

PRINTRONIX®

*Coax/Twinax
Programmer's Reference Manual*

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1

Introduction

About This Manual

This is a reference manual for computer programmers who program printer drivers, print applications, etc.

The book is divided into two major sections: coax control codes (starting on page 11) and twinax control codes (starting on page 59).

For your convenience, there is also an appendix explaining the Load Alternate Character (LAC) feature (page 77), an appendix on Coax/Twinax Character Set Translation to Internal ASCII Characters (page 81), and a Glossary of terms (page 85).

This manual does not contain information about setting up or operating specific printer models. That information is contained in the setup and operation documents that accompany each printer.

For additional information, it is very important that you read and comply with all information highlighted under notes:

NOTE: A note gives you helpful tips and additional programming information.

Coax/Twinax Emulations

With a coax interface, the printer emulates the following IBM® coax printer models:

- 3287 Models 1 and 2 (color models 1C and 2C are not supported)
- 4234 Model 1

With a twinax interface, the printer emulates the following IBM twinax printer models:

- 4234 Models 2 and 12
- 5225 Models 1, 2, 3, and 4

These emulations are discussed in the following chapters.

2

Coax Control Codes

Overview

With a coax interface, the printer emulates these IBM coax printer models:

- 3287 Models 1 and 2 (color models 1C and 2C are not supported)
- 4234 Model 1

The coax interface supports the following data stream formats used to communicate with the host computer:

- LU-1 Mode

This is a Systems Network Architecture (SNA) communication mode that supports the SCS (SNA Character String) data string.

- 3270/DSC/DSE Mode

The 3270 data stream is the internal data format used by the IBM 3270 display subsystem.

The DSC (Data Stream Compatible) mode is a 3270 data stream compatible with non-SNA controllers.

The DSE (Data Stream Emulation) mode is a 3270 data stream that is supported by Systems Network Architecture (SNA) as the LU-3 data stream.

Emulation Pass-through Feature

Although the printer emulates the IBM 3287 and 4234 printer models, it is not restricted to the printing functions of those models. With the emulation pass-through feature, the host can access the currently-selected ASCII emulation to perform the following functions:

- Selectable pitch
- Emphasized print
- Bold print
- Expanded print
- Automatic underline/overscore
- Superscript/subscript printing
- Several ASCII character sets

For further information on accessing these functions, refer to the Hex Transparent command on page 27.

Emulation Exceptions

The following features are *not* available on the printer with a coax interface:

- AC line cords of 12 and 15 feet
- Friction feed paper handling
- Dot matrix of 9 positions wide by 8 high
- Graphic Escape
- Programmed symbols-2 = two, 190-character, downloadable fonts
- Programmed symbols-4 = four, 190-character, downloadable fonts
- Data analysis = APL feature
- Dot matrix of 4 or 7 print positions wide by 8 high
- Forms widths of 17.7 inches
- Extended Character Set Adapter
- IBM 3287 emulations 1C and 2C

The Printer Operating Mode

The host computer controls the printer operating mode. The two modes available for coax printers are SCS and Non-SCS.

SCS Mode

SCS stands for SNA (System Network Architecture) Character String. An SCS coax printer is also known as an LU-1 (Logical Unit 1) device. The host computer directs all print operations.

SCS mode is more flexible and powerful than the Non-SCS mode. SCS mode contains codes to control print positioning, CPI, LPI, horizontal and vertical tabs, etc.

In SCS mode, the following printing format applies:

- The printer uses the EBCDIC character set and dual-case printing.
- If no value is specified for SCS format-setting functions, the printer assumes the operator-selected values.
- Form Feed (FF) is honored anywhere in the data stream.
- A change in Set Line Density (SLD) requires the appropriate change in Maximum Print Line (MPL) and vice versa.
- SLD should be set prior to setting MPL.
- Any change in format, such as Set Horizontal Format (SHF), Set Line Density (SLD), or Set Vertical Format (SVF), must be followed by the appropriate synchronizing function, such as Carriage Return (CR), New Line (NL), Form Feed (FF), etc., to maintain format integrity.

NOTE: SCS control code sequences should not span data chains. If data chains are spanned, the printer terminates SCS Parameter Processing upon receipt of the first character in the chain and returns to SCS Data Processing.

Non-SCS Mode

A Non-SCS coax printer is also known as an LU-3 (Logical Unit 3) or DSC (Data Stream Compatible) device. Print operations occur in one of three ways:

- Host Direct Copy - The host computer sends print data directly to the printer and directs the print operation.
- Host-Initiated Local Copy - The host computer directs the printer to print information from the display terminal.
- Operator-Initiated Local Copy - The user directs the printer to print information from the display terminal.

The Non-SCS mode can perform only the basic positioning commands, which are Carriage Return, Line Feed, Form Feed, and New Line. The printer accepts the 3270 character stream.

Switching Between SCS and Non-SCS Modes

The host may switch back and forth between SCS mode and Non-SCS mode through the control unit.

SCS Mode to Non-SCS Mode

When switching from SCS mode to Non-SCS mode, the printer performs the following actions:

- Saves Program Attention (PA) and CANCEL PRINT switch values, if pending.
- Saves the current print position.
- Saves the following SCS page characteristics:
 - Horizontal Format parameters
 - Vertical Format parameters
 - Line Density parameters
 - Print Density parameters
- Sets page characteristics to operator panel values.
- Converts to the 3270 character set.
- Resets the printer to column 1.

Non-SCS Mode to SCS Mode

When switching from Non-SCS mode to SCS mode, the printer performs the following actions:

- Restores the saved SCS page characteristics and saved print position.
- Restores the Program Attention (PA) and CANCEL PRINT values.
- Sends a Cancel Request to the host if the CANCEL PRINT switch was pending while in SCS mode.
- Converts to the SCS character set.

Coax SCS Mode

Table 1 lists the coax SCS control codes. Descriptions of each control code follow the table.

A single description of the control code is provided if the code works the same for both the 3287 and 4234 printers; separate descriptions are provided if the control code works differently for each emulation.

NOTE: SCS control codes not listed below are invalid. They cause the printer to return a “Function Not Supported” response to the application program.

Table 1. Coax SCS Control Codes

Hex Value	Control Code Name and Abbreviation
04	Vertical Channel Select (VCS)
05	Horizontal Tab (HT)
08	Graphic Escape (GE) (not supported)
0B	Vertical Tab (VT)
0C	Form Feed (FF)
0D	Carriage Return (CR)
14	Enable Presentation (ENP)
15	New Line (NL)
16	Back Space (BS)
1E	Interchange Record Separator (IRS)
24	Inhibit Presentation (INP)
25	Line Feed (LF)
28	Set Attribute (SA)
2B C1	Set Horizontal Format (SHF)
2B C2	Set Vertical Format (SVF)
2B C6	Set Line Density (SLD)
2B D1	Set Text Orientation (STO) - 4234 emulation only
2B D2	Page Presentation Media (PPM) - 4234 emulation only
2B D2	Set Print Density (SPD) - 4234 emulation only
2F	Bell (BEL)
35	Transparent (TRN)
<i>st1 st2</i>	Hex Transparent (HTRN)

Control Codes

Vertical Channel Select (VCS)

4234 - Hex 04 vs

The 4234 Vertical Channel Select control code moves to the line number designated by one of the 12 vertical channels. A vertical channel is specified by the *vs* value shown in Table 2.

Table 2. Vertical Channel Select Values

Vertical Channel	<i>vs</i> Value
1	81 hex
2	82 hex
3	83 hex
4	84 hex
5	85 hex
6	86 hex
7	87 hex
8	88 hex
9	89 hex
10	7A hex
11	7B hex
12	7C hex

- Vertical channel 1 always specifies the top margin.
- If the VCS code specifies a channel whose line number is less than or equal to the current print line, the vertical print position moves to the specified position on the next page.
- A VCS code to an undefined channel defaults to a Line Feed.
- For an explanation of setting channels, see the Set Vertical Format description.
- If the *vs* value entered is invalid, an Invalid Parameter Error occurs and printing stops.

3287 - Hex 04

The 3287 Vertical Channel Select control code performs a Line Feed, since the 3287 printer does not support the VCS code. Refer to the description on Line Feed.

Horizontal Tab (HT) - Hex 05

The Horizontal Tab control code moves the print position to the next horizontal tab stop on the line.

- If the current print position is greater than or equal to the last tab stop on the current line, or if there are no tab stop settings, the HT control code produces a space.
- If the HT code is sent after the printer passes the Maximum Print Position (MPP), the HT moves the print position to the $LM+1$ of the next line. If the print position is at the Bottom Margin, the HT moves the print position to the Top Margin of the next page.
- To set horizontal tabs, see the Set Horizontal Format description.

Graphic Escape (GE) - Hex 08 *CP* (not supported)

CP = APL Code Point.

The Graphic Escape control code defines the next character sent as a character from the APL character chart. Since the APL character chart is not supported, a hyphen is printed in place of the 08. The APL code point is printed in the currently selected language.

Vertical Tab (VT) - Hex 0B

The Vertical Tab control code moves the print position down to the next vertical tab stop. CPP is not altered.

- If the current line number is greater than or equal to the last tab stop value, or if there are no vertical tab stop settings on the the page below the current print line, the printer performs a Line Feed.
- If the current print position is at $MPP+1$, the VT moves the print position to $MPP+1$ at the next vertical tab stop.
- If the current print position is the last printable line of the form (MPL or BM), the VT moves the print position to the TM of the next form.
- To set vertical tabs, see the Set Vertical Format description.

Form Feed (FF) - Hex 0C

The Form Feed control code moves the print position to the top left margin of the next page.

- If MPL equals 1, the print position moves to the beginning of the next line.

Carriage Return (CR) - Hex 0D

The Carriage Return control code moves the print position horizontally to the left margin column 1 on the same line.

- If the print position is already at the left margin, the CR code is ignored.
- If a CR is detected at $MPP+1$, the print position moves to the left margin of the current line.

Enable Presentation (ENP) - Hex 14

The Enable Presentation control code is accepted by the printer, but no function is performed. However, the code appears in the data dump listing.

New Line (NL) - Hex 15

The New Line control code moves the print position to the left margin column 1 and down vertically to the next line, which is the functional equivalent of a Carriage Return followed by a Line Feed.

- If the printer receives the NL code when the print position is at $MPP + 1$, the location of the code is interpreted as being in the current line.
- If the printer does not find the NL character before it reaches the end of a line, the printer automatically performs the NL function and continues printing.
- If the current position is the last line of the page when the NL code is sent, the print position moves to the top left margin of the next page.

Back Space (BS) - Hex 16

The Back Space control code moves the print position one position to the left.

- If the print position is at column 1, the BS code is ignored.
- The Left Margin setting is ignored.
- If a BS is detected at $MPP+1$, the print position moves left one position on the current line.

Interchange Record Separator (IRS) - Hex 1E

The Interchange Record Separator control code performs the same function as the New Line control code. Refer to the description on New Line.

Inhibit Presentation (INP) - Hex 24

The Inhibit Presentation control code is accepted by the printer, but no function is performed. However, the code appears in the data dump listing.

Line Feed (LF) - Hex 25

The Line Feed control code moves the print position to the next printable line, without altering the current horizontal position.

- If the current print position is beyond the maximum print position ($MPP+1$), the print position will be moved to $MPP+1$ of the next printable line.
- If the current print position is at the bottom margin (BM), or the last printable line of the page (MPL), the next printable line is the top margin (TM) of the next page.

Set Attribute (SA) - Hex 28 *t v*

The Set Attribute control code sets character set attributes. Table 3 defines the four Set Attribute types and their values.

t Contains the attribute type.

v Contains the attribute value.

Each attribute value continues in effect until another attribute value of that attribute type is received.

Each “begin” chain resets the attribute value to the default (normal) and a non-loadable base character set.

Table 3. Set Attribute Types and Values

<i>t</i> (Type)	<i>v</i> (Value)	Definition
00 - Reset	00	Reset highlighting, color, and character set attributes to the default.
41 - Highlight	00 F1 F2 F4	Set highlight - Normal; no effect on printing. Set highlight - Normal; no effect on printing. Set highlight - Normal; no effect on printing. Set highlight - Underline
42 - Color	XX	Set color - All values ignored by printer.
43 - Character Set	00 40-EE FF	Base character set (default). Reserved. Invalid.

Set Horizontal Format (SHF) - Hex 2B C1 *COUNT MPP LM RM T1...Tn*

The Set Horizontal Format control code sequence defines the horizontal format parameters, including the Maximum Print Position (*MPP*), the Left Margin (*LM*), the Right Margin (*RM*), and the horizontal tab stops (*T1...Tn*). All values are expressed as one-byte binary numbers. The following components define the control code sequence:

2B C1 The two-byte sequence for SHF.

COUNT A one-byte binary count indicating the number of bytes to the end of the SHF string, including the count byte.

- Valid values are 01 through FF.
- A count byte of 01 sets the Maximum Print Position to the operator panel value and other horizontal formatting parameters to their system default values.
- A count byte of 02 and a Maximum Print Position byte of 00 sets all horizontal formatting parameters to their system default values (Table 5).
- A count byte of FF (hex) is valid, with up to 251 tab entries.
- A value of 00 generates an Invalid Parameter Error.

MPP Defines the Maximum Print Position, also known as line length. The line length cannot exceed the Physical Maximum Print Position (PMPP) at the current CPI. See Table 4.

PMPP This is determined by the front panel setting for the menu item Max. Print Width. The two choices are a logical 13.2" or the printer's physical width.

- If *MPP*=0, the Maximum Print Position is set to the PMPP (default value).
- If *MPP* is greater than 00 and less than or equal to the PMPP, the Maximum Print Position is equal to the specified value.
- If the specified value is greater than the PMPP, an Invalid Parameter Error is sent to the host. Control code processing stops, and all horizontal format controls remain equal to their default values.

The *MPP* parameter is used as follows: if the printer reads a graphic character at *MPP*+1, the printer performs a New Line function (CR + LF), and prints the graphic character in the print position defined by the left margin (*LM*) parameter.

NOTE: For a description of how the printer responds to a particular control code at *MPP*+1, see the description for the particular function.

Table 4. Physical Maximum Print Position at Various CPI For Max. Width Setting of 13.2 Inches

CPI	PMPP
10	132
12	158
13.3	176
15	198
16.7	220
17.1	226
18	238
20	264

LM Left Margin sets the column value of the left-most print position. The *LM* also serves as the first horizontal tab stop.

- Valid values for *LM* must be less than or equal to the value of *MPP*. Otherwise, an Invalid Parameter Error is sent to the host; control code processing stops, and all remaining horizontal format controls (except *MPP*) are at their default values.
- The default value for *LM* is column 1.
- If *LM* = 00 or is not present, the left margin is equal to column 1.

RM Right Margin. The printer does not use this parameter but does check this value.

- Valid values for *RM* are 00, or can range from the *LM* to *MPP*. If the value is invalid, an Invalid Parameter Error is sent to the host.

T1...Tn Horizontal tab stop settings. Tab stop values may be entered in any order.

- Valid tab stop settings are greater than or equal to *LM* and less than or equal to *MPP*.
- If there are no tab stop settings, the printer acts as though tabs are set at every print position.
- If a tab stop value of 00 is the only tab stop specified, the printer clears all tab stops except the left margin stop.
- The maximum number of different stops that can be set is *PMPP*. The first unique tab stop value sets the stop; subsequent identical values do not set a tab stop. Therefore, duplicate tab values can exist.
- A tab stop value outside the valid range of *LM* through *MPP* generates an Invalid Parameter Error, and control code processing stops. The error does not affect horizontal format values, *MPP*, *LM*, *RM*, and tabs already set prior to the erroneous tab.

NOTE: An SHF control code should be followed by a New Line (NL) or a Carriage Return (CR), especially if the left margin is changed.

The following conditions generate Invalid Parameter Errors:

- *MPP* exceeds *PMPP*.
- *LM* exceeds *MPP*.
- *RM* exceeds *MPP* or is less than *LM*.
- Tab stop values are outside the valid range.

NOTE: When the SHF is received, all controls are first set to their system default values. Then each control is set to any valid value contained in the parameter list. (A zero parameter is valid but leaves the control set to the system default value.) This procedure is terminated when the count is completed or an invalid parameter is detected. Any unset control value remains at the system default value. Any invalid value will cause an SCS parameter error to be sent back to the host. System default values are shown in Table 5.

Table 5. System Default Values

Code	Default
<i>MPP</i>	PMPP (see Table 4)
<i>LM</i>	1
<i>RM</i>	PMPP
<i>T1...Tn</i>	No tab stops set

Set Vertical Format (SVF) - Hex 2B C2 COUNT MPL TM BM T1 ... Tn

The Set Vertical Format control sequence defines the vertical format parameters, including the Maximum Print Line (*MPL*), the Top Margin (*TM*), the Bottom Margin (*BM*), and up to 251 vertical tab stops. All values are expressed as one-byte binary numbers. The minimum SVF sequence is a one-byte length.

NOTE: The SVF function sets the current line to the top margin.

The following components define the control code sequence:

2B C2 The two-byte sequence for SVF.

COUNT A one-byte binary count indicating the number of bytes to the end of the SVF string, including the count byte.

- Valid values are 01 - FF.
- A count byte value of 01 sets the *MPL* and *BM* to the operator panel value, and other vertical formatting parameters to their system default values.
- A count byte of 02 and an *MPL* byte of 00 sets all vertical formatting parameters to their system default values.
- All other count values are valid; however, if the count is greater than *MPL*+4, some tab settings must be repeated.
- A count byte value of 00 causes an Invalid Parameter Error.

- MPL* Maximum Print Line, also known as forms length. This byte specifies the number of lines from the top margin of one page to the top margin of the next page.
- Valid values are 1 through 255.
 - If *MPL* = 00, the maximum print line is set to 1 (default).
 - If *MPL* is greater than 00 and less than or equal to 255, the maximum print line is equal to the specified value.
 - If *MPL* is not present, the maximum print line is equal to the operator panel value.
- TM* Top Margin. Specifies the line value of the uppermost print position. The *TM* also serves as the first vertical tab stop. It is assumed that the form is positioned at the physical *TM* line when the SVF sequence is received (for example, at physical line 5 when SVF is received, where *TM*=5).
- Valid *TM* values must be less than or equal to *MPL*. Otherwise, an Invalid Parameter Error is sent to the host, control code processing stops, and all remaining vertical format controls are set to their default values.
 - The default value for *TM* is 1.
 - If *TM* = 00 or is not present, the top margin is set to 1.
- BM* Bottom Margin. Specifies the last line of a page where printing may occur. If the print position exceeds this value, the print position automatically moves to the *TM* of the next page.
- Valid *BM* values must be greater than or equal to *TM* and less than or equal to *MPL*. Otherwise, an Invalid Parameter Error is sent to the host, control code processing stops, and all remaining vertical format controls are set to their default values.
 - The default value for *BM* is *MPL*.
 - If *BM* is 00 or not present, the bottom margin is set to *MPL*.
- T1...Tn* Vertical tab stop settings. The vertical tab stop parameters set line number values for both the Vertical Tab (VT - Hex 0B) function and for the Vertical Channel Select (VCS - Hex 04) function.
- Valid *Tn* values must be greater than or equal to *TM* and less than or equal to *BM*. Otherwise, an Invalid Parameter Error is sent to the host and control code processing stops.
 - A value of 00 is permissible, but sets no stop.
 - A channel value of 00 does not assign a line number to that channel.
 - Vertical tab stops of *T1* through *T11* can be used for channels 2 through 12 in the Vertical Channel Select control code, or as tab stops for the vertical tab control code.
 - Values of *T12* through *Tn* are used as vertical tab values only.
 - The Top Margin (*TM*) value is also the first tab stop and the vertical channel 1 value.

Set Line Density (SLD) - Hex 2B C6 *COUNT LPI*

The Set Line Density control code sequence defines the vertical spacing for NL, LF, Vertical Tab (VT; 4234 only), and Vertical Channel Select (VCS; 4234 only). The SLD code must be set prior to setting the Set Vertical Format (SVF) code in order to calculate the correct page length. If the SLD code is not specified, the printer uses the current operator panel LPI value. The following components define the control code sequence:

2B C6 The two-byte sequence for SLD.

COUNT A one-byte binary count indicating the number of bytes to the end of the SLD string, including the count byte.

- Valid values are hex 01 and 02. Any other value generates an Invalid Parameter Error.
- A count byte of 01 uses the line density value set through the operator panel.
- A count byte of 02 sets the lines per inch to the value of the *LPI* byte.

LPI Lines Per Inch. This byte sets the value of the line spacing in 1/72 inch increments.

- Valid values are defined in Table 6. Any other value generates an Invalid Parameter Error.
- MPL reflects the number of single-spaced lines per page. For double-spacing, two single-spaced lines are used. For example, an 11-inch form with MPL set to 66 allows 33 printed lines at 3 LPI.

Table 6. Line Density Values (*LPI*)

Hex Code	Lines Per Inch	Line Spacing (Density)
00	6	6 LPI single spaced
09	8	8 LPI single spaced
0C	6	6 LPI single spaced
12	4	8 LPI double spaced
18	3	6 LPI double spaced

Set Text Orientation (STO) - Hex 2B D1 (4234 only)

The Set Text Orientation control code instructs the printer on whether to print left to right or right to left. The default text orientation is left to right. The following components define the control code sequence:

2B D1 06 83 00 00 2D 00 Left-to-right text orientation

2B D1 06 83 5A 00 2D 00 Right-to-left text orientation

The value remains in effect until another value is sent through the data stream.

An error occurs if the STO code is on a print line that already has data.

An STO code should follow any of these codes:

- Vertical Channel Select
- Vertical Tab
- Form Feed
- New Line
- Interchange Record Separator
- Line Feed

Left-to-Right Languages

Print orientation is based on the Set Text Orientation (STO) command and the operator panel PRINT TEXT DIRECTION selection:

- If PRINT TEXT DIRECTION is CONTROLLED BY HOST (the default), the STO command selects the print orientation. If no STO command or an invalid STO command is received, left-to-right is used, with the exception of the right-to-left languages listed below.
- If PRINT TEXT DIRECTION is LEFT-TO-RIGHT or RIGHT-TO-LEFT, the print orientation is controlled by this operator panel selection, regardless of any STO commands received.

Right-to-Left Languages

Hebrew, a right-to-left language, *always* prints in dual case mode, regardless of the operator panel selection. Printing begins at the MPP setting.

Set Print Density (SPD) - Hex 2B D2 *COUNT* 29 00 *vv* (4234 only)

The Set Print Density control code defines the number of horizontal characters per inch (CPI). Character position is calculated based on the logical character column and the current CPI in effect.

Changing the print density affects the physical print position of the left margin, the MPP, and the horizontal tabs. When the CPI changes, if the current MPP is greater than the Physical Maximum Print Position (PMPP), the MPP is set to PMPP for the CPI in effect.

2B D2 The two-byte sequence for SPD.

COUNT A one-byte binary count indicating the number of bytes to the end of the SPD string, including the count byte.

- Valid values are hex 02 and 04. Any other values generate an Invalid Parameter Error.
- An SPD string of "2B D2 02 29" sets the CPI to the operator panel value.
- An SPD string of "2B D2 04 29 00 *vv*" sets the CPI to the value specified by *vv*.

vv Characters per inch, printed horizontally. Table 7 shows the valid values for CPI. Any other value generates an Invalid Parameter Error reported to the host, and the CPI is set to the operator panel setting.

Table 7: Valid CPI Values for Setting Print Density

vv (Value)	CPI	13.2 Inches PMPP	4 Inch PMPP	6 Inch PMPP	8 Inch PMPP
00	10	132	41	66	85
0A	10	132	41	66	85
0C	12	158	49	79	102
0D	13.3	176	54	87	113
0F	15	198	61	99	127
10	16.7	220	68	110	141
*N/A	17.1	226	70	112	145
12	18	238	73	118	153
*N/A	20	264	82	132	170

* Selected through the operator panel only.

Page Presentation Media (PPM) - Hex 2B D2 *COUNT* 48 00 00 00 00 00 00 00 *PQ* 00 00 00 (4234 only)

The Page Presentation Media control code selects the type face.

COUNT A one-byte binary count indicating the number of bytes to the end of the PPM string, including the count byte. Valid values are hex 02 through 0C.

PQ Print quality. Any values other than the following generate an Invalid Parameter Error.

- 00 = No change
- 01 = DP mode
- 02 = NLQ mode
- 03 = Draft mode
- FF = Set to the operator panel setting

Bell (BEL) - Hex 2F

The Bell control code causes an alarm to sound. The LCD shows this message:

06 HOST REQUEST

BEL does not cause printing to stop. To clear the warning message, press CLEAR. Then, press ON LINE to place the printer in ON LINE mode.

Transparent (TRN) - Hex 35 COUNT

The Transparent control code defines the specified characters (*not* including the count byte) as transparent data. Transparent data between 00 and 3F, and hex FF, print as a hyphen. The printer will not scan the data for SCS control codes within a transparent data stream. Instead, the printer accepts the complete field as data.

COUNT A one-byte binary count indicating the number of transparent bytes to the end of the TRN string, *not* including the count byte. Valid values are 1 through 255. If *COUNT* = 0, no operation is performed.

Accessing Additional Features While in Coax SCS Mode

Hex Transparent (HTRN) - Hex *st1 st2 (B1, B2), . . . (B1, B2) stp*

The Hex Transparent control code sequence allows you to access features that are not available in standard IBM emulations. These escape codes are not SCS control codes.

NOTE: Care should be taken when using these codes, since they can change the printer configuration normally controlled by the host. For the control code sequences for additional printer features, refer to the appropriate emulation *Programmer's Reference Manual*.

st1 st2 The two-byte starting sequence for HTRN.

B1,B2 A two-byte sequence packed into one 8-bit output character for the printer.

stp The sequence terminator.

To access non-IBM codes, a control sequence must begin with two EBCDIC character codes (*st1 st2*) and end with a single EBCDIC character code (*stp*).

The values for *st1*, *st2*, and *stp* can be selected from the operator panel.

Default 1:

<% = the starting codes *st1 st2*

> = the terminating code *stp*

Default 2:

↵↵ = the starting codes *st1 st2*

\$ = the terminating code *stp*

Default 3:

_ % = the starting codes *st1 st2*

_ = the terminating code *stp*

EBCDIC to ASCII Conversion for Non-IBM Control Codes

The printer converts pairs of EBCDIC hexadecimal data characters between *st1 st2* and *stp* delimiters to single characters in the range 00 through FF, and sends them to the printer for processing. As these characters are used to form special (non-coax and non-twinax) printer commands, the printer does not increment the horizontal character count between the HTRN and *stp* delimiters. Based on this, these characters should be accounted for if included in a print line, in addition to the normal print count. The following steps explain the conversion process.

1. Upon receipt of *st1 st2*, the printer translates the EBCDIC characters 0 through 9 and A through F (also a through f) into hexadecimal data. Two EBCDIC hexadecimal characters are combined into one byte and sent to the printer.
2. If a character is selected other than 0 through 9 or A through F, the character is translated from the current printer character mapping and sent to the printer.
3. Data translation continues until the printer receives an *stp* symbol. If the printer receives an odd number of hexadecimal digits before receipt of the *stp* symbol, the last byte is not sent to the printer.
4. The printer does not count any of the characters between the *st1 st2* and the *stp* as IBM data character positions, nor will it take into account any features enabled by the control codes.

NOTE: When sending a control sequence, it is important to maintain page and line integrity.

Table 8 is an example of a Hex Transparent control sequence used to print the word "BOLD" using bold print, for the Proprinter[®] III XL emulation.

Table 8. Using Hex Transparent to Produce Bold Print - Proprinter III XL Example

	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	G	B	O	L	D	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	H
Host sends this code	4C	6C	F1	C2	6E	C7	C2	D6	D3	C4	4C	6C	F1	C2	6E	C8
EBCDIC Char. Representation	<	%	1	B	>	G	B	O	L	D	<	%	1	B	>	H
Proprinter III XL Sequence			1B		G		B	O	L	D			1B		H	
Printer Output	BOLD															

Coax Non-SCS Mode

Non-SCS control codes are used in the DSC/DSE LU3 mode. The operation of these control codes can be modified by the compatibility options in the Coax Interface Menu.

Table 9 lists Non-SCS control codes. A description of the operation of each code follows the table.

The Non-SCS control codes listed below have different meanings depending on whether they are in print fields or in non-print fields, and whether they appear in formatted or unformatted mode. In formatted mode, the printer control unit translates EM, NL, and CR into space characters (in print fields) or Null characters (in non-print fields).

Table 9. Coax Non-SCS Control Codes

Hex Value	Control Code Name and Abbreviation
00	Null (NUL)
01	End of Message (EM)
02	Form Feed (FF)
03	New Line (NL)
05	Carriage Return (CR)
<i>st1 st2</i>	Hex Transparent (HTRN)

Control Codes

Null (NUL) - Hex 00

The Null control code, in the unformatted mode, does not produce a printer function. In formatted mode, the NUL code prints as a space in print fields.

End of Message (EM) - Hex 01

The End of Message control code, in the unformatted mode, stops the printer from printing and indexes vertically one line. If EM follows a CR, NL, or FF, the vertical index will not be performed. In the formatted mode, the EM code prints as a space, and the printer continues printing.

- If EM is not followed by a New Line or Form Feed character, the printer performs a New Line.
- If the EM code occurs at the left margin or at $MPP + 1$, the printer sets the print position to the left margin.

Form Feed (FF) - Hex 02

The Form Feed control code moves the print position to the top line, second print position of the next page. The FF code is processed in either formatted or unformatted mode.

- If the FF code occurs either at the first print position of a line or at $MPP + 1$, the printer performs a Form Feed.
- If the printer encounters a Form Feed code at any other position, it prints a space.
- If FF is at end of message (either buffer end or EM), the auto new line normally associated with the end of the print order will be suppressed.

New Line (NL) - Hex 03

The New Line control code, in the unformatted mode, moves the print position to the first print position and vertically to the next line, which is the functional equivalent of a Carriage Return followed by a Line Feed. In the formatted mode, the NL code prints as a space.

- If the printer receives an NL code when the print position is at $MPP + 1$, the location of the code is interpreted as being in the current line.
- If the printer does not find an NL character before it reaches the end of a line, the printer automatically performs an NL function and continues printing.
- If the current position is the last line of the page when the NL code is sent, the printer performs a Form Feed.

Carriage Return (CR) - Hex 05

The Carriage Return control code, in the unformatted mode, moves the print position to the first print position on the same line. In the formatted mode, the CR code prints as a space.

- If the CR code is received at $MPP + 1$, the print position returns to the first print position on the same line.

Accessing Additional Features while in Non-SCS Mode

Hex Transparent (HTRN) (Non-IBM) - Hex *st1 st2 (B1, B2), . . . (B1, B2) stp*

The Hex Transparent control code allows you to access features that are not available in standard IBM emulations. These escape codes are not SCS control codes.

NOTE: Care should be taken when using these codes, since they can change the printer configuration normally controlled by the host. For the control code sequences for additional printer features, refer to the appropriate emulation *Programmer's Reference Manual*.

st1 st2 The two-byte sequence for HTRN.
B1,B2 A two-byte sequence packed into one 8-bit output character for the printer.
stp The sequence terminator.

To access non-IBM codes, a control sequence must begin with two 3270 character codes (*st1 st2*) and end with a single 3270 character code (*stp*).

The values for *st1*, *st2*, and *stp* can be selected from the operator panel.

Default 1:

<% = the starting codes *st1 st2*

> = the terminating code *stp*

Default 2:

↵↵ = the starting codes *st1 st2*

\$ = the terminating code *stp*

Default 3:

_% = the starting codes *st1 st2*

_ = the terminating code *stp*

3270 to ASCII Conversion for Non-IBM Control Codes

The printer converts pairs of EBCDIC hexadecimal data characters between *st1 st2* and *stp* delimiters to single characters in the range 00 through FF, and sends them to the printer for processing. As these characters are used to form special (non-coax and non-twinax) printer commands, the printer does not increment the horizontal character count between the HTRN and *stp* delimiters. Based on this, these characters should be accounted for if included in a print line, in addition to the normal print count. The following steps explain the conversion process.

1. Upon receipt of *st1 st2*, the printer translates the 3270 characters 0 through 9 and A through F (also a through f) into hexadecimal data. Two EBCDIC hexadecimal characters are combined in one byte and sent through the printer.
2. If a character is selected other than 0 through 9 or A through F, the character is translated from the current printer character mapping and sent to the printer.

3. Data translation continues until the printer receives an *stp* symbol. If the printer receives an odd number of hexadecimal digits before receipt of the *stp* symbol, the last byte is not sent to the printer.
4. The printer does not count any of the characters between the *st1 st2* and the *stp* as IBM data character positions, nor will it take into account any features enabled by the control codes.

NOTE: When sending a control sequence, it is important to maintain page and line integrity.

Table 10 is an example of a Hex Transparent control sequence used to print the word "BOLD" using bold print, for the Proprinter III XL emulation.

Table 10. Using Hex Transparent to Produce Bold Print - Proprinter III XL Example

	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	G	B	O	L	D	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	H
Host sends this code	09	2E	21	A1	08	A6	A1	AE	AB	A3	09	2E	21	A1	08	A7
3270 Char. Representation	<	%	1	B	>	G	B	O	L	D	<	%	1	B	>	H
Proprinter III XL Sequence			1B		G		B	O	L	D			1B		H	
Printer Output	BOLD															

Coax Structured Field Data Stream Processing (SCS Mode)

Coax structured field processing of the data stream in the SCS mode allows the host to save or restore print formats and to request printer definition. A structured field data stream begins with a Function Management (FM) header, followed by one or more structured fields. SCS structured field processing applies to the 4234 emulation only.

FM Header

The FM header must contain the information shown in Table 11. If it does not, an Invalid FM Header Error is returned to the host and printing stops.

Table 11. FM Header Format

FM Header: 06 01 00 0B 60 00	
06	Specifies the FM Header length (always 6 bytes)
01	Specifies type 1 and no concatenation
00	Specifies console medium select with logical address 0
0B/8B	Specifies data stream profile select; i.e. structured fields follow. Value is 0B if inbound data; value is 8B if outbound data
60	Specifies begin/end destination select
00	Reserved; must be zero

Structured Fields

A structured field consists of a two-byte data length field, a one-byte type field, and a variable-length data field.

- The length field specifies the length of the structured field in bytes, including the length and type field bytes.
- If the length field equals 0000, the structured field continues to the end of the chain.
- The only valid values for the type field are defined in the Table 12. If the type field contains a value other than those listed in Table 12, an Invalid Type Code Error is sent to the host.

Table 12. Valid Type Fields for Structured Fields

Hex Value	Type of Structured Field	Direction
01	Read Partition Query Read Partition Query List	Control Unit to Printer
10	Save/Restore Formats	Bidirectional
41	SCS Data	Control Unit to Printer
81	Query Reply	Printer to Control Unit

Coax SCS Mode Host-to-Printer Structured Fields

Read Partition Query

Table 13. Read Partition Query

Byte	Value	Meaning
0, 1	0000 or 0005	Structured Field Length
2	01	Type = Read Partition
3	FF	Query (Partition ID)
4	02 or 03	Code = Query

- The Read Partition Query structured field must be the last or only structured field in the chain.
- A “Function Not Supported” response is returned to the host if byte 4 is not 02 or 03.
- An “Invalid Control Code Parameter” response is returned to the host if any of the following conditions exist:
 - Bytes 0 and 1 are not 0000 or 0005.
 - Byte 2 is not 01.
 - Byte 3 does not contain FF.
 - The structured field is not the last data in the chain.

Read Partition Query List

Table 14. Read Partition Query List

Byte	Value	Meaning
0,1	00xx	Structured Field Length
2	01	Type = Read Partition
3	FF	Query (Partition ID)
4	03	Code = Query List
5	x0	Extended Request x = 0 List Only x = 4 Query Plus List x = 8 All Query Replies
6-n	xx ... xx	Q Codes of Requested Query Replies

- The Read Partition Query List structured field must be the only or the last structured field in the chain.
- All other codes for byte 5 are reserved.
- Byte 6-n specifies the following Q code values:
 - 80 Summary
 - 81 Usable Area
 - 85 Character Sets
 - 86 Color
 - 87 Highlight
 - 92 Save/Restore Formats
 - A0 Device Characteristics
 - A2 Data Streams
 - A7 Paper Feed Techniques
 - FF Null (no listed Q Codes supported)

Save/Restore Formats

The Save/Restore Formats structured field provides a way to save or restore a Format Parameter Control Block (FPCB), either locally (at the printer) or remotely (at the host). The FPCB consists of all parameters needed to define the way SCS data currently appears on the page.

- The Save/Restore Formats structured field must be the only or the last structured field in the chain, and must have the format shown in Table 15.
- When the printer receives a remote Save/Restore Formats field, it responds with a remote Save Structured Field that contains the FPCB saved data. In a remote restore, the contents of the saved bytes (5-n) must be equal to the contents of the restored bytes, or an error occurs. FPCB contents are described in Table 16.

Table 15. Save/Restore Formats

Byte	Value	Meaning
0,1	00LL	Structured Field Length (0005 to 0065)
2	10	Type = Save/Restore
3	34	Format ID
4		Flag Byte 00 = Save FPCB locally at the printer 40 = Save FPCB remotely 80 = Restore FPCB locally from printer C0 = Restore FPCB remotely All other codes reserved
5-n		FPCB data to Remote Save/Restore

NOTE: This structured field type is valid only in SCS mode.

Table 16. FPCB Contents

Code	Byte	Meaning
GPI	2	CPI value (X10 for resolution)
LPI	2	Lines per inch
SPACE	1	Spacing value
QUALITY	2	Print quality value
MPP	2	Maximum print position (default or operator panel setting)
SCSMPP	1	Explicit MPP set by data stream
MPL	2	Maximum print line
BM	1	Bottom margin in lines
VCS	12	Vertical channel selects
VT	16	Vertical tabs
HT	32	Horizontal tabs
LM	1	Left margin in columns
TM	1	Top margin in lines
FORM	2	Form type, only applicable if an auto sheet-feed device is installed.

Table 16. FPCB Contents (continued)

Code	Byte	Meaning
PDRAWER	2	Paper source drawer, only applicable if an auto sheet-feed device is installed.
EDRAWER	2	Envelope source drawer, only applicable if an auto sheet-feed device is installed.
DDRAWER	2	Reserved
DIRECTION	1	Print orientation flags
CRC	2	Check character

SCS Data

The SCS Data structured field enables you to combine SCS data with other structured fields in the same chain. Table 17 defines the format for the SCS Data structured field.

Table 17. SCS Data Structured Field

Byte	Value	Meaning
0,1	LLLL	Structured Field Length
2	41	Type = SCS Data
3	00	Partition Identifier
4-n	data	SCS Data Stream

Coax SCS Mode Printer-to-Host Structured Fields

Printer-to-Host structured fields are replies transmitted from the printer to the host in response to structured field queries. The printer supports the printer-to-host structured fields listed in Table 18, as well as Null Query Reply.

Summary Reply

Table 18. Summary Reply

Byte	Value	Meaning
0,1	000D	Structured Field Length
2	81	Type = Query Reply
3	80	Summary Indicator
4	80	Summary Reply
5	81	Usable Area Supported
6	85	Character Sets Supported
7	86	Color Supported
8	87	Highlight Supported
9	92	Device Characteristics Supported
10	A0	Save/Restore Formats Supported
11	A2	Data Streams Supported
12	A7	Paper Feed Techniques Supported

Usable Area Reply

The Usable Area Reply specifies the page and print character cell characteristics. Table 19 defines the format for this structured field.

Table 19. Usable Area Reply

Byte	Value	Meaning
0,1	0015	Structured Field Length
2	81	Type = Query Reply
3	81	Usable Area Indicator
4	1F	Extended Structure Field Supported A Hard Copy Device No Explicit Partition Addressing
5	00	Variable Cell Size Not Supported Matrix Characters
6-7	0084 009E 00B0 00C4	Usable Area Width PMPP = 132 Maximum (10 CPI) PMPP = 158 Maximum (12 CPI) PMPP = 176 Maximum (13 CPI) PMPP = 198 Maximum (15 CPI)
8-9	00FF	MPL = 255 Usable Area Height
10	00	Unit of Measure = Inches
11-14	0001005A 00010078 00010078 000100B4	Horizontal Pel Distance (DP mode) 1/90 (.011) 90 PEL (10 CPI) 1/120 (.0083) 120 PEL (12 CPI) 1/120 (.0083) 120 PEL (13 CPI) 1/180 (.0055) 180 PEL (15 CPI)
15-18	00010048 00010060	Vertical Pel Distance (Fraction) 1/72 (0.013889) 72 PEL (6 LPI) 1/96 (0.010417) 96 PEL (8 LPI)
19	09 0C	Horizontal Units Per Cell 9 Slices Per Cell, 10 CPI 12 Slices Per Cell, 15 CPI
20	08	Vertical Units Per Cell (Always 8 rows) - DP mode

Character Set Reply

The Character Set Reply specifies the character sets available at the printer. Table 20 defines the format for this structured field.

Table 20. Character Set Reply

Byte	Value	Meaning
0,1	0014	Structured Field Length
2	81	Type = Query Reply
3	85	Character Set Indicator
4	02	Graphic Escape Not Supported
5	00	Reserved
6	09 0C	Default Matrix Width (10 CPI) Default Matrix Width (15 CPI)
7	08	Default Matrix Height (8 rows)
8-11	06000000	Format Type 5
12	07	Char. Set Descriptor Length, bytes
13-19		First Character Set Descriptor
13	00	Character Set ID: ROS 00
14	10	- Unloadable Character Set- Single Plane - 1 Byte Coded Character Set - LCID Compare Allowed
15	00	Character Set = ROS 0 (Base)
16-17	See Table 21	Global Graphic Character Identifier
18-19	See Table 21	Global Code Page Identifier

**Table 21. Global Coded Character Set Identifiers
(Bytes 16 to 19)**

Country	Bytes 16-17 (GCID)	Bytes 18-19 (GPID)
English US - Default	0065	0025
English UK	0139	011D
Austrian/German	0109	0111
German (alt)	0109	0111
Belgian	045A	01F4
Brazilian	0111	0113
Canadian French	0389	0025
Cyrillic	0269	0025
Danish/Norweg	0119	0115
Danish (alt)	0119	0115
Finnish/Swedish	011D	0116
Finnish (alt)	011D	0116
French	02AA	0129
International Set 5	0067	01F4
International Set 1	0065	01F4
Italian	0125	0118
Japanese Eng	0129	0119
Japanese Katak.	014C	0122
Portuguese	045A	0025
Portuguese (alt)	045A	0025
Spanish	028A	011C
Spanish (alt)	028A	011C
Spanish Speak	0135	011C
Swiss French/Ger	038C	01F4
Hebrew Old	03AD	01A8
Hebrew	03AD	01A8
Farsi/Latin	02B9	0025

Table 21. Global Coded Character Set Identifiers
(Bytes 16 to 19) (continued)

Country	Bytes 16-17 (GCID)	Bytes 18-19 (GPID)
Greek Old	00DA	01A7
Greek New	00DA	036B
Arabic	00EB	01A4
Turkish	03C5	0389
Turkish Old	03C5	0389
Latin 2/ROECE	03BF	0366
Yugoslavian	019A	0374

Color Reply

The Color Reply is part of a standard set of replies used in SCS operations. Color is not supported; the printer prints in black in all cases. However, the printer responds with the following reply as defined in Table 22.

Table 22. Color Reply

Byte	Value	Meaning
0,1	0016	Structured Field Length
2	81	Type = Query Reply
3	86	Color Indicator
4	40	Monochrome Ribbon Loaded
5	08	Length of Color Attribute List
6-7	00F7	Color 1 - Black
8-9	F100	Color 2 - Black
10-11	F200	Color 3 - Black
12-13	F300	Color 4 - Black
14-15	F400	Color 5 - Black
16-17	F500	Color 6 - Black
18-19	F600	Color 7 - Black
20-21	F700	Color 8 - Black

Highlight Reply

The Highlight Reply specifies the highlighting options available at the printer. Only underline is supported. Table 23 defines the format for this structured field.

Table 23. Highlight Reply

Byte	Value	Meaning
0,1	000D	Structured Field Length
2	81	Type = Query Reply
3	87	Highlight Indicator
4	04	Number of Highlight Options
5-6	00	First Highlight Option Attribute Value (default)
	F0	Highlight Option = Normal
7-8	F1	Second Highlight Option Attribute Value (Blink)
	00	Highlight Option = Normal
9-10	F2	Third Highlight Option Attribute Value (Reverse Video)
	00	Highlight Option = Normal
11-12	F4	Fourth Highlight Option Attribute Value = Underline
	F4	Highlight Option = Underline

Device Characteristic Reply

The Device Characteristic Reply describes the horizontal and vertical dimensional boundaries of the dot-addressable area on the page. Horizontal parameters are described as valid combinations of CPI and MPP. Vertical parameters are described as combinations of points (1/72 inch) and MPL. Table 24 defines the format for this structured field.

Table 24. Device Characteristic Reply

Byte	Value	Meaning
0,1	0038	Structured Field Length
2	81	Type = Query Reply
3	A0	Device Characteristics Indicator
4-14		First Descriptor
4-5	0011	Length of First Descriptor
6-7	FF01	Horizontal Dimensional Parameter Identifier
8	80	SPD (Set Print Density) Supported
9-A	0A84	10 CPI, MPP = 132 (default)
B-C	0C9E	12 CPI, MPP = 158
D-E	0DB0	13.3 CPI, MPP = 176
F-10	0FC6	15 CPI, MPP = 198
11-12	10DC	16.7 CPI, MPP = 220
13-14	12EE	18 CPI, MPP = 238
15-21		Second Character Set Descriptor
15-16	000D	Length of Second Descriptor
17-18	FF02	Vertical Dimensional Parameter
19	80	SLD (Set Line Density) Supported
1A-1B	0CFF	6 LPI
1C-1D	09FF	8 LPI
1E-1F	18FF	3 LPI
20-21	12FF	4 LPI
22-32		Third Descriptor
22-23	0011	Length of Third Descriptor
24-25	FF03	Page Presentation Media Parameters
26	80	PPM (Page Presentation Media) Supported

Table 24. Device Characteristic Reply (continued)

Byte	Value	Meaning
27-2A	00000000	Reserved
2B	C0	Quality Parameter Supported and Selectable from the Operator Panel
2C	05	Number of Quality Parameters Supported
2D-31	FF00010203	Discrete Quality Parameters Supported FF = Operator Panel 00 = No Change 01 = Lowest (DP) 02 = Middle (DP Text) 03 = Highest (NLQ)
32	00	Reserved
33-37		Fourth Descriptor
33-34	0005	Length of Fourth Descriptor
35-36	FF04	Set Text Orientation Parameters
37	80	ST0 Supported

Save/Restore Format Reply

The Save/Restore Format Reply specifies the format parameter control block length. Table 25 defines the format for this structured field.

Table 25. Save/Restore Format Reply

Byte	Value	Meaning
0,1	0006	Structured Field Length
2	81	Type = Query Reply
3	92	Save/Restore Format
4-5	0056	FPCB Length

Data Streams Query Reply

This query reply indicates that the printer supports data streams. This reply is valid only in SCS mode. Table 26 defines the format for this structured field.

Table 26. Data Streams Query Reply

Byte	Value	Meaning
0,1	0005	Structured Field Length
2	81	Type = Query Reply
3	A2	Data Streams Indicator
4	00	SCS Data Stream Supported

Paper Feed Techniques Query Reply

This query reply transmits the currently installed and active forms module. The reply also transmits the size of the restricted print areas (if any) at the top and/or bottom of the form. Table 27 defines the format for this structured field.

Table 27. Paper Feed Techniques Query Reply

Byte	Value	Meaning
0,1	0009	Structured Field Length
2	81	Type = Query Reply
3	A7	Paper Feed Techniques Indicator
4	40	Forms Module Installed 40 = Continuous Forms Module
5-6	0000	Top Margin Offset in 1/1440 Inches 0000 = Continuous Forms Module
7-8	0000	Bottom Margin Offset in 1/1440 Inches 0000 = Continuous Forms Module

Null Reply

The Null Reply occurs when the printer does not support anything specified in the query list. Table 28 defines the format for this structured field.

Table 28. Null Reply

Byte	Value	Meaning
0,1	0004	Structured Field Length
2	81	Type = Query Reply
3	FF	Null Reply

Coax Structured Field Data Stream Processing (Non-SCS)

In the 4234 coax non-SCS mode, the host computer requests information from the printer by sending one of these queries:

- Read Partition Query
- Read Partition Query List
- Set Printer Characteristics

Coax Non-SCS Mode Host-to-Printer Structured Fields

Read Partition Query

The Read Partition Query structured field provides a means for the host to define highlighting, character size, and buffer size characteristics of the printer. Table 29 defines the format for this structured field.

Table 29. Read Partition Query

Byte	Value	Meaning
0,1	0005	Structured Field Length
2	01	Type = Read Partition
3	FF	Query (Partition ID)
4	02	Code = Query

Read Partition Query List

The Read Partition Query List structured field defines which reply the printer uses to reply to the host. Table 30 defines the format for this structured field.

Table 30. Read Partition Query List

Byte	Value	Meaning
0,1	00xx	Structured Field Length
2	01	Type = Read Partition
3	FF	Query (Partition ID)
4	03	Code = Query List
5	x0	Extended Request x = 0 List only x = 4 Query Plus List x = 8 All Query Replies all other codes reserved
6-n	xx	80 Summary Reply 81 Usable Area Reply 85 Character Sets Reply 86 Color Reply 87 Highlight Reply FF Null Reply

- The Read Partition Query List structured field must be the only or the last structured field in the chain.
- All other codes for byte 5 are reserved.
- Bytes 6 through n specifies the following Q code values (DSC/DSE):
 - 80 Summary
 - 81 Usable Area
 - 85 Character Sets
 - 86 Color
 - 87 Highlight
 - A7 Paper Feed Techniques
 - A9 Settable Printer Characteristics (DSC only)

Set Printer Characteristics

This structured field controls the operation of the Early Print Complete (EPC) function. It provides the means for the application program to turn the EPC function on or off. It also enables and disables the manual operator control for EPC. When disabled, the manual operator control will not turn the EPC function on or off.

Set Printer Characteristics is limited to DSC mode only.

Table 31 defines the format for this structured field.

Table 31. Set Printer Characteristics

Byte	Value	Meaning
0,1	0006 0009	Structured Field Length
2-3	0F84	Set Printer Characteristics
4	FLAGS Bit 0 Bits 1-7	Bit 0 = Off (no reset all) Bit 1 = On (reset all) Bit 0000000 - Reserved, must be zeroes
5	FLAGS Bits 0-7	Bit 0000000 - Reserved, must be zeroes

Table 32 defines the self-defining parameters.

Table 32. Self-Defining Parameters

Byte	Value	Meaning
0	03	Parameter Length
1	01	Early Print Complete
2	SREPC Bits 0-1 Bits 2-7	Set/Reset Early Print Complete Bit 00 = Enable Operator Control Bit 01 = EPC Off - Disable Operator Control Bit 10 = EPC On - Disable Operator Control Bit 11 = Reserved Bit 000000 - Reserved, must be zeroes

Coax Non-SCS Mode Printer-To-Host Structured Fields

Printer-to-Host structured fields are replies transmitted from the printer to the host in response to structured field queries. The proper format follows.

Summary Reply

Table 33. Summary Reply

Byte	Value	Meaning
DSE Mode:		
0,1	000A	Structured Field Length
2	81	Type = Query Reply
3	80	Summary Indicator
4	80	Summary Reply
5	81	Usable Area Supported
6	85	Character Sets Supported
7	86	Color
8	87	Highlight Supported
9	A7	Paper Feed Techniques
DSC Mode:		
0,1	000B	Structured Field Length
A	A9	Settable Printer Characteristics

Usable Area Reply

The Usable Area Reply specifies the page and print character cell characteristics. Table 34 defines the format of this structured field.

Table 34. Usable Area Reply

Byte	Value	Meaning
0,1	0017	Structured Field Length
2	81	Type = Query Reply
3	81	Usable Area Indicator
4	11	Extended Structure Field Support A Hard Copy Device 14-Bit Addressing Allowed
5	00	Variable Cell Size Not Supported Matrix Characters
6-7	0000	Usable Area Width - Not Used
8-9	0000	Usable Area Height - Not Used
10	00	Unit of Measure = Inches
11-14	0001005A 00010078 00010078 000100B4	Horizontal Pel Distance 1/90 (.011) 90 PEL (10 CPI) 1/120 (.0083) 120 PEL (12 CPI) 1/120 (.0083) 120 PEL (13 CPI) 1/180 (.0055) 180 PEL (15 CPI)
15-18	00010048 00010060	Vertical Pel Distance (Fraction) 1/72 (0.013889) 72 PEL 6 LPI 1/96 (0.010417) 96 PEL 8 LPI
19	09 0C	Horizontal Units Per Cell 9 Slices Per Cell, 10 CPI 12 Slices Per Cell, 15 CPI
20	08	Vertical Units Per Cell (Always 8 rows) - DP mode only
21-22	0EB0	Buffer Size

Character Set Reply

The Character Set Reply specifies the character sets available at the printer. Table 35 defines the format for this structured field.

Table 35. Character Set Reply

Byte	Value	Meaning
0,1	0014	Structured Field Length
2	81	Type = Query Reply
3	85	Character Set Indicator
4	02	Graphic Escape Not Supported
5	00	Reserved
6	09	Default Matrix Width (10 CPI)
	0C	Default Matrix Width (15 CPI)
7	08	Default Matrix Height (8 rows)
8-11	04000000	Format Type 5
12	07	Char. Set Descriptor Length, bytes
13-19		First Character Set Descriptor
13	00	Character Set ID: ROS 00
14	00	- Non-loadable Character Set - Single Plane - 1 Byte Coded Character Set - LCID Compare Allowed
15	00	Character Set = ROS 0 (Base)
16-17	See Table 21	Global Graphic Character Identifier
18-19	See Table 21	Global Code Page Identifier

Color Reply

The Color Reply is part of a standard set of replies used in non-SCS operations. Color is not supported; the printer prints in black in all cases. However, the printer responds with the following reply as defined in Table 36.

Table 36. Color Reply

Byte	Value	Meaning
0,1	0016	Structured Field Length
2	81	Type = Query Reply
3	86	Color Indicator
4	40	Monochrome Ribbon Loaded
5	08	Length of Color Attribute List
6-7	00F7	Color 1 - Black
8-9	F100	Color 2 - Black
10-11	F200	Color 3 - Black
12-13	F300	Color 4 - Black
14-15	F400	Color 5 - Black
16-17	F500	Color 6 - Black
18-19	F600	Color 7 - Black
20-21	F700	Color 8 - Black

Highlight Reply

The Highlight Reply specifies the highlighting options available at the printer. Only underline is supported. Table 37 defines the format for this structured field.

Table 37. Highlight Reply

Byte	Value	Meaning
0,1	000D	Structured Field Length
2	81	Type = Query Reply
3	87	Highlight Indicator
4	04	Number of Highlight Options
5-6	00 F0	First Highlight Option Attribute Value (default) Highlight Option = Normal
7-8	F1 00	Second Highlight Option Attribute Value (Blink) Highlight Option = Normal
9-10	F2 00	Third Highlight Option Attribute Value (Reverse Video) Highlight Option = Normal
11-12	F4 F4	Fourth Highlight Option Attribute Value = Underline Highlight Option = Underline

Settable Printer Characteristics Reply

This query reply indicates that the printer supports the EPC function and returns the current EPC state. This reply is valid only in DSC mode. Table 38 defines the format for this structured field.

Table 38. Settable Printer Characteristics Reply

Byte	Value	Meaning
0,1	0009	Structured Field Length
2	81	Type = Query Reply
3	A9	Settable Printer Characteristics
4-5	0000	Reserved
		Self-Defining Parameter
0	03	Parameter Length
1	01	Early Print Complete
2	Bit 0-1 (Bit 00) (Bit 01) (Bit 10) (Bit 11)	Printer Operator Control Disabled Printer Operator Control - EPC Set "OFF" Printer Operator Control - EPC Set "ON" Reserved
	Bit 2-7 (Bit 000000)	Reserved

Null Reply

The Null Reply occurs when the printer does not support anything specified in the query list. Table 39 defines the format for this structured field.

Table 39. Null Reply

Byte	Value	Meaning
0,1	0004	Structured Field Length
2	81	Type = Query Reply
3	FF	Null Reply

Coax Structured Field Error Processing

The host records three types of “Function Not Supported” errors:

- Function Not Supported - Sense Code = 1003
- Invalid Parameter - Sense Code = 1005
- Invalid FM Header - Sense Code = 1008

Error Sense Codes

The following tables contain the sense codes returned to the application program, the error conditions, and the results of each error condition.

Table 40. Function Not Supported: Sense Code = X “1003”

Cause	Result
Invalid SA Byte	Stops the order
Invalid SA Value	Stops the order
Invalid SCS Control Codes	Terminate the order if the extended-order-parameter-valid bit is on in the print order parameter byte, and if the stop on error flag is on. Otherwise, a hyphen prints and printing continues.
Invalid SF Type	Stops the order
Invalid Query Code Field	Stops the order
Invalid PARM Value	Stops the order
FM Header Reserved Bits Not Zero	Stops the order

Table 41. Invalid Parameter: Sense Code = X “1005”

Cause	Result
MPP > PMPP	Stops printing
LM > MPP	Stops printing
RM < LM	Stops printing
RM > MPP	Stops printing
TAB < LM	Stops printing
TAB > MPP	Stops printing
TAB < TM	Stops printing
TAB > BM	Stops printing

Table 41. Invalid Parameter: Sense Code = X “1005”

Cause	Result
BM > MPL	Stops printing
BM < TM	Stops printing
MPL > 255	Stops printing
TM > MPL	Stops printing
SHF Count = 0	Stops printing
SVF Count = 0	Stops printing
SLD Count = 0	Stops printing
Invalid SLD Parameter	Stops printing
Invalid Channel Select Value	Stops printing
Query or Save/Restore SF not “Only-in-Chain” or “Last-in-Chain”	Stops the order
Invalid SF Length	Stops the order
Invalid SF Extended Length	Stops the order
Invalid SF Partition ID	Stops the order
Invalid STO Parameter Value	Stops the order
STO on Non-Blank Print Line	Stops the order
Invalid PPM Quality Value	Stops the order
PPM Count < 2 or > 12	Stops the order

Table 42. Invalid FM Header: Sense Code = X “1008”

Cause	Result
FM Header not 0601000B600	Stops the order
FM Header Reserved Bits Not Zero	Stops the order

3

Twinax Control Codes

Overview

With a twinax interface, the printer emulates the following IBM twinax printer models:

- 4234 Models 2 and 12 (IPDS™)
- 5225 Models 1, 2, 3, and 4

Emulation Pass-through Feature

Although the printer emulates the IBM 4234 and 5225 printer models, it is not restricted to the printing functions of those models. With the emulation pass-through feature, the printer can access the following functions:

- Selectable pitch
- Emphasized print
- Bold print
- Expanded print
- Automatic underline
- Automatic overscore
- Superscript/subscript printing
- Various character sets

Emulation Exceptions

The following features are not available on the printer with a twinax interface:

- AC line cords of 12 and 15 feet
- Friction feed paper handling
- Dot matrix of 9 positions wide by 8 high
- Forms widths of 17.7 inches
- AC line cord with locking power plug

The Printer Operating Mode

The host computer controls the printer operating mode. Printer operating mode is set on the host and typically will never be changed. Flags in the data exchanged between the host and printer indicate the printer mode.

Only the SCS mode is available for twinax printers. SCS stands for SNA (System Network Architecture) Character String. An SCS twinax printer is also known as an LU-4 (Logical Unit 4) device.

SCS mode offers powerful configuration capability and enables you to set parameter values that are not available on the operator panel.

For all format control codes, a value continues as set by the control code until any of the following actions occur:

- The printer receives a new value for the same control code.
- You change a value through the printer operator panel.
- The power is set to off/on.
- The printer receives a Reset control code from the host or a soft reset.

Twinax Emulation

Table 43 lists the twinax SCS control codes. Descriptions of each control code follow the table.

Control Codes

Table 43. Twinax SCS Control Codes

Hex Value	Control Code Name and Abbreviation	Used by 4234	Used by 5225
00	Null (NUL)	x	x
0C	Form Feed (FF)	x	x
0D	Carriage Return (CR)	x	x
15	New Line (NL)	x	x
16	Backspace (BS)	x	
1E	Interchange Record Separator (IRS)	x	x
25	Line Feed (LF)	x	x
2B C1	Set Horizontal Format (SHF)	x	x
2B C2	Set Vertical Format (SVF)	x	x
2B C6	Set Line Density (SLD)	x	x
2B C8	Set Graphic Error Action (SGEA)	x	x
2B D1	Set Coded Graphic Character Set (SCGL)	x	x
2B D2	Set Single Line Distance (SSLD)	x	
2B D2	Set Character Density (SCD)	x	x
2B D2	Page Presentation Media (PPM)	x	
2B D4	Begin Underscore (BU)	x	
2B D4	End Underscore (EU)	x	
2B FE	Load Alternate Character (LAC)	x	x
2F	Bell (BEL)	x	x
34 C0	Absolute Horizontal Move (AHM)	x	x
34 C4	Absolute Vertical Move (AVM)	x	x
34 4C	Relative Vertical Move (RVM)	x	x
34 C8	Relative Horizontal Move (RHM)	x	x
35	Transparent (TRN)	x	x
<i>st1 st2</i>	Hex Transparent (HTRN)	x	x

Null (NUL) - Hex 00

The Null control code is ignored by the printer. No characters are printed and no printer functions are performed.

Form Feed (FF) - Hex 0C

The Form Feed control code moves the print position to the top margin and left margin (column 1) of the next page.

- If the Maximum Print Line (MPL) value has not been set (by a Set Vertical Format control code), the printer uses the default value (66 lines) or the value stored in the configuration.
- If MPL equals 1, the printer produces a New Line.

Carriage Return (CR) - Hex 0D

The Carriage Return control code moves the print position horizontally to the left margin on the same line.

- If the print position is already at the left margin, the CR code is ignored.

New Line (NL) - Hex 15

The New Line control code moves the print position to the left margin and down vertically to the next line, which is the functional equivalent of a Carriage Return followed by a Line Feed.

- If the printer receives the NL code when the print position is at $MPP + 1$, the location of the code is interpreted as being in the current line.
- If the printer does not find the NL character before it reaches the end of a line, the printer automatically performs the NL function and continues printing.
- If the current position is the last line of the page when the NL code is sent, the printer moves to the top margin of the next page.

Back Space (BS) - Hex 16

4234 Only

The Backspace control code moves the print position one position to the left.

- If the print position is already at column 1, the BS code is ignored.

Interchange Record Separator (IRS) - Hex IE

The Interchange Record Separator control code performs the same function as the New Line control code. Refer to the description on New Line.

Line Feed (LF) - Hex 25

The Line Feed control code terminates the current print line and moves to the same print position on the next line.

- If a LF code is encountered when the current line is MPL, the next line will be line 1 of the next page.

Set Horizontal Format (SHF) - Hex 2B C1 *COUNT MPP*

The Set Horizontal Format control code sequence defines the Maximum Print Position (MPP). The following components define the control code sequence:

- 2B C1** The two-byte sequence for SHF.
- COUNT*** A one-byte binary count indicating the number of bytes to the end of the SHF string, including the count byte. Valid values are 01 and 02.
- A count byte of 01 sets the Maximum Print Position to the default value for the current character density (132 for 10 cpi; 198 for 15 cpi).
- A count byte of 02 sets the Maximum Print Position to the value defined in the *MPP* byte.
- Any other value generates an Invalid Parameter Error.
- MPP*** Defines the Maximum Print Position, also known as line length.
- If the printer is at 10 cpi, valid values for *MPP* are hex 01 through 84 (1 through PMPP). A value greater than PMPP generates an Invalid Parameter Error.
- If the printer is at 15 cpi, valid values for *MPP* are hex 01 through C6 (1 through PMPP). A value greater than PMPP generates an Invalid Parameter Error.
- A value of 00 results in the printer reverting to the default value: *MPP = PMPP*.

Set Vertical Format (SVF) - Hex 2B C2 *COUNT MPL*

The Set Vertical Format control code sequence sets the Maximum Print Line (MPL), and resets the top of form to the current paper position.

NOTE: If the combination of the Maximum Print Line and Line Density (via Set Line Density or Set Single Line Density) exceeds 100 inches, an Invalid Parameter Error is reported.

- 2B C2** The two-byte sequence for SVF.
- COUNT*** A one-byte hexadecimal count indicating the number of bytes to the end of the SVF string, including the count byte. Valid values are hex 01 or 02.
- A count byte of 01 sets the Maximum Print Line to one line.
- A count byte of 02 sets the Maximum Print Line to the value defined in the *MPL* byte.
- Any other value causes an Invalid Parameter Error.
- MPL*** Defines the Maximum Print Line, also known as forms length. Valid values are 1 through 255. If *MPL = 00*, Maximum Print Line is set to 1.
- The factory default configuration for the Maximum Print Line is 66 lines per page.

Set Line Density (SLD) - Hex 2B C6 *COUNT LPI*

The Set Line Density control code sequence sets the number of lines to be printed per inch of paper.

2B C6 The two-byte sequence for SLD.

COUNT A one-byte binary count indicating the number of bytes to the end of the SLD string, including the count byte. Valid values are hex 01 and 02.

A count byte of 01 reverts the line density to the default of 6 lpi.

A count byte of 02 sets the lpi to the value of the *LPI* byte.

Any other value generates an Invalid Parameter Error.

LPI Lines Per Inch. This byte sets the value of the line spacing in 1/72 inch increments. Valid values are 01 through FF. A value of 00 results in the printer reverting to the default value of 6 lpi.

Some of the popular line spacing settings are:

LPI = Hex 18 for 3 lpi (24/72 inch)

LPI = Hex 12 for 4 lpi (18/72 inch)

LPI = Hex 0C for 6 lpi (12/72 inch)

LPI = Hex 09 for 8 lpi (9/72 inch)

LPI = Hex 08 for 9 lpi (8/72 inch)

The line spacing remains in effect until it is changed to another value or the printer power is turned off and then back on.

Set Graphic Error Action (SGEA) - Hex 2B C8 *COUNT GCHAR UCHAR*

The Set Graphic Error Action control code sequence defines the default character to be printed in place of all unprintable characters received, and also defines the unprintable graphic character option. Until this control code is received, the printer continues printing, no status is reported, and a hyphen is used as the graphic character.

2B C8 The two-byte sequence for SGEA.

COUNT A count byte specifying the total number of bytes to the end of the string, including the count byte. Valid values are 01, 02, or 03. Any other values result in an Invalid Parameter Error.

A count byte of 01 sends no *GCHAR* or *UCHAR*. The control code prints a hyphen for the graphic character. When a graphic error occurs, the printer continues printing and does not report the status.

A count byte of 02 sends no *UCHAR*. *GCHAR* is the graphic character, and when a graphic error occurs, the printer continues printing and does not report the status.

A count byte of 03 sets *GCHAR* to be the graphic check character, and *UCHAR* to be the action definition, as explained in the following paragraphs.

- GCHAR* Defines the graphic character to be printed in place of all unprintable characters. This graphic character may be any character. If the character specified is also unprintable, or if no character is specified, the printer prints a hyphen (-).
- UCHAR* The unprintable character option. Valid values are shown in Table 44. Any other value generates an Invalid Parameter Error.

Table 44. Valid *UCHAR* Values for Setting Graphic Error Action

<i>UCHAR</i> Values	Printer Action
00, 01, 02	No stop; no status is reported.
03, 04	Stop; post "Graphic Check" and "Unit Not Available"

Set Coded Graphic Character Set through Local (SCGL) Hex 2B D1 03 81 *CHARSET*

The Set Coded Graphic Character Set control code sequence selects one of the coded graphic character sets as the language for the printer to use. If an invalid value is used for the language, the language set selected through the operator panel will be used. The default character set is stored in the configuration and is in use the next time the printer is turned on. Valid values are shown in Table 45.

2B D1 The two-byte sequence for SCGL.

CHARSET Designates which character set to use. All data print in this character set until you change it by:

Sending a new SCGCS code.

Changing the character set via the operator panel.

Resetting the printer, which loads the custom power-on character set.

Table 45. Valid Graphic Character Set Values

Hex	Language (Country)
FF	Operator Panel Selection
00	Multinational
01	English US
02	Austrian/German
03	Belgian
04	Brazilian
05	Canadian French
06	Danish/Norweg
07	Finnish/Swedish
08	French
09	Italian
0A	Japanese Eng
0B	Japanese Katak.
0C	Portuguese
0D	Spanish
0E	Spanish Speak
0F	English UK
60	Old Hebrew
23	Hebrew
69	Farsi/Latin
5E	Greek Old
63	Greek New
61	Arabic
5D	Turkish
5B	Latin 2/ROECE
5C	Yugoslavian

Set Single Line Distance (SSLD) - 2B D2 04 15 *ld1 ld2*

4234 Only

The Set Single Line Distance control code sequence terminates the current print line and vertically moves the print head by the specified distance.

2B D2 The two-byte sequence for SSLD.

- The distance is specified in 1440ths of an inch and equals the value ($ld1 \times 256$) + $ld2$. For example, 2B D2 04 15 02 80 causes the print position to advance by 640/1440 inches.
- The $ld2$ must be divisible by 5, or an Invalid Parameter Error is reported.

Set Character Density (SCD) - Hex 2B D2 04 29 00 *CPI*

The Set Character Density control code sequence defines the number of horizontal characters per inch (cpi).

2B D2 The two-byte sequence for SCD.

CPI A byte defining the number of characters printed per horizontal inch. The default character density is 10 cpi. Valid values for *CPI* are shown in Table 46. The corresponding Physical Maximum Print Position (PMPP) will be determined by the front panel setting of the menu item Max. Print Width. Any other values cause an Invalid Parameter Error.

For the Max. Print Width setting of 13.2", the PMPP at 10 cpi is 132 characters, and at 15 cpi is 198 characters. If the Max. Print Width is set to printer width, then the width in characters will be determined by the printer's physical width.

If, after changing *CPI*, the width in characters is greater than the PMPP setting, the width will be reduced to PMPP. For example, going from 15 cpi @ 198 characters to 10 cpi will reduce the width to 132 characters.

Table 46. Valid *CPI* Values for Setting Character Density For Max. Print Width of 13.2 Inches

<i>CPI</i> (hex)	Characters Per Inch	PMPP
00	No Change	n/a
0A	10	132
0F	15	198
FF	10	132

Page Presentation Media (PPM) - 2B D2 09 48 00 00 00 00 00 *PTYPE*

4234 Only

The Page Presentation Media control code specifies the print type used by the printer.

2B D2 The two-byte sequence for PPM.

PTYPE Print Type. Table 47 lists the values for print type. Any other value generates an Invalid Parameter Error.

Table 47. Valid Values for Print Type

<i>PTYPE</i>	Print Type
00	Do not change settings
01	Data Processing Quality
02	Correspondence Quality
03	Draft Quality
FF	Use operator-selected quality

Begin Underscore (BU) - 2B D4 *COUNT* 0A 01 *USPACE*

4234 Only

The Begin Underscore control code sequence activates the continuous underscore feature. It remains in effect until the printer receives an End Underscore control code.

2B D4 The two-byte sequence for BU.

COUNT A count byte specifying the total number of bytes to the end of the string, including the count byte. Valid values are 03 or 04. Any other values result in an Invalid Parameter Error.

A count byte of 03 causes the printer to underscore spaces and Relative Horizontal Print Position control motion.

A count byte of 04 sets underline action to *USPACE*.

USPACE An optional byte, defines whether spaces are underscored. Valid values are 00 and 80. Any other value generates an Invalid Parameter Error.

When the value is set to hex 00, all graphic characters are underscored, including spaces and Relative Horizontal Print Position control motion.

When the value is set to hex 80, all characters *except* spaces and Relative Horizontal Print Position control motion are underscored.

Receipt of the Begin Underscore control code when underscore was previously set generates an Invalid Parameter Error.

Absolute Horizontal Move Print Position motion is not underscored at any time.

End Underscore (EU) - 2B D4 02 0E

4234 Only

The End Underscore control code cancels the Begin Underscore control code.

2B D4 The two-byte sequence for EU.

If you do not send a BU code before sending an EU code, the printer generates an Invalid Parameter Error.

Load Alternate Character (LAC) - Hex 2B FE *COUNT MATRIX l1... In*

The Load Alternate Character control code sequence allows the host system to load alternate character images into the printer. Use the LAC code for designing graphics, bar codes, and charts, or for printing in foreign languages.

2B FE The two-byte sequence for LAC.

COUNT A count byte that defines the number of bytes remaining in the control code plus one. Count cannot exceed 255 bytes.

MATRIX Specifies the character matrix size. Valid values for the 4234 are 01 or 09. The valid value for the 5225 is 01 only. Any other value generates an error message.

If the matrix is 01, the count byte value must be in multiples of 10 plus 2 for the count byte and matrix size.

If the matrix is 09, the count byte value must be in multiples of 12 plus 2 for the count byte and matrix size.

l1... In These bytes define the character image. Each character image requires 10 bytes for a 01 matrix character and 13 bytes for a 09 matrix character. The first byte defines the EBCDIC character code to be redefined (01 through FF). The next nine or 12 bytes define the dot matrix of the alternate character image.

The most significant bit is the top dot and the least significant bit is the bottom dot (descender). One parameter byte is required for each of the nine character matrix columns.

If *l1* is 00, the next nine or 12 bytes (for the 01 and 09 matrix sizes) are not loaded into the printer character memory, and an Invalid Parameter Error is reported.

For further information, refer to Appendix A, "Load Alternate Character."

Bell (BEL) - Hex 2F

The Bell control code activates the following printer functions:

- Prints all data preceding the BEL character.
- Executes all control character functions preceding the BEL character.
- Stops printing.
- Sets the Unit Not Available bit in the Poll Response.
- Displays 06 HOST REQUEST in the LCD.
- The status indicator blinks.
- Sounds the alarm if the operator panel alarm option is set to on.

Absolute Horizontal Move (AHM) - Hex 34 C0 *HPP*

The Absolute Horizontal Move control code sequence defines the placement of the next horizontal print position.

34 C0 The two-byte sequence for AHM.

HPP Horizontal Print Position. Specifies the column of the next horizontal print position. Valid values must be greater than 0 and less than or equal to *MPP*. If *HPP* = 0, no operation is performed.

Any other value generates an Invalid Parameter Error.

MPP values:

84 hex (132 characters) at 10 cpi or

C6 hex (198 characters) at 15 cpi.

Absolute Vertical Move (AVM) - Hex 34 C4 *VPP*

The Absolute Vertical Move control code sequence defines the placement of the next vertical print position.

34 C4 The two-byte sequence for AVM.

VPP Vertical Print Position. Specifies the line number of the next vertical print position. Valid values must be greater than 0 and less than or equal to *MPL*. If *VPP* = 0, no operation is performed.

Any other value generates an Invalid Parameter Error.

If *VPP* is less than the value of the current print line, the printer moves the print position vertically from the current print position to the requested line number on the next page.

Relative Vertical Move (RVM) - Hex 34 4C *RVPP*

The Relative Vertical Move control code sequence defines the next vertical print line position relative to the present position.

34 4C The two-byte sequence for RVM.

RVPP Relative Vertical Print Position. Specifies the number of lines the print head moves vertically. The print head will not move past the end of the page. If *RVPP* = 0, no operation is performed.

If the value of *RVPP* plus the current print position exceeds the page length, an Invalid Parameter Error occurs.

Relative Horizontal Move (RHM) - Hex 34 C8 *RHPP*

The Relative Horizontal Move control code sequence defines the next horizontal print position or character column relative to the present position.

34 C8 The two-byte sequence for RHM.

RHPP Relative Horizontal Print Position. Specifies the number of columns the print head moves toward the end of the line. The print head will not move past the end of the line. If *RHPP* = 0, no operation is performed.

If the value of *RHPP* plus the current print position exceeds *MPP* + 1, an Invalid Parameter Error occurs.

Transparent (TRN) - Hex 35 *COUNT*

The Transparent control code enables characters whose values are from 01 through 3F to print. All other data that follows is treated as normal data. Before specifying hex codes 01 through 3F, make sure a print image has been defined for those codes. If no image for a given code has been loaded, a graphic error occurs.

COUNT A count byte that defines the number of bytes of transparent data to follow, *not* including the count byte. Valid values are from 1 through 255. If *COUNT* = 0, no operation is performed.

This control code may be used in conjunction with the LAC control code. Through LAC, the host may redefine the lower hex digits and print the redefined characters with the Hex Transparent control code.

Accessing Additional Features

Hex Transparent (HTRN)

Hex *st1 st2 (B1, B2), . . . (B1, B2) stp*

The Hex Transparent control code sequence allows you to access features that are not available in standard IBM emulations. These escape codes are not SCS control codes.

NOTE: Care should be taken when using these codes, since they can change the printer configuration normally controlled by the host. For the control code sequences for additional printer features, refer to the appropriate emulation *Programmer's Reference Manual*.

st1 st2 The two-byte starting sequence for HTRN.
B1,B2 A two-byte sequence packed into one 8-bit output character for the printer.
stp The sequence terminator.

To access non-IBM codes, a control sequence must begin with two EBCDIC character codes (*st1 st2*) and end with a single EBCDIC character code (*stp*). Three defaults are available.

Default 1:

<% = the starting codes *st1 st2*

> = the terminating code *stp*

Default 2:

↯↯ = the starting codes *st1 st2*

\$ = the terminating code *stp*

Default 3:

_% = the starting codes *st1 st2*

_ = the terminating code *stp*

Because the not (↯) character is not included in all of the EBCDIC world trade character sets, default 1 is recommended.

EBCDIC to ASCII Conversion for Non-IBM Control Codes

The printer converts pairs of data characters between HTRN and *stp* delimiters to ASCII HEX characters in the range 00 through FF, and sends them to the printer for processing. As these characters are used to form special (non-coax and non-twinax) printer commands, the printer does not increment the horizontal character count between the HTRN and *stp* delimiters. Based on this, you should account for these characters if included in a print line, in addition to the normal print count. The following steps explain the conversion process.

1. Upon receipt of *st1 st2*, the printer translates the EBCDIC characters 0 through 9 and A through F (also a through f) into hexadecimal data. Two characters are combined into one hexadecimal byte and sent to the printer.
2. If you select a character other than 0 through 9 or A through F, the character is translated from EBCDIC to the current printer character mapping and sent to the printer.

3. Data translation continues until the printer receives an *stp* symbol. If the printer receives an odd number of hexadecimal digits before receipt of the *stp* symbol, the last byte is not sent to the printer.
4. The printer does not count any of the characters between the *st1 st2* and the *stp* as IBM data character positions, nor will it take into account any features enabled by the control codes.

NOTE: When sending a control sequence, it is important to maintain page and line integrity.

Table 48 is an example of a Hex Transparent control sequence used to print the word "bold" in uppercase and bold print, for the Proprinter III XL emulation.

Table 48. Using Hex Transparent to Produce Bold Print - Proprinter III XL Example

	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	G	B	O	L	D	<i>st1</i>	<i>st2</i>	(<i>B1</i>	<i>B2</i>)	<i>stp</i>	H
Host sends this code	4C	6C	F1	C2	6E	C7	C2	D6	D3	C4	4C	6C	F1	C2	6E	C8
EBCDIC Char. Representation	<	%	1	B	>	G	B	O	L	D	<	%	1	B	>	H
Proprinter III XL Sequence			1B		G		B	O	L	D			1B		H	
Printer Output	BOLD															

Additional HTRN Macro Commands

As an added feature to the printer (twinax), several special control codes are defined in the IBM Transparent Printer Extensions.

The printer does not increment the horizontal character count between the HTRN (Hex Transparent) and *stp* delimiters. Based on this, you should account for these characters if included in a print line, in addition to the normal print count.

- st1 st2* NLQ Changes the font to the NLQ font. If the pitch is a value that is not available in the NLQ font, the pitch is set to the closest value that is available in the NLQ font. If MPP is greater than the PMPP for the new pitch, the MPP is set to PMPP.
- st1 st2* DPQ Changes the font to the DP font.
- st1 st2* DFQ Changes the font to the High Speed font. If the pitch is a value that is not available in the High Speed font, the pitch is set to the closest value that is available in the High Speed font. If MPP is greater than the PMPP for the new pitch, MPP is set to PMPP.
- st1 st2* OCA Changes the font to the OCRA font. If the pitch is a value that is not available in the OCRA font, the pitch is set to the closest value that is available in the OCRA font. If MPP is greater than the PMPP for the new pitch, MPP is set to PMPP.
- st1 st2* OCB Changes the font to the OCRB font. If the pitch is a value that is not available in the OCRB, the pitch is set to the closest value that is available in the OCRB font. If MPP is greater than the PMPP for the new pitch, MPP is set to PMPP.

<i>st1 st2</i> PDP	Operates in the same manner as the IDP control code.
<i>st1 st2</i> IDP	Enables the twinax buffer dump mode as settable from program mode. The two 256 byte twinax input buffers are dumped in the same format as defined in the buffer dump section. When this dump mode is enabled from the host data stream, and if you place the printer in the hold state, the printer operates as if you put the printer in the buffer dump mode. When enabled, the BUFFER PRINT LED is lit. See the NML control code below for host control for exiting this control code.
<i>st1 st2</i> LST	Enables a dump of the IBM Printer Extension Escape Codes. No hex conversion is performed and the two character "escape code" is sent to the printer as text. The NML control code will exit this mode.
<i>st1 st2</i> IHC	Turns on the Host Override feature. This performs the same function in the host data stream as turning it on from the operator panel. Host Override can be turned off from the operator panel or by the NML control code.
<i>st1 st2</i> NML	Turns off the host override special function if set by the IHC control code; it also turns off the three trace control codes (LST, PDP, IDP); and it turns on the LAC approximation if LAC was disabled by the BRC control code.
<i>st1 st2</i> PGM	Allows you to change the two-character IBM Extension Escape Codes to any two EBCDIC characters from 00 through FF hex. The form of the control code is ^^PGMxx where "xx" are two EBCDIC characters. These two EBCDIC characters become effective immediately as the "escape code."
<i>st1 st2</i> BRC	Disables the LAC approximation. All LAC data is printed as received. This control code generates a narrower graphic at 10 cpi and a wider graphic at 15 cpi as the data is printed at 120 dpi instead of 90 or 135 dpi, respectively.

A

Load Alternate Character

Load Alternate Character (LAC)

The Load Alternate Character (LAC) feature, available on the IBM 4234 or 5225 twinax printers, or other printers running these emulations, is used for printing bar codes, charts, and diagrams. Plotting is accomplished by redefining character cells.

Character Cell Sizes

The sizes of the character cells at 10 and 15 cpi differ between the IBM 5225 and 4234 printer models and the Printronix® printers.

The 5225 model prints at 10 and 15 cpi. The character cell for both settings is 8 dots high by 9 dots wide.

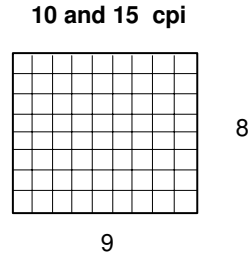


Figure 1. IBM 5225 Character Cells

The 4234 model prints at 10 and 15 cpi. At 10 cpi, a character cell is 8 dots high by 12 dots wide. At 15 cpi, a character cell is 8 dots high by 9 dots wide.

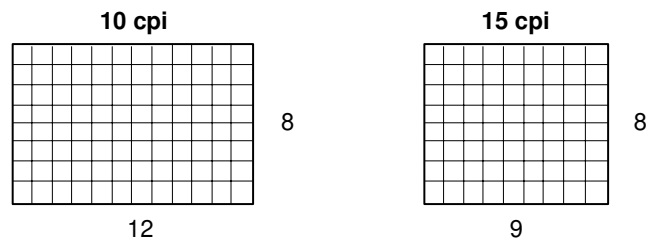


Figure 2. IBM 4234 Character Cells

LAC Approximation

Figure 4 shows how the conversions are done for each emulation at 10 cpi and 15 cpi. The conversion follows the rules for each cpi. For example, for 10 cpi, the matrix size is expanded from 9 bytes to 12 bytes.

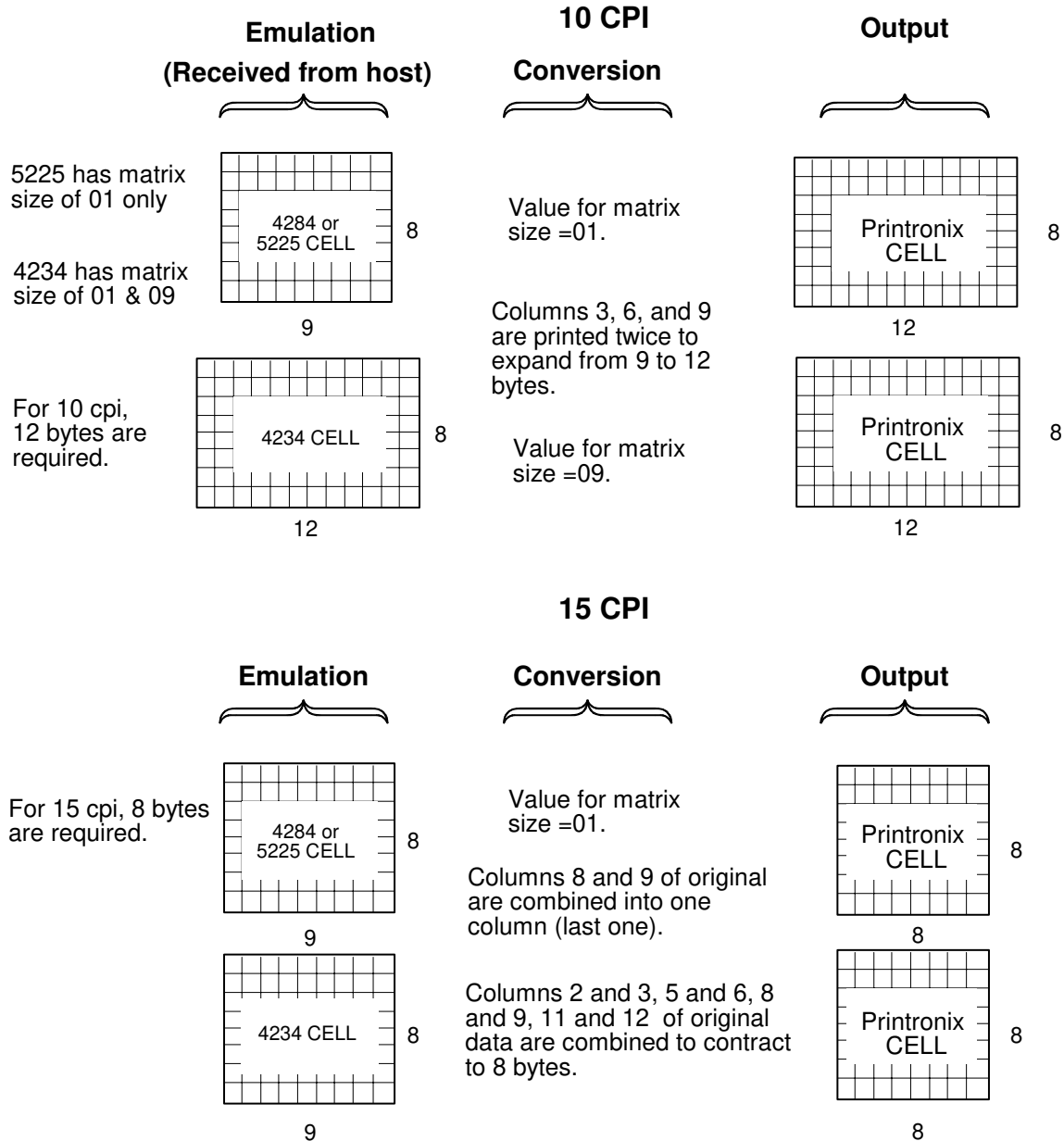


Figure 3. LAC Approximation

Enabling and Disabling LAC

To disable LAC approximation, send a BRC control code. This causes all data to be printed as received. The printer will print LAC codes at 120 dpi. Also, a narrower graphic will print at 10 cpi and a wider graphic will print at 15 cpi.

Sending an NML control code cancels the BRC control code and turns on LAC.

B

Coax/Twinax Character Set Translation to Internal ASCII Characters

Overview

If you create Coax or Twinax print applications using PGL[®], PPI, or VGL Graphics Extensions or Printronix Hex Transparent Mode, be aware of the following: character codes sent by the host computer are converted to internal codes by the Coax/Twinax interface before being processed by the PGL, PPI, or VGL Graphics Extensions or the currently selected ASCII Printer Emulation.

Figure 5 shows the data flow in the printer when using the Coax or Twinax interface.

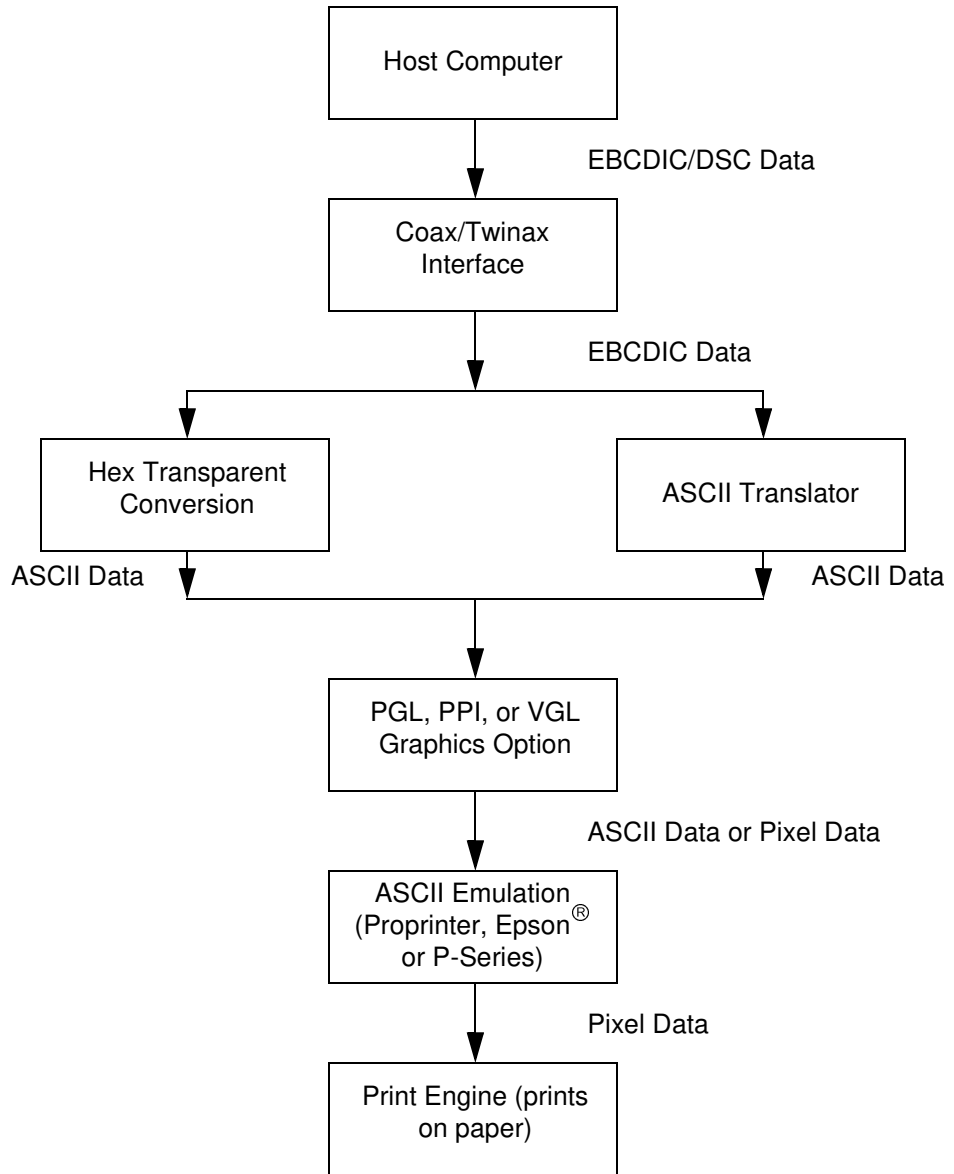


Figure 4. Data Flow

ASCII Translator

The ASCII Translator will convert the host computer's symbol set into an ASCII symbol set that contains all of the print symbols in the host set.

If you want to view the translation character sets, you will need the *Character Sets Reference Manual*. To print the ASCII character set equivalent of the Coax or Twinax character set chosen, perform the following steps:

1. Go to the Print Translation Tbl menu option and press ENTER (make sure the panel is unlocked first). This will cause the printer to print out a table of the current Coax or Twinax character set.
2. Go into the LP+ emulation menu to the Print Char. Set menu option and press ENTER. This will cause the printer to print out a table of the current ASCII character set.

You may now use these tables to see how characters are translated from EBCDIC into ASCII.

3. If you want to set the Special Function Control Code (SFCC) in the printer, for example, you will need to see where in the ASCII character set the original EBCDIC Coax or Twinax character resides. To do this, take whichever character you want to use as the SFCC in the Coax or Twinax character set and match it with the same character in the ASCII set. (See the following example, which uses the Coax International character set and the NOT character (¬). You will use your currently selected language set.)
4. Use the Hex value of the character location in the ASCII table to set the SFCC from the front panel. See the following example. (You will need to convert the Hex value to a decimal value.)

CURRENT COAX SCS SET																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|	-	-	-	-	&	-	ø	Ø	°	µ	£	{	}	\	0
1	|	-	-	-	-	é	/	É	a	j	~	£	A	J	÷	1
2	|	-	-	-	-	ë	æ	Ë	b	k	s	¥	B	K	S	2
3	|	-	-	-	-	ä	è	Ä	ë	c	l	t	•	C	L	T
4	|	-	-	-	-	à	è	À	é	d	m	u	©	D	M	U
5	|	-	-	-	-	á	i	Á	í	e	n	v	§	E	N	V
6	|	-	-	-	-	ã	i	Ã	í	f	o	w	¶	F	O	W
7	|	-	-	-	-	â	i	Â	ï	g	p	x	‰	G	P	X
8	|	-	-	-	-	ç	i	Ç	ï	h	q	y	‰	H	Q	Y
9	|	-	-	-	-	ñ	β	Ñ	ˆ	i	r	z	‰	I	R	Z
A	|	-	-	-	-	[	]	]	ˆ	ˆ	ˆ	ˆ	ˆ	-	-	-
B	|	-	-	-	-	\$	ˆ	#	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
C	|	-	-	-	-	<	*	%	@	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
D	|	-	-	-	-	(	)	_	'	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
E	|	-	-	-	-	+	;	>	=	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ
F	|	-	-	-	-	!	^	?	"	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ	ˆ

NOT character address: BA

CURRENT ASCII CHARACTER SET																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0					0	@	P	\	p		°	À	Ð	á	ä	
1					1	A	Q	a	q		±	Á	Ñ	â	å	
2					"	B	R	b	r		¢	Â	Ò	ã	ö	
3					#	C	S	c	s		£	Ã	Ó	ä	ó	
4					\$	D	T	d	t		¤	Ä	Ô	å	õ	
5					%	E	U	e	u		¥	Å	Õ	ä	ö	
6					&	F	V	f	v		¦	Æ	Ö	æ	ö	
7					'	G	W	g	w		§	•	Ç	×	ç	÷
8					(	H	X	h	x		¨	ˆ	È	Ø	è	ø
9					)	I	Y	i	y		©	ˆ	É	Ù	é	ú
A					*	:	J	Z	j	z	®	ˆ	Ê	Ú	ê	û
B					+	;	K	[	k	[	®	ˆ	Ë	Û	ë	ü
C					,	<	L	\	l	\	®	ˆ	Ë	Ü	ë	ü
D					-	=	M	]	m	]	®	ˆ	Ì	Ü	ì	ý
E					.	>	N	^	n	^	®	ˆ	Í	Ý	í	ÿ
F					/	?	O	_	o	_	®	ˆ	Î	ÿ	î	ÿ

New ASCII address: AC

CURRENT COAX DSC SET																
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	|	-	0	&	-	{	-	[	a	q	A	Q	-	-	-	-
1	|	-	=	1	-	-	-	-	b	r	B	R	-	-	-	-
2	|	-	/	2	-	-	-	-	c	s	C	S	-	-	-	-
3	|	-	"	3	-	-	-	-	d	t	D	T	-	-	-	-
4	|	-	/	4	-	-	-	-	e	u	E	U	-	-	-	-
5	|	-	\	5	+	{	-	#	-	f	v	F	V	-	-	-
6	|	-	-	6	-	!	-	@	-	g	w	G	W	-	-	-
7	|	-	|	7	-	-	-	-	h	x	H	X	-	-	-	-
8	|	>	?	8	[	{	-	A	-	i	y	I	Y	-	-	-
9	|	<	!	9	-	}	-	E	-	j	z	J	Z	-	-	-
A	|	[	\$	~	^	]	-	E	-	k	-	K	-	-	-	-
B	|	]	-	@	~	~	-	I	-	l	-	L	-	-	-	-
C	|	)	#	#	-	!	-	D	-	m	-	M	-	-	-	-
D	|	(	-	@	\	ˆ	-	U	-	n	ˆ	N	\	-	-	-
E	|	}	-	%	}	-	-	-	-	o	;	O	;	-	-	-
F	|	{	-	_	-	\	-	C	-	p	*	P	*	-	-	-

Result of Step 1

Result of Step 2

C

Glossary

A

active column	The horizontal location on the paper where the next character will print. After printing a character, the printer advances the active column. A logical unit on line printers, since line printers form entire lines at a time.
active line	The vertical location on the paper where the next character will print. After printing a line, the printer advances the active line.
active position	The position on the paper where the next character will print. The active position is defined by the horizontal position (active column) and the vertical position (active line). A logical unit on line printers, since line printers form entire lines at a time.
AHM	Absolute Horizontal Move.
ASCII	American Standard Code for Information Interchange. A standard character encoding scheme introduced in 1963 and used widely on many computers and printers. It is a 7-bit code with 128 different bit patterns. There is no parity recommendation.
AVM	Absolute Vertical Move.

B

bar code	A printed code consisting of parallel bars of varied width and spacing and designed to be read by a one-dimensional scanning device.
baud	A unit of speed that measures the rate at which information is transferred. Baud rate is the reciprocal of the length in seconds of the shortest pulse used to carry data. For example, a system in which the shortest pulse is 1/1200 second operates at 1200 baud. On RS-232 serial lines, the baud rate equals the data flow rate in bits per second (bps). To communicate properly, a printer must be configured to operate at the same baud rate as its host computer.
BEL	Bell.

BM	Bottom Margin.
bps	bits per second.
BS	Back Space.
BU	Begin Underline.
buffer	A reserved area in memory that data is written to and read from during data transfers.

C

character cell	The invisible rectangular space occupied by a character, including the white space around the character. The height of a cell remains constant even with changes in the current line spacing, and the width is equal to the current character spacing. Used as a unit of spacing.
character set	A set of codes instructing the printer how to construct a set of printable characters, including symbols, punctuation, numbers, diacritical markings, and alphabet characters. Each character is assigned a unique address in memory.
character weight	The degree of lightness and thickness of printed text. For example: “ Bold ” refers to a heavy or thick character weight. “Medium,” “normal,” or “book weight” refer to the character weight used in this sentence.
checksum	A value used to verify microcode correctness.
coax	Coaxial cable. An electrical signal conductor consisting of a single wire surrounded by insulation and a braided shield. Used to connect computers to input or output devices.
command	An operating instruction (e.g., form feed, or FF) sent from a computer to the printer. Also called a control code or nonprintable character. Commands are opposed to data, which is printed.
command sequence	Two or more bytes that instruct the printer to perform a special function. The first character in the sequence is a special function control character (SFCC). This character alerts the printer that the string which follows is a command sequence, not characters to be printed.
compatibility	The ability of one printer to accept and properly process commands meant for a different printer. <i>See also</i> emulation.
configuration	Refers to the operating properties that define how the printer responds to signals and commands received from the host computer at the printer interface. These properties are called configuration parameters and are set to match the operating characteristics of the host computer system.

controller	An independent logic unit in a data processing system that controls data paths between one or more units of peripheral equipment.
cpi	characters per inch: a measurement of monospaced fonts indicating the horizontal character density. For example, 10 cpi is 10 characters produced in a one-inch space.
CR	Carriage Return.

D

DPU	Data Processing Unit. <i>See also</i> controller.
default	A value, parameter, attribute, or option that is used by a program or system if another is not specified by the user.
diagnostic	Pertaining to the detection and isolation of a printer malfunction or mistake.
disable	To deactivate or set to OFF.
DSC	Data Stream Compatible.
DUP	Duplication Control.

E

EBCDIC	Extended Binary Coded Data for Information Communication.
EEPROM	Electrically Erasable Programmable Read Only Memory.
EM	End of Message.
emulation	The ability of a printer to print data using the control language of another printer.
enable	To activate or set to ON.
enable state	Online. The printer is ready to receive and process commands and data.
ENP	ENable Presentation.
EU	End Underline.

F

family	The set of all of the weights and styles of a typeface.
FF	Form Feed.
fixed-pitch font	<i>Same as</i> font, monospaced.
FM	Function Management.

font	The complete set of a given size of type, including characters, symbols, figures, punctuation marks, ligatures, signs, and accents. Seven characteristics fully define a font: 1) typeface 2) spacing (proportional or monospaced) 3) type size (12 point, 14 point, etc.) 4) scale factor (character height/width ratio) 5) type style 6) character weight 7) character proportion (normal, condensed, expanded).
font name	See typeface.
font pattern	The matrix of pixels which represents a character, symbol, or image.
font, landscape	A font printed parallel to the long edge of a page.
font, monospaced	Also called fixed-pitch fonts. Every character, regardless of horizontal size, occupies the same amount of font pattern space. All monospaced fonts use specific pitch size settings. Monospaced fonts are sometimes used when strict character alignment is desired (tables, charts, spreadsheets, etc.).
font, portrait	A font printed parallel to the short edge of a page.
font, proportional	A font in which the width of a character cell varies with the width of the character. For example, [i] takes less space to print than [m]. Using proportional fonts generally increases the readability of printed documents, giving text a typeset appearance.
font weight	The thickness of the lines making up a character. For example, “ bold ” and “light” are different font weights.
font width	The measurement of the width of a character cell in dots.
FPCB	Format Parameter Control Block

G

GCID	Global Coded Character Set Identifier.
GE	Graphic Escape.

H

hex codes	Based on a numeral system with a radix of 16.
hold state	Offline. The printer is not ready to receive and process commands and data.
host computer	The computer that stores, processes, and sends data to be printed. The host computer communicates directly

with the printer. The term “host” is used to indicate the controlling computer, since modern printers are themselves microprocessor-controlled computer systems.

HT Horizontal Tab.
HTRN Hex TRANSPARENT.
Hz Hertz. Cycles per second.

I

IGP Intelligent Graphics Processor.
INP Inhibit Presentation.
interface The hardware component used to link two devices by common physical interconnection, signal, and functional characteristics.
IRS Interchange Record Separator.

L

LAC Load Alternate Characters.
LCD Liquid Crystal Display.
LCID Load Coded Graphic Character Set Identifier.
LED Light Emitting Diode.
lpi lines per inch.
LM Left Margin.
LTR Left To Right.
LU Logical Unit.

M

MPL Maximum Print Line. Also called forms length. The number of lines that can be printed on a page.
MPP Maximum Print Position. Also called line length.

N

NL New Line.
NUL Null.

NVRAM Non-Volatile Random Access Memory. A type of RAM in which stored data are not lost when the power is interrupted or turned off. A battery supplies power to NVRAM when the system does not. Unlike ROM (another type of nonvolatile memory), NVRAM is accessible and its contents can be altered.

O

offline An operational state in which the printer cannot accept commands or data from the host computer, but can perform self tests, form settings, and record configuration changes.

online An operational state in which the printer is under direct control of the host computer. In this state, the printer accepts commands and data sent from the host computer, and acts on them immediately.

P

PA Program Attention.

PAI IBM 3174/3274 control unit to Device Product Attachment Information.

parity (check) Parity checking is the addition of non-data bits to data, resulting in the number of 1 bits being either always even or always odd. Parity is used to detect transmission errors. Parity represents value in the check digit of the received or transmitted data.

PCBA Printed Circuit Board Assembly.

PCIA Printer Control Information Area.

pitch The number of text characters printed per horizontal inch. Specified in characters per inch (cpi).

pixel Derived from picture element. The smallest displayable picture element on a video monitor or printable unit. In printing, a pixel is a dot.

PMPP Physical Maximum Print Position. The longest line the printer is capable of printing. This differs from MPP in that the printer may be capable of printing lines 132 characters wide (PMPP), but the print job is only 80 characters wide (MPP). (*See also* MPP.)

point A unit of length in printing and typography, used to specify the size of alphanumeric characters. There are 72 points in a vertical inch; thus, one point equals 1/72 inch, or approximately 0.0138 inch. Some examples of

point sizes are: This is 8 point type. This manual is printed in 10 point type. **This is 14 point type.**

port	A channel used for receiving data from or transmitting data to one or more external devices.
PPM	Page Presentation Media.
protocol	In general, a set of rules governing the exchange of information between computer systems. For printers, a protocol is the coding system used to convey and print characters and graphics. A printer protocol includes character codes, printer function codes, and machine-to-machine communication codes. In this manual, protocol and emulation mean the same thing.

R

RAM	Random Access Memory. Can be read from or written to at any time. RAM is volatile: Whatever is in RAM is lost when the printer is powered off.
read	To retrieve data from memory (RAM, ROM, NVRAM) or a mass storage device (hard disk, floppy diskette, etc.).
resolution	A measure expressing the number of component units in a given range used to create an image; in printing, expressed as the number of dots per inch (dpi) horizontally and vertically.
RHM	Relative Horizontal Move.
RM	Right Margin.
ROM	Read Only Memory. Programs, instructions, and routines permanently stored in the printer that cannot be written to. Files in ROM are not lost when the printer is powered off. (ROM-resident fonts are fonts permanently stored in a printer and available at any time via software commands.)
ROM-resident fonts	Fonts that are permanently stored in a printer and available at any time from the operator panel or via software commands.
RTL	Right To Left.
RVM	Relative Vertical Move.

S

SA	Set Attribute.
SCD	Set Character Density.
SCGCS	Set Coded Graphic Character Set.

SCS	SNA Character String. Usually commands to set printer format, etc.
SFCC	Special Function Control Character. The first character in a command sequence.
SFCC sequence	<i>Same as</i> command sequence.
SGEA	Set Graphic Error Action.
SHF	Set Horizontal Format.
SLD	Set Line Density.
slew	Rapid vertical paper movement.
SNA	Systems Network Architecture. A hardware and software protocol used on IBM mainframe networks.
SPD	Set Print Density.
SSLD	Set Single Line Distance.
STO	Set Text Orientation.
SVF	Set Vertical Format.

T

TM	Top Margin.
TRN	TRaNsparent. Transparent commands enable IBM printers to access features that are not available in the IBM emulation.
twinax	Twinaxial cable. An electrical signal conductor consisting of two wires surrounded by insulation and a braided shield. Used to connect computers to input or output devices.
typeface	A descriptive name or brand name that identifies a particular design of type.
type family	The set of all of the weights and styles of a typeface.

V

VCS	Vertical Channel Select.
VT	Vertical Tab.

W

write	To place data in memory (RAM, NVRAM) or a mass storage device (hard disk, floppy diskette, etc.).
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Americas 1-714-368-2686
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Americas 1-800-733-1900
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Printronix, Inc.
14600 Myford Road
P.O. Box 19559
Irvine, CA92623-9559
Phone: 714-368-2300
Fax: 714-368-2600

Printronix Schweiz Gmbh
42 Changi South Street 1
Changi South Industrial
Estate Singapore 486763
Phone: 65-6542-0110
Fax: 65-6543-0220

Printronix, Inc.
Nederland BV
P.O. Box 163 Nieuweweg 283
NI-6600 Ad Wijchen
The Netherlands
Phone: 31-24-6489-489
Fax: 31-24-6489499

Or visit the Printronix web site at www.primtronix.com

