuse Communications Loop Installation Guide, GA23-0039

Related Publications

Detailed operating instructions are in the *IBM 3287 Printer Models 11 and 12 Operator's Guide*, GA27-3189.

Instructions that help the user set up the printer without the aid of an IBM service representative are in the *IBM 3287 Printer Models 11 and 12 Setup Instructions*, GA27-3186.

Information on installation and physical planning is in the *IBM Remote Multiplexers and Communications Terminals Installation Manual—Physical Planning*, GA27-3006.

Information on preinstallation planning, which describes the correct physical environment for the *IBM Printer Models 1, 2, 11, and 12 Planning and Site Preparation Guide*, GA18-2018.

Procedures for problem determination are in the *IBM 3287 Printer Models 11 and 12 Problem Determination Guide*, GA27-3191.

Details concerning the forms used in the 3287 Printer Models 11 and 12 are in the *IBM Forms Design Reference Guide for Printers*, GA24-3488.

Additional SNA/SDLC Publication Information:

Systems Network Architecture General Information, GA27-3102
IBM Synchronous Data Link Control General Information, GA27-3093

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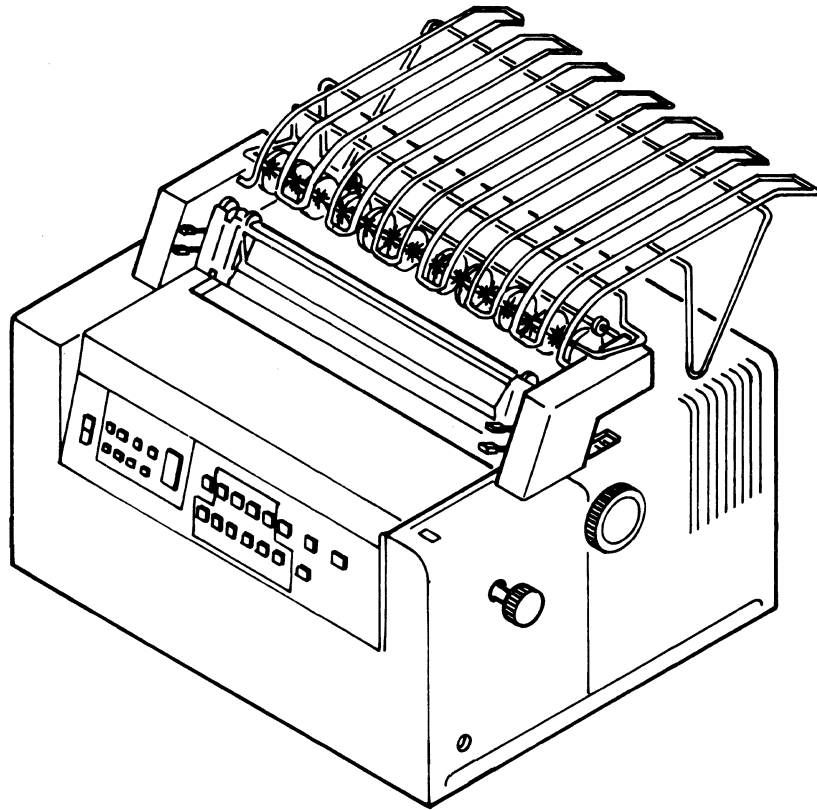
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3287 Printer Model 11 or 12 with Variable Width Forms Tractor

Chapter 1. Introduction

The IBM 3287 Printer (Models 11 and 12) is a compact, movable, desk top printer that is attached to a controlling unit either by a direct attached or data-link attached system communication loop. Figure 1-1 illustrates a direct attachment or data-link attachment to a system communication loop.

3287 Printer Highlights:

- An operator panel that contains lights, switches, and a status indicator to aid in problem determination and error recovery.
- A *3287 Problem Determination Guide*, GA27-3191, supplied with each 3287 Printer, that describes the procedures the operator should use if a problem occurs with the printer.
- Bidirectional matrix printing.
- Maximum printing speed of 80 characters per second (model 11), or 120 characters per second (model 12).
- Printing of up to 132 character positions (including spaces) on each line of print (10 characters per 25.4 mm [1 inch]), and up to 102 print lines per page length.
- Multipart forms capability (up to 6 part forms).
- Optional variable width forms tractor, or friction feed paper handling device.
- Cancel print function.
- An audible alarm to signal for operator intervention.
- EBCDIC dual case operation.
- SCS (SNA Character String) format control that allows user definable horizontal and vertical formatting of the paper form.
- Designed for unpacking, setup and checkout by the user.

The 3287 can operate in either communication or test mode. In communication mode, the 3287 is online and communicating with the controlling unit. In test mode, the 3287 runs offline diagnostic tests, collectively called the basic assurance test.

The 3287 LSC cable attaches the printer to the system communication loop through the Loop Station Connector (LSC). Figure 1-2 shows an example of a loop station connector. The LSC is also used for testing and bypassing loop problems, as described in the *IBM Multiuse Communications Loop Planning Guide*, GA23-0038.

The 3287 buffered printer operates under control of System Network Architecture/ Synchronous Data Link Control as described in Chapter 4.

The 3287 operates at data rate speeds up to 38.4k bits per second (bps). The speed depends on such factors as the type of communication loop used, configuration of the controlling unit, application program being used to control the printer, carrier rate (as described in Chapter 1), and the setting of the 3287 data rate switches (as described in Chapter 2).

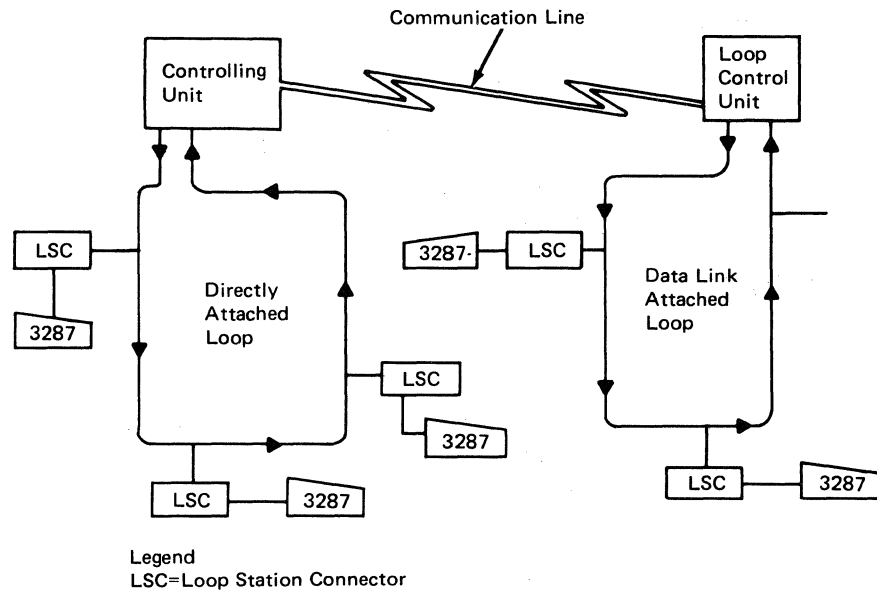


Figure 1-1. Example of Direct Attached and Data Link Attached Loops

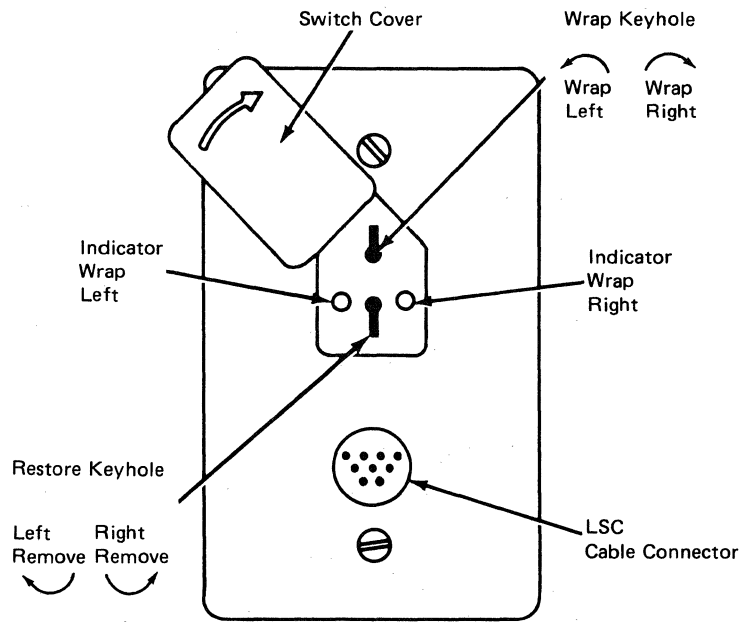


Figure 1-2. Loop Station Connector (LSC)

Features

Several features are available on the 3287 Models 11 and 12. These features comprise three categories: specify (no extra charge), special (for an extra charge), and accessory (purchase only). Contact the IBM Marketing Representative for details. The following is a brief description of these features.

Specify Features

Language

A language group must be specified for the 3287 Printer. Chapter 5 and Appendix A describe the language groups that are available.

Machine Nomenclature

Machine nomenclature must be specified at the time the 3287 Printer is ordered from IBM. Chapter 5 describes the nomenclatures that can be ordered for the 3287 Printer.

Blower

This feature is a cooling fan that must be specified when the 3287 Printer Models 11 or 12 is being used in an environment where the temperature may exceed 32.2°C (90°F), but does not exceed 40.5°C (104°F).

Power

For the United States, specify 120 Vac, 1 phase, 60 Hz. Chapter 5 has information on international considerations.

Plugs

For the United States, specify either a locking or non-locking plug. These plugs are for use with 120 Vac, 1-phase, 3-wire, 60 Hz power sources. Chapter 5 has information on international considerations.

The IBM 3287 Printer Models 1, 2, 11, and 12 Planning and Site Preparation Guide, GA18-2018, has detailed information about power plugs.

Power Cords

The standard power cord length is 2.8 m (9 ft.). Lengths of 1.8 m (6 ft.), 3.7 m (12 ft.), or 4.5 m (15 ft.) can be specified. Chapter 5 has detailed information about power cords.

Loop Attachment

Specify either a direct attached loop operation or data link attached loop operation.

Carrier Rate

Specify a carrier rate of either 9600 or 38400 bits per second (bps). The 9600 bps feature allows a data rate selection (via 3287 data rate switches) of 600, 1200, 2400, 4800 or 9600 bps. The 38400 bps feature allows a data rate selection (via 3287 data rate switches) of 2400, 4800, 9600, 19200 or 38400 bps. Chapter 2 describes the data rate switches.

Variable Width Forms Tractor-Paper Handling

To feed paper forms having an overall width of 76.2 mm (3 inches) to 203.2 mm (8 inches), the Paper Handling device is ordered with the Variable Width Forms Tractor (special feature described in this chapter). The Paper Handling device provides additional feed rollers on the left-hand side of the VWFT that improve paper feeding of the narrow width forms.

Hyphenate Invalid Control Codes

Specify either print hyphen or halt printing for invalid control codes. With print hyphen specified, the printer prints a hyphen when an invalid control code occurs, and then continues normal printing without operator intervention. With halt printing specified, the printer stops printing when an invalid control code occurs.

Special Features

Variable Width Forms Tractor

When the Variable Width Forms Tractor (shown in Figure 1-3) is installed, the 3287 Printer can feed pre-printed, multi-part (6 parts maximum) continuous forms containing punched holes in the margins. Total thickness of the forms should not exceed 0.457 mm (0.018 inches). Five and six part continuous forms should be tested on an individual basis to ensure that paper feeding, print registrations, and print quality are acceptable to the individual user requirements. Maximum overall forms width is 381 mm (15 inches).

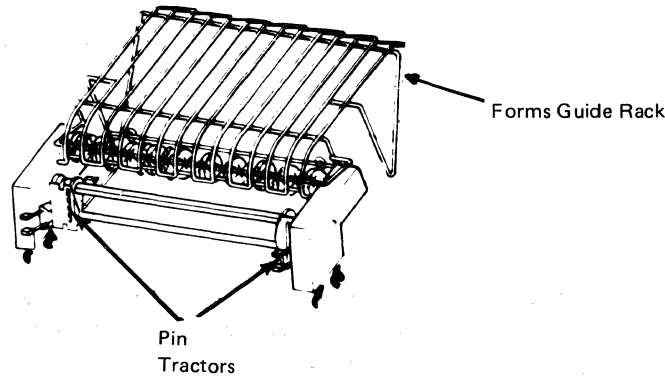


Figure 1-3. Variable Width Forms Tractor

Friction Feed Paper Handling Device

The 3287 Printer can feed non-preprinted single part, fan-fold, or continuous roll paper using the Friction Feed Paper Handling Device (shown in Figure 1-4). Minimum width of the paper is 203 mm (8 inches), and maximum overall width is 378 mm (14-7/8 inches). The Friction Feed Device is equipped with a paper tear bar that enables the operator to tear off a continuous form approximately 51 mm (2 inches) above the print line.

The *IBM Forms Design Reference Guide for Printers*, GA24-3488, has additional information about form specifications and limitations.

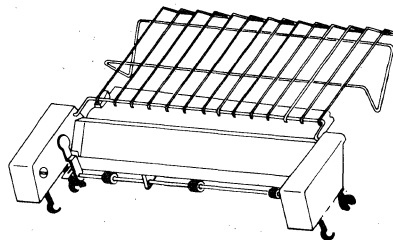


Figure 1-4. Friction Feed Paper Handling Device

Accessory Feature

Forms Stand

This feature (Figure 1-5) is available to assist in handling the continuous fan-fold forms. The forms stand allows placing the forms on a stand above floor level and provides for stacking after they are printed.

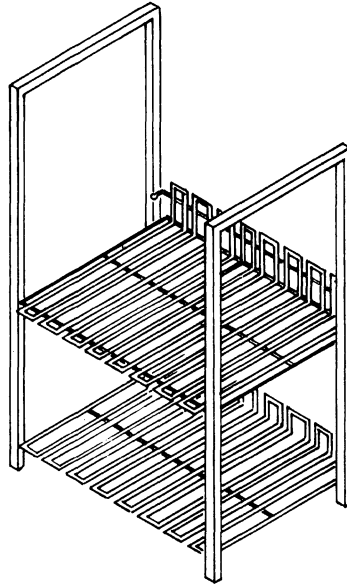


Figure 1-5. Forms Stand

Forms

For acceptable feeding, registration, and print quality, the forms used in the 3287 Printer must meet the following dimensions:

Dimensions	Variable Width Forms Tractor	Friction Feed Paper Handling
Thickness (maximum)	0.457 mm (0.018 in.)	0.165 mm (0.0065 in.)
Width (minimum)*	77 mm (3 in.)	203 mm (8 in.)
Width (maximum)	381 mm (15 in.)	378 mm (14 7/8 in.)

*With VWFT Paper Handling Feature: Minimum width without this feature is 203 mm (8 inches).

The Variable Width Forms Tractor is recommended for any multipart or preprinted continuous forms. If five- and six-part continuous forms are required, they should be tested for acceptable feeding, registration, and print quality before quantities are purchased. If you use forms with a width of 76.2 to 203.2 mm (3 to 8 in.), the Variable Width Forms Tractor—Paper Handling feature is recommended.

Friction Feed Paper Handling may be used with nonpreprinted, single-part, roll or fan-fold paper. Card stock forms are not recommended for use in the 3287 Printer.

Best results are obtained when multipart continuous forms are glued together. No hard or metallic fasteners can be used.

Caution: Print head travel should be restricted to the print area of the form being used. Print head damage can occur if printing is done on the edge, or across the prepunched holes, of a document.

Additional form specifications are in the *IBM Forms Design Reference Guide for Printers*, GA24-3488.

User Responsibilities

The user is responsible for the following:

- Supplying a desk or tabletop to support the 3287 Printer.
- Adequate site, system, and other vendor preparation.
- Receipt at the user's receiving dock, unpacking, and placement of the 3287 Printer.
- Physical preparation, connection of the cables, switch settings, and checkout of the 3287 Printer.
- Notifying IBM of any intent to move the printer and following IBM Customer Setup instructions for relocation. See *IBM 3287 Models 11 and 12 Setup Instructions*, GA27-3186.
- Using the problem determination procedures and filling out trouble reports before requesting IBM service.
- Disconnecting packing (in accordance with IBM packing instructions), and moving the printer to the user shipping dock at the time of discontinuance. Appropriate instructions will be provided by IBM.

Maintenance Aids

The 3287 Printer is designed for quick analysis and repair of malfunctions by service personnel. It is packaged so that failing units can be easily adjusted or exchanged. Indicators, printouts, automatic test procedures, online tests, and maintenance analysis procedures are supplied to aid in problem determination.

Model Upgrading

The IBM 3287 Printer Model 11 can be upgraded to a Model 12, at the user's site, to increase printing speed to a maximum of 120 characters per second.

Information concerning RPQs (Request for Price Quotation) available for the 3287 Printer can be obtained by contacting the IBM Branch office nearest the user location.

Chapter 2. Operating Characteristics

This chapter describes the 3287 Printer modes of operation, internal diagnostic testing, SCS format control, address select switches and data rate switches, audible alarm, end of forms detection and 3287 internal error handling procedures.

Modes of Operation

The 3287 Printer has two basic modes of operation: online operation (communication mode) and offline operation (local test mode).

Online Operation

While in online operation, the 3287 Printer receives and prints data from a controlling unit. The printer enters online mode after a successful ending of the built-in power-on or the operator-initiated test sequence.

Offline Operation

The 3287 Printer automatically performs the internal diagnostic tests (collectively called the basic assurance test) that check for correct operation of the printer when the Power switch is turned on. These tests can also be initiated by pressing the Local Test switch. In either case, the 3287 Printer remains in offline operation until these tests have ended successfully. The printer then goes to online operation.

Basic Assurance Test

The basic assurance test (BAT) is executed when the Power switch on the printer is turned on. This test takes approximately 30 seconds to check the condition of the 3287 Printer, and the test tells the operator if any problems are found, by displaying suitable codes in the Status Indicator, by the audible alarm, and by various panel lights. The successful ending of the BAT is indicated by the Ready light coming on.

BAT In-Depth Test

The BAT in-depth test is run when the Local Test switch is pressed. The 3287 prints status information and error conditions that have previously been logged in the 3287. This printout is used to aid user supervising personnel and the service representative in analyzing error conditions that might exist. Upon completion of the test printout, the 3287 automatically runs the basic assurance test to determine the present status of the 3287 Printer.

Note: The paper in the printer must be at least 203.2 mm (8 in.) wide and at least 1.5 m (60 in.) long, to provide enough space for the test to be printed out.

SCS Format Control

The 3287 operates in SCS (SNA character string) format control, using the EBCDIC character set and dual case printing. Under control of the system application program, SCS control codes can be used to define the 3287 printing format.

Caution: All SCS format control settings must be set to conform to the physical page width and page length of the paper form being used in the 3287. Otherwise, damage to the print head and loss of printed data can result.

SCS Control Codes

The 3287 accepts the following SCS control codes:

Code	EBCDIC (hex)	Name
CR	0D	Carriage Return
LF	25	Line Feed
NL	15	New Line
BS	16	Back Space
NUL	00	Null Function
FF	0C	Form Feed
HT	05	Horizontal Tab
VT	0B	Vertical Tab
SHF	2BC1	Set Horizontal Format
SVF	2BC2	Set Vertical Format
SLD	2BC6	Set Line Density
VCS	04	Vertical Channel Select
TRN	35	Transparent
IRS	1E	Interchange-Record Separator
BEL	2F	Bell Function
INP	24	Inhibit Presentation
ENP	14	Enable Presentation

The SCS codes are defined as follows:

Carriage Return (CR)—is a format control code that moves the print position horizontally to the left margin on the same line. If the print position is already at the left margin, the function is inoperative.

Line Feed (LF)—is a format control code that moves the print position vertically down to the next line.

New Line (NL)—is a format control code that moves the print position to the left margin and vertically down to the next line. NL is functionally equivalent to a CR followed by an LF.

Back Space (BS)—is a format control code that moves the print position, horizontally, one position to the left. If the print position is at column 1, the function is inoperative. Left margin settings are ignored.

Null (NUL)—is a format character that moves the print position horizontally one position to the right. If the print position is at the right margin when a NUL function is requested, the 3287 initiates a New Line (NL) function.

Form Feed (FF)—is a format control code that moves the print position to the top and left margin (or column 1) of the next form. If the maximum print line (MPL) value has not been set, the printer uses a default value of 1, and the print position moves to the left margin of the next line and may be specified anywhere in the print job.

Horizontal Tab (HT)—is a format control code that moves the print position, horizontally, from left to right, to the next tab stop setting. Horizontal tab stop values are set by using the Set Horizontal Format (SHF) function. If there are no horizontal tab stops set to the right of the current print position, the horizontal tab function results in a space. If an HT function is requested after passing the maximum print position (MPP), a new line function is performed.

Vertical Tab (VT)—is a format control code that moves the print position, vertically, down to the next vertical tab stop setting. Vertical tab stops are set by using the Set Vertical Format (SVF) function. If there are no vertical tab stops below the current print position, the vertical tab function results in an LF function. If a VT function is requested after the printing has passed the maximum print line, the form feed function is performed.

Set Horizontal Format (SHF)—is a data-defining control that is used to set the horizontal format controls. These include the left margin, the right margin, the horizontal tab stops, and the maximum print position. A one-byte binary count follows the SHF code that indicates the number of bytes to the end of the SHF string (including the count byte). The first three bytes following the count byte define the maximum print position (MPP), the left margin (LM), and the right margin (RM), respectively. The tab stop settings follow the right margin setting. All values are expressed as one-byte binary numbers.

The minimum SHF sequence is one-byte length that sets the horizontal format controls to their default values. The default value for each function is as follows:

<i>Function</i>	<i>Default</i>
MPP	132
LM	1
RM	MPP
HT	Every Column

The SHF sequence is:

(SHF) (cnt) (MPP) (LM) (RM) (T1) (T2) . . (Tn)

MPP is used to define a print line length of less than, or equal to, the platen length. The MPP default value is the platen length.

LM specifies the column value of the leftmost print position. The LM also serves as the first horizontal tab stop. Valid LM values are less than, or equal to, the MPP and less than the RM.

The RM specifies the right margin and is not used in printing operations. Valid RM values are greater than the LM and less than, or equal to, the MPP.

T1 . . . Tn are horizontal tab stop settings that set column values for use with the horizontal tab function. The tab stops need not be in order. Valid tab stop settings are equal to, or greater than, LM and less than, or equal to, the MPP. If no tab stops are set, the default is a space function.

The parameters must be specified in the preceding sequence. If some parameters are zero, or are not included in the SHF sequence, the 3287 Printer uses the default values.

An error condition is established and a code is returned to the controlling unit if any one of the following conditions occurs:

- The MPP specified is greater than the maximum line length (132).
- The LM is greater than the line length.
- The RM is not inside the valid range.
- The tab values are outside the valid range.

Set Vertical Format (SVF)—is a data-defining control that is used to set the vertical format controls. These include the maximum print line (MPL), the top margin (TM), the bottom margin (BM), and the vertical tab stops. A one-byte binary count follows the SVF code that indicates the number of bytes to the end of the SVF string (including the count byte).

The first three bytes followed the count byte define the maximum print line (MPL), the top margin (TM), and the bottom margin (BM), respectively. The tab stop settings follow the bottom margin setting. All values are expressed as one-byte binary numbers.

The minimum SVF sequence is a one-byte length, which sets the vertical format controls to their default values. The default values for each function are as follows:

<i>Function</i>	<i>Default</i>
MPL	1
TM	1
BM	MPL
VT	Every line

The SVF sequence is:

(SVF) (cnt) (MPL) (TM) (BM) (T1) (T2) . . . (Tn)

MPL defines the page length. All values from 1 to 102 are valid.

TM specifies a line value to be used in place of line 1 for the top of the page. The TM is also the first vertical tab stop. Valid TM values are equal to, or less than, the MPL.

BM specifies the line value that, if exceeded, causes an automatic skip to the top margin of the next page. The MPL must be specified when the bottom margin (BM) is specified. Valid BM values must be greater than, or equal to, the TM and less than, or equal to, the MPL.

T1 . . . Tn are vertical tab stop settings, which set line values for use with the vertical tab function. Vertical tab stops must be listed in increasing order. Valid tab stop values are equal to, or greater than, the TM and are equal to, or less than, the BM. The MPL must be specified as a value greater than 1.

The parameters must be specified in the preceding sequence. If some parameters are zero, or are not included in the SVF sequence, the 3287 Printer uses the default values.

An error condition is established and a code is returned to the controlling unit if any one of the following conditions occurs:

- The MPL specified is greater than the maximum number of print lines (102) allowed.
- The TM is greater than the MPL.
- The BM is greater than the MPL or less than the TM.
- The tab stop values are outside the valid range.

Set Line Density (SLD)—specifies the distance to be moved for single-line vertical spacing, as in LF or NL. A two-byte parameter follows the SLD control code. The first byte is a count field and is always a X'02'. The second byte specifies the distance to be moved for single-line vertical spacing.

The SLD sequence is:

(SLD) (X'02')	X'09'=8 LPI
	X'0C'=6LPI
	X'12'=4LPI
	X'18'=3LPI

The printer uses a default of six lines per inch, if no SLD value is specified.

Vertical Channel Select (VCS)—is a device control code that allows the selection of one of 12 vertical channels to control the vertical format. The first character of the code is the Select code, followed by a function value that selects the appropriate channel. The 3287 Printer does not support skipping to the specified channel. The 3287 always performs a LF when the VCS code is received in data.

Transparent (TRN)—is a data-definition character, that provides for transmitting data in transparent mode. A one-byte binary value follows the TRN code, which specifies the number of bytes of transparent data to follow. The length does not include the length byte. Transparent data is user-defined and is not checked for SCS control codes. As each data byte is interpreted, the print mechanism moves one character position. Valid graphics are printed and invalid graphics are printed as a dash (-).

Interchange Record Separator (IRS)—is defined as a grouping control character, that terminates an information block called a record. When an IRS is received, an NL function is performed by the printer.

Bell (BEL)—causes the audible alarm to sound. The alarm comes on and goes off at one-second intervals until the Hold Print switch is pressed. This function has no effect on the print operation; therefore, printing will not be stopped.

Inhibit Presentation (INP)—is accepted by the printer but has no effect upon the printing, and no function is performed.

Enable Presentation (ENP)—is accepted by the printer but has no effect upon the printing, and no function is performed.

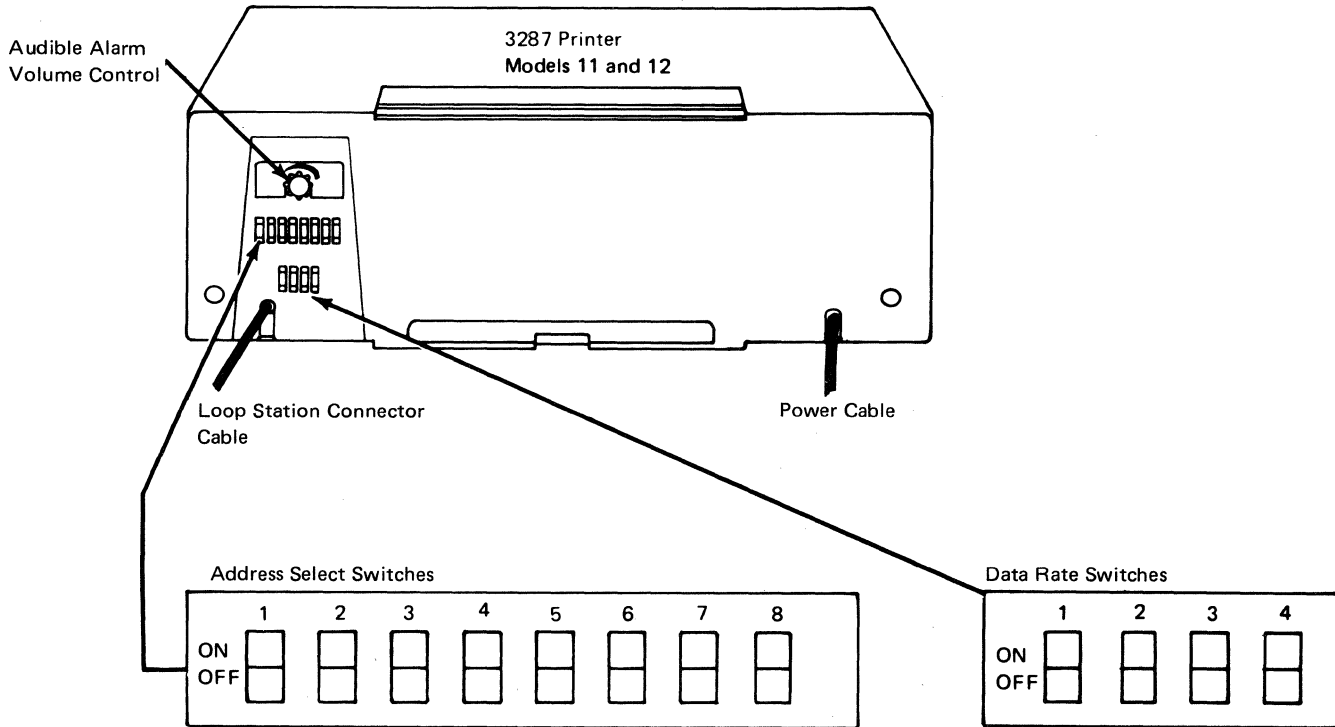


Figure 2-1. IBM 3287 Printer Rear Panel

Audible Alarm

The audible alarm sounds at approximately one-second intervals (until the Hold Print switch is pressed) when operator intervention is required. The alarm sounds when:

- The printer has run out of paper (end of forms condition).
- An error check has occurred as a result of a 3287 or system error condition.
- The controlling unit requests operator intervention.

To determine the cause of the audible alarm, check the operator panel lights, paper path, status code (status indicator) and any message printout from the controlling unit.

When the 3287 runs the offline self-checking tests (Local Test switch pressed), the audible alarm is tested and sounds for approximately one second to verify the alarm is operational.

The volume of the alarm can be adjusted by turning the audible alarm volume control knob (shown in Figure 2-1) located on the right rear panel of the 3287.

Address Select Switches

The address select switches (shown in Figure 2-1) are used to assign a unique hexadecimal (hex) device address to the 3287 and to enable communication between the printer and the controlling unit. The device address is manually set in the switches when the user installs the 3287 Printer.

The eight address select switches (labeled 1 through 8) can be switched to either an on or off position. A device address that has been assigned (by the user) to the 3287 Printer is activated by setting the proper address select switches to the on position. All addresses are valid except hex '00' and 'FF'.

See the chart in Figure 2-2 for an example of 3287 Printer address assignments.

Device Address	Address Select Switches							
	1	2	3	4	5	6	7	8
10	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
03	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
24	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
C8	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
3E	OFF	OFF	ON	ON	ON	ON	ON	OFF
57	OFF	ON	OFF	ON	OFF	ON	ON	ON
19	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
BF	ON	OFF	ON	ON	ON	ON	ON	ON

Figure 2-2. Example of 3287 Printer Address Assignments

Carrier Transmission Rate

The carrier data rate speed (as described in "Carrier Rate" in Chapter 1) is a specified feature selected by the user. A rate of either 9600 or 38.4k bits per second (bps) is specified. The rate is set at the factory and can be changed by the service representative.

Data Rate Switches

The data rate switches (shown in Figure 2-1) are used to set the data rate speed in bits per second (bps), in which the 3287 Printer communicates with the controlling unit. The data rate is manually set in the switches when the user installs the 3287 Printer.

The four data rate switches (labeled 1 through 4) can be switched to either an on or off position. A data rate that has been assigned (by the user) to the 3287 Printer is activated by setting the proper Data Rate switches to the on position.

See the charts in Figure 2-3 for the data rates that can be set in the 3287 Printer.

Data Rate	Data Rate Switches			
	1	2	3	4
600	ON	ON	ON	OFF
1200	ON	ON	OFF	OFF
2400	ON	OFF	OFF	OFF
4800	OFF	ON	OFF	OFF
9600	OFF	OFF	OFF	OFF

Specified Carrier Rate 9600 bps

Data Rate	Data Rate Switches			
	1	2	3	4
2400	ON	ON	ON	OFF
4800	ON	ON	OFF	OFF
9600	ON	OFF	OFF	OFF
19200	OFF	ON	OFF	OFF
38400	OFF	OFF	OFF	OFF

Specified Carrier Rate 38.4K bps

Figure 2-3. Data Rate Switch Settings

End of Forms

When the 3287 detects an end-of-forms condition (Form Release lever in the forward position), the audible alarm sounds and a condition code is displayed in the Status Indicator. The audible alarm continues to sound until the Hold Print switch is pressed by the operator. If the Hold Print switch is not pressed within one minute after the audible alarm sounds, Intervention Required (IR) is sent to the controlling unit.

Error Handling

When the 3287 detects transmission errors in data received from the system communication loop, the External check light comes on and an error code is displayed in the Status Indicator. 3287 printing stops until the controlling unit resets the error condition.

Internal 3287 error conditions result in the Machine Check, or operation check light coming on, and an error code being displayed in the Status Indicator. Some error conditions result in the Audible Alarm sounding. After the error condition has been cleared, communication between the 3287 and the system communication loop is resumed.

See Appendix C for the chart that summarizes the status codes displayed in the Status Indicator.

Chapter 3. Operator Panel Lights and Switches

This Chapter describes the function of the lights and switches on the Operator Panel (shown in Figure 3-1). For details on operating the 3287, refer to the *IBM 3287 Printer Models 11 and 12 Operator's Guide*, GA27-3189.

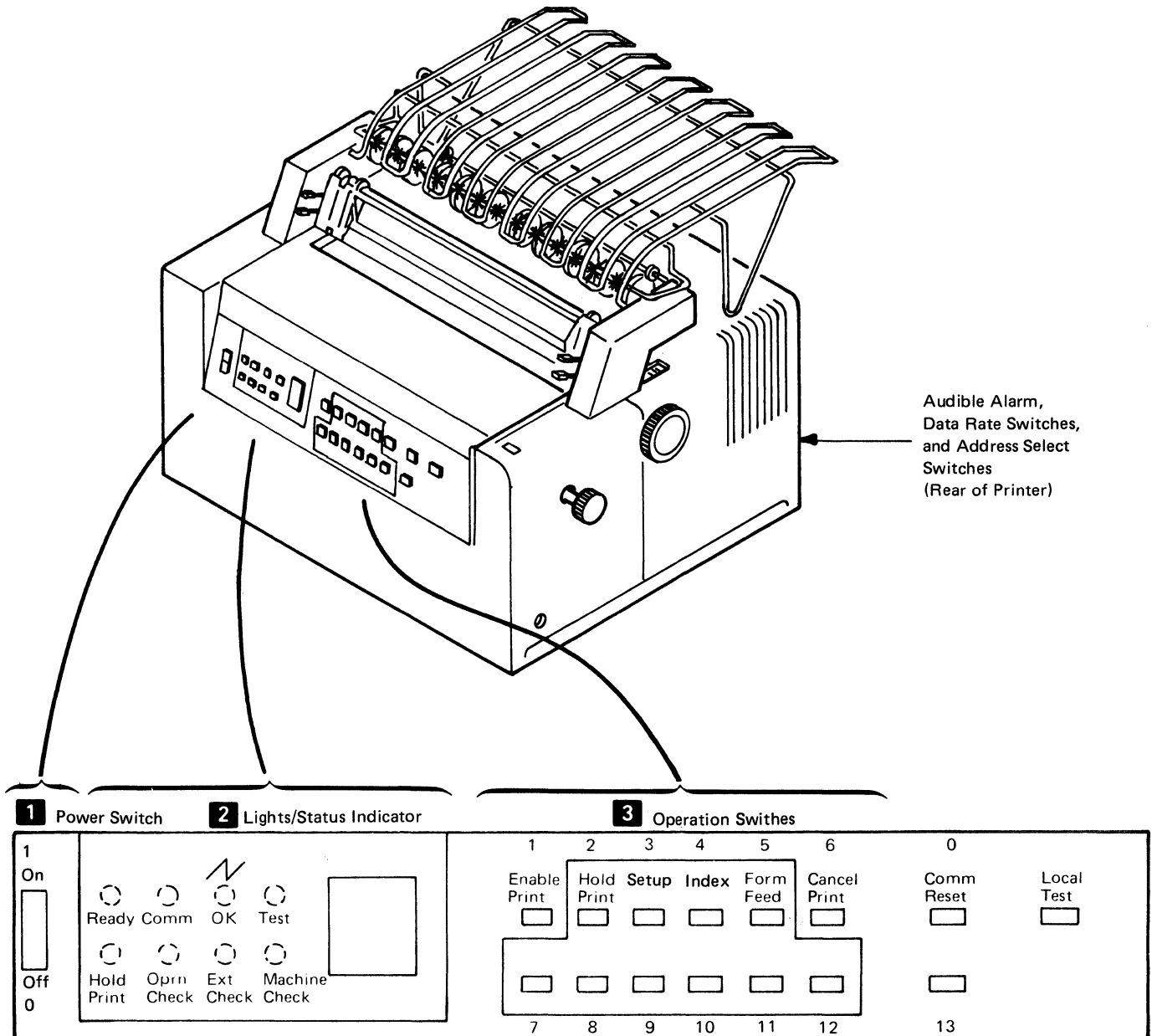


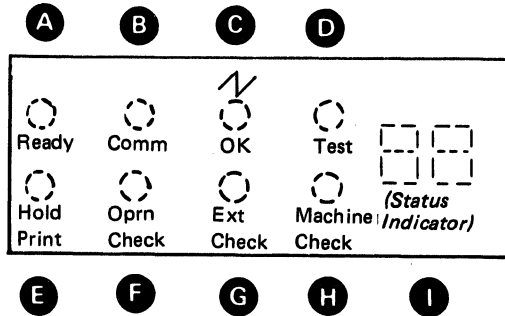
Figure 3-1. 3287 Printer Operator's Panel

1 Power Switch

The Power On/Off switch is located on the Operator Panel. When the Power switch is set to the on position, power is applied to the 3287 Printer and the basic machine functions are tested. The Power-on test (basic assurance test) takes approximately 30 seconds.

2 Lights/Status Indicator

The operator uses the panel lights and Status Indicator (in addition to the Audible Alarm) to assist in 3287 Printer operation, problem determination and error recovery.



A Ready Light

The Ready light is on when the 3287 is ready to print data sent by the Controlling Unit. The Ready light goes off under any of the following conditions:

- The Power switch is set to the off position.
- The Local Test light is on.
- The Hold Print light is on.
- The External or Machine check light is on.
- The Oprn Check light is on.
- The printer runs out of paper (operation check condition).

B Comm Light

The communication (Comm) light is on when the 3287 is physically connected to the system loop (Data-link or directly attached) and is in communication online mode.

The Comm light goes off under any of the following conditions:

- The ready light goes off (except for Hold Print and end of forms condition).
- A loop communication failure occurs.
- The Controlling Unit discontinues communication with the 3287.

C OK Light

The OK light is on when the Controlling Unit has established communication with the 3287.

The light goes off under the following conditions:

- The ready light is off (except for hold print condition).
- A loop communication failure occurs.
- The Controlling Unit discontinues communication with the 3287.

D *Test Light*

The Test light is on when the Local Test switch is pressed and the 3287 BAT-in-depth tests are being executed. The Test light goes off after successful completion of the tests.

E *Hold Print Light*

The Hold Print light is on when the 3287 Printer is in the Hold Print condition. No printing can take place while the 3287 is in the Hold Print condition.

If no check conditions are active on the 3287, the Hold Print light goes off when the Enable Print switch is pressed.

F *Oprn Check Light*

The Oprn (Operation) Check light indicates a check condition exists that can be corrected by the operator or user supervising personnel. The type of check condition is displayed in the status indicator.

G *Ext Check Light*

The External Check light indicates a check condition exists externally to the 3287 Printer. The type of external check condition is displayed in the status indicator.

If all external check conditions have been corrected, the Ext Check light goes off when the Comm Reset switch is pressed.

H *Machine Check Light*

The Machine Check light indicates an error condition exists that requires operator intervention. The type of machine check condition is displayed in the status indicator.

If all machine check conditions have been corrected, the Machine Check light goes off when the Comm Reset switch is pressed.

I *Status Indicator*

The status indicator is normally blank; however, under certain conditions (such as a check condition) the indicator displays a two-digit status code.

See Appendix C for a summary of the status codes.

3 Operation Switches

The operation switches are the momentary pushbutton type and are located on the operator panel. Each operation switch (shown in Figure 3-2) and its associated function is described in this section.

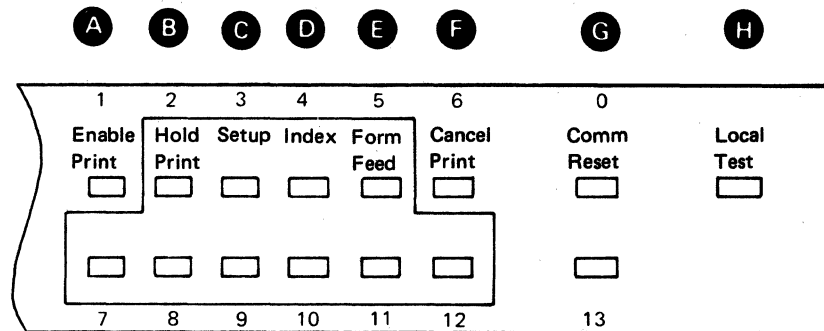


Figure 3-2. Operation Switches

A Enable Print Switch

When the Enable Print switch is pressed, the following occurs:

- The Hold Print light goes off.
- The Ready light comes on.
- The audible alarm is operative.
- The Setup, Index and Form Feed switches are inoperative.
- If there are no printer check conditions, the print head moves to the next print position to resume printing.

B Hold Print Switch

When the Hold Print switch is pressed, the following occurs:

- Printing Stops after the print operation in progress has been completed.
- The print head moves to the extreme left side of the printer.
- The Ready light goes off.
- The Hold Print light comes on.
- The Setup, Index and Form Feed switches are operative.
- The audible alarm is inoperative.

If the Enable Print switch is not pressed within ten minutes after the 3287 has entered the Hold Print condition, Intervention Required (IR) is sent to the Controlling Unit.

C Setup Switch

This switch is used to check the horizontal alignment of the printer paper and is operational only while the 3287 is in the hold print condition (Hold Print switch has been pressed).

When the Setup switch is pressed, the print head moves to the first print position and prints "H"s in each print position across the paper until the Setup switch is released, or the maximum print position (MPP), set by the controlling unit, is reached. The print head then returns to the first print position (no indexing occurs). If no MPP value has been defined by the controlling unit, "H"s are printed in 132 (maximum) print positions before the print head returns to the first print position.

D *Index Switch*

This switch is used for indexing (vertical advancement) of the printer paper and is operational only while the 3287 is in the hold print condition (Hold Print switch has been pressed).

When the Index switch is pressed, the print head moves to the first print position and the printer paper indexes (vertically advances) one print line at a time until the Index switch is released. The 3287 keeps count of the number of print lines that have been indexed, to identify the physical location of the form for proper form feeding and page length control.

E *Form Feed Switch*

This switch is used to skip the paper form to the first print line of the next page and is only operational while the 3287 is in the hold print condition (Hold Print switch has been pressed).

When the Form Feed switch is pressed, the print head moves to the first print position and the form skips to the first print line of the next page. To assure the form skips to the proper position, the paper form must be properly aligned when it is loaded in the 3287 and the maximum page length (MPL) properly defined by the SCS format control. If the MPL has not been properly set, the form will index (advance) one line at a time.

F *Cancel Print Switch*

This switch is used to cancel the 3287 print operation currently in progress. The 3287 transmits a message code to the controlling unit that the print operation has been cancelled. If no print operation is in progress when the Cancel Print switch is pressed, no message code is sent to the controlling unit.

The Cancel Print switch is operational in either the enable print or hold print condition.

Caution: This switch is operational whenever the 3287 is powered on. If the switch is pressed while the 3287 is online and communicating with the controlling unit, the print operation currently in progress will be terminated.

G *Comm Reset Switch*

This switch is used to reset an External or Machine check condition and the associated Status check code (See Appendix C) displayed in the Status Indicator.

H *Local Test Switch*

When this switch is pressed, the Test light comes on and the printer enters offline test mode. 3287 status information and any existing error conditions are printed as part of the test procedure. Then the 3287 BAT-in-depth test is run to determine the present status of the printer. If no errors are detected, the Test light goes off, the Ready, Comm and OK lights come on, and the 3287 resumes online communication with the controlling unit.

Caution: This switch is operational whenever the 3287 is powered on. If the switch is pressed while the 3287 is online and communicating with the controlling unit, the print operation currently in progress will be terminated.

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Chapter 4. SNA/SDLC Communication

This chapter provides information to help the system analyst and the system programmer establish the primary logical unit (PLU) communication to the 3287 secondary logical unit (SLU), using System Network Architecture (SNA) protocols. The chapter assumes knowledge of your host programs and the programs in the controlling unit.

Additional information on SNA can be found in the *Systems Network Architecture*:

- *Introduction*, GA27-3116
- *General Information*, GA27-3102
- *Reference Summary*, GA27-3136
- *Format and Protocol Reference Manual: Architecture Logic*, SC30-3112

Additional information on SDLC can be found in the *Synchronous Data Link Control General Information*, GA27-3093.

3287 SNA Characteristics

The 3287 printer has the following SNA characteristics:

- One Type 2 physical unit
- One Type 1 logical unit
- Function Management profile 3 (LU-LU)
- Transmission Services profile 3 (LU-LU)
- Function Management profile 0 (SSCP-PU and SSCP-LU)
- Transmission Services profile 1 (SSCP-PU and SSCP-LU)
- Half-duplex, flip-flop, in-bracket protocol on LU-LU session
- The 3287 is the first speaker
- Only single-element chains are sent inbound from the 3287; multi-element chains are sent outbound to the 3287
- Inbound and outbound request units (RUs) are not segmented
- In immediate request and response modes, inbound and outbound flow are normal flow

SNA Sessions

Sessions that must exist for an application program and a 3287 to exchange information, are:

SSCP-PU
SSCP-SLU
PLU-SLU

The following topics discuss the sessions individually and identify how they are established and terminated. The SNA commands that establish and terminate the sessions are identified.

SSCP-PU Session

Before establishing the SSCP-PU session, the physical transmission or channel connection must be established. Before communication can be established the 3287 power switch must be turned on and the built-in power-on reset (POR) sequence must be completed successfully.

The SSCP-PU session must be established before establishing the SSCP-SLU or LU-LU sessions. The session is initiated when the SSCP issues the Activate Physical Unit (ACTPU) command to the 3287.

When the SSCP-LU session for the 3287 has been terminated, the SSCP issues the Deactivate Physical Unit (DACTPU) command. When the 3287 returns a positive response to the DACTPU command, the SSCP-PU session is terminated.

SSCP-Secondary LU Session

When the SSCP-PU session is established, an Activate Logical Unit (ACTLU) for the 3287 SLU is sent by the SSCP. The SSCP-SLU session must be established before establishing the LU-LU session.

The SSCP-SLU session is terminated when the SSCP sends a Deactivate Logical Unit (DACTLU) command to the SSCP-SLU. When the 3287 returns a positive response to the DACTLU command, the SSCP-SLU session is terminated.

LU-LU Session

Initiating an LU-LU Session

The 3287 supports a type 1 LU-LU session; the data stream is the SNA character String (SCS).

An LU-LU session is started by the PLU when it issues the Bind request. The 3287 LU examines the session parameters of the Bind and, if they are acceptable, allows the session to be established by sending a positive response to the Bind command (Figure 4-1). If the session parameters are not acceptable, the 3287 LU rejects the Bind command by returning a negative response, indicating Invalid Session Parameters (sense code X'0821').

After the Bind command has been accepted with a positive response, the PLU must issue the Start Data Traffic command to allow data traffic to flow for the session.

Terminating an LU-LU Session

The PLU can terminate a LU-LU session by requesting that the SSCP close the session. The SSCP then sends the Unbind command to the secondary LU and the LU-LU session is terminated.

If a shutdown is received by the 3287, the 3287 returns the Shutdown Complete command after completing any outstanding operation.

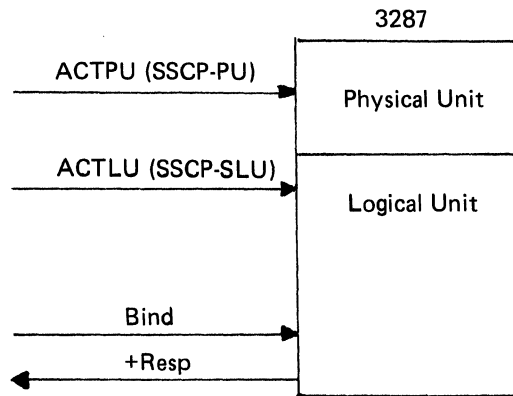


Figure 4-1. Establishing a Session with a 3287

TH and FH Headers

The 3287 supports FID2 transmission headers (TH) and request/response headers (RH). The transmission header consists of six bytes:

TH0:	FID (bits 0-3)	Format Identification
	MPF (Bits 4-5)	Mapping Field
	RES (Bit 6)	Reserved
	EFI (Bit 7)	Expedited Flow Indicator
TH1:	RES (Bits 0-7)	Reserved
TH2:	DAF (Bits 0-7)	Destination Address Field
TH3:	OAF (Bits 0-7)	Origin Address Field
TH4,5:	SNF (Bits 0-15)	Sequence Number Field

The request/response header consists of three bytes:

RH0:	RRI (Bit 0)	Request/Response Indicator
	CAT (Bits 1-2)	RU Category
	RES (Bit 3)	Reserved
	FI (Bit 4)	Format Indicator (NC)
	SDI (Bit 5)	Sense Data Included
	BCI (Bit 6)	Begin Chain Indicator
	ECI (Bit 7)	End Chain Indicator
RH1:	DR1 (Bit 0)	Definite Response 1
	RES (Bit 1)	Reserved
	DR2 (Bit 2)	Definite Response 2
	ERI (Bit 3)	Exception Response Indicator for request
	RTI (Bit 3)	Response type Indicator for response
	RES (Bit 4)	Reserved
	RES (Bit 5)	Reserved
	QRI (Bit 6)	Queued Response Indicator (NC)

	PI (Bit 7)	Pacing Request Response Indicator
RH2:	BBI (Bit 0)	Begin Bracket Indicator for request
	EBI (Bit 1)	End Bracket Indicator for request
	CDI (Bit 2)	Change Direction Indicator for request
	RES (Bit 0-2)	Reserved for response
	RES (Bit 3)	Reserved
	CSI (Bit 4)	Code Selection Indicator for request (NC)
	RES (Bit 4)	Reserved for response
	RES (Bit 5)	Reserved
	RES (Bit 6)	Reserved
	RES (Bit 7)	Reserved

(NC) = Not checked by 3287

The 3287 handles transmission headers and request/response headers received on outbound requests as follows:

1. All reserved parameters are ignored on requests.
2. MPF—The 3287 supports only whole basic information units (BIUs).
3. EFI—The expedited flow indicator identifies normal (0) or expedited (1) flow requests.

EFI=1

The 3287 supports the following requests as outbound expedited flow requests:

<i>RU Category</i>	<i>Request</i>
SC	ACTPU,DACTPU,ACTLU,DACTLU,BIND,UNBIND,CLEAR,SDT
NC	Not supported
DFC	SIGNAL,SHUTDOWN
FMD	Not supported

When the 3287 receives any requests listed above with correct categories and EFI=1, they are passed through for further processing. When the 3287 receives any requests listed above with incorrect categories and EFI=1 or any requests not listed above with EFI=1, it rejects them with the negative response Function Not Supported (X'1003'). The 3287 handles all expedited flow request as if they have ONLY-IN-CHAIN, NO BRACKET, NO CD, NO QRI, and NO PACING.

EFI=0

The 3287 supports the following requests as outbound normal flow requests:

<i>RU Category</i>	<i>Normal Request</i>
SC	Not supported
NC	Not supported
DFC	CANCEL, BID, CHASE
FMD on PLU-SLU	Any request
FMD on SSCP-SLU	Not supported
FMD on SSCP-SPU	Not supported

When the 3287 receives any of the requests listed above associated with the correct categories and EFI=0, they are passed through for further processing. When the 3287 receives any requests listed above with incorrect categories and EFI=0 or any requests not listed above with EFI=0, they are rejected with the negative response Function Not Supported (X'1003').

SNA Commands

SNA commands define a set of controls to establish and terminate sessions, and to assist in the management of data-flow and sessions.

Three types of SNA commands are discussed in the following topics:

- Session Control (SC) commands—These commands establish and terminate sessions in the network.
- Data Flow Control (DFC) commands—These commands control the flow of data in an LU-LU session.
- Function Management Data (FMD) command—This command is used to transfer data in the LU-LU session.

Commands Supported

The SNA commands supported by the 3287 are listed in Figure 4-2.

SNA Command		SSCP-->PU	SSCP-->SLU	PLU-->SLU	SLU-->PLU
ACTPU	SC	X			
DACTPU	SC	X			
ACTLU	SC		X		
DACTLU	SC		X		
BIND	SC			X	
UNBIND	SC			X	
SDT	SC			X	
CLEAR	SC			X	
CANCEL	DFC			X	
CHASE	DFC			X	
LUSTAT	DFC				X
SHUTD	DFC			X	
SHUTC	DFC				X
BID	DFC			X	
SIGNAL	DFC			X	
DATA	FMD			X	

Figure 4-2. SNA Commands Supported by the 3287

Activate Physical Unit (ACTPU)

The ACTPU command is sent to establish the SSCP-PU session with a 3287. The SSCP-PU session is established when the 3287 returns a positive response to the ACTPU command.

The ACTPU command can be transmitted when the SSCP-SLU and LU-LU sessions are active, for example, when a restart procedure occurs. When the 3287 receives the ACTPU command, active sessions are terminated immediately. The 3287 returns a positive response to the ACTPU command, and the SSCP-PU session is reestablished.

Deactivate Physical Unit (DACTPU)

When the 3287 receives the DACTPU command, LU-LU and SSCP-SLU sessions and the SSCP-PU session are terminated. If a command other than ACTPU is received after a positive response has been returned from the DACTPU command, the 3287 returns a negative response with sense data indicating No Session (X'8005').

Activate Logical Unit (ACTLU)

The ACTLU command is sent by the SSCP to establish the SSCP-SLU session with the 3287 LU. The SSCP-SLU session is established when the 3287 returns a positive response to the ACTLU command. The SSCP-PU session must be established prior to the receipt of ACTLU to allow the 3287 to return a positive response to this command. If the 3287 receives a command other than ACTPU, ACTLU, DACTPU, or DACTLU before the SSCP-LU session is established, a negative response is returned with sense data indicating LU Not Active (X'8009').

When the SSCP-SLU session has been previously established and the 3287 receives an ACTLU command, any active session between the LU and the PLU is terminated. The 3287 returns a positive response to the ACTLU command, and the SSCP-LU session is reestablished.

Deactivate Logical Unit (DACTLU)

Receipt of this command terminates the SSCP-SLU session. If the LU-LU session is established when the DACTLU command is received, the session is terminated. When the 3287 receives a command other than DACTPU, ACTPU, or ACTLU after a positive response has been returned for the DACTLU command, a negative response is returned with sense data indicating No Session (X'8005').

Bind

This command is sent to request an LU-LU session between the PLU and the 3287 SLU. The 3287 returns a positive response to establish the LU-LU session. When the session cannot be established, the 3287 returns a negative response with sense data that describes the reason the session was rejected.

When the SSCP-SLU session is established and the 3287 receives a command that flows in the LU-LU session, other than Bind, a negative response is returned with sense data indicating No Session established (X'8005').

When a LU-LU session exists, that is, one Bind has been accepted, and the 3287 receives a subsequent Bind command for the LU, a negative response is returned with sense data indicating Function Active (X'0815') if the Bind sender address is the same as the session already bound. A negative response indicating Session Limit Exceeded (X'0805') is returned if the Bind sender address differs from the session already bound.

Unbind

Receipt of this command directs the 3287 to terminate the LU-LU session. The LU-LU session is terminated when the 3287 returns a positive response to the Unbind command.

Clear

Receipt of the Clear command causes the 3287 to enforce the Data Traffic Reset state upon the LU-LU session. Clear also causes the 3287 clear the

receive buffer in preparation for the new chain. When Data Traffic Reset state is activated for an LU-LU session, only the following commands are valid for that session: Clear, Unbind, and start Data Traffic (SDT).

Start Data Traffic (SDT)

This command allows data traffic to flow during an LU-LU session. The SDT command must be issued after a Bind command has established the LU-LU session. It is also sent after CLEAR to complete a session resynchronization sequence with the 3287. SDT is valid only when the Data Traffic Reset state is active for an LU-LU session.

To complete a session resynchronization sequence, the PLU must request transmission of the SDT command.

Cancel

When received, normal SNA usage of this command directs the receiver to discard all elements of the chained transmission being received. However the 3287 processes data RUs as they are received without waiting until end-of-chain. Therefore, the Cancel command serves the purpose of providing a proper termination for an otherwise incomplete chain. Processing of a chained transmission is terminated when the Cancel command is received. EB or CD may be sent with the command.

When a chained transmission is in progress, and the 3287 returns a negative response to an element of that chain, the PLU should terminate that chained transmission and issue the Cancel command if the last chain element has not already been sent to the 3287.

Chase

Chase is used to confirm that all preceding requests have passed through the network and have been processed. When this command is received, the 3287 returns a positive response to the PLU, indicating all previous chains have been processed.

The PLU should complete or cancel the current chained transmission before issuing the Chase command. When a chained transmission is sent with exception-only responses requested, the Chase command can be used to verify that all responses for that chain have been received. The EB or CD indicators can be issued with the Chase command.

Shutdown

The PLU sends the Shutdown command. Receipt of this command directs the 3287 SLU to prepare for a session termination sequence. The 3287 returns a positive response to the PLU, but data-transfer sequences are not inhibited.

The Shutdown command causes the session to enter Shutdown Complete Pending state. The SLU then immediately sends the Shutdown Complete command to the PLU.

Shutdown Complete

When the Shutdown Complete command is sent to the PLU, the session enters Shutdown state. When Shutdown state is active, no requests will be sent to the PLU; the PLU, however, may continue to send data to the 3287.

The PLU may either terminate the session using Unbind when the Shutdown Complete command is received from the 3287, or use Shutdown as a means of quiescing traffic. Exit from Shutdown Complete requires a Clear and SDT if the command is used as a quiesce function.

FM Data

This command is used to transfer data in the LU-LU session or in SSCP-LU session. It may only be sent in LU-LU session when data traffic is allowed (SDT has been issued and received a positive response).

When communicating with a 3287 SLU, the following FM data protocols are used:

Bracket: Bracket protocol is used to delimit a series of related outbound FM data request units (RUs).

Chaining: Chaining logically connects one or more RUs; for example, all RUs required to complete a page.

Change Direction: Change direction informs the receiving LU that the sending LU has completed transmission and expects the next transmission to be from the receiving LU.

Bid

The Bid command is sent by the PLU to a 3287 SLU to request permission to begin a bracket. The use of Bid avoids long chains of data using transmission time and then being discarded because the SLU won bracket contention. If the Bid is accepted by the SLU, a positive response is returned and the SLU goes to Begin Bracket Pending state and waits for the request containing BB.

The 3287 SLU can reject a Bid command by winning bracket contention when the SLU is already in bracket (INB) and a PLU protocol error exists. The sense code is X'0813'.

Signal

The PLU can send the Signal command to the 3287 SLU to request the Change Direction (CD) indicator. The SLU completes any chained transmissions that are in progress and sends the CD to the PLU. A request with CD but no data (a null-RU) is sent if the SLU is in send state but has not started transmitting. If the SLU is already in receive state, BETB, or ERP1 state (see "Session States"), the signal is positively responded to but no SLU action is taken.

LU Status (LUSTAT)

The 3287 SLU sends the LUSTAT command to notify the PLU that a processing error has been detected or that a change in the operational status has occurred. A 4-byte status code is sent by the 3287 SLU to describe the error condition or the device status change.

For LUSTAT codes and conditions that determine which LUSTAT is sent, refer to "Logical Unit Status" later in this chapter.

Bracket Protocol. A series of related outbound requests to the 3287 are delimited in accordance with a Bracket Protocol. The following protocols apply for 3287 bracket processing.

For type 1 sessions, the PLU may begin a bracket any time the session is between brackets. The PLU may start a bracket by sending a transmission that contains BB or by sending Bid, waiting for a positive response, and then sending a transmission that contains BB.

If a Bid or BB from the PLU is rejected (the 3287 SLU will not reject the PLU's Bid or BB unless a protocol error is detected) the PLU should restart the transaction.

The PLU can end a bracket. The 3287 cannot end a bracket.

Bracket protocol establishes the following restrictions on beginning and ending brackets:

1. BB and EB cannot be sent with response RUs.
2. The EB cannot be sent with the Bid.
3. All outbound chains that begin a bracket but do not carry EB must be sent with definite response requested. The 3287 enters bracket state but does not send a positive response to the chain.

The 3287 supports bracket termination rule 1 as follows:

1. When the EB is received and the last element of a chain requires definite response, the 3287 will enter between-bracket state (BETB) from in-bracket state (INB) after +RSP to the chain or stay INB after -RSP.
2. When EB is received and the last element of a chain requires exception response, the 3287 will enter BETB from INB immediately.

The 3287 ignores the BB bit on all outbound requests except FM data, and ignores EB on all outbound requests except FM data and DFC commands 'Cancel' and 'Chase'.

Chaining Operations. When the 3287 receives a chain with chaining indicators in an improper sequence (for example, FIC, MIC, FIC), a negative response, with sense data indicating a chaining error (X'2002'), is returned to the PLU. The 3287 purges the chain, ignoring subsequent elements of that chain until a data RU with the LIC or a Cancel command is received. Receipt of an OIC data RU terminates the purging of the chain; the OIC message is also purged. Sending RUs having chaining indicators in the sequence FIC, MIC, OIC is a violation of chaining protocol. In this case, when the 3287 receives the OIC transmission, the chaining error is detected, the OIC transmission is purged, purging of chain elements is stopped, and a negative response is sent for the OIC transmission (sense code X'2002'). The 3287 is now ready to normally process the next chain.

Change Direction. The 3287 uses a Half Duplex, Flip-Flop (HDX-FF) mode to transfer normal flow data. Only one of the two LUs in the session may send at a given time. The flip-flop protocol demands that when one LU is sending, the other must be prepared to receive. Therefore, the two states of Send and Receive (RCV) exist on each end of the session.

A bit in the request header, called the change direction (CD) indicator, is used to keep the two end-point LUs in synchronization. Each time an LU accepts this CD in a request, it means it is that LU's turn to send. Each time an LU sends the CD in a request, that LU must then be prepared to receive. The 3287 sends a CD with no data (a null RU) in response to Signal. Exceptions may occur following negative responses. See "ERP1" state.

Pacing

Outbound pacing is supported by the 3287; the pacing count must be one.

Summary of SNA Commands

Figure 4-3 summarizes the validity of SNA commands received by the 3287 relative to the sessions (SSCP-PU, SSCP-LU, and LU-LU) to two LU-LU session processing states (Data Traffic Reset and In Brackets). Figure 4-4 shows the same for SNA commands sent by the 3287.

SNA Command Received	SSCP-PU Session Active	SSCP-LU Session Active	LU-LU Session Active	LU-LU Session Processing States			
				Data Traffic Reset		In Bracket	
				On	Off	On	Off
ACTLU	R	E	T				
ACTPU	E	T	T				
DACTLU	R	T	T				
DACTPU	R,T	T	T				
BIND			E,I	X			X
UNBIND			R,T		R		
CANCEL			R	R			
CHASE			R		R	R	
CLEAR			R	X			X
SDT			R	R	X		
SIGNAL			R		R		
SHUTDOWN			R		R		
FM DATA			R		R	R	

Legend:

R - Required state for this command to be valid.

I - Command invalid if in this processing state.

E - Command establishes this session.

T - Command terminates this session.

X - Command sets the processing state to the indicated status.

Figure 4-3. Summary of SNA Commands Received

SNA Command Sent	SSCP-PU Session Active	SSCP-LU Session Active	LU-LU Session Active	LU-LU Session Processing States			
				Data Traffic Reset		In Bracket	
				On	Off	On	Off
LUSTAT			R		R		
SHUTDOWN COMPLETE			R		R		R

Legend:

R - Required state for this command to be valid.

Figure 4-4. Summary of SNA Commands Sent

Session Processing States

The 3287 controls the processing of SNA commands, responses, and user data transmissions with a set of session states. When the 3287 receives the clear or Bind command, all 3287 session states are reset.

This section describes the processing states used by the 3287. When several states relate to a common processing function such as bracket or chain processing, they are described under a common heading. The remaining processing states are described individually.

Data Traffic (Reset/Active) State

Reset of all SNA LU-LU states in the 3287 is assured by entering Data Traffic Reset state. This state is entered when a Bind or Clear command is received from the PLU. When Data Traffic Reset state is turned off by SDT, the state is referred to as Data Traffic Active.

When in Data Traffic Reset state for any LU-LU session, the 3287 SLU cannot transmit data or commands. The PLU can send only session-recovery and session-termination commands when in this state. The 3287 only accepts data RUs for an LU-LU session during Data Traffic active state.

When in Data Traffic Reset state and a data RU or a command other than SDT or Unbind is received from the PLU, the 3287 returns a negative with system sense data indicating that data traffic is inactive (X'2005'). No other state, except Contention, can exist when the SLU is in Data Traffic Reset state.

Contention (CONT) State

The Contention state on the LU-LU session exists only between brackets. In this state, the SLU can accept data from the PLU. The first arrival triggers a change to Send or Receive state.

For the SSCP-SLU session, Contention state exists between the successful completion of all chains.

Send (SEND) State

The Send state is common to both Contention and HDX FF modes of operation.

In the Send state, the 3287 LU is ready for inbound (to the primary) operations.

After going from Contention to Send state, any normal outbound requests received on that session are discarded and a negative response HDX Flip Flop Error with sense code X'2004' is sent. Once INB, any normal outbound requests received on that session (FMD with BB or Bid) while in Send state is discarded and a negative response 'Bracket Bid Reject' with sense code X'0813' is sent. Neither of these responses causes any state change in the 3287 SLU. If INB and in Send state, a request received that does not carry BB is rejected by the 3287 with sense code X'2004'.

During Send state, the data is being transferred from the 3287 to the PLU. Except for a possible LUSTAT, all normal flow chains on the LU-LU session will carry the CD. The transition out of Send depends upon the response type carried with the inbound request. If a definite response is requested, the

transition from Send to Receive takes place after the response to the inbound request is returned to the 3287. If an exception response is requested, the transition from Send to Receive takes place as soon as the end-of-chain has been successfully transferred to the transmission link.

The SSCP-SLU session operates in Definite Response mode only. Therefore, the transition is from Send to Contention upon the receipt of a positive response, or Send to Receive if a negative response is returned.

Receive (RCV) State

The Receive state is common to both Contention and HDX-FF modes of operation. In this state, the 3287 SLU is ready for outbound (from the PLU) operations.

When RCV state is active, inbound normal flow requests cannot be sent. Responses, as requested, and control commands of the expedited flow can be sent inbound.

Normal flow traffic from the PLU is passed to the device when it is in Receive state. For the LU-LU session, Receive state is entered from Contention state if an outbound normal flow message is accepted for processing. It is entered from Send state after receiving a response from an inbound request carrying CD and definite response, or after successfully transferring the chain to the data link when the request carries CD and exception response. For the SSCP-LU session, Receive state is entered from Contention if an outbound normal flow message is accepted for processing. It is entered from Send state if a negative response is received for an inbound request.

For the LU-LU session, Receive state is changed to Send state after successfully processing a last-of-chain carrying the CD. Receive state is changed to Contention state after successfully processing and responding to a chain carrying EB, or after receiving a chain carrying EB which carries exception response requested. Receive state is changed to ERP1 state if any negative response except X'0813' or X'081B' is returned to the outbound request.

For the SSCP-SLU session, Receive state is changed to Contention after returning the response to the outbound request.

ERP1 State

ERP1 is a special state created to allow for error recovery protocols. The PLU is always responsible for error recovery; therefore, the SLU state structure generally is awaiting an outbound request to correct the error condition. However, there are times when the SLU must first recover and notify the PLU of its recovery by use of LUSTAT command before the PLU can take action. Thus, the SLU ERP1 state allows a form of Contention mode within brackets. This state has the characteristic of being able to receive any request but only sending LUSTATs.

When an LUSTAT flows inbound, the SLU remains in ERP1 state. This allows successive LUSTATs to flow without requiring the general exchange of CD between each LUSTAT. LUSTAT does not request change direction when sent while in ERP1 state.

ERP1 state is entered by an SLU after responding with any negative response except X'0813' and X'081B'. If the negative response does not change the state to Between Brackets (BETB), the transition to ERP1 takes place at end-of-chain.

ERP1 state is changed by accepting an outbound chain carrying CD. Following processing of the CD bit, the transition is made to Send state.

Bracket States

The 3287 has three major states associated with bracket protocols. These states are Between Bracket (BETB), In Bracket (INB), and Pending Begin Bracket (PEND.BB). These states are used to ensure synchronization of traffic between the PLU and the SLU. Transitions between these states are controlled by the BB or EB bits or by the Bid command.

Between Bracket (BETB) State

BETB state exists when the PLU and SLU are in contention to begin a bracket. This is the state entered after the SDT command is accepted. When the Bid or BB is accepted from the PLU BETB state ends. If the PLU cancels the chain containing the Begin Bracket, or if the SLU sends negative response for the chain containing the Bid or BB, the 3287 returns to BETB state. BETB state is normally assumed when an EB has been processed successfully.

When a chain carrying both BB and EB is being processed, BETB state is not changed.

BETB is terminated and INB is entered when the first (or only) element of a chain with BB bit on is ready to be transmitted.

Pending Begin Bracket (PEND.BB) State

In the PEND.BB state, the 3287 is waiting for a bracket to be begun by the PLU. The 3287 has returned a positive response to a Bid command. When the PLU attempts to begin a bracket and the 3287 is in PEND.BB state, the 3287 does not reject the bracket with sense code X'0813'.

In Bracket (INB) State

INB state is entered when the 3287 receives a BB without the EB or when the 3287 begins a bracket. INB state is maintained by the 3287 until the positive definite response to the EB chain is returned to the PLU or until the 3287 receives the last element of the EB chain when exception response is requested.

3287 Bracket State Errors

Error codes generated for bracket error conditions are as follows. The Bracket state conditions remain unchanged after sending the error code.

Command State	CHASE &EB	CHASE &-EB	BID	CANCEL &EB	CANCEL &-EB	FMD &BB	FMD E-BB	FMD &BB&-RQD
BETB	080B	-	-	080B	-	-	080B	2003
INB	-	-	0813	-	-	0813	-	0813
PEND.BB	2003	-	-	2003	-	-	2003	-

RU Lengths

The 3287 can send or accept RUs with a maximum length of 256 bytes. If the RU size specified in byte 11 of Bind exceeds this value, the 3287 sends a Bind reject X'0821' (Invalid Session Parameters).

Segmenting

The 3287 does not accept segmented PIUs. If the 3287 receives a segmented PIU, it sends the negative response X'8007' (Segmenting Error).

3287 Errors

Data Link

For data link control, action is as discussed in the *IBM Synchronous Data Link Control General Information* manual, GA27-3093. Unique action is that if the Set Normal Response Mode command is received when the PU is active the 3287 resets from an Activated Physical Unit to a Deactivated Physical Unit. All sessions must be restarted by the sequence starting with ACTPU.

LU-LU Session Error Reporting

The 3287 supports the sense codes described under "SNA Sense Codes"; the user sense field is set to zero.

The 3287 ignores the sense data in a negative response from the host. All negative responses cause the 3287 to enter RCV state and await further action by the host.

SDLC Commands and Responses

The 3287 supports the following SDLC commands and responses:

Commands	Responses
I-format	I-format
RR	RR
RNR	RNR
TEST	TEST
XID	XID
SNRM	UA (formerly NSA)
DISC	DM (formerly ROL)
CFGR	FRMR (formerly CMDR)
UP	CFGR
	BCN

For information on these commands, see *IBM Synchronous Data Link Control General Information*, GA27-3093.

Transmission Frames

For a detailed description of the SDLC frame format, refer to *IBM Synchronous Data Link Control General Information*, GA27-3093. Support of the frame sequence, flag byte, Address byte, and Frame Check Sequence bytes conforms to the referenced document.

Response Modes

The 3287 functions in two loop operating modes: normal response mode (NRM) and normal disconnect mode (NDM). In NRM, the 3287 can initiate transmission only as a result of receiving a frame which contains the P bit set to

1 or an Unnumbered Poll. Only single frames are sent by the 3287. The frame transmitted by the 3287 in response to a command received with the P bit set to 1 must have the F bit set to 1. When the 3287 has completed a transmission, a new transmission cannot be initiated until a subsequent frame is received which contains the P bit set to 1 or an Unnumbered Poll. A response transmission initiated by the 3287, which requires acknowledgment, is repeated each time the 3287 is polled until the acknowledgment is received. There is a limit of 15 of transmissions, the 3287 then does a wrap test. Responses which require acknowledgment from the communications controller are I frames, FRMR (formerly CMDR), and RR when transmitted with the F bit set to 0, to report clearing of a busy condition.

When in NDM, the 3287 cannot accept or transmit I or supervisor (S) frames. Nonsequenced responses are not transmitted unless the 3287 is solicited to reply. Invalid or nonimplemented commands received in NDM cause the 3287 to transmit a DM (formerly ROL) response at the next response opportunity. DM can be retransmitted until an SNRM or DISC command is received. When a DISC is received, the 3287 returns a DM. Command reject conditions are not present in NDM.

The following paragraphs describe the 3287 support of the Control and Information fields.

Supervisory Commands

The 3287 supports only the Supervisory commands Receive Ready (RR) and Receive Not Ready (RNR).

The C-field formats are as follows:

RR	N _r	P/F	00	01
	012	3	45	67
RNR	N _r	P/F	01	01
	012	3	45	67

The 3287 transmits RNR when it cannot accept further data from the link.

When the reported RNR condition is cleared, the 3287:

- Transmits an I-frame or RR with the F bit on after a frame with the P bit on is received.
- Transmits an RR with the F bit off when an optional response poll frame (a UP command with the P bit off) is received.

When an RR with the F bit off reports the clearing of busy condition, the 3287 repeats the RR with F bit off for each Poll cycle in NRM until the primary acknowledges receipt by an I frame with the P bit on or off or an S frame with the P bit on. If the 3287 does not receive this acknowledgement after it has repeated RR with the F bit off fifteen times, it stops sending RR and enters Normal Disconnected Mode.

The transmission or receipt of a Non-Sequenced format does not indicate the busy condition has cleared.

Nonsequenced Commands and Responses

The following Nonsequenced commands and responses are supported by the 3287. Note that the names and acronyms of some SDLC commands have been revised:

Command/Response	C-Field	Hex Code
Set Normal Response Mode (SNRM) Command	1 0 0 P/F 0 0 1 1 0 1 2 3 4 5 6 7	93
Disconnect (DISC) Command	0 1 0 P/F 0 0 1 1 0 1 2 3 4 5 6 7	53
Unnumbered Acknowledgment (UA) Response (was NSA)	0 1 1 P/F 0 0 1 1 0 1 2 3 4 5 6 7	73
Disconnect Mode (DM) Response (was ROL)	0 0 0 P/F 1 1 1 1 0 1 2 3 4 5 6 7	1F
Frame Reject (FRMR) Response (was CMDR)	1 0 0 P/F 0 1 1 1 0 1 2 3 4 5 6 7	97
Test Command Response	1 1 1 P/F 0 0 1 1 0 1 2 3 4 5 6 7	F3
Exchange Station ID Command/Response	1 0 1 P/F 1 1 1 1 0 1 2 3 4 5 6 7	BF
Unnumbered Poll (UP) Command (Was NSP)	0 0 1 P/F 0 0 1 1 0 1 2 3 4 5 6 7	33
Configure (CFGR) Command	1 1 0 P/F 0 1 1 1 0 1 2 3 4 5 6 7	D7
Beacon (BCN) Command	1 1 1 P/F 1 1 0 0 0 1 2 3 4 5 6 7	FF

SNRM

The SNRM command sets the 3287 in NRM. Receipt of SNRM causes the 3287 to deactivate the physical unit if it is in active state.

DISC

The DISC command sets the 3287 in NDM.

UA

The UA response is sent by the 3287 to acknowledge receipt and acceptance of the SNRM and DISC commands.

TEST

The Test command is used to initiate one round-trip transmission of test data both in NRM and NDM. The 3287 station will return the Test response without data if buffering is not available to hold the complete test data, or with data if buffering is available.

DM

The Disconnect Mode (DM) response is sent by the 3287 in normal disconnect mode (NDM) to request on-line status. DM is sent in response to any

command except Test and XID. DM is sent in response to the SNRM command when the 3287 cannot enter NRM.

FRMR

The FRMR response is implemented by the 3287 as described in *SDLC General Information*, GA27-3093. The FRMR is sent in response to any poll until an SNRM or DISC is received to reset the 3287, or the printer goes offline with the error.

XID

The Exchange Station Identification (XID) number must be added to the host programs for a 3287. The XID command and response contains additional data beyond the C byte. The 3287 responds to the XID command in NRM or NDM, except when a FRMR condition exists, in which case the FRMR response takes precedence over XID. The request/response unit (RU) of the XID consists of 21 bytes, defined as follows:

Byte 0	bits 0-3 4-7	B'0001' B'0010'	Variable XID Format PU Type 2
Byte 1		X'15'	XID Information Field Length
Bytes 2-5	bits 0-11 12-31	X'028' X'YYYY'	Block Number + Specific Terminal ID
Byte 6-7		X'0000'	Reserved
Byte 8		X'00'	Loop Secondary
Byte 9		X'30'	No Segments allowed
Bytes 10-11		X'0109'	256 byte max. for I field
Byte 12		X'00'	SDLC command profile = SNA Link set
Byte 13		X'00'	SDLC function flags (SREJ, SARM, SIM & RQI not supported)
Bytes 14-15		X'0000'	Reserved
Byte 16		X'01'	Modulus and Maxout count
Byte 17		X'00'	Reserved
Byte 18		X'01'	SDLC Address Assignment Field
Byte 19		X'ZZ'	SDLC Address
Byte 20		X'00'	Number of dial digits

An information field is not necessarily included in all I frames. When present, the maximum length of this field is 265 bytes to allow a 256 byte RU plus a 9-byte TH, RH to be transmitted.

UP

The unnumbered poll (UP) command is used with the P bit off to solicit traffic from the 3287.

No information field is permitted. The address field of this command contains the all ones address. The 3287 responds if:

1. An I frame has been received since the previous response opportunity.
2. A NS command which requires an explicit response has been received (SNRM, DISC, TEST, and CFGR), since the previous response opportunity.
3. A command reject condition or status change is to be reported.

4. The 3287 has not received link acknowledgment of a previous I frame.

A response is optional following the receipt of an UP if none of the above apply, but traffic is pending transmission or retransmission. A response may be sent if an I frame is pending.

CFGR

The Configure (CFGR) command is used to invoke one of the following configuration functions specified in the one byte data of the information field of the frame:

Clear (0000000): - causes all functions which may have been set to be cleared.

Beacon Test (0000001X): - causes the 3287 to suppress (C7=1) or reinitiate (C7=0) the transmission of carrier. If carrier is suppressed, the next downstream station transmits beacon responses.

Monitor Mode (0000010X): - causes the 3287 to enter a monitor mode if bit C7=1. In this mode the 3287 is not capable of transmitting on the link and Clear or Monitor Mode reset (C7=0) CFGR command must be received to reinitiate transmit capability.

When the 3287 receives the CFGR command it confirms acceptance by transmission of a CFGR response.

CFGR is active in both modes, NRM and NDM.

The resetting of an action taken as a result of a previous CFGR command will be done only by the receipt of a subsequent CFGR command. CFGR functions are not affected by the receipt of SNRM or DISC command.

CFGR command always accompanies one byte of data which indicates the configuration function to be performed.

If bit C7 of this byte is set to one, it indicates the function described in C0 through C6 is to be set. If bit C7 is set to zero, it indicates the function described is to be cleared.

The Configure (CFGR) response is transmitted only in response to the receipt of a CFGR command. Its structure is identical to that specified for the CFGR command. If a command reject condition exists when a CFGR command is received, the CFGR command is ignored and the FRMR response takes precedence.

If a CFGR command is received with an invalid information field, the CFGR response is returned with no information field.

BCN

The Beacon (BCN) response is repetitively transmitted by the 3287 upon detection of a loss of signal condition to permit fault isolation on the loop.

On entering Beacon, the receive signal is sampled, and two counters maintained: X for each good sample and Y for each bad sample. A Beacon command is transmitted, the signal is sampled again, and counters are advanced. If Y equals 50 before X equals 50, the counters are reset and

beaconing continues. But, if X equals 50 before Y equals 50, beaconing is stopped and a normal completion code is returned.

TA/GA

The 3287 must recognize a turn around (TA) sequence and a Go-Ahead (GA) sequence before initiating any transmission. A GA is defined as the sequence of a zero bit followed by seven one bits (01111111). TA is defined as consecutive 8 zero bits following the flag (0111 1110 0000 0000).

If a transmission is pending, the 3287, upon recognizing a GA, converts the GA to a beginning FLAG by changing the seventh one bit to zero bit. One or more frames may be transmitted but only one I frame can be included in these frames.

Any frame received from the Primary station with the 'P' bit on requires a 3287 response. The response is transmitted following the receipt of a GA. The 3287 may also initiate a transmission following the receipt of UP command with the P bit off and the first subsequent GA. If a transmission is not initiated coincident with the first GA received following the UP, it may not be initiated until a subsequent UP cycle is initiated by the primary station.

Terminal Identification and Addressing

Terminal ID

Each 3287 operating under SLDC has a permanent, unique, six-byte identification that it will transmit in response to a request for its ID (XID command). This identification is fixed at the time of manufacture and is not selectable. The 3287 sends its serial number.

SDLC Station Address

The SDLC station address is a one-byte address that must be selected by the customer at setup time.

An SDLC Station address of either X'00' or X'FF' should not be assigned.

Information (I) Frame

The Information frame is used to transmit message data. When transmitted, the I frame contains a maximum of 256 bytes of RU message data preceded by six bytes of transmission header (TH) and, optionally three bytes of request/response header (RH).

Sequence Error Recovery Procedures

A sequence error occurs when the 3287 receives an I frame with an incorrect Ns sequence count and valid FCS bytes. The 3287 does not accept the I frame that caused the sequence error and rejects all following I frames until an I frame is received which contains the correct Ns value, at which time the sequence error condition is reset.

The 3287 transmits I frames in the sequence indicated by the last Nr count received, which may include retransmission of previously transmitted I frames that have not been acknowledged.

All I frames, including those pending initial transmission, are transmitted in contiguous sequence according to the Ns value within the constraints of the

modulo count. This may include retransmission of previously transmitted I frames that were not acknowledged.

Abort Function

The abort function is used by the primary station or by the 3287 when a frame being transmitted is to be discarded. The abort function is performed by transmitting eight contiguous 1 bits without zero insertion at the earliest possible time following recognition of an abort situation. No FCS is transmitted. When, for example, the 3287 receives seven contiguous 1 bits, it discards the aborted frame. The 3287 employs the abort function when an equipment malfunction occurs that causes an erroneous transmission. An abort is also transmitted when a transmit underrun occurs within the 3287.

Timeout Controls

The 3287 supports automatic disconnection from the loop.

When the 3287 does not recognize any valid outbound frame for 8 seconds, a nonproductive timeout occurs. This timeout causes OK indicator to be turned off. The timer is reset to zero every time the 3287 detects a valid outbound frame and is started at the end of each valid frame received by the station.

After the OK indicator is turned off, sampling is initiated to examine whether a signal on the loop exists or not. When no signal exists after 7 retries the 3287 turns off the COMM indicator and goes into wrap test. If the wrap test is successfully completed, a two-digit error code is displayed and a Beacon (BCN) response is sent out. If the wrap test is not successfully completed, the machine check indicator is turned on, along with the two-digit error code.

Wrap Test

This test performs a basic path check of the communication adapter. The adapter is placed in wrap mode and messages are wrapped through the Loop Station Connector (LSC). The interrupt sequence and character transfer are checked for correct operations.

Shut Off

When the 3287 receives eight contiguous zeros during the process of active transmission, it presents an error status display, disconnects from the loop and turns off the COMM indicator.

SNA Reference Data

Bind Default

The following is suggested as a setting for the Bind parameters for LU type 1:

Byte	Binary Bits	Byte	Binary Bits
-	0123 4567	9	0000 0001
0	0011 0001	10	1000 0101
1	0000 0001	11	1000 0101
2	0000 0011		
3	0000 0011	12-13	0000 0000
4	1011 0001	14	0000 0001
5	0001 0000	15	0000 0001
		16-17	0000 0000
6	0011 0000	18	1111 1001
7	1000 0000	19-26	0000 0000
8	0000 0000		

Bind Check

The Bind parameters sent to the 3287 are checked according to the following table:

LU Type 1				
Byte	Bit	Check	Reject if	
1		C	-X'01'	Bind Type and Format
2		C	-X'03'	FM Profile
3		C	-X'03'	TS Profile
4	0	NC		
	1	NC		
	2-3	C	B'00'	Chaining Responses
	4,5	NC		
	6	C	B'1'	Compression Indicator
	7	C	B'0'	Send EB Indicator
5	0	NC		
	1	NC		
	2-3	C	B'00'	Chaining Responses
	4-5	NC		
	6	C	-B'0'	Compression Indicator
	7	NC		
6	0	NC		
	1	C	B'1'	FM Header Usage
	2	C	B'0'	Bracket Usage
	3	C	B'0'	Bracket Termination Protocol
	4	C	B'1'	Alternate Code Selection
	5-7	NC		
7	0,1	C	-B'10'	Normal Flow Send/Receive Mode Selection
	2	C	B'1'	Recovery Responsibility
	3	C	B'1'	Brackets First Speaker
	4-7	NC		
8	0-1	NC		
	2-7	NC		
9	0,1	NC		
	2-7	C	-B'000001'	Primary to Secondary Pacing Count
10	0-7	C	>X'85'	Maximum RU Size Sent by Secondary LU
11		C	>X'85'	Maximum RU size sent by Primary LU
12,13		NC		
14		C	-X'01'	Print Function Type
15	0-3	C	-B'0000'	FM Header Subsets
	4-7	C	-B'0001'	or
			B'0000'	SCS Basic Controls
16-24		NC		
25		NC		
26*				
27+	All bytes ignored			

Notes:

* Bytes 26-34 are reserved for the Encrypt feature.

If present, byte 26 must equal X'00'.

C - Check

NC - No check

B - Bit

- - Logical Not

SNA Sense Codes

Each major error code has modifiers for further description in sense byte one. The modifier codes supported and the condition causing the negative response to be returned are described below.

**Sense
Byte**

One Description

Path Error X'80'

X'04' Unrecognized DAF

X'05'- NO SESSION

- A Bind has not been received or accepted by the 3287.
- A request other than Bind is sent to an SLU which has already accepted a Bind, and the OAF is not X'00' or the OAF in the accepted Bind.

X'07'- SEGMENTING ERROR

- Segmented PIU was received by the 3287

X'08'- PU NOT Active

The 3287 has not received or accepted an ACTPU, or a control condition caused an internally generated DACTPU.

X'09'- LU NOT Active

The 3287 has not received or accepted an ACTLU, or a control condition caused an internally generated DACTLU.

X'0F'- Invalid Address Combination

A request was addressed to the PU (DAF=X'00'), and the OAF was not SSCP (OAF=X'00')

State Error X'20'

X'01'- Sequence Number Error

The sequence number of the normal flow request did not match the number expected by the 3287.

Sense Byte One	Description
X'02'	Chaining Error Chain elements were out of protocol sequence.
X'03'	Bracket State Error A Bracket state error occurred.
X'04'	HDX Flip-Flop Error A normal outbound request was received while the 3287 was in send state.
X'05'	Data Traffic Reset An FM or DFC request was received before an SDT was received or accepted.
Request Error X'10'	
X'03'	Function Not Supported. <ul style="list-style-type: none"> • Unsupported Session Control Request • Unsupported Data Flow Control Request • SIGNAL Code is not X'00010000' • Network Control Request • FM Data Stream • Invalid Command <ul style="list-style-type: none"> - Data Following a Read, RM, RMA, or EAU command.
X'05'	Parameter Error SCS parameter error (for example MPP, LM, RM, SVF, etc.)
Request Reject X'08'	
X'02'	Intervention Required <ul style="list-style-type: none"> • Printer condition such as end of form, paper jam, printer cover up, or hold time out.
X'05'	Session Limit Exceeded A Bind was received whose OAF differs from the PLU already bound
X'0B'	Bracket Race Error
X'11'	Break Sent when the operator depresses Cancel key, if a chain has not completed printing.
X'13'	Bracket Bid Reject <ul style="list-style-type: none"> • Returned to a BID or BID with Begin Bracket if the 3287 has won contention and started a bracket. • Returned when a BID or Begin Bracket was received, and INB state already exists. This may be a protocol error.
X'15'	Function Active Bind reject if the same OAF already has an accepted Bind to the SLU.
X'1C'	Request Not Executable

The 3287 has a nonrecoverable error.

X'21'- Invalid Session Parameters

- Bind parameters do not match the 3287 Bind checks.
- 3287 rejection of ACTPU or ACTLU if FM/TS profile bytes is not X'01'.

Logical Unit Status (LUSTAT)

LUSTAT provides a means for the SLU to send device status information when the SLU is not in Receive state (a negative response is used when the SLU is in Receive state). The following are the CD settings that accompany LUSTAT and the state changes, if any, that occur.

SLU State When LUSTAT Sent	CD Setting	State Change
BETB	CD set	None
ERP1	CD not set	None
Send	CD set	to Receive

The 3287 sends inbound LUSTATs with exception response or with definite response. The 3287 must receive the response to an LUSTAT before it will send any further normal flow requests on that session; however, it accepts outbound requests prior to receiving the response to LUSTAT.

The 3287 returns the LUSTAT code 00010000 to clear the negative response condition X'0802' or to report an SLU error condition.

Error Recovery Procedures

The 3287 sends sense code X'0802' when End of Forms timeout expires (after 1 minute) or when Hold Print Time Out expires (after 10 minutes). If the sense code is transmitted, an LUSTAT Must be sent after the condition has been corrected and Enable print has been pressed. The PLU should resend the chain.

Chapter 5. International Considerations

The following text describes special considerations pertaining to the 3287 Printer in various countries throughout the world.

Power Supplies

Power supplies for the 3287 Printer are available, at the time of ordering, to match the following World Trade power sources:

<i>Voltage (Vac)</i>	<i>Hertz (Hz)</i>
100	50
110	50
200	50
220	50
230	50
240	50
100	60
110	60
120	60
127	60

Power Cords and Plugs

In the US and A/FE the standard power cord length is 2.8 m (9 ft.). If the standard length is not required, Power cord lengths of 1.8 m (6 ft.), 3.7 m (12 ft.), or 4.5 m (15 ft.) can be specified.

For E/ME/A, a 2.8 m (9 ft.) Power cord is standard and a length of 4.5 m (15 ft.) can be specified.

Several types of power plugs are available with the 3287 Printer. For details, see *The IBM 3287 Models 1, 2, 11, and 12 Planning and Site Preparation Guide*, GA18-2018, has detailed information about power plugs.

Character Sets

The 3287 Printer supports the EBCDIC character set in several languages. The language that is specified when the 3287 Printer is ordered must be the same as the transmitted code/character set used on the controlling unit to which the printer is to be attached.

Appendix A shows the characters that are printed for each language that is supported by the 3287 printer.

The following World Trade character sets are available as specify features:

Language

Austrian/German
Austrian/German (A)
Belgian
Brazilian
Canadian French
Danish/Norwegian
Danish/Norwegian (A)
English UK
English US
Finnish/Swedish
Finnish/Swedish (A)
French
International
Italian
Japanese English
Katakana
Portuguese
Portuguese (A)
Spanish
Spanish (A)
Spanish Speaking

Note: Alternate character sets (A) are available for Austrian/German; Danish/Norwegian; Finnish/Swedish; Portuguese; and Spanish to ensure compatibility with the existing 3271/3272 data files.

Nomenclature

The IBM 3287 Printer, at the time of original manufacture, can be ordered with the following nomenclatures for the operator's panel lights and switches:

Brazilian	German
Canadian French	Italian
English UK	Japanese
English US	Spanish
French	Spanish Speaking

Note: English US is standard on any 3287 Printer ordered for use in the United States.

Appendix A. Language Group Character Sets

The figures in this appendix show the SCS characters (hex locations "40 to FE") printed by the 3287 Printer for each language that is supported.

SCS control codes are shown in hex locations "00 to 3F", and "FF".

Second Hex Character	First Hex Character															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	Nul				SP	&	-						()	\	0
1						/		a	j	-		A	J		1	
2								b	k	s		B	K	S	2	
3								c	l	t		C	L	T	3	
4	VCS	ENP	INP					d	m	u		D	M	U	4	
5	HT	NL	LF	TRN				e	n	v		E	N	V	5	
6		BS						f	o	w		F	O	W	6	
7								g	p	x		G	P	X	7	
8								h	q	y		H	Q	Y	8	
9		EM						i	r	z		I	R	Z	9	
A					Q	!	!	:								
B	VT				^	\$,	#								
C	FF	DUP			<	*	%	@								
D	CR				()	...	'								
E		FM	IRS		+	;	>	=								
F			BEL			~	?	*								

Notes:

1. The characters shown in the shaded areas vary among languages. See "Figure A-2. Language Differences—EBCDIC" for the characters that are applicable to the language the 3287 Printer is using.
2. All invalid SCS characters received by the 3287 are printed as a hyphen.

Legend:

- | | |
|----------------------|--------------------------------------|
| CR = Carriage Return | VT = Vertical Tab |
| FF = Form Feed | SHF = Set Horizontal Format |
| NL = New Line | SVF = Set Vertical Format |
| SP = Space | SLD = Set Line Density |
| TRN = Transparent | VCS = Vertical Channel Select |
| LF = Line Feed | IRS = Interchange — Record Separator |
| BS = Back Space | BEL = Bell Function |
| Nul = Space | INP = Inhibit Presentation |
| HT = Horizontal Tab | ENP = Enable Presentation |

Figure A-1. English U.S.—EBCDIC

Language	EBCDIC Hex Code														
	4A	4C	5A	6A	79	5B	7B	7C	5F	A1	C0	D0	E0	4F	7F
English U.S.	¢	<	!		\	\$	#	@	^	~	<	>	/		"
Austrian/German	Ä	<	Ü	Ö	\	\$	#	§	^	ß	ä	ü	ö	!	"
Austrian/German (Alternate)	ö	<	ü	ß		Ü	Ä	Ö						!	ä
Danish/Norwegian	#	<	×	ø	\	À	Æ	Ø	^	ü	æ	ø	/	!	"
Danish/Norwegian (Alternate)	ø	<	à	!		À	Æ	Ø						!	æ
Finnish/Swedish	§	<	×	ö	é	À	Ä	Ö	^	ü	ä	ö	é	!	"
Finnish/Swedish (Alternate)	ö	<	à	!		À	Ä	Ö						!	ä
French	°	<	§	ù	\	\$	£	à	^	·	é	è	ç	!	"
Italian	°	<	é	ò	ù	\$	£	§	^	·	é	è	ç	!	"
Portuguese	¡	ç	¡	õ	\	\$	À	Ö	^	ç	ã	/	ç	!	"
Portuguese (A)	¡	ç	¡	õ	\	\$	À	Ö	^	ç	ã	/	ç	!	"
Spanish	¡	<	¡	ñ	\	Ñ	Ñ	@	^	·	<	>	/	!	"
Spanish (Alternate)	¢	<	!	!		Ñ	Ñ	@						!	ñ
English U.K.	\$	<	!		\	£	#	@	^	~	<	>	/	!	"
Belgian	¡	<	¡	ù	\	\$	#	à	^	·	é	è	ç	!	"
Brazilian	é	<	\$	ç	é	ç	ç	ç	^	·	ó	é	/	!	"
Spanish Speaking	¡	<	¡	ñ	\	\$	Ñ	@	^	·	<	>	/	!	"
International	¡	<	¡	!	\	\$	#	@	^	~	<	>	/	!	"
Japanese/English	£	<	!		\	¥	#	@	^	~	<	>	\$!	"
Canadian French	à	<	/	ù	\	\$	#	@	^	·	é	è	ç	!	"

Canadian French Extensions	EBCDIC Hex Code									
	42 48 52 53 56 57 CB DB DC 62 64									
	ä	ç	é	è	í	ï	ö	ü	ü	Ä
Canadian French Extensions	EBCDIC Hex Code									
	68 71 72 73 74 76 77 EB FB FC FD									
	ç	é	é	é	é	í	ï	ö	ü	ü

Note: Alternate character sets are provided to ensure compatibility with the existing 3271/3272 data files.

Figure A-2. Language Differences—EBCDIC

Second Hex Character	First Hex Character															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	Nul				SP	&	-			∩					£	0
1					o	I	/		ア	イ	-		A	J		1
2					Γ	α			イ	チ	∧		B	K	S	2
3					∟	∩			ウ	ツ	*		C	L	T	3
4	VCS	ENP	INP		,	1			I	チ	マ		D	M	U	4
5	HT	NL	LF	TRN	+	∩			オ	ト	∩		E	N	V	5
6		BS			ヲ	ツ			カ	チ	△		F	O	W	6
7					ア				キ	ニ	メ		G	P	X	7
8					イ	-			ク	ヌ	モ		H	Q	Y	8
9		EM			ウ				ケ	ネ	ヤ		I	R	Z	9
A					£	!		:	コ	ノ	ユ	レ				
B	VT		SHF	SVF		.	¥	,	≠				□			
C	FF	DUP			<	*	%	@	ウ		ヨ	ワ				
D	CR				<)	∩	'	ウ	ハ	ラ	フ				
E		IRS			+	;	>	=	ス	ヒ	リ	"				
F			BEL			∩	?	"	セ	フ	ル	。				

Note: All invalid SCS characters received by the 3287 are printed as a hyphen.

- Legend:
- CR = Carriage Return
 - FF = Form Feed
 - NL = New Line
 - SP = Space
 - TRN = Transparent
 - LF = Line Feed
 - BS = Back Space
 - Nul = Space
 - HT = Horizontal Tab
 - VT = Vertical Tab
 - SHF = Set Horizontal Format
 - SVF = Set Vertical Format
 - SLD = Set Line Density
 - VCS = Vertical Channel Select
 - IRS = Interchange-Record Separator
 - BEL = Bell Function
 - INP = Inhibit Presentation
 - ENP = Enable Presentation

Figure A-3. Katakana-EBCDIC

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Appendix B. SDLC Commands and Responses: Acronym Update

This appendix shows the relationship between the current acronyms for SDLC commands and responses and ones that a reader may encounter in earlier SDLC documentation.

NEW ACRONYM AND MEANING

UI—unnumbered information frame
SNRM—set normal response mode
DISC—disconnect
UA—unnumbered acknowledgement
RIM—request initialization mode
SIM—set initialization mode
DM—disconnect mode
FRMR—frame reject
TEST—test
RD—request disconnect
UP—unnumbered poll
BCN—beacon
CFGR—configure

OLD ACRONYM AND MEANING

NSI—nonsequenced information frame
unchanged
unchanged
NSA—nonsequenced acknowledgement
RQI—request for initialization
unchanged
ROI—request online
CMDR—command reject
unchanged
RQD—request disconnect
(none)

Appendix C. Status Codes

The following section Summarizes the 3287 status codes (Figure C-1).

For details on problem determination using status codes/panel lights/audible alarm, refer to the *IBM 3287 Printer Models 11 and 12 Problem Determination Guide, GA27-3191*.

Status Code	Summary of Status Codes
01	End of Form
08	Hold Print or end-of-form timeout
09	Address Select switches not set properly
20	Transmission halted by the Controlling Unit
21	Wrap test error
22	Wrap test error
23	Wrap test error
24	Transmission error between the 3287 and Controlling Unit
25	Data Set timeout
26	Transmission error between the 3287 and Controlling Unit
27	Controlling Unit not ready
28	Controlling Unit transmission error
41	3287 Print error
42	3287 not ready
43	Form feed error
44	3287 Print head error condition
45	3287 Print head error condition
46	3287 Print head error condition
47	3287 Print head error condition
XX	All other 3287 error conditions

Figure C-1. Status Code Summary

Appendix D. List of Acronyms and Abbreviations

ACTLU	Activate Logical Unit	FCS	frame check sequence
ACTPU	Activate Physical Unit	FI	format indicator
A/FE	IBM Europe/Middle East/Africa Corporation	FF	form feed
BB	begin bracket		flip-flop
BBI	begin bracket indicator	FIC	first-in-chain
BAT	basic assurance test	FID	format identification
BBP	begin bracket pending	FM	function management
BC	begin chain	FMD	function management data
BCI	begin chain indicator	FMH	function management header
BCN	Beacon	FRMR	Frame Reject (was CMDR)
BEL	bell	FS	field separator
BETB	between bracket state	GA	go-ahead
BIU	basic information unit	HDX	half duplex
BM	bottom margin	hex	hexadecimal
bps	bits per second	HT	horizontal tab
BS	backspace	HZ	hertz
CAT	(RU) category	ID	identification
CB	circuit breaker	IFS	intermediate field separator
CD	change direction	INB	in bracket state
CDI	change direction indicator	INP	inhibit presentation
CFGR	Configure	IPR	isolated pacing response
CMDR	Command Reject (now FRMR)	IR	intervention required
COMM	communication	IRS	interchange record separator
cps	characters per second	IUS	information unit separator
CR	carriage rerun	LF	line feed
CSI	code selection indicator	lpi	lines per inch
CSU	customer setup	LM	left margin
DACTLU	Deactivate Logical Unit	LSA	loop station adapter
DACTPU	Deactivate Physical Unit	LSC	loop station connector
DAF	destination address field	LU	logical unit
DFC	data flow control	LUSTAT	Logical Unit Status
DISC	Disconnect	mm	millimeters
DM	Disconnect Mode (was ROL)	MPF	mapping field
DR1	definite response 1	MPL	maximum print line
DR2	definite response 2	MPP	maximum print position
DTR	data traffic reset	NDM	normal disconnect mode
EB	end bracket	NL	new line
EBI	end bracket indicator	NRM	normal response mode
EC	end chain	NS	non-sequenced
ECI	end chain indicator	NSA	Non-Sequenced Acknowledgement (now UA)
EF	expedited flow	NSI	Non-Sequenced Information (now UI)
EFI	expedited flow indicator	OAF	origin address field
E/ME/A	IBM Europe/Middle East/Africa Corporation	OIC	only in chain
ENP	enable presentation	PI	pacing request/response indicator
EOF	end of form	PLU	primary logical unit
ER	exception response	POR	power-on reset
ERI	exception response indicator	PS	presentation services
ERP	error recovery procedure	PU	physical unit
EX	exception	QRI	queued response indicator
EXT	external	RD	request disconnect

RES reserved
RCV receive
RH request/response header
RLM request initialization mode
RLSD receive line signal detect
RM right margin
RNR receive not ready
ROL Request Online (now DM)
RPQ Request Price Quotation
RQI request for initialization
RR receive ready
RRI request/response indicator
RS record separator
RSP response
RTI response type indicator
RU request/response unit
SC session control
SCB string control byte
SCS SNA character string
SCU system controlling unit
SDI sense data included
SDLC Synchronous Data Link Control
SDT Start Data Traffic
SHF set horizontal format
SHUTC Shutdown Complete
SHUTD Shutdown

SIM set initialization mode
SLD set line density
SLU secondary logical unit
SNA System Network Architecture
SNF sequence number field
SNRM set normal response mode
SPU secondary physical unit
SS start/stop
SSCP system services control point
SVF set vertical format
TA turnaround
TCAM telecommunication access method
TH transmission header
TM top margin
TRN transparent
UA Unnumbered Acknowledgement (was NSA)
UI unnumbered information
UP Unnumbered Poll
US United States
VAC Volts Alternating Current
VCS vertical channel select
VT vertical tab
VTAM virtual telecommunications access method
VWFT variable width forms tractor
XID transmit ID

Appendix E. Glossary

Asterisked (*) definitions are reproduced with permission from the *American National Dictionary for Information Processing*, copyright 1977 by the Computer and Business Equipment Manufacturers Association, copies of which may be purchased from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

ASCII (American National Standard Code for Information Interchange): *The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), used for information interchange among data processing systems, communication systems, and associated equipment. The ASCII character set consists of control characters and graphic characters.

audible alarm: An alarm that is activated when predetermined events occur that require operator attention or intervention for system operation.

basic assurance test: 3287 internal diagnostic tests.

bits per second: The speed at which data is transmitted.

buffer: *A routine or storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transmitting data from one device to another.

carrier rate: The data rate speed of the telecommunication service facilities.

circuit breaker: An electrical overload protection power switch that can be manually reset.

characters per second: The number of characters per second (including spaces) that can be printed by the 3287.

character string: *A connected sequence of characters.

communication: See data communication.

communication loop: Cabling and accessories that connect controlling units and devices to a common communication cabling system.

Controlling Unit: (1) The unit that controls input/output operations at one or more devices. (2) The functional unit that interprets and executes instructions.

data communication: *The transmission and reception of data.

data link attached loop: A communication loop that connects a Controlling Unit to remote devices through a loop control unit.

Device: A mechanical, electric or electronic product such as the 3287.

direct attached loop: A communication loop that connects a Controlling Unit to local or remote devices.

EBCDIC: *Extended binary-coded decimal interchange code. A coded character set consisting of 8-bit coded characters.

format: *The arrangement or layout of data on a data medium.

Hexadecimal: A numbering system formed from a set of 0 through 9 and A through F.

loop control unit: A data link communication device that connects the Controlling Unit with the remote terminal device.

loop station connector: Provides the 3287 device with a physical connection to the system communication loop.

maximum print line: The maximum (102) number of print lines that can be printed on a 3287 page.

maximum print position: The maximum (132) number of print positions (including spaces) that can be printed on a 3287 print line.

null character: An all binary-0 character that occupies a position in the storage buffer and is displayed as a blank position.

offline: *Pertaining to equipment or devices not under control of a Controlling Unit.

online: *Pertaining to equipment or devices under the direct control of a Controlling Unit.

paper handling device: The unit that can be installed on top of a 3287 to feed paper.

platen: A cylindrical backing against which printing mechanisms strike to produce a printed impression.

print head: The printing mechanism of the 3287.

Systems Network Architecture (SNA): The total description of the logical structure, formats, protocols, and operation sequences for transmitting information units through the communication system. Communication system functions are separated into three discrete areas: the application layer, the function management layer, and the transmission subsystem layer. The structure of SNA allows the ultimate origins and destinations of information—that is, the end users—to be independent of, unaffected by, the specific communication-system services and facilities used for information exchange.

timeout: (1) A time interval allotted for certain operations to occur; for example, response to polling or addressing before system operation is interrupted and must be restarted. (2) A terminal feature that logs off a user if an entry is not made within a specified period of time.

user: Anyone who requires the services of a communication system.

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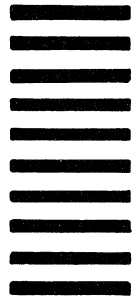
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360 Hamilton Avenue, White Plains, N.Y., U.S.A. 10601



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IBM 3287 Printer Models 11 and 12 Component Description

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This Technical Newsletter provides replacement pages for the subject publication. Pages to be inserted and/or removed are:

A-1, A-2

A change or addition to text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

This Technical Newsletter includes a technical change to Appendix A: Language Group Character Sets, page A-2.

Note: *Please file this cover letter at the back of the manual to provide a record of changes.*



Technical Newsletter

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1-1, 1-2	3-5, 3-6
1-3, 1-4	4-13, 4-14
2-3, 2-4	5-1, 5-2
2-5, 2-6	A-1, A-2
2-7, 2-8	A-3, A-4

A change or addition to the text or illustration is indicated by a vertical line to the left of the change.

Summary of Changes

This technical newsletter includes technical changes and corrections as a result of Engineering Change 321789. With this change, the user can set the number of lines per inch to be printed on the 3287 to 3, 4, 6 or 8 LPI. This change also allows the user to specify whether the 3287 prints a hyphen or halts printing for an invalid control code.

This technical newsletter also contains miscellaneous technical and editorial changes.

Note: Please file this cover letter at the back of this manual to provide a record of changes.

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International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, N.Y. 10604

IBM World Trade Americas/Far East Corporation
Town of Mount Pleasant, Route 9, North Tarrytown, N.Y., U.S.A. 10591

IBM World Trade Europe/Middle East/Africa Corporation
360 Hamilton Avenue, White Plains, N.Y., U.S.A. 10601