

IBM 6400
Line Matrix Printers

S246-0148-00

Intelligent Printer Data Stream
Programmer's Reference

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Note!

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First Edition (October, 1995)

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GDDM	CICS
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BCOCA	MO:DCA
AFP	AIForm
PSF	MVS

This manual also contains a glossary, which defines the special terms and abbreviations used in this book, and an index.

Related Publications

The following publications contain additional reference information:

- *6400 Operator's Guide*, S246-0115. Includes step-by-step instructions for daily printer operations.
- *6400 Setup Guide*, S246-0116. Provides information on installing and configuring the printer.
- *IBM Data Stream and Object Architectures, Bar Code Object Content Architecture (BCOCA) Reference*, S544-3766.
- *IBM Data Stream and Object Architectures, Font Object Content Architecture (FOCA) Reference*, S544-3285.

- *IBM Data Stream and Object Architectures, Graphics Object Content Architecture (GOCA) Reference*, SC31-6804.
- *IBM Data Stream and Object Architectures, Mixed Object Document Content Architecture (MO:DCA) Reference*, SC31-6802.
- *IBM Data Stream and Object Architectures, Presentation Text Object Architecture (PTOCA) Reference*, SC31-6803.
- *IBM Application System/400 Information Directory*, GC21-9678.
- *IBM System/370, 30xx, and 4300 Processors Bibliography*, GC20-0001.

Chapter 1. Introduction

This chapter introduces the Intelligent Printer Data Stream (IPDS) and describes some of the capabilities of IPDS when used with this printer.

About IPDS

IPDS lets you print pages containing an unlimited mix of different types of data: high-quality text, images, vector graphics, and bar codes.

You can send IPDS data to printers attached to the IBM Application System/400 (AS/400) intelligent work stations, local area networks, IBM 3270-family controllers, and spooled systems. In some of these environments, you can create applications to directly control IPDS printers such as this printer. For more information about IPDS as a component of printing subsystems, refer to *Intelligent Printer Data Stream Reference*, S544-3417.

IBM provides a variety of host software products with components that generate IPDS commands for this printer or other IPDS printers. These software products vary in their use of IPDS functions. Contact your IBM representative for information about software products that support these printers.

Capabilities of IPDS

A printer controlled by IPDS has a number of advantages over conventional printers. With IPDS you can:

- Use the printer's all-points-addressable printing to print text, graphics, images, or bar codes at any point on a page.
- Print text in a variety of type styles and switch fonts within a printed page.
- Use both images and vector graphics (explained later in this chapter) to print line drawings, pie charts, bar charts, graphics, logos, tables, and signatures.
- Combine text with images and graphics on the same page (creating what is known as a *composite document*).
- Electronically store and later print forms and letterheads that are always printed in the same predetermined type style.
- Electronically store and later print text where the type style printed is the same as that used in the rest of the text.
- Print any of 16 different kinds of bar codes in many sizes and with a number of variations.
- Print either portrait (upright, letter orientation) or landscape (printing "on the side," with the page wider than it is tall).

Printing a Letter

IPDS lets you print a letter in just one step. In conventional printing (Figure 1), you must load letterhead paper into your printer, print the text of your letter, and then manually sign the letter.

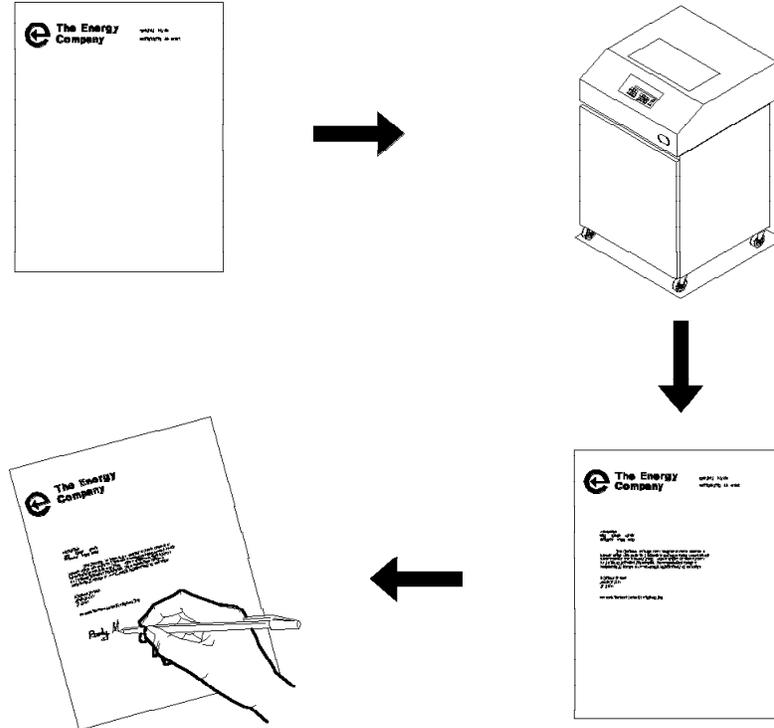


Figure 1. Conventional Letter Preparation

Using IPDS (Figure 2), you can temporarily store your letterhead and signature in the printer's memory and then merge the letterhead, text, and signature with additional data to form a complete letter. You can also include graphics, such as a line chart or bar chart, in your letter, creating a composite document.

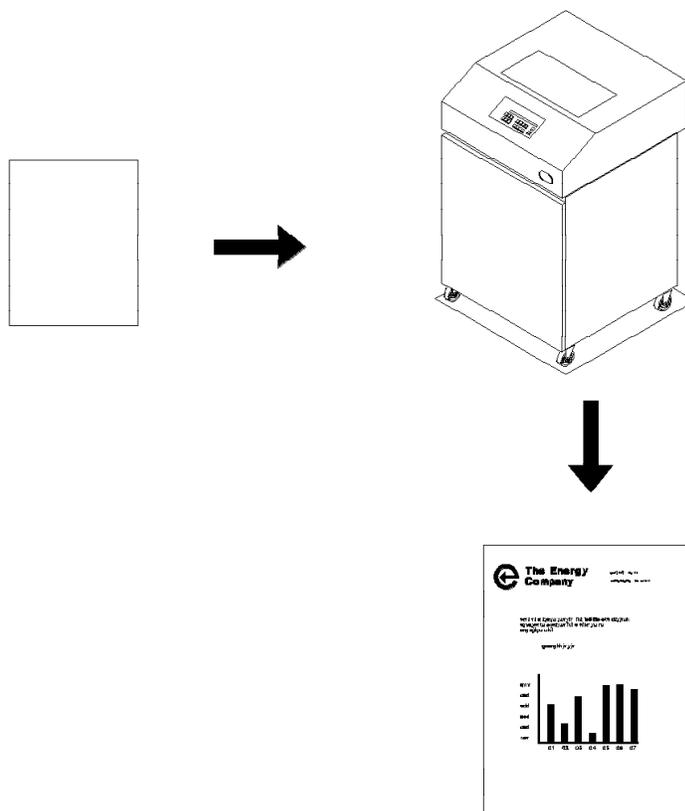


Figure 2. IPDS Letter Preparation

An IPDS-driven printer offers flexibility. For example, you can highlight a list of items by printing the list in a different type style from the rest of the text; or you can print your letterhead in one font and your text in another font.

You can electronically store your letterhead so it is always printed in the same type style. This printing concept is discussed in “Using Overlays” on page 4.

You can store your printed signature block so it is printed in the type style used in the rest of the letter or memo. That way the signature block’s type style matches the letter in which it appears, no matter how many different fonts you use for different kinds of letters. This printing concept is discussed in “Using Page Segments” on page 5.

You can include bar charts or line graphs in your letter. Such graphic material can be generated through either the Image function or the Graphics function. See “Using Images and Graphics” on page 6.

Using Overlays

Overlays are stored constructs (text, graphics, images, and bar codes), often in complex configurations, with all the instructions needed to print. An overlay always prints in the type style used when it was stored and can be positioned anywhere on the page.

Overlays are useful for letterheads and for forms, as shown below in Figure 3.

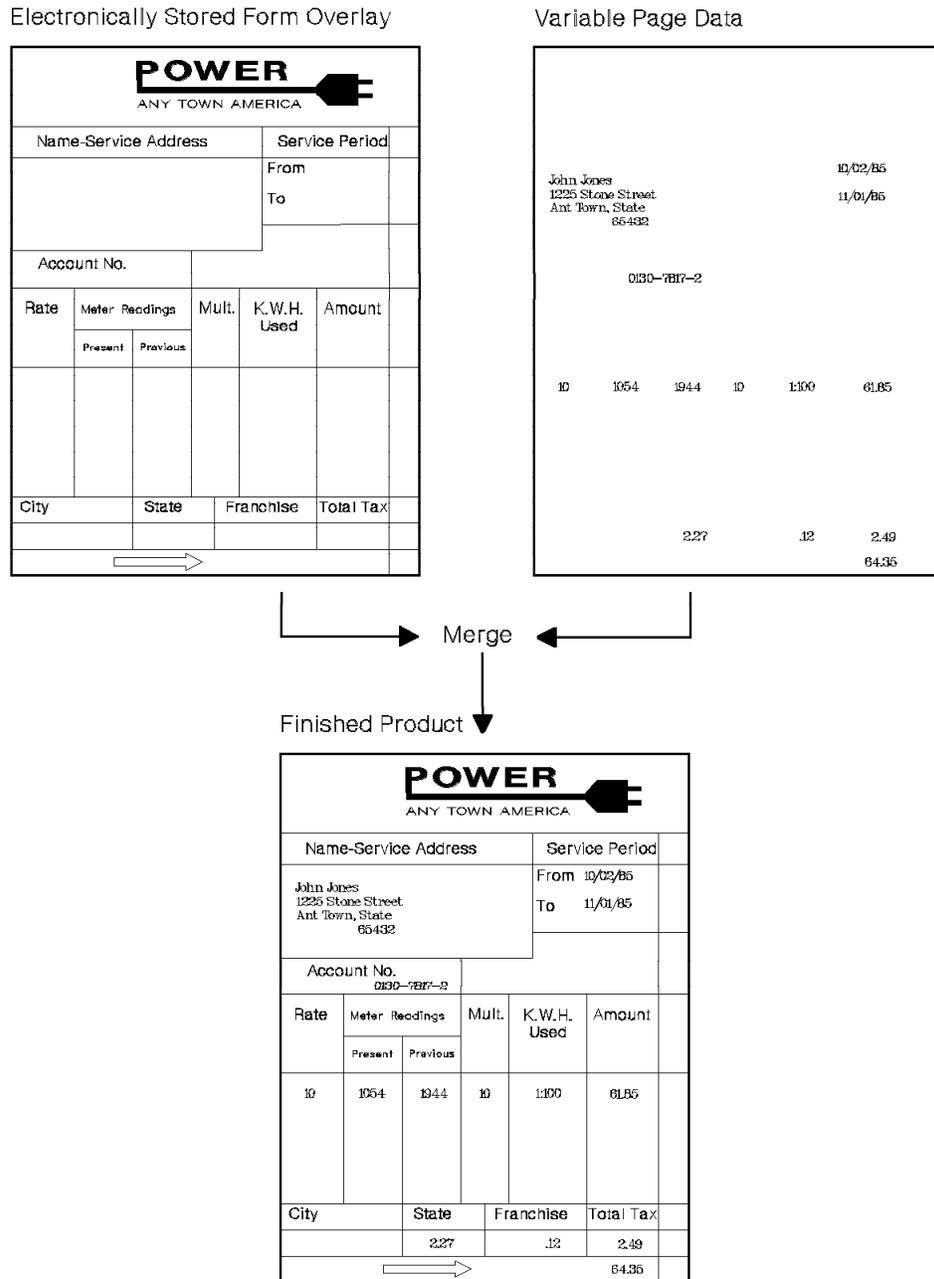


Figure 3. Using Overlays

Using Page Segments

Page segments are similar to overlays, except that the construct is stored without specific instructions for type styles and position on the page. Page segments are printed in the type style in use at print time. You can place a page segment anywhere on the page.

One way to use a page segment is as text under a signature, as shown in Figure 4.

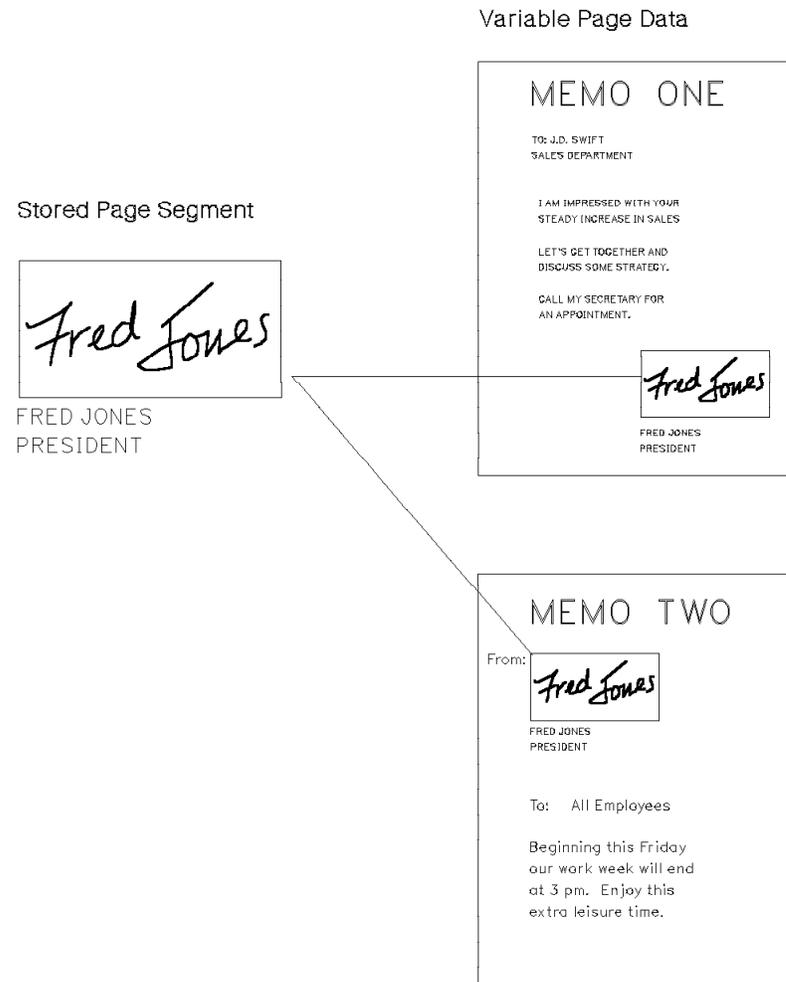


Figure 4. Using Page Segments

Using Images and Graphics

Graphic material—charts, engineering drawings, and line drawings—can be sent to the printer as IM Images or Graphics.

In all-points-addressable printing by the printer, a page can consist of 120 by 144 pels per inch or 180 by 144 pels per inch, each one of which is individually addressable. These addressable points are called *picture elements* or *pels*.

IM Images

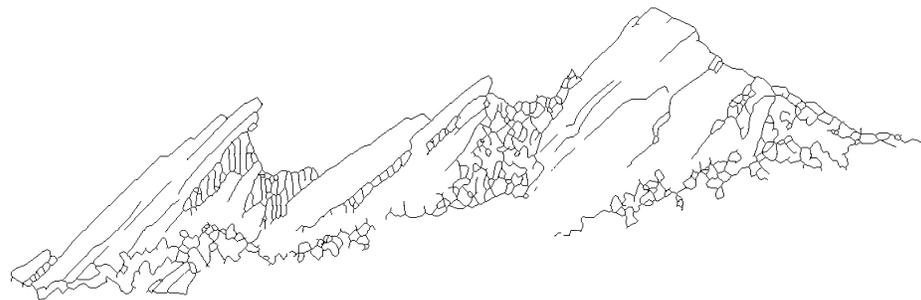
Images are figures on the page created by explicitly specifying each pel in the figure. There is one bit of image data per pel, so a large quantity of data is needed to create an image.

IM images are uncompressed raster data images. A raster pattern is composed of a series of pels arranged in scan lines.

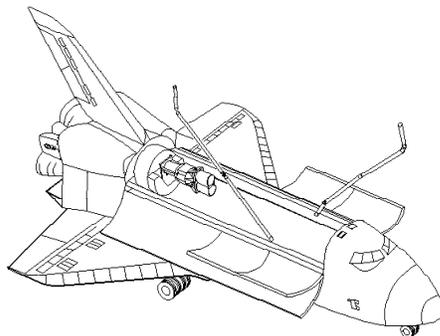
Graphics

Graphics are line drawings created from separate lines, arcs, and markers. With vector graphics, only control information such as the end points of a line are sent to the printer. This process lets you create complex figures with a minimum of data.

Figure 5 illustrates how Vector Graphics (the space shuttle) and Image (the sailing ship) commands can be used to generate graphic material. For details about these commands, see *Intelligent Printer Data Stream Reference*, S544-3417. For details on graphics commands, see *IBM Data Stream and Object Architectures Graphics Object Content Architecture (GOCA) Reference*, SC31-6804.



Raster Image



Vector Graphic

Figure 5. Graphic Material Created by Image and Graphics Commands

Using Bar Codes

Bar code data is encoded information that is recognized by optical scanning devices. The printer can print the bar code types shown in Figure 6 on page 8 in many sizes and with other variations, such as with or without the human-readable characters.

Using Bar Codes



Figure 6. Bar Codes From The Printer

Chapter 2. System Configuration

The following information provides information useful in attaching and configuring this printer when the IDPS feature is installed. There are three basic steps you need to complete:

1. Configure your host system for the printer.
2. Configure applicable host software, such as PSF/MVS.
3. Configure the printer to match host system settings.

Each of the above steps is described in this section. Also, you will need access to information about your host system and applicable host applications. Where appropriate, references are made to a host documentation you will need to review. For instance, you will need a copy of the *PSF/MVS Systems Programming Guide*, S544-3672, when configuring PSF/MVS and this printer.

If you are not familiar with physical and logical unit types, review “Summary of Physical and Logical Unit Types” on page 16 for descriptions of commonly used physical and logical units.

Note: Throughout the following examples, this printer is referred to as the 6400.

Attaching Printer with IPDS to S/370-S/390 Host Systems

It is necessary to define a printer in the S/370-S/390 environment to VTAM, JES2, POWER, PSF, VPS, JES328X Print Facility, NCP, VM, VSE, MVS, and/or other software depending upon your operating environment and printing requirements.

VTAM Definition Type Supported						
Support Desired	ASCII (Parallel, Serial, and Dataproducts)	DSC LU0 NON-SNA 3174	DSE LU3	LU1 SCS	LU1 IPDS	LU1 IPDS PSF
6400	X	X	X	X	X	X

Table 1. Supported VTAM LU Types/Connections

VTAM Definition Type Required					
Support Desired	DSC LU0 NON-SNA 3174	DSE LU3	LU1 SCS	LU1 IPDS	LU1 IPDS PSF
NON-SNA Communication Link (VTAM Controlled)	X				
NO HOST COMMAND OVERRIDES (Use Printer Settings)	X	X			
SCS COMMANDS			X	X	X
IPDS COMMANDS				X	X
ADVANCED FUNCTION PRINTING					X
<p>Note:</p> <p>SCS may be sent on an IPDS defined connection but not while PSF has control of the printer. The printer must be taken out of PSF control to send an SCS or native IPDS print job to the printer. This may be accomplished via console command or by setting the PSF timeout value to have PSF release the printer from its control after a period of printer inactivity.</p> <p>Refer to <i>PSF/MVS Systems Programming Guide</i>, S544-3672 for further details.</p>					

Table 2. Definition Selection

Attaching to LU1-IPDS-PSF/MVS-Local SNA 3174 Control Unit

LU1-IPDS mode with FM Header support is utilized when PSF support is required to accomplish the print function desired. (The optional IPDS feature is required for this function to work.) An existing local 3174 SNA-connected control unit is assumed. The steps required to install an LU1-IPDS printer for host printing are as follows:

1. Define to VTAM and add to or selecting from a logmode entry in the VTAM Logmode Table
2. Define to JES2
3. Define to PSF/MVS
4. Select the printer options that are appropriate for the environment.

Step 1 - VTAM Definition

The following should be added to the Local Major Node VTAM definition. The printer will be attached as an LU1-IPDS capable printer.

```
LOC3174 VBUILD TYPE=LOCAL
LOCPU74 PU      CUADDR=nnn,MAXBFRU=2
LOC6400 LU      LOCADDR=8,MODETAB=MYMODETB,DLOGMODE=6400PSFL,ISTATUS=ACTIVE
```

The following entry should be placed in the VTAM MODE TABLE specified above or another of your choice. Alternatively, you may utilize the IBM provided entry "IBM3812C".

```
6400PSFL MODEENT LOGMODE=6400PSFL,
          FMPROF=X'03',TSPROF=X'03',PRIPROT=X'B1',
          SECPROT=X'B0',COMPROT=X'7080',RUSIZES=X'85C7'
          PSERVIC=X'014000010000000001000000'
          PSNDPAC=X'02',SRCVPAC=X'02',SSNDPAC=X'00'
```

Step 2 - JES2 Definition (SYS1.PARMLIB)

```
FSSDEF FSSNAME=FSS1,.....
PRT2   FSS=FSS1,Mode=FSS,PRMODE=(LINE,PAGE,SOSI1),
       CLASS=B,UCS=0,SEP,NOSEPDS,CKPTPAGE=100,DRAIN,MARK
```

Step 3 - PSF/MVS Definition

Add the following definition to the PSF STARTUP PROC

```
//PRT2   CNTL
//PRT2   PRINTDEV FONTDD=*,FONT01, /*FONT     LIBRARY DD           */
//       OVLYDD=*,OLAY01,          /*OVERLAY LIBRARY DD           */
//       PSEGDD=*,PSEG02,          /*SEGMENT LIBRARY DD           */
//       PDEFDD=*,PDEF01,          /*PAGEDEF LIBRARY DD           */
//       FDEFDD=*,FDEF01,          /*FORMDEF LIBRARY DD           */
//       JOBHDR=*,JOBHDR,          /*JOB HEADER SEPARATOR OUTPUT  */
//       JOBTRLR=*,JOBTLR,         /*JOB TRAILER SEPARATOR OUTPUT */
//       DSHDR=*,DSHDR,           /*DATA SET HEADER SEPARATOR    */
//       MESSAGE=*,MSGDS,          /*MESSAGE DATA SET OUTPUT     */
//       FORMDEF=A10110,           /*DEVICE FORMDEF DEFAULT       */
//       PIMSG=(YES,16),           /*ACCUMULATE DATA SET MESSAGES */
//       DATAACK=BLOCK,           /*BLOCK DATA CHECKS           */
//       TRACE=NO,                 /*BUILD INTERNAL TRACE         */
//       FAILURE=WCONNECT,         /*VTAM: ATTEMPT RECONNECT      */
//       DISCINT=0,                /*VTAM: NO TIME OUT           */
//       MGMTMODE=IMMED,           /*VTAM: MAINTAIN SESSION       */
//       APPLID=PSFAPP1,           /*VTAM: APPLID OF PSF         */
//       LUNAME=LOC6400,           /*VTAM: PRINTER LOGICAL UNIT NAME */
//PRT2   ENDCNTL
```

Refer to *PSF/MVS Systems Programming Guide*, S544-3672 for further details.

Step 4 - Printer Settings

It is recommended that the following fastest default printer settings be used:

- Printer Control => Interface Selection => Coax
- Coax Interface => CT0 Format Control => Standard
- Emulation Configuration => IPDS
- Emulation Configuration => IPDS => Override Hosts => *Disable
- Emulation Configuration => IPDS => Check Graphic Quality, Bar Code Quality, and Graphics Quality settings for desired quality.

Review "Configuring IPDS from the Printer Operator Panel" on page 17 and the *6400 Setup Guide*, S246-0116 for information on setting printer configuration values.

Attaching to LU1-IPDS-PSF/MVS-Remote SNA 3174 Control Unit

LU1-IPDS mode with FM Header support is utilized when PSF support *is required* to accomplish the print function desired. (The optional IPDS feature is required to utilize PSF.) An existing remote 3174 SNA-connected control unit assumed. The steps required to install an LU1-SCS printer for host definitions are as follows:

1. Define to NCP point to LU1 default logmode entry defined below.
2. Define to VTAM by adding logmode entry to VTAM Logmode Table.
3. Define to JES2.
4. Define to PSF/MVS product.
5. Select the options on the printer that are appropriate for the environment.

Step 1 - NCP Definition

```
XYZ      GROUP  TYPE=NCP,...
          LINK  ADDRESS=(032),...
REMPU74  PU     ADDR=C1,...
REM6400  LU     LOCADDR=#,      (Where # relates to 3174 port number)
          DLOGMOD=6400PSFR,(Default LOGMODE ENTRY NAME)
          MODETAB=MYTABLE (Table name containing MODEENT)
```

Step 2 - VTAM Definition

The following entry should be placed in the VTAM MODE TABLE specified above or another of your choice. Alternately, you may utilize the IBM provided entry "IBM3812"

```
6400PSFR  MODEENT LOGMODE=6400PSFR,
          FMPROF=X'03',TSPROF=X'03',PRIPROT=X'B1',
          SECPROT=X'B0',COMPROT=X'7080',RUSIZES=X'8585',
          PSERVIC=X'014000010000000001000000',
          PSNDPAC=X'03',SRCVPAC=X'03',SSNDPAC=X'00'
```

Step 3 - JES2 Definition (SYS1.PARMLIB)

```
FSSDEF FSSNAME=FSS1,.....
PRT2   FSS=FSS1,Mode=FSS,PRMODE=(LINE,PAGE,SOSI1),
       CLASS=B,UCS=0,SEP,NOSEPDS,CKPTPAGE=100,DRAIN,MARK
```

Step 4 - PSF/MVS Definition

Add the following definition to the PSF STARTUP PROC

```
//PRT2  CNTL
//PRT2  PRINTDEV FONTDD=*,FONT01, /*FONT    LIBRARY DD          */
//      OVLYDD=*,OLAY01,          /*OVERLAY LIBRARY DD          */
//      PSEGDD=*,PSEG02,          /*SEGMENT LIBRARY DD          */
//      PDEFDD=*,PDEF01,          /*PAGEDEF  LIBRARY DD          */
//      FDEFDD=*,FDEF01,          /*FORMDEF  LIBRARY DD          */
//      JOBHDR=*,JOBHDR,          /*JOB HEADER SEPARATOR OUTPUT */
//      JOBTRLR=*,JOBTLR,         /*JOB TRAILER SEPARATOR OUTPUT*/
//      DSHDR=*,DSHDR,           /*DATA SET HEADER SEPARATOR   */
//      MESSAGE=*,MSGDS,          /*MESSAGE DATA SET OUTPUT    */
//      FORMDEF=A10110,           /*DEVICE FORMDEF DEFAULT      */
//      PIMSG=(YES,16),           /*ACCUMULATE DATA SET MESSAGES*/
//      DATAACK=BLOCK,           /*BLOCK DATA CHECKS          */
//      TRACE=NO,                 /*BUILD INTERNAL TRACE        */
//      FAILURE=WCONNECT,         /*VTAM: ATTEMPT RECONNECT     */
//      DISCINT=0,                 /*VTAM: NO TIME OUT           */
//      MGMTMODE=IMMED,           /*VTAM: MAINTAIN SESSION      */
//      APPLID=PSFAPP1,           /*VTAM: APPLID OF PSF         */
//      LUNAME=LOC6400,           /*VTAM: PRINTER LOGICAL UNIT NAME */
//PRT2  ENDCNTL
```

Refer to the *PSF/MVS Systems Programming Guide*, S544-3672 for further information.

Step 5 - Printer Settings

It is recommended that the following fastest default printer settings be used:

- Printer Control => Interface Selection => Coax
- Coax Interface => CT0 Format Control => Standard
- Emulation Configuration => IPDS
- Emulation Configuration => IPDS => Override Hosts => *Disable
- Emulation Configuration => IPDS => Check Graphic Quality, Bar Code Quality, and Graphics Quality settings for desired quality.

Review “Configuring IPDS from the Printer Operator Panel” on page 17 and the *6400 Setup Guide*, S246-0116 for information on setting printer configuration values.

Attaching to LU1-IPDS-Local SNA 3174 Control Unit

LU1-IPDS mode with FM Header support is utilized when PSF support *is not required* but IPDS commands are needed to accomplish the print function desired. (The optional IPDS feature is required for this function to work.) An existing local 3174 SNA-connected control unit is assumed. The steps required to install an LU1-IPDS printer for host definitions are as follows:

1. Define to VTAM by adding logmode entry to VTAM Logmode Table
2. Define to JES2 (Not required but recommended. See details below)
3. Define to CICS or another Application Program such as VPS or JES328X products.
4. Select the options on the printer that are appropriate for the environment.

Step 1 - VTAM Definition

The following should be added to the Local Major Node VTAM definition. The printer will be attached as an LU1-IPDS capable printer.

```
LOC3174 VBUILD TYPE=LOCAL
LOCPU74 PU      CUADDR=nnn,MAXBFRU=2
LOC6400 LU      LOCADDR=n,MODETAB=MYMODETB,DLOGMODE=6400IPDL,ISTATUS=ACTIVE
```

The following entry should be placed in the VTAM MODE TABLE specified above or another of your choice.

```
6400IPDL MODEENT LOGMODE=6400IPDL,
          FMPROF=X'03',TSPROF=X'03',PRIPROT=X'B1',
          SECPROT=X'90',COMPROT=X'7080',RUSIZES=X'87C6',
          PSERVIC=X'01000001E100000000000000',
          PSNDPAC=X'01',SRCVPAC=X'01',SSNDPAC=X'00'
```

Step 2 - JES2 Definition (SYS1.PARMLIB)

```
RMT1  LUTYPE1,BUFSIZE=3840,LINE=1,NUMRD=0,NUMPR=1,NOCOMP,NOCMPCT,
      SETUPHDR,CONSOLE
R1.PR1 CLASS=A,NOSEP,PRWIDTH=132,NOFCBLOD,WS=(W,R,Q,PMD,LIM,F,T/C,P),
      CKTPAGE=30
DESTID NAME=LOC6400,DEST=R1
```

Refer to the *PSF/MVS Systems Programming Guide*, S544-3672 for further details.

Step 3 - Define to CICS or another application program

An application program must provide the IPDS datastream to control the printer. GDDM, VPS, and other applications support IPDS as well as numerous application programs, both customer written and vendor supplied. Refer to the vendor documentation for defining an IPDS printer to that program. If specific reference is not made to the 6400 you may use an IBM 4234 definition.

Step 4 - Printer Settings

It is recommended that the following fastest default printer settings be used:

- Printer Control => Interface Selection => Coax
- Coax Interface => CT0 Format Control => Standard
- Emulation Configuration => IPDS
- Emulation Configuration => IPDS => Override Hosts => *Disable
- Emulation Configuration => IPDS => Check Graphic Quality, Bar Code Quality, and Graphics Quality settings for desired quality.

Review "Configuring IPDS from the Printer Operator Panel" on page 17 and the *6400 Setup Guide*, S246-0116 for information on setting printer configuration values.

Attaching to LU1-IPDS-Remote SNA 3174 Control Unit

LU1-IPDS mode is utilized when *PSF is not needed* to to accomplish the print function desired but IPDS is. (The optional IPDS feature is required to use this function.) An existing remote 3174 SNA-connected control unit is assumed. The steps required to install an LU1-IPDS printer for host definitions are as follows:

1. Define to NCP point to LU1 default logmode entry defined below
2. Define to VTAM by adding logmode entry to VTAM Logmode Table
3. Define to JES2 (May not required if VPS. See details below)
4. Define to JES328X Print Facility, VPS, or equivalent
5. Select the options on the printer that are appropriate for the environment.

Step 1 - NCP Definition

```
MYPRINT Group ...
      Line ...
      Service ...
REMPU74 PU ...
REM6400 LU LOCADDR=#, (# replaced by port on control unit)
          DLOGMOD=6400IPDR, (Default LOGMODE ENTRY NAME)
          MODETAB=MYTABLE (Table name containing MODEENT)
```

Step 2 - VTAM Definition

The following entry should be placed in the VTAM MODE TABLE specified above or another of your choice.

```
6400IPDR MODEENT LOGMODE=6400IPDR,
          FMPROF=X'03', TSPROF=X'03', PRIPROT=X'B1',
          SECPROT=X'90', COMPROT=X'7080', RUSIZES=X'87C6',
          PSERVIC=X'01000000E100000000000000',
          PSNDPAC=X'01', SRCVPAC=X'01'
```

Step 3 - JES2 Definition

This definition is not required if you are using VPS and using U1 - U9999 as the printer ID.

```
RMT1 LUTYPE1, BUFSIZE=3840, LINE=1, NUMRD=0, NUMPR=1, NOCOMP, NOCMPCT,
      SETUPHDR, CONSOLE (SETUPHDR=PDIR JES2 V3)
R1.PR1 CLASS=A, NOSEP, PRWIDTH=132, NOFCBLOD, WS=(W,R,Q,PMD,LIM,F,T/C,P),
      CKPTPAGE=30
DESTID NAME=P6400, DEST=R1
```

Step 4 - JES328X Print Facility or VPS Definition

An application program must provide the IPDS datastream to control the printer. GDDM, VPS, and other applications support IPDS as well as numerous application programs, both customer written and vendor supplied. Refer to the vendor documentation for defining an IPDS printer to that program. If specific reference is not made to the 6400 you may use an IBM 4234 definition.

Step 5 - Printer Settings

It is recommended that the following fastest default printer settings be used:

- Printer Control => Interface Selection => Coax
- Coax Interface => CT0 Format Control => Standard
- Emulation Configuration => IPDS
- Emulation Configuration => IPDS => Override Hosts => *Disable

- Emulation Configuration => IPDS => Check Graphic Quality, Bar Code Quality, and Graphics Quality settings for desired quality.

Review “Configuring IPDS from the Printer Operator Panel” on page 17 and the *6400 Setup Guide*, S246-0116 for information on setting printer configuration values.

Summary of Physical and Logical Unit Types

This section provides a brief description of some commonly used Physical Unit (PU) types and Logical Unit (LU) types that you need to understand when configuring your printer on your host system.

The PU defines the type of communications relationship that the HOST VTAM has with a communications controller such as a 3174 control unit or a controller inside a printer such as a 3820 or 3935. Alternatively, it can describe the relationship that one host VTAM has to another host VTAM or equivalent such as AS/400.

Physical Unit Types and Examples

Physical Units (PU) are tied to physical hardware such as a control unit (3174, 3274). VTAM and NCP use various PU types in conjunction with the Logical Unit (LU) types to define the device and logical session to be established with an SNA network.

PU type 2: The PU type 2 is the physical unit type that is required for an LU type 0, type 1, or type 3 (see LU type description following). Examples of PU type 2 are 3174 or 3274 control units.

PU type 2.1: The PU type 2.1 is the physical unit type that is required for an LU 6.2. Examples of PU type 2.1 is an IBM 3820, IBM 3935, or PSF/2.

Logical Unit Types and Typical IBM Products

Listed below are the LU types that SNA currently defines and the kind of configuration or application that each type represents. Also mentioned are hardware or software products that typically use each type of logical unit. A logical unit (LU) describes the type of relationship that the Host VTAM and applications have with a specific device such as a printer. This relationship determines the commands supported from the host to the device and the type of feedback the device gives to the host.

LU type 0: LU type 0 printers are Non-SNA Local or Bisync connections. This mode is also commonly called DSC (Data Stream Compatibility) mode printing. An example of an LU 0 printer connection is an IBM 3816 attached to a non-SNA 3274 or 3174 control unit. Not all printers support this type connection. This connection type is used when VTAM is controlling the non-SNA control unit and device.

LU type 1: An LU type 1 is for an application program that communicates with single or multiple-device data processing workstations in an interactive, batch data transfer, or distributed data processing environment. The data stream conforms to the SNA Character String (SCS) or Document Content Architecture (DCA). An examples of a printer that is able to communicate via LU1 are 4230, 4234, 3930, 6400 and others.

LU type 1 is the basic logical unit type for SCS and IPDS printing. The type of connection is determined by the application that will be driving the printer. The selection is made by changes in the VTAM logmode entry that is used for the logical unit. See the examples for the type of connection desired.

LU type 3: An LU type 3 is for an application program that communicates with a single printer using the SNA 3270 data stream. Another name for this connection is DSE Data Stream Extended. This type of connection will not support the SCS data stream and may be used when no host controls are to be sent to the printer and printer settings are desired only. An example of printers that may use this method of connection are 4230, 3912, 6400, 3930, and others.

Configuring IPDS from the Printer Operator Panel

Matching certain printer operational settings to those of the host computer is known as printer configuration. The settings, or configuration parameters, such as selecting the host interface, are adjusted according the configuration instructions in your *6400 Setup Guide*, S246-0116. Configure IPDS in the same way you would configure the printer for other features.

You can select IPDS parameters directly from the operator panel as explained in this chapter, or by control codes as explained in Chapter 3, "IPDS Commands Reference" on page 23.

Note:

Before you reconfigure the IPDS feature, print a configuration sheet to see all of the current settings. Refer to the *6400 Setup Guide*, S246-0116.

The configuration menu is shown in Figure 7 on page 18.

The IPDS configuration menu is shown in Figure 8 on page 19.

The IPDS parameters are described in "IPDS Configuration Menu" on page 19. Parameters marked with an asterisk (*) indicate the default value. The printer must be not ready to enter the configuration structure.

Enter and exit the IPDS configuration menu according to the steps outlined in the *6400 Setup Guide*, S246-0116.

Printer Configuration Main Menu

The following shows an overview of the printer configuration menus and also shows where to access IPDS configuration values. For information about other configuration values, refer to the *6400 Setup Guide*, S246-0116.

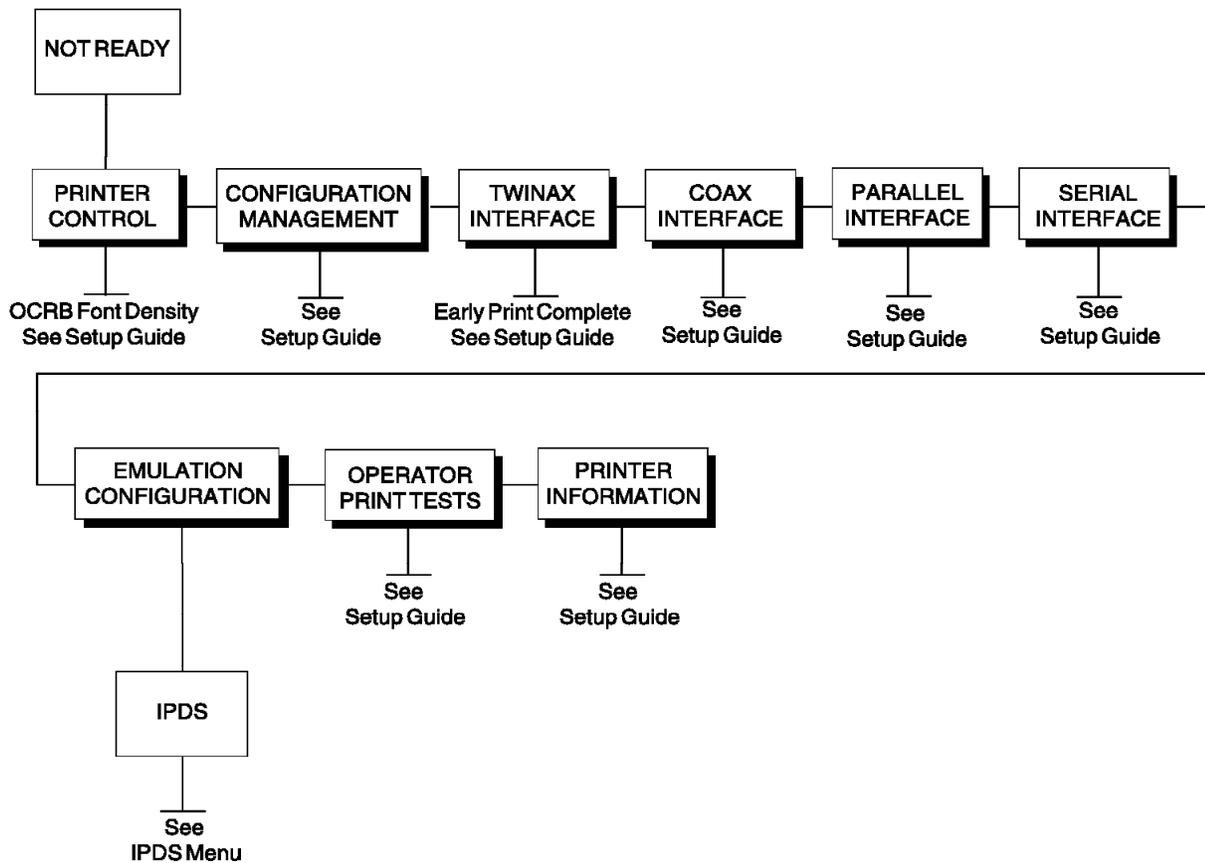
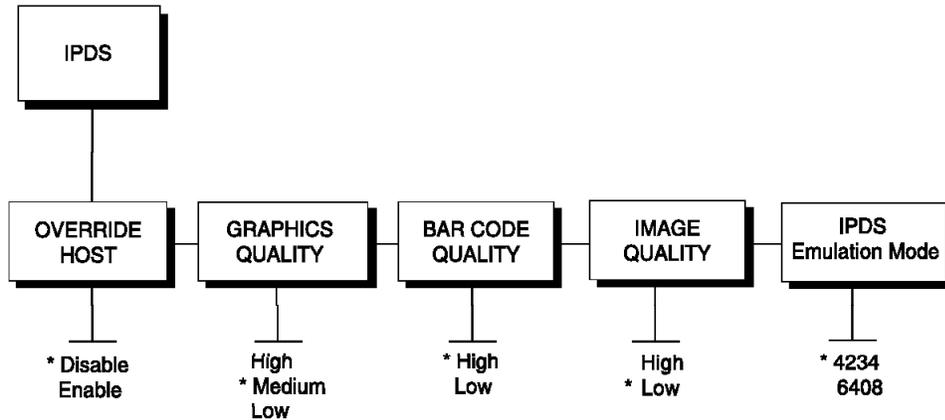


Figure 7. Configuration Main Menu

IPDS Configuration Menu



* Default Value

Figure 8. IPDS Menu

IPDS Configuration Values

This sections describes the following operator panel configuration values for IPDS.

Table 3. IPDS Operator Panel Configuration Values		
Functions	Default Value	Other Value(s)
Override Host	Disable	Enable
Graphics Quality	Medium	High or Low
Bar Code Quality	High	Low
Image Quality	Low	High
IPDS Emulation Mode	4234	6408
OCRB Font Density	120	180
Early Print Complete	Disable	Enable
Note:		
1. OCRB Font Density is not accessed from the IPDS configuration menu but is accessed from the Printer Control menu selections.		
2. Early Print Complete is not accessed from the IPDS configuration menu but is accessed from the Twinax Interface menu selections.		

The following pages contain information you can use to configure the printer for the above items.

Override Host

Override Host determines if the operator panel overrides the IPDS application commands for the following IPDS menu values:

1. Graphics Quality
2. Bar Code Quality
3. Image Quality.

Note: No other IPDS menu values or printer operator panels are affected by Override Host. Only the three values listed above are affected.

Select one of the two following values:

Disable (Default)	Does not allow operator panel settings to override IPDS application commands.
Enable	Does allow operator panel settings to override IPDS application commands.

Graphics Quality

Determines the quality for graphics printing. Override Host must be enabled to use these settings. Here are the supported resolutions in pels:

High	Vertical is 180; horizontal is 144
Medium (Default)	Vertical is 120; horizontal is 144
Low	Vertical is 60; horizontal is 72

Note:

The higher the resolution you select, the slower the print speed. So when selecting a resolution, try to balance the resolution quality your application requires with how fast you want the print job to print.

Bar Code Quality

Determines the quality for bar code printing. Override Host must be enabled to use Bar Code Quality. Below are the values for non-rotated bar code.

High (Default)	Vertical is 120; horizontal is 144
Low	Vertical is 60; horizontal is 72

Note:

The higher the resolution you select, the slower the print speed. So when selecting a resolution, try to balance the resolution quality your application requires with how fast you want the print job to print.

Image Quality

Determines the quality for image printing. Override Host must be enabled to use Image Quality. If Override Host is disabled, then the image is assumed to be 144 by 144 and the image is printed at 120 by 144.

High	Accepts images with 120 by 144 and prints images 120 by 144. With this setting, the image is printed as is and requires no conversion. Because no conversion is required, there is more fidelity between the original image and the printed image.
-------------	--

Low (Default) Accepts images with 144 by 144 and prints images at 120 by 144. With this setting, the image is converted from 144 by 144 to 120 by 144. Since there is some conversion required, there may be some differences between the original image and the printed image. Review the note below for more information.

Note: There is one bit of image data per pel. If your print job contains an image created to print 144 by 144, which is very common for IBM 4234 printers, some bits of data will be dropped out to support the best fit resolution, which is 120 by 144.

When printing jobs with images created for an IBM 4234 printer, you will want to print a few samples to ensure the results are satisfactory.

IPDS Emulation Mode

Select which type of printer you want IPDS to support. You can choose either to emulate a 4234 or you can choose 6408. You should choose which mode you use based on your software applications. For instance, if you are using PSF/MVS, then you would choose 6408 as PSF/MVS provides support for this printer.

Note: You can only use IPDS Emulation Mode with a coax interface.

4234 (Default) IPDS supports 4234 printer functions. This is the default which should be used most often. If you are using IPDS with PSF applications, except PSF/MVS, make sure you select 4234.

Please review Chapter 3, "IPDS Commands Reference" on page 23 for information on using IPDS commands when you select 4234 from the IPDS Emulation Mode menu.

6408 IPDS supports 6408 printer functions. Use this value when you are using IPDS with PSF/MVS. This value enables IPDS and PSF/MVS to take advantage of 6408 printer functions which are supported directly by PSF/MVS. (Other PSF applications only support this printer as a 4234 printer.)

Please review Chapter 4, "IPDS Command Differences" on page 135 for information on using IPDS commands when you select 6408 from the IPDS Emulation Mode menu.

Note: If you want to use the value 6408 as the default value, you will need to select 6408 as the default, save the value as a custom set, and then power the printer off and then power the printer back on.

Other IPDS Menu Selections

OCRB Font Density and Early Print Complete are not accessed under the IPDS menu selections but are accessed from other menu selections.

OCRB Font Density

OCRB Font Density is accessed under Printer Control menu selections and determines the print quality for OCRB character sets:

120 (Default) Vertical is 120; horizontal is 144

180 Vertical is 180; horizontal is 144

Note: The higher the resolution you select, the slower the print speed. So when selecting a resolution, try to balance the resolution quality your application requires with how fast you want the print job to print.

Early Print Complete

Early Print Complete is accessed under Twinax Interface menu selections. The value described below only applies to IPDS and Twinax; this does not apply to Early Print Complete under Coax Interface, which is a separate function. Early Print Complete is used to determine when the next print job can be sent to the printer. Do not select Early Print Complete while a print job is in process. If you do, you will need to restart the printer.

Disable (Default) Disable means that the printer waits for the system or controller to finish a job before issuing a print complete status. The spool file is not released until printing is completed. This can cause the printer to print at less than rated speed but can help ensure that all data is printed.

Enable Enable means that the printer does not wait for the system or controller to finish a job before issuing a print complete status. The spool file can be deleted before printing is completed. This can cause the printer to print at rated speed but some data, particularly the last few lines, of the last print job may be lost.

Chapter 3. IPDS Commands Reference

Under the IPDS Emulation Mode configuration menu, you can select either 4234 (default) or 6408. Usually, you select 4234 when you are using PSF applications or you want to emulate a 4234 printer. (If you are using PSF/MVS, you should select 6408 to take advantage of support offered by PSF/MVS.)

The following information describes how IPDS commands function when you are using this printer to emulate a 4234 printer.

Note: These commands also apply to this printer when you are not emulating a 4234 printer and have selected 6408 under IPDS Emulation Mode. There are some exceptions to how the IPDS commands function when you select 6408. These differences are described in Chapter 4, "IPDS Command Differences" on page 135.

IPDS Initialization Defaults

Defaults are those values that are used for control parameters when any of the following conditions exist:

- The command stream specifies that the printer default should be used.
- The command stream does not specify a value.
- Previously-transmitted values are lost and initial machine settings are reestablished at POR time.

These values remain in effect until overridden by the following IPDS commands:

Load Copy Control
 Load Font Equivalence
 Logical Page Descriptor
 Logical Page Position
 XOA Exception Handling Control
 XOA Print Quality Control
 XOH Set Media Size
 Control Sequences (that is, STO, SIA, SBI, SCFL, STC, DIR and DBR)

<i>Table 4 (Page 1 of 2). Initialization Defaults</i>	
Description	Value
Media origin	X'00' Top-left corner as defined in <i>Intelligent Printer Data Stream Reference</i> for continuous forms media.
Input Media Source	X'00' (Continuous Forms)
Unit-Base (measurement units)	X'00' (10 Inches)
L-units per unit-base	X'3840' (14400 per 10 inches)
X-Extent of Medium Presentation Space	Determined by Operator's Panel MPP setting
Y-Extent of Medium Presentation Space	Determined by Op Panel MPL setting
X Coordinate (logical page origin)	X'0000'
Y Coordinate (logical page origin)	X'0000'
Xp-Extent of Logical Page	Determined by Operator Panel MPP setting

<i>Table 4 (Page 2 of 2). Initialization Defaults</i>	
Description	Value
Yp-Extent of Logical Page	Determined by Operator Panel MPL setting
Ordered Data	X'00' (Unordered Page, Object, and Text)
Inline Sequence Dir. (+I)	X'0000' (0 deg.)
Baseline Sequence Dir. (+B)	X'2D00' (90 deg.)
Graphic Character Set Global ID (GCSGID)	Determined by configuration settings
Code Page Global ID (CPGID)	Determined by configuration settings
Font Global ID (FGID)	Determined by configuration settings
Font Width (FW)	Determined by configuration settings
Initial I print coordinate	X'0000'
Initial B print coordinate	X'00A0' (160 L-units below the logical page origin)
Inline Margin	X'0000'
Inter-Character Adjustment	X'0000'
Baseline Increment	Determined by Configuration Settings
Print Quality	Determined by Configuration Settings
Text Color	Black
Exception Reporting	<ul style="list-style-type: none"> • Report undefined characters • Report position Checks • Report all other exceptions • Don't take alternate exception action (AEA) • Terminate, don't take AEA, print page and go to homestate
Number of Copy Groups	1
Number of Identical Copies	1
LCC Copy Modification Keywords	X'C100' - Simplex printing; No Suppression ID's; No Overlays

Notes:

1. Text printing on the first line requires an initial Y-displacement value of 00A0.
2. The printer default font is Courier for DP Text and NLQ print quality. To determine the current values for CPI (characters per inch), language and quality, refer to *Setup Guide*.
3. When Local Font ID equals FF is used, the latest inline sequence established in either "Set Text Orientation (STO)" on page 73 or "Logical Page Descriptor (LPD)" on page 39 determines whether to print in a left-to-right or right-to-left sequence. The default when the printer is powered on is the left-to-right sequence.

Configuration Values

This printer allows flexibility in selecting various configuration values to support a wide range of functions. For example, the printer uses these values to format the page and to control forms movement. The configuration values also allow the operator to select the printer address, language, print mode, and compatibility options, and to turn the alarm on or off.

An operator can choose to set configuration values from the operator panel or through an IPDS application, such as PSF/MVS. However, the operator panel cannot be used to override most configuration values set by an IPDS application. The only exceptions are those values controlled by the Override Host function.

Any new value selection made at the operator panel becomes the new parameter value immediately upon selection. If this configuration is saved by the operator, this value remains as the new parameter value and the power on set matches the “save-set,” even after the printer power switch is turned Off (O). (See the *Setup Guide* for information on saving printer configuration sets.)

The operator can select the following values at the operator panel. Some values that can be selected from the operator panel are not supported by IPDS. These exceptions are noted below:

- Characters per inch (CPI).
 - IPDS does not support 20 CPI.
- Lines per inch (LPI).
 - IPDS does not support 3, 4, and 10.3 LPI.
- Forms width.
 - IPDS supports forms width up to 13.2 inches. Some printer models support forms width up to 13.6 inches. Make sure your forms width is not greater than 13.2 inches when using IPDS.
- Maximum print position (MPP)
- Maximum page length (MPL)
- Language
- Print quality
 - IPDS does not support NLQ Sans Serif, OCR A, and OCR B print qualities.
- Graphics, bar code, and image quality
- Address

Notes:

1. The address configuration option applies only to the twinax attachment.
2. An MPL setting that results in a page length less than 762 mm (3 in.) causes a throughput reduction. A maximum reduction of about 50 percent occurs at an MPL setting of one line per page.
3. The application program, such as PSF/MVS, can override any of the parameter values, except for changing the address selection. If no program command has specified the value, the printer uses the current parameter value.

Command Format

All the printer commands use the following format:

Length	Command	Flag	Correlation ID (Optional)	Data
--------	---------	------	------------------------------	------

The following chart shows the purpose of each field:

Byte	Hex Code	Description	Error Code
0-1 Length	X'0005' - X'7FFF'		X'0202..02'
2-3 Command	X'D603' X'D61D' X'D62D' X'D633' X'D63D' X'D63F' X'D64D' X'D64F' X'D65D' X'D65F' X'D66D' X'D66F' X'D67D' X'D67F' X'D680' X'D681' X'D684' X'D685' X'D68F' X'D697' X'D69F' X'D6AF' X'D6BF' X'D6CF' X'D6DF' X'D6E4' X'D6EF'	No Operation Load Equivalence Write Text Execute Order Anystate Write Image Control Load Font Equivalence Write Image Deactivate Font End Begin Page Segment Logical Page Position Deactivate Page Segment Include Overlay Include Page Segment Write Bar Code Control Write Bar Code Write Graphics Control Write Graphics Execute Order Homestate Set Home State Load Copy Control Begin Page End Page Logical Page Descriptor Begin Overlay Sense Type and Model Deactivate Overlay	X'8001..00'
4 Flags		Bit 0 0 = Acknowledge Response Not Required 1 = Acknowledge Response Required Bit 1 0 = Correlation ID Not Included 1 = Correlation ID Included Bit 2 0 = Acknowledge Reply Response is Complete 1 = Second Buffer of XOH - OPC Reply Required Bit 3 - 6-Reserved (Always Zero) Bit 7 (NDS DSC mode only) 0 = End Persistent NACK 1 = Persistent NACK	X'0204..02'
5-6 Correlation ID	X'0000' -X'FFFF'		

Table 5 (Page 2 of 2). IPDS Command Format			
Byte	Hex Code	Description	Error Code
7 Data		The specific operands, parameters, or data fields as appropriate for the given command.	

Notes:

1. Bit numbering follows the EBCDIC convention with bit zero being the most significant bit.
2. If the Correlation ID field is not present (byte 4, bit 1 is zero), the data field starts at byte 5 instead of byte 7.
3. Negative values are in twos-complement form.
4. Some bits or bytes in the data fields are Reserved. The printer does not always check the contents of these fields. However, IBM recommends that such fields equal the specified value (if one exists) or zero.
5. The printer will not detect a condition where the specified command length (bytes 0 through 1) exceeds the actual number of bytes received. If this occurs, the printer will not process the command until the printer receives the specified number of bytes.
6. If the host wants to request a continuation of an acknowledgement, the request must be the next command following the request for the first buffer of an acknowledgment. However, it is not required that the host request the second buffer of an acknowledgment.

Notation Conventions

Some field values (or ranges of values) are specified assuming a unit of measure of 14400 L-units per 10 inches. To determine supported values for a unit of measure of 2400 L-units per 10 inches use the following steps.

1. Convert the specified value from hex (2's compliment) to decimal.
2. Divide the + or - decimal number by 6.
3. Round to the nearest integer.
4. Convert the + or - decimal value back to hex (2's compliment).

For example, if the specified value is X'8000' the following steps are performed.

1. 8000(H) = -32768(D)
2. -32768/6 = -5461.333
3. -5461(D) = EAAB(H)

Text Orientation

The combination of the *inline sequence direction* (the direction which characters are added to a line) and the *baseline sequence direction* (the direction which lines are added to a page or overlay) identify the text orientation for a logical page. The inline sequence direction can be either 0 or 180 degrees. The baseline sequence direction is always 90 degrees. Therefore, there are two text orientations for printing pages or overlays. This printer only prints from top to bottom with reference to the feed direction.

Command Sets

Command sets divide the printer commands into various categories. Each command set provides all the necessary controls for its functional area. These command sets are:

- Device Control Command Set
- Presentation Text Command set
- IM Image Command set
- Graphics command set
- Bar Code Command Set
- Overlay Command Set
- Page Segment Command Set

Device Control Command Set

The following commands are contained in the device control command set:

Device-Control Commands are processed by the printer for controlling basic device operations, error reporting and recovery, constructing logical pages on the physical medium, and managing the Acknowledge protocol.

Before the host program sends the Begin Page command to begin defining a page to be printed, it should establish the printing environment in which the page is to be printed. The commands with which the host program controls printing include the following:

<i>Table 6 (Page 1 of 2). Device-Control Commands and Orders</i>			
Name	Command	Order	Disposition
Acknowledgement Reply	X ' D6FF '		See "Acknowledge Reply (ACK)" on page 29
Begin Page	X ' D6AF '		See "Begin Page (BP)" on page 31
Deactivate Font	X ' D64F '		See "Deactivate Font" on page 31
End	X ' D65D '		See "End (END)" on page 32
End Page	X ' D6BF '		See "End Page (EP)" on page 32
Load Copy Control	X ' D69F '		See "Load Copy Control (LCC)" on page 32
Load Font Equivalence	X ' D63F '		See "Load Font Equivalence (LFE)" on page 34
Logical Page Descriptor	X ' D6CF '		See "Logical Page Descriptor (LPD)" on page 39
Logical Page Position	X ' D66D '		See "Logical Page Position (LPP)" on page 41
No Operation	X ' D603 '		See "No Operation (NOP)" on page 42
Sense Type and Model	X ' D6E4 '		See "Sense Type and Model (STM)" on page 42
Set Home State	X ' D697 '		See "Set Home State (SHS)" on page 46

Table 6 (Page 2 of 2). Device-Control Commands and Orders

Name	Command	Order	Disposition
XOA Execute Order Anystate	X ' D633 '		See "Execute Order Any State (XOA)" on page 46
XOA Discard Buffered Data		X ' F200 '	See "Discard Buffered Data (DBD)" on page 46
XOA Request Resource List		X ' F400 '	See "Request Resource List (RRL)" on page 47
XOA Exception Handling Control		X ' F600 '	See "Exception Handling Control (EHC)" on page 48
XOA Print Quality Control		X ' F800 '	See "Print Quality Control (PQC)" on page 49
XOH Execute Order Homestate	X ' D68F '		See "Execute Order Home State (XOH)" on page 50
XOH Print Buffered Data		X ' 0100 '	See "Print Buffered Data (PBD)" on page 50
XOH Erase Residual Print Data		X ' 0500 '	See "Erase Residual Print Data (ERPD)" on page 50
XOH Set Media Size		X ' 1700 '	See "XOH Set Media Size (SMS)" on page 51
XOH Obtain Printer Characteristics		X ' F300 '	See "Obtain Printer Characteristics (OPC)" on page 52

The following pages describe the device control command set commands in detail.

Acknowledge Reply (ACK)

Length	D6FF	Flag	Correlation ID (Optional)	DATA
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The printer uses the Acknowledge Reply to return device status, sense information, and any additionally requested information back to the host application program.

The application program uses the Acknowledge data to maintain control of the printing application and to begin error recovery actions when necessary.

The printer sends an acknowledgment:

- When the Acknowledgement Required (ARQ) flag bit in the command the printer receives is set to 1.
- When the printer detects a command stream error or device error and must send a negative response (NACK).

The Acknowledge Reply is returned to the host in the standard IPDS command format although it goes from the printer to the host. A negative response has priority over a positive response.

If the printer can identify the command and the command has a correlation ID, the Acknowledge Reply contains a correlation ID that matches the command.

However, sometimes the printer will not return a correlation ID, even if every command has a correlation ID.

The maximum length of this command is 255 bytes. If there is a five-byte command header (no correlation ID present), the data field can be up to 250 bytes long. If a correlation ID is present in the header, the maximum data field length is 248 bytes. The Acknowledge Reply data field contains the acknowledgment type, page/copy counters, and a Special Data (SD) area. The printer loads the Special Data area with the appropriate data when one of the following occurs:

- The printer receives one of the following information request commands:
 - Sense Type and Model
 - Obtain Printer Characteristics
 - Request Resource List.
- An error occurs. Under this condition, the printer loads the special data area with the sense bytes and sends a negative acknowledgment (NACK) to the host.

The format of the Acknowledge Reply data field follows:

Command Length	A two byte length
Command ID	X 'D6FF' (Acknowledge Reply)
Flags	One byte field of IPDS command stream flags
Bit 0	Reserved
Bit 1	Correlation Number Present The printer receives a command with this bit set, and then returns the Acknowledge Reply also with this bit set to indicate that a two-byte "Correlation Number" follows.
Bit 2	Acknowledgement Continuation
Bits 3-6	Reserved
Bit 7	The Persistent NACK bit is for DSC Mode NACKs. This bit has no meaning in other attachment environments.

Correlation Number A two byte identifier is returned if available for:

- Synchronous NACKs
- Response to information request commands
- Acknowledgement requested (Flag byte bit 0 = 1)

Special Data	The Special Data area of the Acknowledgement Reply contains: <ul style="list-style-type: none">• Error sense bytes when reporting an exception.• Response to the following information request commands:<ul style="list-style-type: none">- "Sense Type and Model (STM)" on page 42- "Obtain Printer Characteristics (OPC)" on page 52- "Request Resource List (RRL)" on page 47
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<i>Table 7. Acknowledgement Reply</i>			
Byte	Value	Description	Error Code
0	X'00' X'01' X'04' X'06' X'80'	Acknowledgment Type: A one byte field that identifies the type of acknowledgement record and contents (if any) of the Special Data area. None Sense Type and Model Request Resource List Obtain Printer Characteristics Sense Bytes	
1-2	X'0000' - X'FFFF'	Stacked Page Counter. See Note 1.	
3-4	X'0000'	Stacked Copy Counter. See Note 1.	
5-n		Byte: This area contains zero or more bytes of additional data as requested by the host program defined by the Acknowledgement Type. Also see note 2.	

Notes:

1. Page (or Copy) Counters - This field identifies how many stacked pages (Begin Page ... End Page) have been successfully completed.
2. Special Data (SD) - Depending on the acknowledgment type (byte 0), this field either is omitted or contains the requested data or the sense data. The value in the two byte length field in the Acknowledge Reply header determines the amount of data this command returns to the host.

Begin Page (BP)

Length	D6AF	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

This command is valid only in the home state and causes the printer to enter the page state. The printer ignores the contents of the data field for this command. However, the data field must contain four bytes of data.

Deactivate Font

Length	D64F	Flag	Correlation ID (Optional)	DATA
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This command transmits one to six bytes of data to effect the deactivation of one or more coded fonts.

Device Control Command Set

Byte	Value	Description	Error Code
Byte 0	X'11' X'1E' X'1F'	Deactivation Type Deactivate Specified single byte Font Deactivate All single byte Fonts Deactivate All single byte Fonts	X'0217..02'
Bytes 1-2	X'0001' - X'7EFF'	Font Host Assigned ID	X'0214..02' X'0215..02'
3	X'00'	Section ID (single byte font)	X'0214..02' X'0215..02'
Bytes 4-5		Reserved	

End (END)

Length	D65D	Flag	Correlation ID (Optional)	DATA
--------	------	------	------------------------------	------

This command is the ending control for a graphics object, image object, or bar code object state. This command completes a series of write image, write graphics, or write bar code commands. This command does not transmit any data. At the completion of this command, the printer leaves the object state and returns to the page, overlay, or page segment state.

End Page (EP)

Length	D6BF	Flag	Correlation ID (Optional)	DATA
--------	------	------	------------------------------	------

This command causes the printer to return to the home state from the page, page segment, or overlay state. If the printer is in the page state, the printer completes any deferred printing for the current page and advances the forms to the top of the next page.

Zero or more bytes of data may be transmitted with this command but are ignored.

Load Copy Control (LCC)

Length	D69F	Flag	Correlation ID (Optional)	DATA
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The Load Copy Control command controls the production of output from subsequently received input logical pages. A copy control record 2 to 36 bytes long specifies how the printer is to modify and print logical pages in one copy group definition. The copy group definition can be from 2 to 36 bytes long (divisible by 2). The maximum number of key-words that the host program can specify in a copy group definition is:

- X'C1nn' specify 1 time
- X'D1nn' specify 1 to 17 times

X'E1nn' specify 1 to 17 times

The LCC command is valid only while the printer is in the home state, and remains in effect until the printer receives the next LCC. The format of the data field (DATA) for this command is:

Table 9. Load Copy Control			
Byte	Value	Description	Error Code
0	X'02'-X'24'	Copy Group Definition Length	
1	X'01'	Number of Identical Copies	X'0231..01'
2-n		Copy Modification Keywords	X'0232..01'
	X'C100'	Simplex Printing	X'02C1..01'
	X'D101' - X'D1FF'	Suppression	X'0236..01'
	X'E101' - X'E1FE'	Overlay	X'0298..01'
			X'0290..01'

Note: Subsequent LCC commands nullify previous Overlay IDs or Suppression IDs from previous LCC commands.

Copy Modification is an optional modification keyword list made up of two byte controls:

- The first byte is the keyword.
- The second byte is the associated parameter for this keyword.

Valid values for copy modification are:

- C100 - Simplex Printing
- D101 to D1FF - Suppression ID
- E101 to E1FE - Overlay ID.

Simplex Printing is printing on only one side of the document. This is the only type of printing the IBM 64XX Line Matrix Printers can perform.

Suppression ID allows the later suppression of text data. The first byte of the keyword, D1, specifies this keyword as suppression. The second byte of the keyword specifies a suppression identifier. Valid suppression ID values are 01 to FF. Print suppression occurs as follows:

1. The LCC command specifies one or more suppression ID values. (Each ID must begin with the keyword - D1.)
2. The printer receives a Begin Suppression control (inside a Write Text command) with a suppression ID that matches a value in the LCC command.
3. All subsequent text data does not print (text suppression), until the printer receives an End Suppression control (inside a Write Text command) with the same ID.
4. All text data received after the End Suppression control prints normally.

Overlay ID allows later processing of specified overlays. The first byte of the keyword, E1, specifies this keyword as overlay. The second byte of the keyword specifies an overlay identifier. Valid overlay ID values are 01 to FE. An overlay processes as follows:

1. The LCC command specifies one or more overlay ID values. (Each ID must begin with the keyword - E1.)

- The previously stored overlay with this specified identifier merges onto the current page or current overlay at its reference corner.

Load Font Equivalence (LFE)

Length	D63F	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Load Font Equivalence command maps the local font identifiers to coded font host-assigned IDs (HAIDs) and activates the font by supplying a non-zero Global Resource Identifier (GRID).

In the home state, this command creates a new font equivalence record that completely replaces the current LFE record. In the page state:

- The font equivalence entries in this command add to the current LFE entries, or
- If identical local font identifiers (byte 1) exist, this command overlays the current LFE entries.

In the page segment or overlay state, a received LFE is stored as part of the page segment or overlay, and it does not process until the Include Page Segment or Include Overlay command is received.

The font equivalence record is a list of 0-254 font equivalence entries (each entry is 16 bytes). The font equivalence record permits the host program to equate a Local-Font ID (specified in text control “Set Coded Font Local (SCFL)” on page 71, graphics order “Set Character Set” on page 111, or Write Bar Code Control “Bar Code Data Descriptor (BCDD)” on page 121) with a Font Host Assigned ID (HAID) and a Global Resource ID (GRID). The GRID is made up of the following components:

GCSGID	Graphic Character Set Global ID (Ignored)
CPGID	Code Page Global ID
FGID	Font Global ID
FW	Font width in 1/1440 inch units. (Ignored)

The printer ignores GCSGID and FW so the LFE effectively binds the three components, LID, HAID and Resident Font (described as a CPGID, FGID combination). The set of supported CPGID-FGID combinations is described in “Code Page ID Values” on page 36. The Host may use the OPC Resident Symbol-Set Support SDF to determine which combinations are supported. Exception X'021D..02' is reported if the code page is not available in a requested CPGID-FGID combination. If the CPGID-FGID combination is not supported but the requested code page is present, the printer performs a font substitution using the requested code page.

Each font equivalence entry is 16 bytes, in the following format:

Byte	Value	Description	Error Code
Byte 0	X'00' - X'FF'	Local-Font ID	X'0218..02'
1-2	X'0001' - X'7EFF'	Font Host Assigned ID	X'0218..02' X'021F..02'

Table 10 (Page 2 of 2). Load Font Equivalence			
Byte	Value	Description	Error Code
3 - 4	X'0000' X'5A00'	Font Inline Sequence 0 Degrees 180 Degrees	X'0247..02'
5 - 6		GCSGID (Ignored)	
7 - 8	X'xxxx' X'FFFF'	CPGID See "Code Page ID Values" on page 36 Printer Default as specified by Configuration Settings	X'021D..02'
9 - 10	X'xxxx' X'FFFF'	FGID See "Code Page ID Values" on page 36 Printer Default	X'021D..02'
11 - 12	X'0000'	Reserved	
13;	X'00'	Reserved	
14	Bit 0 0/1 Bits 1-2 00 Bit 3 0/1 Bit 4 0/1 Bit 5 0/1 Bit 6 0/1 Bit 7 0/1	Font Attributes Resident Symbol Set (<i>Ignored</i>) Reserved Double High = 1 Italicized = 1 Double Strike = 1 Bold = 1 Double Wide = 1	
15	X'00'	Reserved	
16-n		Additional LFE entries	X'023A..02'

The font equivalences for a given page are those that are in effect when the Begin Page command processes plus those added in the page state. A maximum of 254 different font ID-print quality combinations may be defined in home or page state. Page segments use the font equivalence tables active at the time the Include Page Segment command processes. In addition, the LFEs that were stored as part of the page segment add to the font equivalence tables during the include page segment process up to a maximum of 254 loaded font ID-print quality combinations.

Each Begin Overlay command starts the overlay with the font IDs currently defined and will add its LFE entries during the overlay's definition up to a maximum of 254 loaded font ID or print quality combinations total.

Notes:

1. Additional font equivalence entries, each 16 bytes long, can follow this entry, using the same format.
2. Use the same Loaded Font ID when using the same Font ID and Code Page ID for several Local IDs. This saves storage space and font allocation time in the printer.
3. Local ID byte 0 may use any value 1 to FE. A value of FF is supported for compatibility, but is not recommended. See "Set Character Set" on page 111 and "Logical Page Descriptor (LPD)" on page 39 for more information regarding Local IDs equal to FF.
4. A double high font can be printed only on a page that is unordered. See "Logical Page Descriptor (LPD)" on page 39 for more information.

Code Page ID Values

<i>Table 11. Character Set, Code Page, and Quality Combinations</i>				
Character Set Name	GCSGID	CPGID	LFE Bytes 7-8	Print Quality
USA/Canada	697 Note	037	X'0025'	All
International #1	337	256	X'0100'	All
Canadian French	697	260	X'0104'	All
Austrian/German	697	273	X'0111'	All
Belgian	697	274	X'0112'	All
Brazilian	697	275	X'0113'	All
Danish/Norwegian	697	277	X'0115'	All
Finnish/Swedish	697	278	X'0116'	All
Italian	697	280	X'0118'	All
Japanese/English	697	281	X'0119'	All
Portuguese	697	282	X'011A'	All
Spain/Latin America	697	284	X'011C'	All
English (U.K.)	697	285	X'011D'	All
Denmark Norway Alternate	697	287	X'011F'	All
Finland Sweden Alternate	697	288	X'0120'	All
Spain Alternate	329	289	X'0121'	All
Japanese/Katakana	1172	290	X'0122'	DP, NLQ
APL (4224 Compatibility)	380	293	X'0125'	DP, NLQ
France	697	297	X'0129'	All
APL	963	310	X'0136'	DP, NLQ
OCR (4224 Compatibility)	580/590	340	X'0154'	NLQ Only
Arabic	235	420	X'01A4'	DP, NLQ
Greek	218	423	X'01A7'	DP, NLQ
Hebrew	941	424	X'01A8'	All
International #5	697	500	X'01F4'	All
Hebrew	1147	803	X'0323'	All
Thai	1279	838	X'0346'	DP, NLQ
Latin 2/ROECE	959	870	X'0366'	DP, NLQ
Iceland	697	871	X'0367'	All
Greek	925	875	X'036B'	DP, NLQ
Cyrillic	960	880	X'0370'	DP, NLQ
Yugoslav	410	890	X'037A'	DP, NLQ
OCR-A	968	892	X'037C'	NLQ Only
OCR-B	969	893	X'037D'	NLQ Only
Turkish - old	965	905	X'0389'	DP, NLQ
DCF (Release 2)	1132	1002	X'03EA'	DP, NLQ
Cyrillic Multinational	1150	1025	X'0401'	DP, NLQ
Turkish	1152	1026	X'0402'	DP, NLQ
Farsi	1219	1097	X'0449'	DP, NLQ

Note: GCSGIDs are listed for information only. GCSGID is IGNORED in the LFE GRID and character set selection occurs as a result of CPGID activation.

Font Global ID (FGID)	Font Style Name	Pitch (CPI)	Print Quality
X'0013'	OCR-A	10	OCR Quality
X'0003'	OCR-B	10	OCR Quality
X'001A'	Gothic	10	Draft, DP
X'001C'	Gothic (Bold)	10	Draft, DP
X'013A'	Gothic (Italic)	10	Draft, DP
X'0057'	Gothic	12	Draft, DP
X'006E'	Gothic (Bold)	12	Draft, DP
X'006D'	Gothic (Italic)	12	Draft, DP
X'00CC'	Gothic	13.3	Draft, DP (Courier NLQ)
X'00CF'	Gothic (Bold)	13.3	Draft, DP (Courier NLQ)
X'00D0'	Gothic (Italic)	13.3	Draft, DP (Courier NLQ)
X'00DE'	Gothic	15	Draft, DP
X'00DC'	Gothic (Bold)	15	Draft, DP
X'00D9'	Gothic (Italic)	15	Draft, DP
X'0190'	Gothic	16.7	Draft, DP (Courier NLQ)
X'0194'	Gothic (Bold)	16.7	Draft, DP (Courier NLQ)
X'0198'	Gothic (Italic)	16.7	Draft, DP (Courier NLQ)
X'0102'	Gothic	18	Draft, DP (Courier NLQ)
X'0127'	Gothic (Bold)	18	Draft, DP (Courier NLQ)
X'0128'	Gothic (Italic)	18	Draft, DP (Courier NLQ)
X'000B'	Courier	10	NLQ
X'002E'	Courier (Bold)	10	NLQ
X'0012'	Courier (Italic)	10	NLQ
X'0055'	Courier	12	NLQ
X'006C'	Courier (Bold)	12	NLQ
X'005C'	Courier (Italic)	12	NLQ
X'00DF'	Courier (Bold)	15	NLQ
X'00D6'	Courier	15	NLQ
X'00D7'	Courier (Italic)	15	NLQ
X'00A0'	Essay	PSM	NLQ
X'00A3'	Essay (Bold)	PSM	NLQ
X'00A2'	Essay (Italic)	PSM	NLQ

Font Global ID (FGID)	Font Style Name	Pitch (CPI)	Print Quality
0033	Gothic	10	Draft, DP
004A	Gothic	12	Draft, DP
00CD	Gothic	13.3	Draft, DP (Courier NLQ)
00E8	Gothic	15	Draft, DP
012C	Gothic	16.7	Draft, DP (Courier NLQ)
0103	Gothic	18	Draft, DP (Courier NLQ)
0034	Courier	10	NLQ
004B	Courier	12	NLQ

Device Control Command Set

Font Global ID (FGID)	Font Style Name	Pitch (CPI)	Print Quality
00E9	Courier	15	NLQ
009A	Essay	PSM	NLQ

Notes:

1. The Graphic Character Set Global ID (GCSGID) portion of the Global Font ID is ignored by the 64XX printers.
2. All combinations of CPGID and FGID are valid with the following exceptions:
 - OCR-A code pages and FGID 0013 are only valid in combination together.
 - OCR-B code pages and FGID 0003 are only valid in combination together.
 - The following Code Pages are not available with FGID X'00A0' (PSM)
 - Code Page 290 *Katakana*
 - Code Page 293 *APL (4224)*
 - Code Page 310 *APL*
 - Code Page 340 *OCR A/B*
 - Code Page 420 *Arabic*
 - Code Page 423 *Greek Old*
 - Code Page 424 *Hebrew*
 - Code Page 803 *Hebrew Old*
 - Code Page 838 *Thai*
 - Code Page 870 *Latin-2*
 - Code Page 875 *Greek*
 - Code Page 880 *Cyrillic*
 - Code Page 890 *Yugoslav*
 - Code Page 892 *OCR-A*
 - Code Page 893 *OCR-B*
 - Code Page 905 *Turkish - old*
 - Code Page 1002 *DCF Compatibility*
 - Code Page 1025 *Cyrillic Multinational*
 - Code Page 1026 *Turkish*
 - Code Page 1097 *Farsi*
 - All code pages are Version 1 wherever versions apply.
3. Compressed fonts are not used for 8 lines per inch (LPI). Instead, standard fonts that work for 6 and 8 LPI are substituted for compressed FGIDS.

Logical Page Descriptor (LPD)

Length	D6CF	Flag	Correlation ID (Optional)	DATA
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This command establishes the print characteristics for the logical page. The Logical Page Descriptor command is only valid in the home state. See “XOH Set Media Size (SMS)” on page 51 for physical medium size information.

The format of the data field (DATA) for this command is:

Before the printer can present a page of data it must know the following:

- The units in which distances have been measured
- The boundaries of the logical page
- Initialization values for control parameters (margins, line spacing, and so on)

The controls established in a Logical Page Descriptor command remain in effect until the next Logical Page Descriptor is received unless superseded by explicit controls in other commands (see “Write Text (WT)” on page 62). In any case, the latest LPD control values are restored with each Begin Page or Begin Overlay command.

The LPD command is valid with 24, 28, 34, 36, 38, 40, 41 or 43 bytes. The 64XX accept the LPD command using any of these valid lengths.

Byte	Value	Description	Error Code
0	X'00'	Unit-Base (Measurement Units) 10 inches	X'0264..02'
1		Reserved	
2-3	X'3840' X'0960'	X and I L-units per unit base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0260..02'
4-5	X'3840' X'0960'	Y and B L-units per unit base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0261..02'
6		Reserved	
7-9	X'000001' - X'007FFF'	X-Extent of logical page (Width). See “Notation Conventions” on page 27	X'0262..02'
10		Reserved	
11-13	X'000001' - X'007FFF'	Y-Extent of logical page (Length) See “Notation Conventions” on page 27	X'0263..02'
14		Reserved	
15	Bit 0 0/1 Bits 1-7 0000000	Ordered Data Flag Bit Order Page = 1 Reserved	
16-23		Reserved	
24-25	X'0000' X'5A00' X'FFFF'	I-Axis Orientation 0 Degrees 180 Degrees Printer Default	X'0268..02'

Device Control Command Set

<i>Table 14 (Page 2 of 2). Logical Page Descriptor</i>			
Byte	Value	Description	Error Code
26-27	X'2D00' X'FFFF'	B-Axis Orientation 90 Degrees Printer Default	X'0269..02'
28-29	X'0000' - X'7FFF'	Initial I Print Coordinate (X-Displacement) See <i>"Notation Conventions"</i> on page 27	X'026A..02'
30-31	X'0000' - X'7FFF'	Initial B Print Coordinate (Y-Displacement) See <i>"Notation Conventions"</i> on page 27	X'026B..02'
32-33	X'0000' - X'7FFF' X'FFFF'	Inline Margin (Left Margin) See <i>"Notation Conventions"</i> on page 27 Printer Default	X'0210..01'
34-35	X'0000' - X'7FFF' X'FFFF'	Intercharacter Adjustment (+) See <i>"Notation Conventions"</i> on page 27 Printer Default	X'0212..01'
36-37		Reserved	
38-39	X'0000' - X'7FFF' X'FFFF'	Baseline Increment See <i>"Notation Conventions"</i> on page 27 Printer Default	X'0211..01'
40	X'00' - X'FE' X'FF'	Local Font ID Printer Default	
41-42	X'0000' X'0008' X'FF00' X'FF07' X'FF08' X'FFFF'	Text Color Printer Default (Black) Black Printer Default (Black) Printer Default (Black) Color of Medium Printer Default (Black)	X'0258..03'

Notes:

1. The LPD command accepts logical page values from X'0001' to X'7FFF'. However, attempts to print outside the intersection of the physical medium (as defined by the Set Media Size command) and the logical page result in an error.
2. If the Ordered Data Flag is on, this indicates to the printer that subsequent data is in order and can print as it is received. If page data is unordered, printing is deferred (buffered), because the printer must place the received data in the proper sequence.
3. The high-order 9 bits of the two byte fields 24-25 and 26-27 are interpreted as a 9-bit binary value that describes the orientation of the X and Y axes.
4. If bytes 28-29 and bytes 32-33 are all 0, each line begins at the leftmost print position for 0, 90 orientation and rightmost print position for 180, 90 orientation.
5. The IBM 64XX Line Matrix Printers can print right-to-left by selecting a 180, 90 degree orientation within the Logical Page Descriptor command or within the Set Text Orientation control sequence. The IBM 64XX Line Matrix Printers force an inline sequence of 180 degrees for the default font to maintain upright printing when right-to-left printing is selected.

Figure 9 on page 41 shows how the Logical Page Descriptor command defines the logical page.

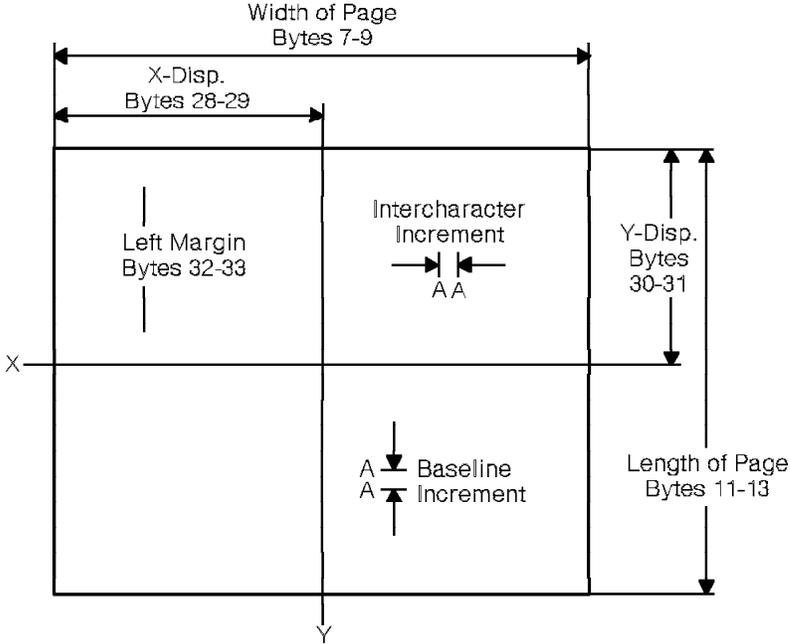


Figure 9. Using the Logical Page Descriptor Command to Specify the Logical Page

Logical Page Position (LPP)

Length	D66D	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

This command positions the upper left corner of the logical page (defined by the Logical Page Descriptor control) with respect to the physical medium. The Logical Page Position command is only valid in the home state.

Figure 10 shows the LPP command positioning the logical page on the physical medium.

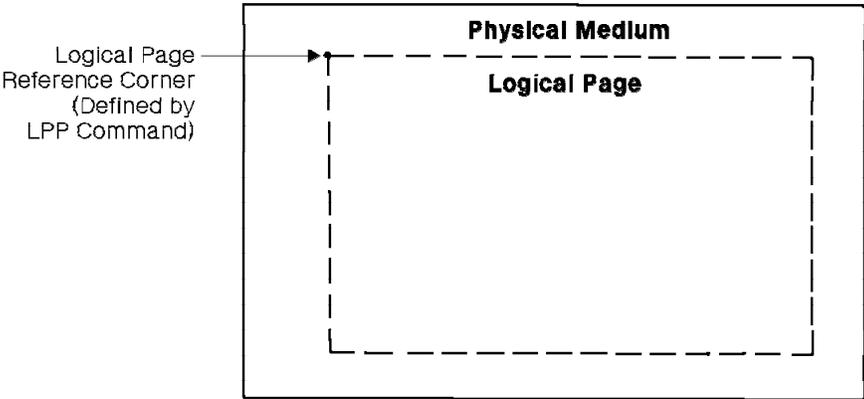


Figure 10. Using the Logical Page Position Command to Position the Logical Page

The physical medium dimensions do not change. The X and Y coordinates of the LPP command specify the location of the Logical Page Reference Corner relative to the corresponding corner of the physical medium. These coordinates are

Device Control Command Set

expressed in terms of the units in effect at the time the LPP command is received.

Only positive values are valid for the data field. The format of the data field (DATA) for this command is:

Byte	Value	Description	Error Code
0	X'00'	Reserved	
1-3	X'FF8000' - X'007FFF'	X Coordinate of the Logical Page Origin in L-Units	X'02AD..01'
4	X'00'	Reserved	
5-7	X'FF8000' - X'007FFF'	Y Coordinate of the Logical Page Origin in L-Units	X'02AD..01'
8-9	X'0000'	Reserved	

No Operation (NOP)

Length	D603	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

An NOP command is valid in any printer state. The printer does not perform any operation as a result of receiving this command. The printer ignores any data in this command.

Sense Type and Model (STM)

Length	D6E4	Flag	Correlation ID (Optional)
--------	------	------	---------------------------

This command is valid in any state. The Sense Type and Model command requests the printer to respond with the printer's type and model information and the functions it supports. The printer returns this information to the host application program in the Special Data (SD) portion of the Acknowledge Reply to the STM command (see "Acknowledge Reply (ACK)" on page 29).

This command is effectively a NOP if the ARQ bit is not on in the command header.

Acknowledge Reply for Sense Type and Model

Length	D6FF	Flag	Correlation ID	Data
--------	------	------	----------------	------

The format of the data field returned with the Acknowledge Reply is: acknowledgment type, page or copy counters, and 6 bytes of general information, followed by a sequence of command set vectors identifying the functions supported by this printer. The following chart shows the Data field:

Byte	Description
0	01 (Acknowledgment Type)
1-4	Page/Copy Counters
5	FF (System/370 Convention)
6-7	Printer Product Number 4234.
8	Printer Model Number (See Note)
9-10	0000 (Reserved)
11-36	Device Control Command Set Vector
37-50	Text Command Set Vector
51-62	Image Command Set Vector
63-74	Graphics Command Set Vector
75-80	Page Segment Command Set Vector
81-88	Overlay Command Set Vector
89-94	Reserved
95-106	Bar Code Command Set Vector
<p>Note: The format for byte 8, the printer model number, is:</p> <p>11 - Model CTA NDS 12 - Model CTA AS/400</p>	

Command set vectors contain information relating to each specific command set. The format of each command set vector group follows:

Sense Type and Model

Table 16. Sense Type and Model

Byte	Value	Description
0	X'FF'	System/370 convention
1-2	X'4234'	Product Code
3	X'11' X'12'	Model CTA NDS Model CTA AS/400
4-5	X'0000'	Reserved

Device Control Command Set

Table 17 (Page 1 of 2). Device-Control Command Set

Byte	Value	Description
0-1	X'0016'	Vector Length
2-3	X'C4C3'	Device Control Command-Set ID
4-5	X'FF10'	DC1 Subset ID
6-7	X'80F2'	XOA Discard Buffered Data
8-9	X'80F4'	XOA Request Resource List
10-11	X'80F6'	XOA Exception Handling Control
12-13	X'80F8'	XOA Print Quality
14-15	X'9005'	XOH Erase Residual Print Data

<i>Table 17 (Page 2 of 2). Device-Control Command Set</i>		
Byte	Value	Description
16-17	X'9017'	XOH Set Media Size
18-19	X'F001'	END Persistent NACK Without Leaving IPDS
20-21	X'FF02'	3-Byte Sense Data Support

Presentation Text Command Set

<i>Table 18. Presentation Text Command Set</i>		
Byte	Value	Description
0-1	X'000C'	Vector Length
2-3	X'D7E3'	Presentation Text Command Set - TX1 Subset
4-5	X'FF20'	PT2 Data
6-7	X'1001'	Unordered Text
8-9	X'4022'	Color of Medium Supported Limited Simulated color supported
10-11	X'5041'	Text Orientations

IM Image Command Set

<i>Table 19. IM Image Command Set</i>		
Byte	Value	Description
0-1	X'000A'	Vector Length
2-3	X'C9D4'	IM Image Command Set - IM1 Subset
4-5	X'FF10'	IMD1 Data
6-7	X'1001'	Unordered Image Objects
8-9	X'4022'	Color of Medium Supported Limited Simulated color supported
10-11	X'A004'	All four scan directions supported

Graphics Command Set

<i>Table 20. Graphics Command Set</i>		
Byte	Value	Description
0-1	X'000C'	Vector Length
2-3	X'E5C7'	Graphics Command Set - GR1 Subset
4-5	X'FF20'	DR/2V0 Data
6-7	X'1001'	Unordered Graphics Objects
8-9	X'4022'	Color of Medium Supported Limited Simulated Color Supported
10-11	X'A004'	All four orientations supported.

Bar Code Command Set

<i>Table 21. Bar Code Command Set</i>		
Byte	Value	Description
0-1	X'000C'	Vector Length
2-3	X'C2C3'	Bar Code Command Set - BC1 Subset
4-5	X'FF10'	BCD1 Data
6-7	X'1001'	Unordered Bar Code Objects
8-9	X'4022'	Color of Medium Supported
10-11	X'A004'	All four orientations supported

Note: See “Bar Code Type, Name, and Modifier Description and Values” on page 125 for a list of Bar Code Types supported by the 64XX printers.

Overlay Command Set

<i>Table 22. Overlay Command Set</i>		
Byte	Value	Description
0-1	X'0008'	Vector Length
2-3	X'D6D3'	Overlay Command Set
4-5	X'FF10'	OL1 Subset
6-7	X'1505'	Overlay Nesting = 5 Levels

Page Segment Command Set

<i>Table 23. Page Segment Command Set</i>		
Byte	Value	Description
0-1	X'0006'	Vector Length
2-3	X'D7E2'	Page Segment Command Set
4-5	X'FF10'	PS1 Subset

Loaded Font Command Set

<i>Table 24. Loaded Font Command Set</i>		
Special Data Area	Value	Description
Bytes 0-1	X'0006'	Vector Length
Bytes 2-3	X'C3C6'	Loaded Font Command Set
Bytes 4-5	X'FF20'	LF2 Subset - Symbol Sets

Note: The printer reports the LF2 subset in the STM, but do not accept downloaded symbol sets or the LSS command.

Set Home State (SHS)

Length	D697	Flag	Correlation ID (Optional)
--------	------	------	------------------------------

This command is valid in any state. When the printer receives the Set Home State command, the current page ends, all buffered data prints, and the printer returns to the home state. If the printer receives this command while already in the home state, the printer treats this command as a No Operation command.

Execute Order Any State (XOA)

Length	D633	Flag	Correlation ID (Optional)	Data
--------	------	------	------------------------------	------

Subcommand	Subcommand Data
------------	--------------------

The Execute Order Any State command identifies a set of subcommands (orders) that take effect immediately, regardless of the current printer command state. This command is valid in any state.

Each data field contains a two byte order (subcommand), followed by a zero or more bytes of parameters for that order. There is only one subcommand for a single XOA command.

The valid orders for the XOA command are:

Order	Description
F200	Discard Buffered Data (DBD)
F400	Request Resource List (RRL)
F600	Exception Handling Control (EHC)
F800	Print Quality Control (PQC)

Discard Buffered Data (DBD)

The XOA Discard Buffered Data (DBD) subcommand deletes all buffered data from the printer storage and returns the printer to home state. Any data currently being received is deleted. If this order is syntactically correct, no exceptions can result from its execution. The DBD order does not affect completely received resources, such as fonts, page segments, and overlays; however, if the printer is in any resource state, the printer deletes the partial resource before returning to home state. If the printer is in Ordered Page Mode, the subcommand prints all buffered data to the point of the command, does a page eject, and returns to Home State.

The DBD order is a *synchronizing* command. Any command following a synchronizing command is not processed until all preceding commands have been completely processed. Also, the ACK of the DBD order is not returned until DBD processing is complete.

Request Resource List (RRL)

This subcommand is a request from the host application program for the printer to identify resources currently allocated in the printer. The printer responds by placing the requested information in the Special Data (SD) area of a subsequent Acknowledge Reply.

This order causes the Resource List (see “Acknowledge Reply for Request Resource List” on page 48) to be placed in the Special Data Area of the Acknowledge Reply (see “Acknowledge Reply (ACK)” on page 29) requested with this order. If the ARQ flag was not set for this XOA subcommand, it is treated as a NOP.

A Resource List Reply may consist of multiple entries. If the Resource List Reply contains an entry that does not fit in the space available in the Special Data Area of Acknowledge Reply, 64XX follows either the acknowledge continuation method or the RRL-continuation method, depending on the host.

Entry Length is calculated as follows:

$$\text{Entry Length} = 255 - (\text{Device Header} + \text{IPDS Header} + \text{Acknowledge Reply})$$

Device Header = 6 Bytes (NDS); 0 Bytes (ARCTIC)

IPDS Header = 5 Bytes

Acknowledgement Reply = 19 Bytes

Table 25. XOA Request Resource List

Byte	Value	Description	Error Code
0-1	X' F400 '	Request Resource List (RRL)	
2	X' FF '	Device defined Ordering	X' 0291..02 '
3-4	X' 0000 '-X' FFFF '	Entry Continuation Indicator	
5	X' 03 '-X' xx '	Entry Length	X' 0291..02 '
6	X' 01 ' X' 04 ' X' 05 ' X' FF '	Resource Type Single Byte Coded Fonts (Symbol Sets) Page Segments Overlays All Resources	X' 0291..02 '
7	X' 00 '	Resource ID Format Host-Assigned Resource ID	X' 0291..02 '
8-9		Resource Identifier	

Notes:

1. The printer does not support multiple-entry queries. Byte 5 indicates the length of the command.
2. If the entire resource list does not fit in the Special Data area of the Acknowledge Reply, continuation is necessary which the printer indicates using the acknowledgement continuation bit in the flag byte of the Acknowledgment Reply. If the host requests Acknowledgement continuation by sending a command with ARQ bit and the Continuation bit set, the printer completes the RRL reply using Acknowledgement continuation. If the host requests RRL continuation (by sending an RRL command with non-zero value in bytes 3 and 4) the printer uses conventional RRL continuation to finish the reply. If the host requests both RRL and ACK continuation, the printer defaults to RRL continuation.

3. Bytes 8 and 9 are ignored when the resource type is ALL.
4. Exception ID 0291..02 in bytes 6 and 7 are for invalid values. If either value is unsupported, then the query is not understood and the reply is a single entry that sets the resource type to zero, echos other values, and sets the resource size to zero (not present).

Acknowledge Reply for Request Resource List

Length	D6FF	Flag	Correlation ID (Optional)	Data
--------	------	------	---------------------------	------

The format of the resource list returned with the Acknowledge Reply is as follows:

<i>Table 26. Resource Reply List</i>		
Byte	Value	Description
0	X'FF'	Unordered List
1	X'01' X'06'	End of List Length of this Entry
2	X'00' X'01' X'04' X'05' X'FF'	Resource Type Resource Size=0. The queried Resource Type, ID Format, or ID is unknown, unsupported, or inconsistent Single Byte Coded Font Page Segment Overlay Resource Size=0. The List Query requested is not supported
3	X'01'	Resource ID Format (RIDF) Host-Assigned Resource ID
4	X'00' X'01'	Resource Size Indicator Resource not present Resource present
5-6	X'xxxx'	Resource ID

Notes:

1. Bytes 2-6 repeat for each resource type.
2. The RRL reply is limited to 80 resource entries (maximum). See "Code Page ID Values" on page 36 for a complete set of supported CPGID/FGID combinations.

Exception Handling Control (EHC)

An exception (error) exists when the printer detects an invalid or unsupported command, control, or parameter value in the data stream received from the host. The IPDS structure provides Alternate Exception Action (AEA) when the printer receives a valid parameter value, but the printer does not support this value. The Exception Handling Control subcommand allows the host control of exception handling by the printer. This subcommand specifies the action the printer is to take with respect to the reporting and processing of exception (error) conditions. The format of the EHC subcommand is:

Table 27. Exception Handling Control			
Byte	Value	Description	Error Code
0-1	X'F600'	Exception Handling Control (EHC)	
2	Bit 0 0 1 Bit 1 0 1 Bits 2-5 00 Bit 6 0 Bit 7 0 1	Exception Reporting Do not Report Undefined Character Check Report Undefined Character Check Do not Report Page Position Check Report Page Position Check Reserved Position Check Highlighting (Ignored) Do not Report All other Exceptions with AEA's Report All other Exceptions with AEA's	
3	Bits 0-6 0 Bit 7 0 1	Alternate Exception Actions Reserved Take AEA (if defined) Don't take AEA	
4	Bits 0-5 0 Bit 6 0 1 Bit 7 0 1	Exception Presentation Processing Reserved No Page Continuation Page Continuation Action <i>No Independent Exception Page Print support</i> Discard Page Print to point of Exception <i>(Process limits may apply)</i>	

Note: Control of highlighting is not supported.

Print Quality Control (PQC)

The Print Quality Control subcommand allows the host to specify the desired print quality without changing fonts (see notes). The quality selection (from the PQC subcommand) specifies the quality for printing text associated with fonts selected by the Set Coded Font Local (SCFL) command and defined by the Load Font Equivalence (LFE) command. A PQC specifying a print quality compatible with the desired font should precede the SCFL command.

The PQC affects only the presentation of page data, and it has no effect in either of the following cases:

- When the default font (defined by the offline operator panel selection) is in use.
- When downloading resources such as overlays or page segments.

Table 28. XOA Print Quality Control			
Byte	Value	Description	Error Code
0-1	X'F800'	Print Quality Control (PQC)	
2	X'01' - X'55' X'56' - X'AA' X'AB' - X'FE' X'FF'	Print Quality Level Draft (Low Density Bar Code / Image / Graphics) DP (High Density Bar Code / Image (Medium Density Graphics) NLQ (High Density Bar Code / Image / Graphics) Depends on Op Panel Setting	X'0292..02'

Notes:

1. The lowest value of each Print Quality range of values is used in the XOH OPC Print Quality Support SDF (see "Print Quality Support Self-Defining Field" on page 59).
2. The printer implements fixed association between some FGIDs and Print Qualities. The printer changes FGIDs to satisfy quality selections for all supported code pages except OCR (340), OCR-A (892), or OCR-B (893). It does not change the selected code page to provide a requested quality.

Execute Order Home State (XOH)

Length	D68F	Flag	Correlation ID (Optional)	Data
--------	------	------	---------------------------	------

Subcommand	Subcommand Data
------------	-----------------

The Execute Order Home State command identifies a set of subcommands (orders) for formatting physical mediums of data, printing groups of physical mediums, and managing the fonts, page segments, and overlays. This command is only valid while the printer is in the home state.

The data field contains a two byte order, called the subcommand, and a subcommand data field. There is only one subcommand for a single XOH command. The subcommand data field contains parameters for that order.

The valid orders for the XOH command for the IBM 64XX Line Matrix Printers are:

Order	Description
0100	Print Buffered Data (PBD)
0500	Erase Residual Print Data (ERPD)
1700	Set Media Size (SMS)
F300	Obtain Printer Characteristics (OPC)

Print Buffered Data (PBD)

This subcommand causes the printer to print all buffered data pages prior to sending the Acknowledgment Reply, if requested. The print buffer clears at the completion of this command.

Erase Residual Print Data (ERPD)

This is a data security and privacy order. This order causes the printer to first complete a Print Buffered Data order, then delete all page segments, overlays, and buffered page data (text, image, graphics, and bar codes) from the printer storage.

XOH Set Media Size (SMS)

The Set Media Size subcommand specifies the size of the physical medium.

Note: For Model CTA printers, this order is honored unconditionally only when the printer page parameters (maximum print position, maximum page length, CPI, and LPI) are equal to the factory-set parameter values or if the Media Size Input Priority is set to alternate.

Refer to *IBM 6412-CTA Line Matrix Printer Maintenance Information Manual* for information on setting operator media size input.

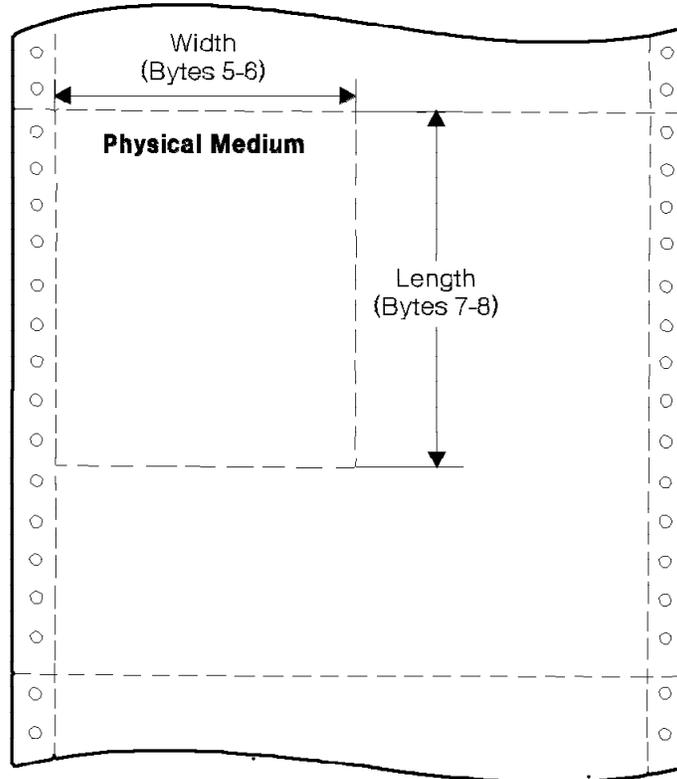


Figure 11. Using the Set Media Size Command to Specify the Physical Medium

The data field for the Set Media Size subcommand has the following format:

Byte	Value	Description	Error Code
0-1	X'1700'	Set Media Size	
2	X'00'	Unit Base (Measurement Units) 10 inches	X'0274..02'
3-4	X'3840' X'0960'	L-Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0270..02'
5-6	X'13B0' - X'4C80' X'FFFF'	X Extent of Medium See "Notation Conventions" on page 27 Printer Default (OP Panel MPP Setting)	X'0272..02'
7-8	X'000A' - X'7FFF' X'FFFF'	Y Extent of Medium See "Notation Conventions" on page 27 Printer Default (OP Panel MPL Setting)	X'0273..02'

Obtain Printer Characteristics (OPC)

This order is a host request for information about the current printer characteristics. The printer responds by placing the requested information, identified as an acknowledgement type X'06', in the Special Data (SD) area of a subsequent Acknowledge Reply. The printer reply is a series of self-defining fields that requires multiple acknowledge reply buffers. After each buffer is returned, and if the user application requests ACK continuation by sending a command with the flag byte set to (bit 0 and bit 2 equals 1) X'A0', the subsequent buffer is returned until all data is sent.

Acknowledge Reply for Obtain Printer Characteristics

Length	D6FF	Flag	Correlation ID (Optional)	Data
--------	------	------	---------------------------	------

Data Area (Byte)	Description
0-23	Printable Area Self-Defining Field
24-33	Image and Coded Font Resolution Self-Defining Field
34-48	Storage Pools Self-Defining Field
49-54	Color Support Self-Defining Field
55-326	Resident Symbol Set-Defining Field
327-333	Print Quality Support Self-Defining Field
334-339	XOA RRL RT & RIDF Support SDF
340-346	Common Bar Code Type/Modified Self-Defining Field
347-353 or 354-413	Product Identifier (7-byte) and Product Identifier SDF (60-byte)

The self-defining fields contain specific information about the printer characteristics.

The following charts describe these self-defining fields.

Printable Area Self-Defining Field: Page extents are set at initialization time to reflect the operator panel settings. The Set Media Size command can change the page extents.

Byte	Value	Description
0-1	X'0018'	Length of this Self Defining Field
2-3	X'0001'	Printable Area Self Defining Field ID
4	X'FF'	Default Input Media Source
5	X'00'	Reserved
6	X'00'	Unit Base 10 inches
7	X'00'	Reserved
8-9	X'3840'	L-units per Unit Base

Table 31 (Page 2 of 2). Printable Area Self-Defining Field

Byte	Value	Description
10-11	X'13B0' - X'4C80'	Width of the physical medium in L-units (+Xm direction) <i>Does NOT include width of carrier strip for continuous forms media.</i>
12-13	X'000A' - X'7FFF'	Length of the physical medium in L-units (+Y direction)
14-15	X'0000'	X Offset of the Printable Area in L-units
16-17	X'0000'	Y Offset of the Printable Area in L-units
18-19	X'13B0' - X'4A40'	X Extent of the Printable Area in L-units
20-21	X'000A' - X'7FFF'	Y Extent of the Printable Area in L-units
22-23	Bit 0 0 Bits 1-2 01 Bit 3 1 Bit 4 0 Bit 5 0 Bit 6 0 Bits 7-15 00000000	Input Media Source Characteristics 0 = Simplex 01 = Continuous Forms 1 = Bin Available 0 = Retired 0 = No Envelopes 0 = Auto Media Feed Reserved

Image and Coded-Font Self-Defining Field

Table 32. Image and Coded Font Resolution Self-Defining Field

Byte	Value	Description
0-1	X'000A'	Length of this Self Defining Field
2-3	X'0003'	Image and Coded Font Resolution Self Defining Field
4	X'00'	Unit Base 10 inches
5	X'00'	Reserved
6-7	X'05A0'	X Pels per Unit Base (1440 pels per 10 inches)
8-9	X'05A0'	Y Pels per Unit Base (1440 pels per 10 inches)

Storage Pools Self-Defining Field

Table 33. Storage Pools Self-Defining Field

Byte	Value	Description
0-1	X'000F'	Length of this Self Defining Field
2-3	X'0004'	Storage Pools Self Defining Field
4	X'0B'	Length of each Storage Pool Self Defining Field
5	X'01'	Triplet ID
6	X'00'	Storage Pool ID
7-10	X'00080000'	Size of Storage Pool when empty (Bytes)
11-14	X'00000000'	Reserved

Color Support Self-Defining Field

<i>Table 34. Color Support Self Defining Field</i>		
Byte	Value	Description
0-1	X'0006'	Length of this Self Defining Field
2-3	X'0005'	Color Support Self Defining Field
4-5	X'0008'	Black

Resident-Symbol Set Support Self-Defining Field

<i>Table 35. Resident Symbol Set Support Self-Defining Field</i>		
Byte	Value	Description
0-1	X'0110'	Length of this Self Defining Field
2-3	X'0008'	Resident Symbol Set Support Self Defining Field
4-End	<i>See following tables</i>	Resident Symbol Set Repeating Group Lists as shown in the following tables

Base Code Page Support Self-Defining Field

<i>Table 36 (Page 1 of 3). Base Code Page Support Self-Defining Field</i>		
Special Data Area	Value	Description
Byte 4	X'7E'	Total Length of Code Page or Font ID Repeating Group
Byte 5	X'01'	Code Page Support ID
Byte 6	X'28'	Length of Code Page List
Byte 7	X'02'	Length of Code Page Repeating Group Entry
Bytes 8-9	X'01F4'	Code Page 500, International #5
Bytes 10-11	X'0025'	Code Page 037, USA/CANADA
Bytes 12-13	X'0100'	Code Page 256, International #1
Bytes 14-15	X'0104'	Code Page 260, Canadian French
Bytes 16-17	X'0111'	Code Page 273, Austrian/German
Bytes 18-19	X'0112'	Code Page 274, Belgian
Bytes 20-21	X'0113'	Code Page 275, Brazil
Bytes 22-23	X'0115'	Code Page 277, Denmark/Norway
Bytes 24-25	X'0116'	Code Page 278, Finland/Sweden
Bytes 26-27	X'0118'	Code Page 280, Italy
Bytes 28-29	X'0119'	Code Page 281, Japanese/English
Bytes 30-31	X'011A'	Code Page 282, Portuguese
Bytes 32-33	X'011C'	Code Page 284, Spain/Latin America
Bytes 34-35	X'011D'	Code Page 285, English (U.K.)
Bytes 36-37	X'011F'	Code Page 287, Denmark Norway Alternate

Table 36 (Page 2 of 3). Base Code Page Support Self-Defining Field

Special Data Area	Value	Description
Bytes 38-39	X'0120'	Code Page 288, Finland Sweden Alternate
Bytes 40-41	X'0121'	Code Page 289, Spain Alternate
Bytes 42-43	X'0129'	Code Page 297, France
Bytes 44-45	X'0367'	Code Page 871, Iceland
Byte 46	X'52'	Length of Font ID List
Byte 47	X'02'	Length of Font ID Repeating Group Entry
Bytes 48-49	X'001A'	10 CPI Gothic (Draft and DP)
Bytes 50-51	X'001C'	10 CPI Gothic Bold (Draft and DP)
Bytes 52-53	X'013A'	10 CPI Gothic Italic (Draft and DP)
Bytes 54-55	X'000B'	10 CPI Courier (NLQ)
Bytes 56-57	X'002E'	10 CPI Courier Bold (NLQ)
Bytes 58-59	X'0012'	10 CPI Courier Italic (NLQ)
Bytes 60-61	X'0057'	12 CPI Gothic (Draft and DP)
Bytes 62-63	X'006E'	12 CPI Gothic Bold (Draft and DP)
Bytes 64-65	X'006D'	12 CPI Gothic Italic (Draft and DP)
Bytes 66-67	X'0055'	12 CPI Courier (NLQ)
Bytes 68-69	X'006C'	12 CPI Courier Bold (NLQ)
Bytes 70-71	X'005C'	12 CPI Courier Italic (NLQ)
Bytes 72-73	X'00CC'	13.3 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 74-75	X'00CF'	13.3 CPI Gothic Bold (Draft, DP) and Courier (NLQ)
Bytes 76-77	X'00D0'	13.3 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 78-79	X'00DE'	15 CPI Gothic (Draft and DP)
Bytes 80-81	X'00DC'	15 CPI Gothic Bold (Draft and DP)
Bytes 82-83	X'00D9'	15 CPI Gothic Italic (Draft and DP)
Bytes 84-85	X'00DF'	15 CPI Courier (NLQ)
Bytes 86-87	X'00D6'	15 CPI Courier Bold (NLQ)
Bytes 88-89	X'00D7'	15 CPI Courier Italic (NLQ)
Bytes 90-91	X'0190'	16.7 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 92-93	X'0194'	16.7 CPI Gothic Bold (Draft, DP) and Courier (NLQ)
Bytes 94-95	X'0198'	16.7 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 96-97	X'0102'	18 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 98-99	X'0127'	18 CPI Gothic Bold (Draft, DP) and Courier (NLQ)

Table 36 (Page 3 of 3). Base Code Page Support Self-Defining Field

Special Data Area	Value	Description
Bytes 100-101	X'0128'	18 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 102-103	X'00A0'	PSM Essay (NLQ)
Bytes 104-105	X'00A3'	PSM Essay Bold (NLQ)
Bytes 106-107	X'00A2'	PSM Essay Italic (NLQ)
Bytes 108-109	X'0033'	10 CPI Compressed Gothic (Draft and DP)
Bytes 110-111	X'0034'	10 CPI Compressed Courier (NLQ)
Bytes 112-113	X'004A'	12 CPI Matrix Gothic (Draft and DP)
Bytes 114-115	X'004B'	12 CPI Compressed Courier (NLQ)
Bytes 116-117	X'00CD'	13.3 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)
Bytes 118-119	X'00E8'	15 CPI Compressed Gothic (Draft and DP)
Bytes 120-121	X'00E9'	15 CPI, 8 LPI Courier (NLQ)
Bytes 122-123	X'012C'	16.7 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)
Bytes 124-125	X'0103'	18 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)
Bytes 126-127	X'009A'	PSM Compressed Essay (NLQ)

Notes:

1. Compressed fonts are not required for 8 lpi (as with the 4234). Compressed FGIDs are substituted with standard fonts which work for 6 and 8 lpi.
2. The printer accepts LFE activation of the Bold and Italic FGIDs listed, however the actual bold or italic attribute will be generated internally.

NLS and APL Code Page Support Self-Defining Field

Table 37 (Page 1 of 3). NLS and APL Code Page Support Self-Defining Field

Special Data Area	Value	Description
Byte 128	X'70'	Total Length of Code Page or Font ID Repeating Group
Byte 129	X'01'	Code Page Support ID
Byte 130	X'24'	Length of Code Page List
Byte 131	X'02'	Length of Code Page Repeating Group Entry
Bytes 132-133	X'0122'	Code Page 290, Japanese/Katakana (DP & NLQ only)
Bytes 134-135	X'0125'	Code Page 293, APL 4234 Compatibility (DP & NLQ only)
Bytes 136-137	X'0136'	Code Page 310, APL (DP & NLQ only)
Bytes 138-139	X'01A4'	Code Page 420, Arabic (DP & NLQ only)

Special Data Area	Value	Description
Bytes 140-141	X'01A7'	Code Page 423, Greek Old (DP & NLQ only)
Bytes 142-143	X'01A8'	Code Page 424, Hebrew
Bytes 144-145	X'0323'	Code Page 803, Hebrew
Bytes 146-147	X'0346'	Code Page 838, Thai (DP & NLQ only)
Bytes 148-149	X'0366'	Code Page 870, Latin 2/ROECE (DP & NLQ only)
Bytes 150-151	X'036B'	Code Page 875, Greek (DP & NLQ only)
Bytes 152-153	X'0370'	Code Page 880, Cyrillic (DP & NLQ only)
Bytes 154-155	X'037A'	Code Page 890, Yugoslav (DP & NLQ only)
Bytes 156-157	X'0389'	Code Page 905, Turkish - old (DP & NLQ only)
Bytes 158-159	X'03EA'	Code Page 1002, DCF (Release 2) DP & NLQ only
Bytes 160-161	X'0401'	Code Page 1025, Cyrillic Multinational (DP & NLQ only)
Bytes 162-163	X'0402'	Code Page 1026, Turkish (DP & NLQ only)
Bytes 164-165	X'0449'	Code Page 1097, Farsi (DP & NLQ only)
Byte 166	X'4A'	Length of Font ID List
Byte 167	X'02'	Length of Font ID Repeating Group Entry
Bytes 168-169	X'001A'	10 CPI Gothic (Draft and DP)
Bytes 170-171	X'001C'	10 CPI Gothic Bold (Draft and DP)
Bytes 172-173	X'013A'	10 CPI Gothic Italic (Draft and DP)
Bytes 174-175	X'000B'	10 CPI Courier (NLQ)
Bytes 176-177	X'002E'	10 CPI Courier Bold (NLQ)
Bytes 178-179	X'0012'	10 CPI Courier Italic (NLQ)
Bytes 180-181	X'0057'	12 CPI Gothic (Draft and DP)
Bytes 182-183	X'006E'	12 CPI Gothic Bold (Draft and DP)
Bytes 184-185	X'006D'	12 CPI Gothic Italic (Draft and DP)
Bytes 186-187	X'0055'	12 CPI Courier (NLQ)
Bytes 188-189	X'006C'	12 CPI Courier Bold (NLQ)
Bytes 190-191	X'005C'	12 CPI Courier Italic (NLQ)
Bytes 192-193	X'00CC'	13.3 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 194-195	X'00CF'	13.3 CPI Gothic Bold (Draft, DP) and Courier (NLQ)
Bytes 196-197	X'00D0'	13.3 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 198-199	X'00DE'	15 CPI Gothic (Draft and DP)
Bytes 200-201	X'00DC'	15 CPI Gothic Bold (Draft and DP)

Table 37 (Page 3 of 3). NLS and APL Code Page Support Self-Defining Field

Special Data Area	Value	Description
Bytes 202-203	X'00D9'	15 CPI Gothic Italic (Draft and DP)
Bytes 204-205	X'00DF'	15 CPI Courier (NLQ)
Bytes 206-207	X'00D6'	15 CPI Courier Bold (NLQ)
Bytes 208-209	X'00D7'	15 CPI Courier Italic (NLQ)
Bytes 210-211	X'0190'	16.7 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 212-213	X'0194'	16.7 CPI Gothic Bold (Draft, DP) and Courier (NLQ)
Bytes 214-215	X'0198'	16.7 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 216-217	X'0102'	18 CPI Gothic (Draft, DP) and Courier (NLQ)
Bytes 218-219	X'0127'	18 CPI Gothic Bold (Draft, DP) and Courier (NLQ)
Bytes 220-221	X'0128'	18 CPI Gothic Italic (Draft, DP) and Courier (NLQ)
Bytes 222-223	X'0033'	10 CPI Compressed Gothic (Draft and DP)
Bytes 224-225	X'0034'	10 CPI Compressed Courier (NLQ)
Bytes 226-227	X'004A'	12 CPI Matrix Gothic (Draft and DP)
Bytes 228-229	X'004B'	12 CPI Compressed Courier (NLQ)
Bytes 230-231	X'00CD'	13.3 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)
Bytes 232-233	X'00E8'	15 CPI Compressed Gothic (Draft and DP)
Bytes 234-235	X'00E9'	15 CPI, 8 LPI Courier (NLQ)
Bytes 236-237	X'012C'	16.7 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)
Bytes 238-239	X'0103'	18 CPI Compressed Gothic (Draft, DP) and Courier (NLQ)

OCR-A Code Page Support Self-Defining Field

Table 38 (Page 1 of 2). OCR-A Code Page Support Self-Defining Field

Byte	Value	Description
240	X'0A'	Total Length of Code Page and Font ID Repeating Group
241	X'01'	Code Page Support ID
242	X'04'	Length of Code Page LIST
243	X'02'	Length of Code Page Repeating Group Entry
244-245	X'037C'	Code Page 892, OCR-A
246	X'04'	Length of Font ID List
247	X'02'	Length of Font ID Repeating Group Entry

<i>Table 38 (Page 2 of 2). OCR-A Code Page Support Self-Defining Field</i>		
Byte	Value	Description
248-249	X'0013'	OCR-A

OCR-B Code Page Support Self-Defining Field

<i>Table 39. OCR-B Code Page Support Self-Defining Field</i>		
Byte	Value	Description
250	X'0A'	Total Length of Code Page and Font ID Repeating Group List (including itself)
251	X'01'	Code Page Support ID
252	X'04'	Length of Code Page List
253	X'02'	Length of Code Page Repeating Group Entry
254-255	X'037D'	Code Page 893, OCR-B
256	X'04'	Length of Font ID List
257	X'02'	Length of Font ID Repeating Group Entry
258-259	X'0003'	OCR-B

OCR-A/B Code Page Support Self-Defining Field

<i>Table 40. OCR-A/B (4234 Compatibility) Code Pages Support Self-Defining Field</i>		
Byte	Value	Description
260	X'0C'	Total Length of Code Page and Font ID Repeating Group
261	X'01'	Code Page Support ID
262	X'04'	Length of Code Page List
263	X'02'	Length of Code Page Repeating Group Entry
264-265	X'0154'	Code Page 340, OCR A/B (4234 Compatibility)
266	X'06'	Length of Font ID List
267	X'02'	Length of Font ID Repeating Group Entry
268-269	X'0013'	OCR-A
270-271	X'0003'	OCR-B

Print Quality Support Self-Defining Field

<i>Table 41 (Page 1 of 2). Print Quality Support Self-Defining Field</i>		
Byte	Value	Description
0-1	X'0007'	Length of this Self Defining Field
2-3	X'0009'	Print Quality Support Parameter
4	X'01'	Draft (Low Density Bar Code and Graphics)
5	X'56'	DP (High Density Bar Code and Graphics)

<i>Table 41 (Page 2 of 2). Print Quality Support Self-Defining Field</i>		
Byte	Value	Description
6	X'AB'	NLQ (High Density Bar Code and Graphics)

RRL Resource Type & ID Format Self-Defining Field

<i>Table 42. RRL Resource Type and ID Format Self-Defining Field</i>		
Byte	Value	Description
0-1	X'0006'	Length of this Self Defining Field
2-3	X'000A'	RRL Resource Type Self Defining Field
4-5	X'FF00'	All Resources as Host Assigned Resource ID

Bar Code Type Self-Defining Field

<i>Table 43. Bar Code Type Self Defining Field ID</i>		
Byte	Value	Description
0-1	X'0007'	Length of this Self Defining Field
2-3	X'000E'	Bar Code Type Self Defining Field
4	X'0D.'	Codabar Modifier Byte Options X'01' and X'02'
5	X'11.'	Code 128 Modifier Byte Options X'01' and X'02'
6	X'18'	Postnet Modifier Byte Options X'00' - X'03'

Note: See “Bar Code Type, Name, and Modifier Description and Values” on page 125 for all Bar-Codes supported by the printer.

Product Identifier Self-Defining Field: The Product Identifier includes a 7 byte SDF, which identifies 4234 emulation, and a 60 byte SDF, which identifies printer information, as defined in the tables below:

<i>Table 44. 4234 Emulation Product Identifier Self Defining Field ID</i>		
Special Data Area	Value	Description
Bytes 0-1	X'0007'	Length of this Self Defining Field
Bytes 2-3	X'0013'	Vital Products Data Self Defining Field
Byte 4	X'03'	Length of Self Defining Product ID Parameter
Bytes 5-6	X'0000'	4234 with Page Counter Fix Product ID

<i>Table 45 (Page 1 of 2). Product Identifier Self Defining Field ID</i>		
Byte	Value	Description
0-1	X'003C'	Length of this Self Defining Field
2-3	X'0013'	Product Identifier Self Defining Field ID

Table 45 (Page 2 of 2). Product Identifier Self Defining Field ID

Byte	Value	Description
4	X'38'	Length of Self Defining Product ID Parameter
5-6	X'0001'	Product Identifier Parameter ID
7-12	X'F0F0F6F4FxFx'	64XX Device Type
13-15	X'C3E3C1'	Model Number CTA
16-18	X'C9C2D4'	Manufacturer
19-20	X'0001'	Plant (Endicott)
21-32	12 Bytes	Sequence Number (All X'F0')
33-34	X'0000'	TAG
35-43	9 Bytes	EC Level
44-59	16 Bytes	All (X'00')

Presentation Text Command Set

The text command set contains the commands and data controls for presenting text information on a logical page, page segment, or overlay area on the physical medium. The following commands are the text command set:

Table 46. Presentation Text Commands

Name	Command	Sub-command	Disposition
Load Equivalence	X'D61D'		See "Load Equivalence (LE)" on page 61.
Write Text	X'D62D'		See "Write Text (WT)" on page 62.

The following pages describe the Presentation Text Command Set.

Load Equivalence (LE)

Length	D61D	Flag	Correlation ID (Optional)	DATA

This command permits Begin and End suppression controls imbedded in data stored within the printer to reference different external values. For example, internal suppression values of 06, 07, and 09 (from a Begin Suppression control) can map to an external value of 02 from a Load Copy Control command, if the printer previously has received an appropriate Load Equivalence command. Thus, the printer can use a single Load Copy Control suppression pair for more than one suppression value (see "Begin Suppression (BSU)" on page 65).

If a Load Copy Control command refers to a suppression identifier that has not been specified as an external value in an LE command, the identifier (external value) maps to itself. This is the only case where the identifier maps to itself unless specified.

Presentation Text Command Set

This mapping remains in effect until the printer receives another Load Equivalence command, at which time its values totally replaces this mapping.

This command consists of a two-byte parameter followed by a list of 0 to 127 four-byte entries in the following format:

Byte	Value	Description	Error Code
0-1	X'0100'	Mapping Type - X'0100' is the only valid value, indicating Suppression Mapping.	X02C6..02'
2-3	X'0001' - X'00FF'	Internal Value - Value of the Stored Parameter that the Begin Suppression and End Suppression Controls use.	X'02C1..02' X'02C8..02'
4-5	X'0001' - X'007F'	External Value - Value that the Load Copy Control Command uses.	X'02C8..02'
6-509		Zero or more additional entries analogous to Bytes 2-5	

Notes:

1. Additional entries, each four bytes long, can follow this entry, using the same format as bytes 2 through 5.
2. The mapping of one internal ID to more than one external ID is an error.
3. If more than 127 LE entries are specified, exception X'0202..02' is reported.

Write Text (WT)

Length	D62D	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Write Text command writes text presentation data to the printer. This command is only valid if the printer is in the overlay, page, or page segment state.

The DATA field in this command can contain one or more text controls and text characters. A text control begins with the text control escape sequence introducer, 2BD3. The format for this control is:

2BD3	Length	Control	Parameters
------	--------	---------	------------

The length field of each text control is a one-byte value that gives the number of bytes in the text control. This length value includes the length field itself but excludes the 2BD3 introducer. Multiple text controls without intervening character data can chain together. Bit 7 (the least significant, or rightmost bit) of the control field is the *chain* bit. If this bit is on, the following text control is chained to the previous control. That is, chaining allows one escape sequence introducer for multiple text controls. With chaining, the first text control contains the X'2BD3' introducer, and each subsequent text control starts with its own length field, followed by its control field and any parameters for that control. The last text control in the chain must have the chain bit off.

A Write Text command can *span* to another Write Text command. That is, if a Write Text command ends after the control sequence has begun (the 2B has been received), and before all of the control sequence parameters have been received, this Write Text command spans to the next Write Text command. Spanning also occurs if a Write Text command ends between chained controls. Between the spanned Write Text commands, only STM, XOA, and NOP commands are valid. All other commands received at this time result in an error. The printer uses the following controls with the Write Text command:

<i>Table 48. Write Text Command Controls</i>	
Control	Description
D2 (D3)	Absolute Move Baseline (AMB)
C6 (C7)	Absolute Move Inline (AMI)
D8 (D9)	Begin Line (BLN)
F2 (F3)	Begin Suppression (BSU)
E4 (E5)	Draw I-Axis Rule (DIR)
E6 (E7)	Draw B-Axis Rule (DBR)
F4 (F5)	End Suppression (ESU)
F8 (F9)	No Operation (NOP)
72 (73)	Overstrike (OVS)
C8 (C9)	Relative Move Inline (RMI)
D4 (D5)	Relative Move Baseline (RMB)
EE (EF)	Repeat String (RPS)
D0 (D1)	Set Baseline Increment (SBI)
F0 (F1)	Set Coded Font Local (SCFL)
C0 (C1)	Set Inline Margin (SIM)
C2 (C3)	Set Intercharacter Adjustment (SIA)
74 (75)	Set Text Color (STC)
F6 (F7)	Set Text Orientation (STO)
C4 (C5)	Set Variable Space Increment (SVI)
78 (79)	Temporary Baseline Move (TBM)
DA (DB)	Transparent Data (TRN)
76 (77)	Underscore (USC)
Note: The controls shown in parenthesis are the text controls with their corresponding chain bit on.	

In this Write Text description, references made to pages also apply to overlays and page segments.

The print data is a string of 1-byte code points. The printer uses the code point to identify the character metrics obtained from the Font Local ID (See “Load Font Equivalence (LFE)” on page 34) to determine the character raster pattern.

When the printer processes a Begin Page, it uses the values from the existing Logical Page Descriptor (see “Logical Page Descriptor (LPD)” on page 39) or Initialization Default (see “IPDS Initialization Defaults” on page 23) until it processes one of the following text controls

- Draw B-Axis Rule
- Draw I-Axis Rule
- Set Baseline Increment
- Set Coded Font Local
- Set Inline Margin
- Set Intercharacter Adjustment
- Set Text Color
- Set Text Orientation
- Set Variable Space Character Increment
- Temporary Baseline Move

The text control value supersedes the Logical Page Descriptor or Initialization Default value and it remains in effect until it is changed by another text control or an End Page is received.

Absolute Move Baseline (AMB)

This control moves the baseline coordinate in the B direction. The move is to an absolute position on the baseline (B) axis.

Note: Baseline coordinate values that require a negative baseline displacement in order to print results in an error if the LPD command specifies ordered printing.

<i>Table 49. Absolute Move Baseline</i>			
Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'D2' X'D3'	Absolute Move Baseline Unchained Chained	
4-5	X'0000' - X'7FFF'	Displacement (Bc) See “Notation Conventions” on page 27.	X'0213..01'

Absolute Move Inline (AMI)

This control moves the inline coordinate in the I direction. The move is to an absolute position on the inline (I) axis.

Notes:

1. Values as large as X'7FFF' are valid but might be off the page.
2. Several Absolute Move Inline controls used in a single line reduce throughput. If possible, replace Absolute Move Inline controls with spaces, or combine multiple sequential Absolute Move Inline controls into a single Absolute Move Inline control.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'C6' X'C7'	Absolute Move INLINE Unchained Chained	
4-5	X'0000' - X'7FFF'	Displacement (Ic) See "Notation Conventions" on page 27	X'0214..01'

Begin Line (BLN)

This control moves the inline and baseline coordinates to the first position on the next line. The inline margin sets the inline coordinate. The baseline coordinate increases by the value in the Set Baseline Increment control.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'02'	Length	X'021E..01'
3	X'D8' X'D9'	Begin Line Unchained Chained	

Begin Suppression (BSU)

This control marks the beginning of a string of text that the printer can suppress from the printed output. An End Suppression control, with the same suppression identifier, must follow the Begin Suppression control. An error results when BSU-ESU text controls are not paired properly or have different suppression IDs.

Suppression of the text output occurs only when activated by a Load Copy Control with a matching suppression ID.

For additional information about suppression, see Suppression ID in the "Load Copy Control (LCC)" on page 32.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'03'	Length	X'021E..01'
3	X'F2' X'F3'	Begin Suppression Unchained Chained	
4	X'01' - X'FF'	Suppression ID	X'0298..01'

Draw B-Axis Rule (DBR)

This control specifies the dimensions of a vertical rule (line) extending from the current print position. The current position does not change as a result of this control. The rule is not drawn until the current position advances vertically (as a result of other controls). Negative values are in twos-complement form.

If the length or width is zero, no line is drawn. If the width is the null indicator (FFFFFF) or is omitted, the rule drawn is one dot wide.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04' or X'07'	Length	X'021E..01'
3	X'E6' X'E7'	Draw B-Axis Rule Unchained Chained	
4-5	X'8000' - X'7FFF'	Length (Bl) See "Notation Conventions" on page 27	
6-7	X'8000' - X'7FFF' X'FFFF'	Width (Bw) Printer Default 1 pel (X'0004')	
8		Ignored	

Draw I-Axis Rule (DIR)

This control specifies the dimensions of a horizontal rule (line) extending from the current print position. The current position does not change as a result of this control. The rule is not drawn until the current position advances vertically (as a result of other controls). Negative values are in twos-complement form.

If the length or width is zero, no line is drawn. If the width is the null indicator (FFFFFF), or is omitted, the rule drawn is one dot wide.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04' or X'07'	Length	X'021E..01'
3	X'E4' X'E5'	Draw I-Axis Rule Unchained Chained	
4-5	X'8000' - X'7FFF'	Length (Il) See "Notation Conventions" on page 27	
6-7	X'8000' - X'7FFF' X'FFFF'	Width (Iw) Printer Default 1 pel (X'0005')	
8		Ignored	

End Suppression (ESU)

This control marks the end of a string of text that the printer can suppress from the printed output. A string of suppressed text starts with a Begin Suppression control and ends with an End Suppression control having the same suppression identifier.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'03'	Length	X'021E..01'

Presentation Text Command Set

<i>Table 55 (Page 2 of 2). End Suppression</i>			
Byte	Value	Description	Error Code
3	X'F4' X'F5'	End Suppression Unchained Chained	
4	X'01' - X'FF'	Suppression ID	X'0202..01' X'0204..01' X'0298..01'

No Operation (NOP)

This control specifies a string of bytes that the printer ignores. The printer ignores all parameter data. The data field can be a maximum of 253 bytes.

<i>Table 56. No Operation</i>			
Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'02' - X'FF'	Length	X'021E..01'
3	X'F8' X'F9'	No Operation Unchained Chained	
4-255		Data (Ignored)	

Overstrike (OVS)

This control identifies text that the printer overstrikes with a specified character. The overstrike character prints using the font and character set that is active when the printer receives the Overstrike command.

Note: If bit 7 is on, the printer treats all other bits in byte 4 as zeros, regardless of their values.

An OVS command with a bypass value of 00 ends overstrike mode.

<i>Table 57 (Page 1 of 2). Overstrike</i>			
Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'05'	Length	X'021E..01'
3	X'72' X'73'	Overstrike Unchained Chained	

Byte	Value	Description	Error Code
4	Bits 0-3 Bit 4 0 1 Bit 5 0 1 Bit 6 0 1 Bit 7 0 1	Bypass Identifiers Reserved Overstrike white space from Relative Move Inline Bypass white space from Relative Move Inline Overstrike white space from Absolute Move Inline Bypass white space from Absolute Move Inline Overstrike white space from Space or Variable Space Character Bypass white space from Space or Variable Space Character Bypass Treat Bits 0-6 according to their set values No Bypass Treat Bits 0-6 as if their values are set to zero	
5		Ignored	
6	X'00' - X'FF'	Overstrike Character	

Relative Move Baseline (RMB)

This control moves the baseline coordinate relative to the current baseline coordinate position.

Note: Baseline displacement values that require a negative baseline displacement in order to print results in an error if the LPD command specifies ordered printing.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'D4' X'D5'	Relative Move Baseline Unchained Chained	
4-5	X'8000' - X'7FFF'	Increment (Br) See "Notation Conventions" on page 27	

Relative Move Inline (RMI)

This control moves the inline coordinate of the presentation position relative to the current inline position. Negative values are in twos-complement form.

Notes:

1. Values as large as X'FFFF' are valid but might be off the page
2. Several Relative Move Inline controls used in a single line reduce throughput. If possible, replace Relative Move Inline controls with spaces, or combine multiple sequential Relative Move Inline controls into a single Relative Move Inline control.

Presentation Text Command Set

Table 59. Relative Move Inline

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'C8' X'C9'	Relative Move Inline Unchained Chained	
4-5	X'8000' - X'7FFF'	Increment (Ir) See "Notation Conventions" on page 27	

Repeat String (RPS)

This control contains a string of coded graphic characters that repeats on the current line. The data field can be a maximum of 253 bytes. The printer does not check the data for the control sequence introducer (X'2B'). If the repeat length is zero, this control is a no-op. If the count equals 04, but the repeat length is greater than zero, an error occurs.

Table 60. Repeat String

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04' - X'FF'	Length	X'021E..01'
3	X'EE' X'EF'	Repeat String Unchained Chained	
4-5	X'0000' - X'7FFF'	Repeat Length (RL)	X0219..01'
6-n		Repeat Data	X021F..01'

Set Baseline Increment (SBI)

This control specifies a distance which the printer adds to the current baseline coordinate when the printer performs a Begin Line control. A value of X'FFFF' causes the printer to use the value in the LPD command.

Table 61. Set Baseline Increment

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'D0' X'D1'	Set Baseline Increment Unchained Chained	
4-5	X'8000' - X'7FFF' X'FFFF'	Increment (Bi) See "Notation Conventions" on page 27 Use LPD value or, if no LPD received, use printer default	

Set Coded Font Local (SCFL)

This control selects a previously-assigned font, pitch, and code page. The Load Font Equivalence command assigns a font local identifier (LID) to a specified font, pitch, and character set. The SCFL control then specifies the LID to use for printing. A Print Quality Control subcommand specifying a print quality that is compatible with the LID (defined by a previous Load Font Equivalence command) must precede the SCFL control to provide the desired font and quality selections. Valid values for this parameter are 01 to X'FF'. A value of X'FF' specifies the LPD value.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'03'	Length	X'021E..01'
3	X'F0' X'F1'	Set Coded Font Local Unchained Chained	
4	X'01' - X'FE' X'FF'	Font Local ID Use LPD value or, if no LPD received, use printer default	X'0218..02' X'023F..02'

Set Inline Margin (SIM)

This control specifies the position of the inline margin in the (l) direction, when the printer performs a Begin Line command. Receipt of this control does not change the current print position. A value of X'FFFF' causes the printer to use the value in the LPD command.

Note: Values as large as X'7FFF' are valid but might be off the page.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'C0' X'C1'	Set Inline Margin Unchained Chained	
4-5	X'0000' - X'7FFF' X'FFFF'	Displacement (la) See "Notation Conventions" on page 27 Use LPD value or, if no LPD received, use printer default	X'0210..01'

Set Intercharacter Adjustment (SIA)

This control specifies additional inline adjustment between graphic characters. All values between 0 and X'7FFF' are valid. A value of X'FFFF' causes the printer to use the value in the LPD command.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	

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Byte	Value	Description	Error Code
2	X'04' or X'05'	Length	X'021E..01'
3	X'C2' X'C3'	Set Intercharacter Adjustment Unchained Chained	
4-5	X'0000' - X'7FFF' X'FFFF'	Adjustment (ica) See "Notation Conventions" on page 27 Use LPD value or, if no LPD received, use printer default	X'0212..01'
6	X'00' X'01' X'FF'	Direction Increment Direction Decrement Direction Same as X'00'	X'0212..01'

Set Text Color (STC)

This control specifies the color attributes for text. If the color of medium (FF08) selection occurs, text characters will not print, but the printer updates the current position. Byte 6 is optional and has the following meaning:

- 00** If the color is not supported or cannot be printed as requested, the printer reports an exception. Printing is in the default color if alternate exception action is invoked.
- 01** If the color is not supported or cannot be printed as requested, the printer does not report an exception, regardless of the EHC, and printing is in the default color.
- FF** If the color is not supported or cannot be printed as requested, the printer reports an exception. Printing is in the default color if alternate exception action is invoked.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04' or X'05'	Length	X'021E..01'
3	X'74' X'75'	Set Text Color Unchained Chained	
4-5	X'0000' X'0008' X'FF00' X'FF07' X'FF08' X'FFFF'	Color Printer Default (Black) Black Printer Default (Black) Printer Default (Black) Color of Medium Use LPD color value	X'0258..03'
6	X'00' - X'01' X'FF'	PRECISION Same as X'00'	X'0258..03'

Set Text Orientation (STO)

This control establishes i-direction and b-direction for the presentation text that follows. This control can be set to print right-to-left by selecting 180, 90 (X'5A00', X'2D00') degree orientation. The only valid values are 0 and 180 degrees for the inline direction and 90 degrees for the baseline direction. The Logical Page Descriptor command also can select right-to-left printing.

X'5A00' is an orientation of 180 degrees used to print in a right-to-left direction. X'FFFF' specifies to use the inline direction from the LPD command.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'06'	Length	X'021E..01'
3	X'F6' X'F7'	Set Text Orientation Unchained Chained	
4-5	X'0000' X'5A00' X'FFFF'	I-axis Orientation 0 Deg. (+X direction) 180 Deg. (-X direction) Use LPD value or, if no LPD received, use printer default	X'020F..01'
6-7	X'2D00' X'FFFF'	B-axis Orientation 90 Deg. (+Y direction) Use LPD value or, if no LPD received, use printer default	X'020F..01'

The permitted combinations are those where the difference between the I-axis orientation and the B-axis orientation are 90 degrees. The 64XX can print only from top to bottom with relation to the feed direction.

Inline-Direction	Baseline-Direction
0 deg. rotation	90 deg. rotation
180 deg. rotation	-90 deg. rotation

Set Variable Space Increment (SVI)

The Variable Space Increment is a two byte positive value that defines the width of the variable space character in units. Bytes 4 and 5 are the **width** value. The variable space character is X'40' for EBCDIC code pages and X'20' for ASCII code pages.

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'04'	Length	X'021E..01'
3	X'C4' X'C5'	Set Variable Space Character Increment Unchained Chained	
4-5	X'0000' - X'7FFF' X'FFFF'	Increment (vsi) See "Notation Conventions" on page 27 Default Variable Space Increment for Current Font	X'0217..01'

Temporary Baseline Move (TBM)

This control changes the position of the sequential baseline without change to the established baseline, and stops and starts both subscript and superscript printing.

Note: When subscript or superscript is active, double high printing will not occur.

Table 68. Temporary Baseline Move

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'03' or X'06'	Length	X'021E..01'
3	X'78' X'79'	Temporary Move Baseline Unchained Chained	
4	X'00' X'01' X'02' X'03' X'FF'	Direction Baseline is Unchanged Return to Established Baseline Shift Baseline away from I-axis (Subscript) Shift Baseline toward I-axis (Superscript) Same as X'01'	X'0298..03'
5	X'00' X'01' X'FF'	Precision Same as X'01' A substitute font with characteristics identical to the current font may be used to simulate baseline shift (superscript/subscript) Same as X'01'	X'0298..03
6-7	X'0000' - X'7FFF' X'FFFF'	Temporary Baseline Increment See "Notation Conventions" on page 27 Half the current baseline increment	X'0298..03'

Transparent Data (TRN)

This control marks the beginning of a string of coded characters for which the printer does not check for an embedded X'2B' escape sequence. The inline position increments for each position in the string.

Table 69. Transparent Data

Byte	Value	Description	Error Code
0-1	X'2BD3'	Text Control Escape Sequence	
2	X'02' - X'FF'	Length	X'021E..01'
3	X'DA' X'DB'	Transparent Data Unchained Chained	
4-255		Character String	

Underscore (USC)

This control identifies text the printer underscores at the baseline of the current line. The underscore prints using the same print quality as the text.

A USC command with a bypass value of 00 ends underscore mode.

Table 70. Underscore

Byte	Value	Description	Error Code
0-1	X '2BD3'	Text Control Escape Sequence	
2	X '03'	Length	X '021E..01'
3	X '76' X '77'	Underscore Unchained Chained	
4	Bits 0-3 Bit 4 0 1 Bit 5 0 1 Bit 6 0 1 Bit 7 0 1 X 'FF'	Bypass Identifiers Reserved Underscore white space from Relative Move Inline Bypass white space from Relative Move Inline Underscore white space from Absolute Move Inline Bypass white space from Absolute Move Inline Underscore white space from Space or Variable Space Character Bypass white space from Space or Variable Space Character Bypass Treat Bits 0-6 according to their set values No Bypass Treat Bits 0-6 as if their values are set to zero No Bypass in Effect	

IM Image Command Set

The IM Image command set contains the commands and data controls for presenting image data on a logical page, page segment, or overlay area on the physical medium. The following commands comprise the image command set:

Command	Code	Description
WIC	D63D	Write Image Control
WI	D64D	Write Image
END	D65D	End

The following pages describe the image command set.

Write Image Control (WIC)

The Write Image Control command causes the printer to enter the image object state. The command sequence that follows directs an image presentation object area on the current page, overlay, or page segment that is being constructed. The parameters of this command define the input and output size of the image array, image placement parameters, and the necessary information for interpreting the input data.

In the page state, the printer checks all the Write Image Control command parameter values for validity. If the parameters are not within the valid ranges, an exception condition exists.

An image cannot print outside the page without an error. If any part of the image extends beyond the physical or logical page, no image prints and an exception occurs.

The Write Image Control command is the first command in the sequence to send raster image data to the printer. Several Write Image commands may be required to a complete raster image. The DATA field bytes have the following meaning for this command:

<i>Table 71 (Page 1 of 2). Write Image Control</i>			
Byte	Value	Description	Error Code
0-1	X'0001' - X'7FFF'	Pels per scan line in the output image	X'0242..01' X'0243..01'
2-3	X'0001' - X'7FFF'	Number of scan lines in the output image	X'0244..01' X'0245..01'
4-5	X'0001' - X'7FFF'	Pels per scan line in the input image	X'0242..01' X'0243..01'
6-7	X'0001' - X'7FFF'	Number of scan lines in the input image	X'0244..01' X'0245..01'
8	X'00'	Uncompressed input image	X'0246..01'
9	X'00'	One bit per pel in the input image format	X'0246..01'
10	X'01' X'02'	PEL Magnification Factor No Magnification Factor Magnification Factor of 2	X'0247..01'
11	X'01' X'02'	Scan Line Magnification Factor No Magnification Factor Magnification Factor of 2	X'0247..01'
12-13	X'0000' X'2D00' X'5A00' X'8700'	Scan Line Direction 0 Degrees 90 Degrees 180 Degrees 270 Degrees	X'0248..01'
14-15	X'0000' X'2D00' X'5A00' X'8700'	Scan Line Sequence Direction 0 Degrees 90 Degrees 180 Degrees 270 Degrees	X'0249..01'

Byte	Value	Description	Error Code
16	X'00' X'20' X'40' X'60' X'A0'	Reference Coordinate System (See Note) Absolute I, Absolute B Absolute I, Relative B Relative I, Absolute B Relative I, Relative B Xp, Yp	X'024A..01'
17-19	X'FF8000' - X'007FFF'	Xp, I or I offset coordinate of the IM image object origin	X'024A..01'
20	X'00'	Reserved	
21-23	X'FF8000' - X'007FFF'	Yp, B or B offset coordinate of the IM image object origin	X'024A..01'
24-25	X'0000' X'0008' X'FF00' X'FF07' X'FF08'	IMAGE COLOR Printer Default (Black) Black Printer Default (Black) Printer Default (Black) Color of Medium	X'0253..01'

Note: Only X'A0' can be used if text is set to 180 or 90 degrees.

Reference Coordinate System: The type of reference coordinate can be either an absolute or a relative value. Absolute values specify a location on the logical page relative to the reference coordinates. Relative values specify a location on the logical page relative to the current coordinates.

If byte 16 equals X'00', the printer uses the absolute values of I and B, as specified in bytes 17 through 19 and bytes 21 through 23 of this command. These values are the text inline and text baseline coordinates, respectively.

If byte 16 equals X'20', the printer uses the absolute value of I and the relative value of B. The absolute I value is the text inline coordinate (bytes 17 through 19 of this command); the relative B value is the sum of the current text baseline coordinate and the value specified in bytes 21 through 23 of this command.

If byte 16 equals X'40', the printer uses the relative value of I and the absolute value of B. The relative I value is the sum of the current text inline coordinate and bytes 17 through 19 of this command; the absolute B value is the text baseline coordinate, specified in bytes 21 through 23 of this command.

If byte 16 equals X'60', the printer uses the relative value of I and the relative value of B. The relative I value is the sum of the current text inline coordinate and bytes 17 through 19 of this command; the relative B value is the sum of the current text baseline coordinate and bytes 21 through 23 of this command.

If byte 16 equals X'A0', the current logical page X and Y coordinates determine the origin. When the object is within a page, WIC bytes 17 through 19 and 21 through 23 specify the offset from the X-coordinate and Y-coordinate origin specified in a previously-received LPP command (or from the printer default coordinates if no LPP command is received). When the object is within an overlay that is invoked using an LCC command, WIC bytes 17 through 19 and 21 through 23 specify the offset from the X_m-coordinate and Y_m-coordinate origin. When the object is within an overlay that is invoked using an IO command, WIC

IM Image Command Set

bytes 17 through 19 and 21 through 23 specify the offset from the X-coordinate and Y-coordinate origin specified in the IO command.

Bytes 12 through 13 must equal 0 degrees scan line direction and bytes 14 through 15 must equal 90 degrees scan line sequence direction. Byte 16 is not used to modify the image direction.

Write Image (WI)

This command transmits an object of image data to the printer. A sequence of one or more Write Image commands follows the Write Image Control command and terminates with an End command.

The total number of bits of image is equal to the product of the number of source scan lines and the number of bits on each scan line. Thus, the number of bytes sent is:

Bytes 4 through 5 x bytes 6 through 7 of the WIC command divided by 8

Note: If this calculation yields a fractional remainder, round the result to the next whole number. The DATA parameter bytes contain the image bit string.

The data is a binary representation of the raster image. In binary data, a 1-bit represents a colored pel and a 0-bit represents a pel left unchanged in the page map. If a pel is set black by another object on the page (for example, text), it is not reset to white if it is written with a 0-bit in the image object. Several Write Image commands may be required to a complete raster image.

An error occurs if the host program sends the End command and the total number of bytes of image data is a different number than specified in the image control record.

Byte	Value	Description	Error Code
0-End		Binary Raster Image	X'026A..01 ' X'026B..01 ' X'0264..01 '

End (END)

For a description of the End control, see "End (END)" on page 32.

Graphics Command Set

The graphics command set contains the commands and data controls for presenting graphics pictures on a logical page, page segment, or overlay area on the physical medium. The following commands are the graphics command set:

Name	Command	Sub-command	Reference
Write Graphics Control	X ' D684 '		See "Write Graphics Control (WGC)" on page 83.
Graphics Area Position		X ' AC6B '	See "Graphics Area Position Control (GAP)" on page 83.
Graphics Output Control		X ' A66B '	See "Graphics Output Control (GOC)" on page 85.
Graphics Data Descriptor		X ' A6BB '	See "Graphics Data Descriptor (GDD)" on page 87.
Write Graphics	X ' D685 '		See "Write Graphics (WG)" on page 94 and the
Begin Segment Introducer		X ' 70 '	See "Begin Segment Introducer (BSI)" on page 95.

Graphics is a data type the printer uses to present line art picture drawings in a graphics object area on a page. A sequence of **drawing orders** produce arcs, lines, fillets, character strings, markers, and other elements that define the drawing. These orders, grouped into one or more segments, present the picture.

The control unit sends a Write Graphics Control command to the printer to establish the control parameters and initial drawing conditions for presenting the picture data. The picture segments themselves are sent to the printer as data in one or more Write Graphics commands.

Knowing how the graphics picture is developed allows an understanding of the relationship between the Write Graphics command and the Write Graphics Control command. The following pages explain the drawing order coordinates, the graphics medium presentation space, and the graphics object area.

The Drawing Order Coordinate System

The drawing orders specify graphics in an abstract space rather than directly on the page. This allows repositioning graphics on a page without changing the drawing orders. Coordinates (Graphics X and Y) specify the position of the graphic.

Note: The Graphics X and Y coordinates are not the same as the media X and Y coordinates. The horizontal axis is Graphics X; the vertical axis is Graphics Y. The intersection of the Graphics X and Y axes is coordinate (0,0). The horizontal axis is positive to the right of center and negative to the left of center. The vertical axis is positive to the top of center and negative to the bottom of center. Therefore, both positive and negative values are valid. Negative values are specified in twos-complement form.

Graphics Command Set

All coordinates are in coordinate units, called **drawing units** that are the same as units in the Graphics Data Descriptor (GDD) structured fields. Figure 12 shows the Graphics X and Y coordinate system.

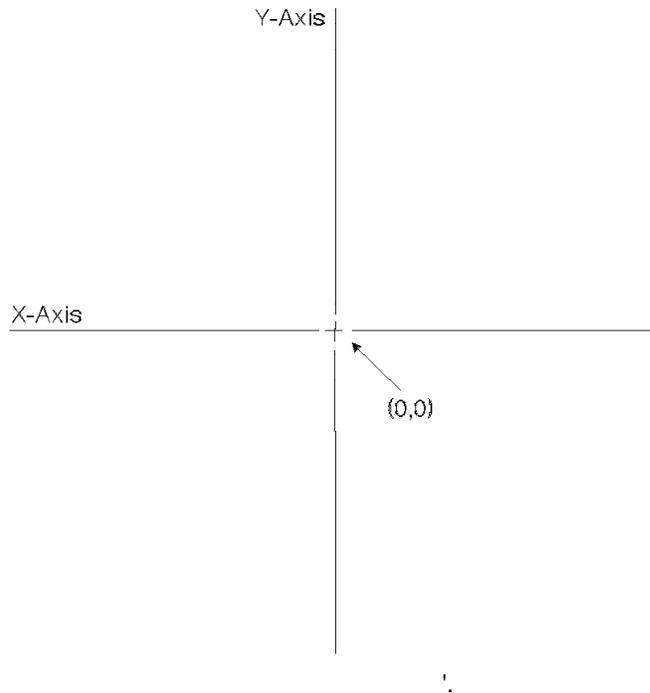


Figure 12. The Graphics X and Y Coordinate System

The Graphics Medium Presentation Space

The graphics medium presentation space is an abstract coordinate space where graphics are composed. It is a conceptual structure defined by the limits of the coordinate space as shown in Figure 13. Units are defined in “Graphics Data Descriptor (GDD)” on page 87.

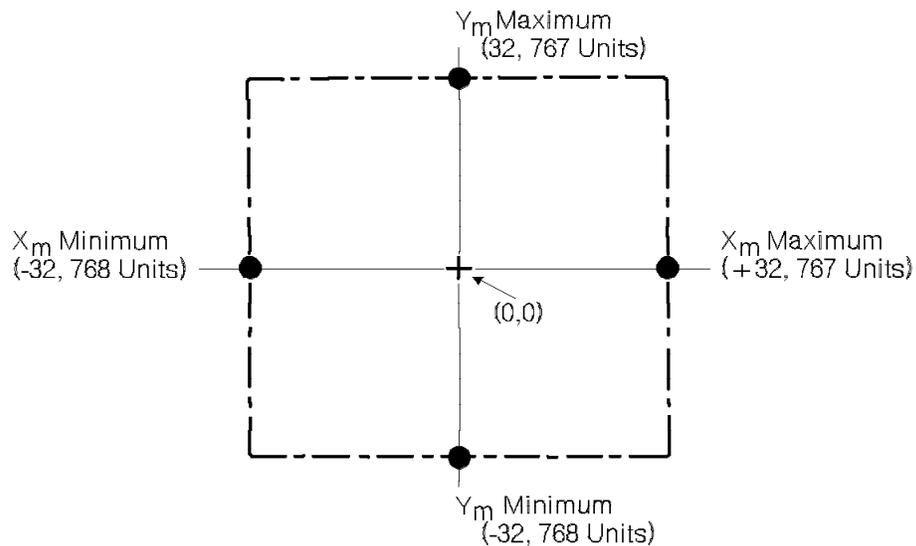


Figure 13. The Graphics Medium Presentation Space and Its Limits

The Graphics Window

The graphics window is a user-defined, rectangular area within the graphics medium presentation space. This area is the source from where information is selected for printing. Figure 14 illustrates the relationship of the graphics window to the graphics medium presentation space.

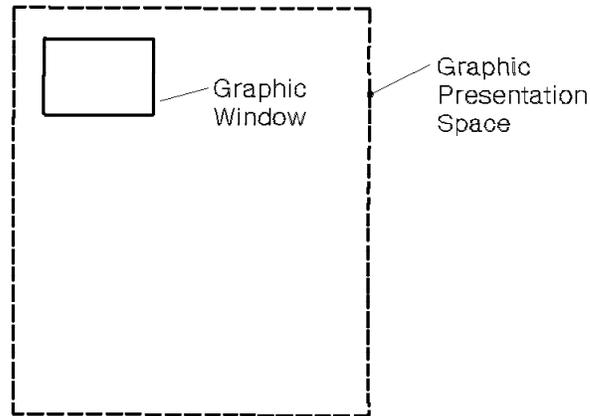


Figure 14. The Graphics Window within the Graphics Medium Presentation Space

The Graphics Object Area

The graphics object area is the part of the current physical medium in which the graphics is printed.

The graphics object area can overlap other output (such as text or images) specified earlier for the same page. Likewise, subsequent output specified by other commands for the same page can overlap the graphics object area. Figure 15 on page 82 shows the graphics object area and its relationship to the physical medium.

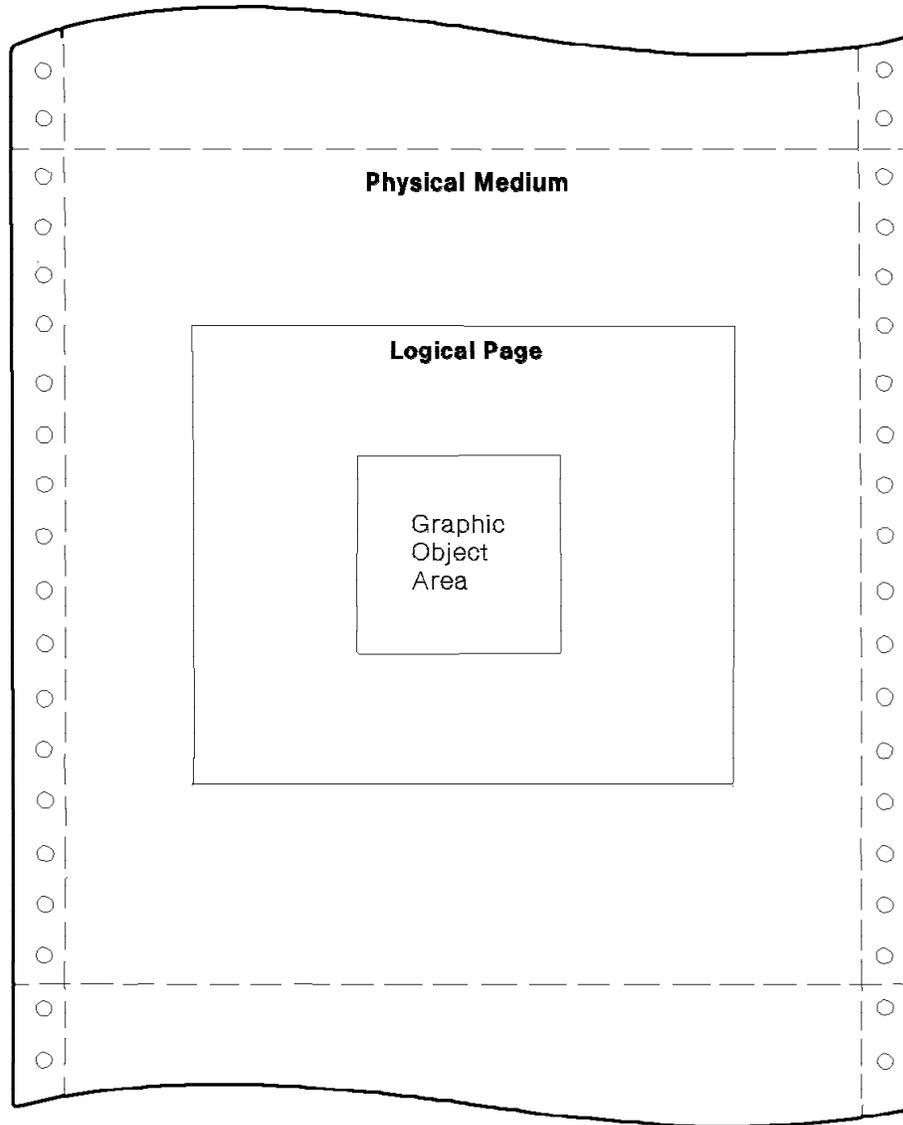


Figure 15. The Graphics Object Area on the Physical Medium

Positioning the Graphics Window in the Graphics Object Area

As mentioned previously, the graphics window can be any size within the graphics presentation space limits. The graphics object area size can be the entire physical Medium or a portion of the physical medium

The Write Graphics Control command, described in detail in “Write Graphics Control (WGC)” on page 83, specifies the mapping of the graphics window to the graphics object area.

The term **mapping** refers to the transformation of an abstract space into its size and position on the physical medium. There are three ways to map the abstract space. They are scale-to-fit, center-and-trim, and position-and-trim mapping. These mapping methods are described in detail in “Area Mapping Control Options” on page 88.

Write Graphics Control (WGC)

Length	D684	Flag	Correlation ID (Optional)	DATA (GAP, GOC, GDD)
--------	------	------	------------------------------	-------------------------

The Write Graphics Control command causes the printer to enter the graphics object area state. The parameters of this command define the size, placement, and orientation of the graphics object area and establish the initial conditions for interpreting the graphics data. Receiving the End command in the graphics object area state terminates the processing of the graphics data.

The Write Graphics Control data consists of three consecutive structured fields:

- The Graphics Area Position control defines the position of the graphics picture on the page.
- The Graphics Output Control (GOC) defines the size of this picture on the page.
- The Graphics Data Descriptor (GDD) defines the size of the graphics window and the default characteristics of the graphics picture.

Each structured field contains a two byte length field, then a two byte structured field ID, and finally a data field.

Graphics Area Position Control (GAP)

Length	AC6B	DATA
--------	------	------

The Graphics Area Position Control structured field is the first structured field in the DATA portion of the Write Graphics Control command. This field defines the position and orientation of the graphics object area. The top left corner of the graphics object area is defined relative to the reference coordinate system.

The format of the GAP field is:

Byte	Value	Description	Error Code
0-1	X'000B' -End of GAP	Length of Graphics Area Position	X'0202..05'
2-3	X'AC6B'	Structured Field ID.	X'020B..05'
4-5	X'8000' -X'7FFF'	Graphics Object Area Origin Xp, I, or I-offset Coordinate Position See "Notation Conventions" on page 27	
6-7	X'8000' -X'7FFF'	Graphics Object Area Origin Yp, B, or B-offset Coordinate Position See "Notation Conventions" on page 27	
8-9	X'0000' X'2D00' X'5A00' X'8700'	Orientation of Graphics Object Area 0 Degrees 90 Degrees 180 Degrees 270 Degrees	X'0203..05'

Table 74 (Page 2 of 2). Graphics Area Position			
Byte	Value	Description	Error Code
10	X'00' X'20' X'40' X'60' X'A0'	Coordinate Reference System Absolute I, Absolute B Absolute I, Relative B Relative I, Absolute B Relative I, Relative B Page Xp, Yp	X'0204..05'
11-End		Ignored	

Figure 16 shows the Graphics Object Area Position control specifying the top left reference point for the graphics object area.

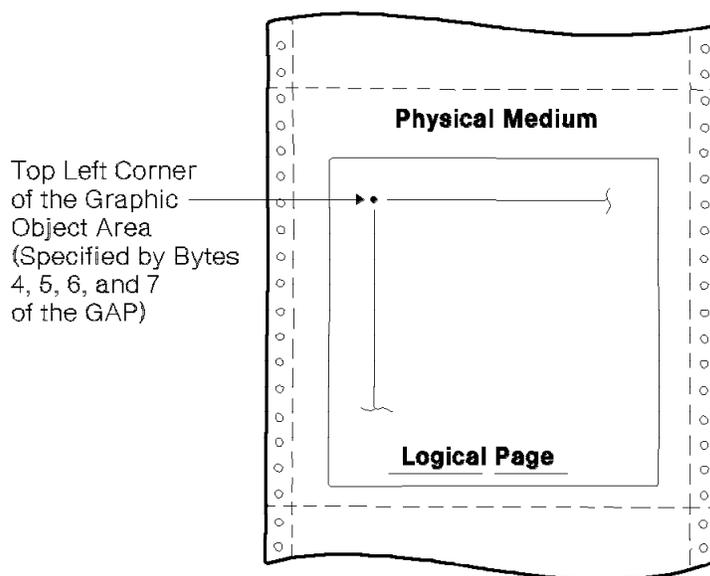


Figure 16. Graphics Object Area Position Control and the Graphics Object Area

Byte 10 of the GAP specifies the reference coordinate system. The reference coordinate system used for determining the top left corner of the graphics object area can be either the media X,Y or the I,B coordinate system.

If byte 10 equals X'00', the absolute I and B coordinates determine the top left corner. GAP bytes 4 and 5 specify the text inline coordinate. GAP bytes 6 and 7 specify the text baseline coordinate.

If byte 10 equals X'20', the absolute I and relative B coordinates determine the top left corner. GAP bytes 4 and 5 specify the text inline coordinate. GAP bytes 6 and 7 add to the last text baseline coordinate position used prior to graphics.

If byte 10 equals X'40', the relative I and absolute B coordinates determine the top left corner. GAP bytes 4 and 5 add to the last text inline coordinate position used prior to graphics. GAP bytes 6 and 7 specify the text baseline coordinate.

If byte 10 equals X'60', the relative I and B coordinates determine the top left corner. GAP bytes 4 and 5 add to the last text inline coordinate position used prior to graphics. GAP bytes 6 and 7 add to the last text baseline coordinate position used prior to graphics.

If byte 10 equals X 'A0 ' , the current logical page X and Y coordinates determine the origin. When the object is within a page, GAP bytes 4 through 7 specify the offset from the X-coordinate and Y-coordinate origin specified in a previously received LPP command (or from the printer default coordinates if no LPP command was received). When the object is within an overlay that is invoked using an LCC command, GAP bytes 4 through 7 specify the offset from the X_m-coordinate and Y_m-coordinate origin. When the object is within an overlay that is invoked using an IO command, GAP bytes 4 through 7 specify the offset from the X-coordinate and Y-coordinate origin specified in the IO command.

When you use the X,Y coordinate system **or** the I,B coordinate system with the inline orientation equal to 0 degrees, you must use the 0 degree orientation for graphics.

When you use the I,B reference system and the inline orientation is 180 degrees, you must use the 180 degree orientation for graphics.

Graphics Output Control (GOC)

Length	A66B	DATA
--------	------	------

The Graphics Output Control structured field is the second structured field in the DATA portion of the Write Graphics Control command. This field specifies the size of the graphics object area and a mapping option for placing the graphics window into the graphics object area. This field is optional and does not need to be in the Write Graphics Control command. If the GOC field is not present, the printer uses:

- The mapping option X '30 ' (where offset equals zero)
- X offset and Y offset equals zero
- Graphics object size equals the graphics medium presentation space window size defined in the GDD self-defining field.

Figure 17 shows the Graphics Output Control parameters specifying the size of the graphics object area.

The format of the GOC field is:

<i>Table 75 (Page 1 of 2). Graphics Output Control</i>			
Byte	Value	Description	Error Code
0-1	X '0010 ' -End of GOC	Length of Graphics Output Control (GOC)	X '0202..05 '
2-3	X 'A66B '	Structured Field ID	X '020B..05 '
4	X '00 '	Unit Base (Measurement Units) Unit Base is 10 Inches	X '0205..05 '
5-6	X '3840 ' X '0960 '	L-Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X '0206..05 '
7-8	X '0001 ' -X '7FFF ' X 'FFFF '	X Extent of Graphics Object Area in L-units <i>See "Notation Conventions" on page 27</i> Use Logical Page Descriptor Value	X '0207..05 '
9-10	X '0001 ' -X '7FFF ' X 'FFFF '	Y Extent of Graphics Object Area in L-units <i>See "Notation Conventions" on page 27</i> Use Logical Page Descriptor Value	X '0207..05 '

Graphics Command Set

Byte	Value	Description	Error Code
11	X'10' X'20' X'30'	Mapping Control Option Scale to Fit Center and Trim Position and Trim	X'0208..05'
12-13	X'8000'-X'7FFF'	X Offset L-units See "Notation Conventions" on page 27	X'0209..05'
14-15	X'8000'-X'7FFF'	Y Offset L-units See "Notation Conventions" on page 27	X'0209..05'
16-End		Ignored	

Notes:

- The Graphics Output Control Self Defining Field is optional and may be omitted from the WGC command. If the GOC is omitted the printer uses the following:
 - Mapping Control Option X'30' (Position and Trim)
 - X Offset = 0
 - Y Offset = 0
 - Graphics Object Area size equals the Graphics Presentation Space Window size which is defined in the Graphics Data Descriptor (GDD) Self Defining Field (See "Graphics Data Descriptor (GDD)" on page 87).
- See "Area Mapping Control Options" on page 88 for a description of scale-to-fit, center-and-trim, and position-and-trim.
- The printer ignores the X and Y offset fields unless byte B equals X'30'. These values are the offset of the top left corner of the graphics window relative to the top left corner of the graphics object area.

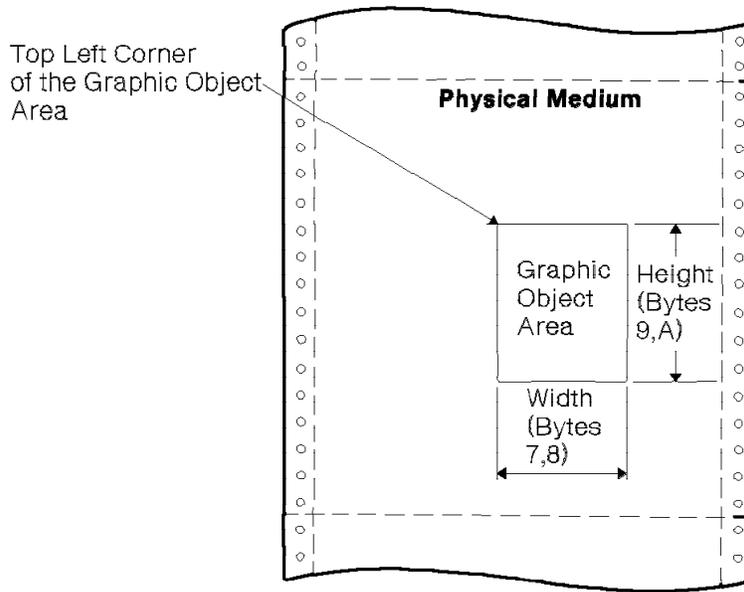


Figure 17. Graphics Output Control and the Graphics Object Area

Graphics Data Descriptor (GDD)

Length	A6BB	Data
--------	------	------

The Graphics Data Descriptor is the last structured field in the DATA portion of the Write Graphics Control command. This field specifies the parameters for the graphics window in the graphics medium presentation space (GPS) and sets the drawing default conditions. The graphics window limits define the range of drawing order coordinate values that map to the graphics object area.

Without causing an error, the drawing orders can specify GPS coordinates in the X'8000' to X'7FFF' range. The specified GDD graphics window limits select the part of the drawing order's picture to consider for mapping to the output area.

The format of the GDD field is:

Byte	Value	Description	Error Code
0-1	X'001C' -End of GDD	Length of Graphics Data Descriptor (GDD)	X'0202..05'
2-3	X'A6BB'	Structured Field ID	X'020B..05'
4	X'00'	Unit Base (Measurement Units) Unit Base is 10 Inches	X'0205..05'
5	X'00'	Reserved	
6-7	X'3840' X'0960'	Xg Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0206..05'
8-9	X'3840' X'0960'	Yg Units per Unit Base $Yg = Xg$ 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0206..05'
10-13	X'00000000'	Reserved	
14-15	X'8000' -X'7FFF'	Xg Left Limit of Graphics Presentation Space Window See "Notation Conventions" on page 27	
16-17	X'8000' -X'7FFF'	Xg Right Limit of Graphics Presentation Space Window See "Notation Conventions" on page 27	
18-19	X'8000' -X'7FFF'	Yg Top Limit of Graphics Presentation Space Window See "Notation Conventions" on page 27	
20-21	X'8000' -X'7FFF'	Yg Bottom Limit of Graphics Presentation Space Window See "Notation Conventions" on page 27	
22-27	X'000000000000'	Reserved	
28-End		Initial graphics default. See "GDD Initial Graphics Defaults Self-Describing Instructions" on page 91	

Note: See "GDD Initial Graphics Defaults Self-Describing Instructions" on page 91. Figure 18 shows the Graphics Data Descriptor control parameters specifying the size of the graphics window.

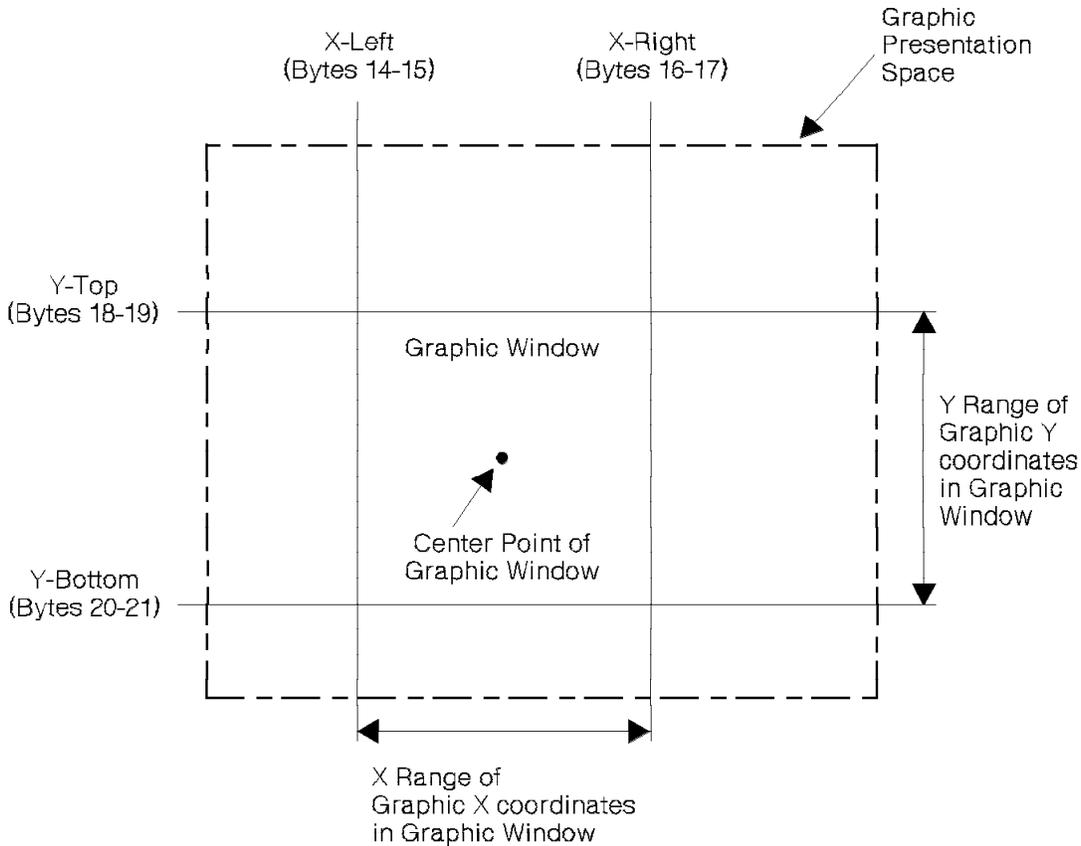


Figure 18. Graphics Data Descriptor and the Graphics Medium Presentation Space

Area Mapping Control Options

Byte B in the GOC data field is the area mapping control option byte. The option values are:

- 10 - Scale to fit
- 20 - Center and trim
- 30 - Position and trim.

Scale to Fit Mapping: The center of the graphics window is mapped to the center of the graphics object area and the graphics data is scaled by the printer (to a printer-supported unit per unit base) so that the picture within the graphics window fits entirely within the output area at the closest maximum scale.

Figure 19 shows the result of scale-to-fit mapping. For this example, the graphics window is shown larger than the graphics object area. The parameters in the Graphics Data Descriptor specify the size of the graphics window (in GPS coordinate units). The parameters in the Graphics Area Position and the Graphics Output Control specify the size and location of the graphics object area on the physical medium.

If the graphics object area is smaller than the graphics window, as shown in this example, the graphics window is proportionally reduced to fit in the graphics object area. That is, the entire graphics drawing contained within the graphics window appears in the graphics object area, reduced in size to fit in the graphics

object area. This size reduction is done to scale, keeping the same proportions as the original graphics drawing.

Notes:

1. The printer will not rescale graphics image data. If the image data does not fit within the output area, clipping of the image data occurs.
2. Graphics markers are not scaled; they are always 3 mm (0.12 in. [17/144-in.]) square. If markers are drawn close to the boundary of a page and the page is then scaled down, the center points of the markers are scaled closer to the boundary of the page but the marker size is still the same. The markers may be clipped from the page if the scaling factor scales the centers of the markers too close to the edge.

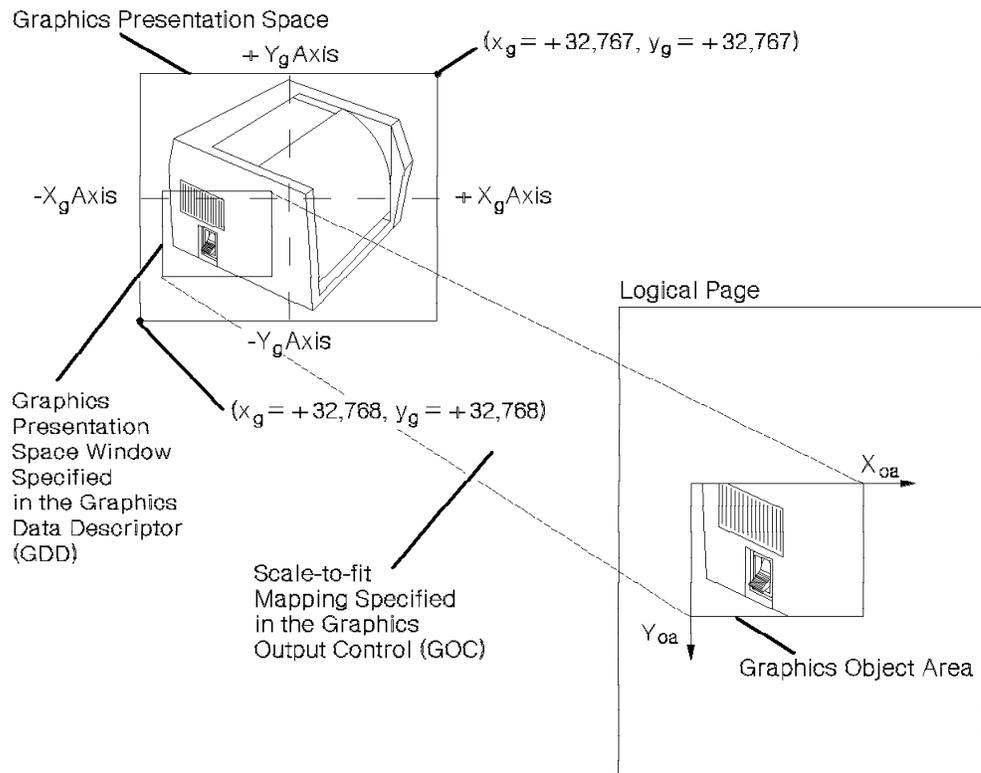


Figure 19. Scale-to-Fit Mapping

Center and Trim Mapping: The center of the graphics window is mapped to the center of the graphics object area and the graphics data is presented at the specified scale. Any portion of the picture that goes outside the graphics object area is clipped to the graphics object area boundary. Figure 20 shows the result of center-and-trim mapping. For this example, the graphics window is shown smaller than a previously defined graphics picture. This picture is to be placed on the physical medium. The parameters in the Graphics Data Descriptor specify the size of the graphics window (in graphic medium presentation space (GPS) units). The parameters in the Graphics Area Position and the Graphics Output Control specify the size and location of the graphics object area on the physical medium.

If the graphics object area is smaller than the graphics window, as shown in this example, a portion of the graphics picture is eliminated. The centers of the

graphics window and the graphics object area coincide, and the boundaries of the graphics object area determine the limits of the graphics picture. Any portion of the graphics picture extending beyond the graphics object area is not drawn on the page.

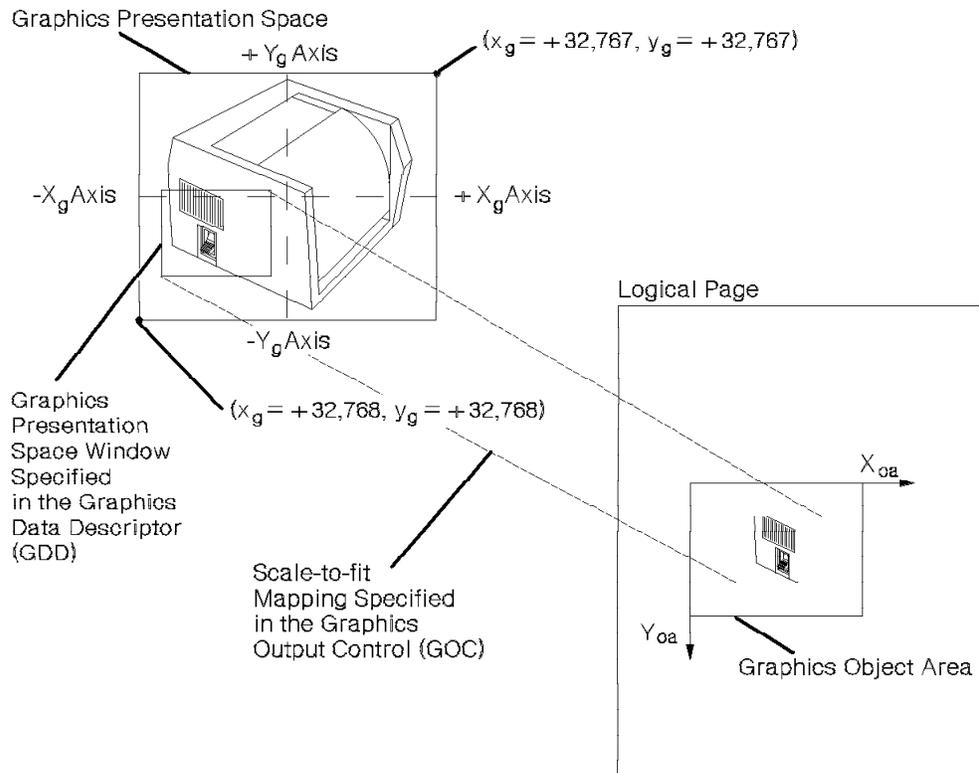


Figure 20. Center-and-Trim Mapping

Position and Trim Mapping: The upper left-hand corner of the graphics window is mapped to the graphics object area using the specified offset and presented at the specified scale. Any portion of the picture that goes outside the graphics object area is clipped to the area boundary. Figure 21 shows the result of position-and-trim mapping. For this example, the graphics window is shown smaller than a previously defined graphics picture. This picture is to be placed on the physical medium. The parameters in the Graphics Data Descriptor specify the size of the graphics window. The parameters in the Graphics Area Position and the Graphics Output Control specify the size and location of the graphics object area on the physical medium.

If the graphics object area is smaller than the graphics window, a portion of the graphics picture is eliminated. The top-left corner of the graphics window is either coincident with the top left corner of the graphics object area, or it is offset from the top left corner of the graphics object area by a distance specified in the Graphics Output Control. Only the portion of the picture contained within the overlapping areas of the graphics window and the graphic object area will be drawn. The printer trims (eliminates) the portion of the graphics picture outside this area.

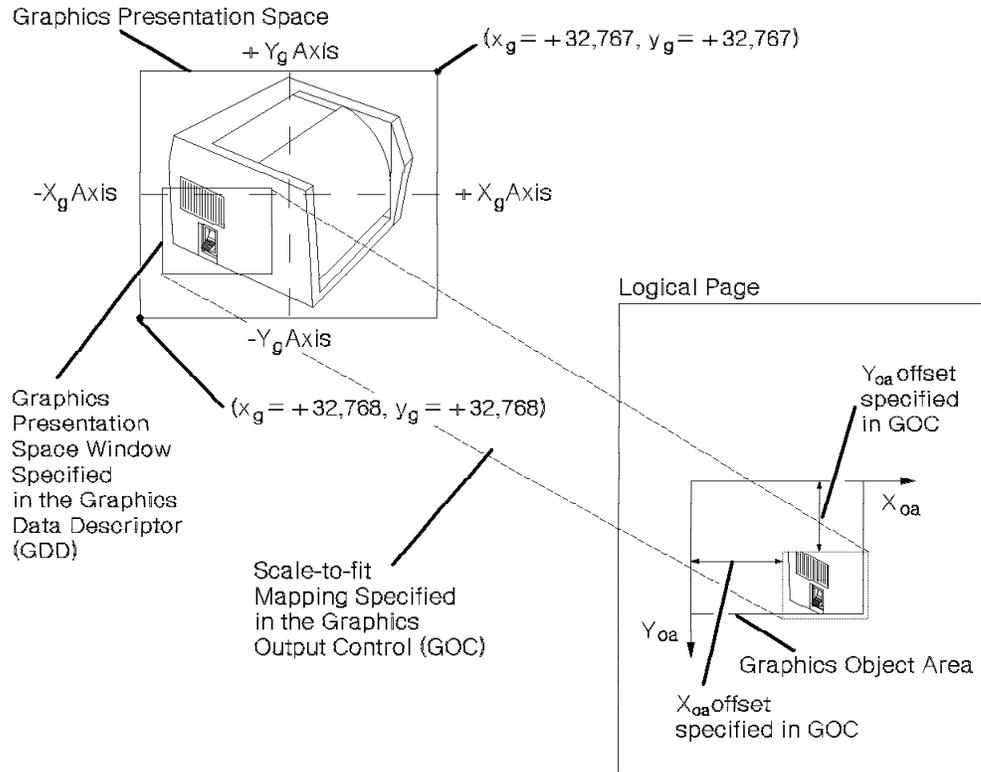


Figure 21. Position-and-Trim Mapping

GDD Initial Graphics Defaults Self-Describing Instructions

This portion of the Graphics Data Descriptor structured field contains zero or more self-describing instructions that set the drawing defaults for the graphics picture. The general format of a self-describing instruction is:

21	Length	Set	Mask	Default	Data
----	--------	-----	------	---------	------

The first byte, **21**, indicates that the following parameter is a Set Current Defaults instruction.

The **Length** byte is the length of the following data. If this value equals 4, the printer uses the standard default values.

The **Set** byte indicates the type of attribute or parameter this instruction is specifying.

The bits 0 through 15 in the **Mask** bytes correspond to attribute items within the indicated set. The individual set descriptions explain the meanings of these bits. When a mask bit equals one, the value of the default byte selects one of two options. See the default byte description for details. When a mask bit equals zero, the default does not change and the data does not include the value for the corresponding attribute.

Graphics Command Set

The **Default** byte has a value of either 0F or 8F. A value of 0F sets all indicated items to their standard default values. A value of 8F and a mask bit equal to one requires the appropriate data for a new default to be defined in the data field for the corresponding attribute. Unreferenced data bytes not addressed by the mask field are ignored.

The **Data** bytes contain immediate data that specifies values for the attributes in this instruction. If the **Default** byte is 0F, these Data bytes are not present.

The **Set** byte specifies one of the following attributes or parameters:

Byte	Value	Description	Error Code
0	X'21'	Set Current Defaults	X'0300..21'
1	X'04'-X'FF'	Length of Data	X'0300..03'
2	X'00' X'01' X'02' X'03' X'04' X'0B'	Set Byte Drawing Attributes Line Attributes Character Attributes Marker Attributes Pattern Attributes Arc Parameters	X'0300..02'
3-4		Mask Bytes See "Graphics Drawing Order Defaults and Masks" on page 93 for explanation	X'0300..03'
5	X'0F' X'8F'	Default Byte Use Standard Values Use the following Data Bytes	X'0300..02' X'0300..03'
6-End		Data bytes	X'0300..21'
Note: See "Drawing Orders" on page 97 for valid drawing order defaults.			

Graphics Drawing Order Defaults and Masks

The following chart shows the mask bits for each of the Set instructions. See the drawing order descriptions for supported attribute values.

Set Byte	Mask Bit	Description
X'00'	0	Drawing Attributes
	1	Color
	2	Reserved
	3	Foreground Mix
	4-15	Background Mix Reserved
X'01'	0	Line Attributes
	1	Line Type
	2-15	Line Width Reserved
X'02'	0	Character Attributes
	1	Angle X, Y
	2	Character Cell Size CW, CH
	3	Direction
	4	Precision
	5-15	Character Set Shear X, Y Reserved
X'03'	0-2	Marker Attributes
	3	Reserved
	4	Precision
	5-6	Marker Set
	7-15	Reserved Marker Symbol Reserved
X'04'	0-3	Pattern Attributes
	4	Reserved
	5-6	Pattern Set
	7	Reserved
	8-15	Pattern Symbol Reserved
X'0B'	0	ARC Parameters
	1	P Value
	2	R Value
	3	Q Value
	4-15	S Value Reserved

Write Graphics (WG)

Length	D685	Flag	Correlation ID (Optional)	BSI and Drawing Orders
--------	------	------	------------------------------	---------------------------

The Write Graphics command transmits graphics data to the printer. The data in this command consists of picture segments that contain the drawing orders that define the picture in the graphics medium presentation space. Also see “Begin Segment Introducer (BSI)” on page 95 for more information. Any number of Write Graphics commands may follow the Write Graphics Control command.

The Write Graphics command has a data length restriction of 32K. Within this data-length limit, the Write Graphics command can transmit partial segments, full segments, multiple segments, or any combination of these. Segments and drawing orders must be transmitted in the order in which they are to take effect.

When the printer encounters a partial segment, the printer expects the next graphics data to be the remainder of the segment. This condition is called graphics spanning. For a spanned segment, the segment length is the length of the entire segment before spanning. The Write Graphics command length is the actual number of bytes being transmitted in the current command.

The valid sequence for graphics spanning is as follows:

- Write Graphics command with zero or more segments, followed by the start of a partial segment
- Zero or more XOA, NOP, or STM commands
- A new Write Graphics command with a continuation of the partial segment, followed by zero or more segments.

All segments are run in deferred mode; drawing orders are included in the picture as they are received. The printer does not retain or store the segments. Receipt of the first segment starts the drawing process.

Write Graphics Defaults

The following defaults are used if not previously defined by “Graphics Drawing Order Defaults and Masks” on page 93. The current value of an attribute is considered when the drawing order is received.

Table 79. Write Graphics Defaults

Description	Value
Color	Black
Line Type	Solid
Line Width	Normal (1 pel)
Character Cell	19 High by 21 Wide X 1/144 inches
Character Set	Selected via Op Panel
Character Angle	No Rotation
Character Direction	Left to Right
Marker Symbol	Cross
Pattern Symbol	Solid Shading
Current Position	X,Y = 0,0
Arc Parameters	P=Q=1; R=S=0
Foreground Mix	Overpaint
Background Mix	Leave Alone
Character Precision	Character Precision
Marker Precision	Character Precision
Marker Symbol Set	Resident Set in Printer

Begin Segment Introducer (BSI)

BSI	One or More Drawing Orders
-----	----------------------------

The Begin Segment Introducer precedes all of the drawing orders that are together in the graphics segment. The following chart shows the format of the BSI:

Table 80. Begin Segment Introducer

Byte	Value	Description	Error Code
0	X'70'	Begin Segment code	
1	X'0C' or X'0E'	Length of the following parameters	X'0370..C1'
2-5		Segment ID (Ignored)	
6	X'00'	Reserved	
7	Bit 0 0 Bits 1-2 00 Bit 3 0/1 Bit 4 0 Bits 5-6 00 10 11 Bit 7 0	Flags UNCHAIN CHPOS No Prolog (0); Prolog (1) Reserved New Segment (reinitialize graphics defaults) Replace Append Segment (do not reinitialize defaults) DATAFL	X'0370..01' X'0370..82'
8-9	X'0000'-X'FFFF'	Length of this segment (SEGLEN)	
10-13	X'00000000'	P/SNAME	
14-End		See "Drawing Orders" on page 97	

Graphics Command Set

If bit 3 of byte 7 is on, a prologue is the first sequence of drawing orders in a new segment. The prologue, if present, is always at the beginning of a new segment's data and ends by an End Prologue order within the same segment.

If bits 5 and 6 of byte 7 are zero, the drawing attributes are re-initialized to the current default values. If bits 5 and 6 of byte 7 are equal to 11, this segment appends to the previous segment and the current drawing attributes do not reinitialize.

Drawing Orders

The printer supports all DR2 Drawing Orders and valid data values listed in this section. One or more drawing orders follow each Begin Segment Introducer. The format of a drawing order is:

Order Code

Order Code	Parameter(s)
------------	--------------

Order Code	Length	Parameter(s)
------------	--------	--------------

The order code specifies the type of graphics to print or the assigned drawing attribute.

The Length field, if present, is a one byte value that specifies the length of the drawing order following this byte. See the specific drawing orders for information about the length field.

The parameter bytes contain the specific characteristics for the drawing order. For information about the parameters, see the specific drawing orders, following this description.

The following list contains all the drawing orders for this printer:

Code	Drawing Order
68	Begin Area
D1	Begin Image
91	Begin Image at Current Position
C3	Character String
83	Character String at Current Position
01	Comment
60	End Area
93	End Image
3E	End Prologue
71	End Segment (Treated as a No-op)
C5	Fillet
85	Fillet at Current Position
C7	Full Arc
87	Full Arc at Current Position
92	Image Data
C1	Line
81	Line at Current Position
C2	Marker
82	Marker at Current Position
00	No Operation
E1	Relative Line
A1	Relative Line at Current Position

Code	Drawing Order
04	Segment Characteristics
22	Set Arc Parameters
0D	Set Background Mix
34	Set Character Angle
33	Set Character Cell
3A	Set Character Direction
39	Set Character Precision
38	Set Character Set
0A	Set Color (Graphics)
21	Set Current Position
26	Set Extended Color
11	Set Fractional Line Width
18	Set Line Type
19	Set Line Width
3B	Set Marker Precision
3C	Set Marker Set
29	Set Marker Symbol
0C	Set Mix
08	Set Pattern Set
28	Set Pattern Symbol

The following sections describe the drawing orders.

Begin Area

68	P1
----	----

Description: This order indicates the beginning of the boundary of an area that the printer shades. The area definition must terminate with an End Area order.

The area boundaries consist of one or more closed figures. Each closed figure is made up of a continuous set of straight lines, full arcs, and fillets defined using the Line at Current Position, Fillet at Current Position, and Full Arc at Current Position orders. The pattern symbol and the shading color for the area are the attribute values that are current prior to the Begin Area order. Only the following orders are valid between a Begin Area and an End Area order:

- Comment
- Line or Relative Line
- Line at Current Position
- Relative Line at Current Position
- Set Arc Parameters
- Full Arc at Current Position
- Full Arc or Fillet
- Fillet at Current Position
- Set Color or Set Extended Color (see note)
- Set Line Type, Set Line Width, or Set Fractional Line Width (see note)
- Set Current Position.

Note: When used between Begin Area and End Area drawing orders, the orders Set Color, Set Extended Color, Set Line Type, Set Line Width, and Set Fractional Line Width update the values of their respective current attributes only for the Area boundary, if drawn. These orders do not update their respective current values for the area fill pattern after an area has begun.

Use of the Line, Relative Line, Full Arc, and Fillet in the non At Current Position form can cause the printer to arbitrarily close the area figure. The recommended orders to use within an area definition are those in the At Current Position form.

The printer cannot nest Area orders. The Begin Area order does not change any other graphics drawing attributes. However, orders between a Begin Area/End Area pair can update the current position.

Parameter **P1** is a **flag** byte that specifies whether boundary lines are to be drawn, as shown:

Bit 0	Reserved
Bit 1	0 = Do Not Draw Boundary Lines 1 = Draw Boundary Lines
Bit 2	Inside
Bits 3-7	Reserved

The printer uses the current values of color, mix, background mix, pattern, and pattern set when shading the area. If boundary lines are drawn, the printer uses the current values of graphics color, line type, and line width. The printer shades any commented region with an odd number of line crossings from

infinity. This shading uses the current values of pattern symbol, color, mix, and background mix from the Begin Area order. The printer will not shade regions with an even number of line crossings from infinity. The printer counts all coincident boundary lines when counting line crossings.

The current position is the last coordinate value of the preceding drawing order. The Set Current Position order can move the current position to any drawing order coordinate within the limits of the GDD defined medium presentation space window.

Note: When filled areas are drawn such that some boundaries coincide, it is recommended that they be drawn with the same value for Parameter P1 so that the area boundary is drawn properly.

Begin Image

D1	0A	P1-P10
----	----	--------

Description: This order defines an image at the graphics position specified by parameters P1 to P4. An image consists of a rectangular region defined in increments of 1/144 in. One or more Image Data orders follow the Begin Image order. The Image Data orders contain the image data itself. The Begin Image order introduces a graphics image. Only Image Data, Comment, or No-op orders are valid between Begin Image and End Image orders.

Parameters P1 and P2 form a two byte value that specifies the X coordinate for the start of the image. Parameters P3 and P4 form a two byte value that specifies the Y coordinate for the start of the image. Parameters P1 to P4 define the location of the top left corner of the image. Parameters P5 and P6 are always zero for this order. Parameters P7 and P8 form a two byte value that specifies the width of the image in increments of 1/144 in. Parameters P9 and P10 form a two byte value that specifies the height of the image in increments of 1/144 in.

The printer draws the image in the current values of color and mix.

This order updates the current graphics position to the coordinates of the image (parameters P1 to P4).

Notes:

1. The Begin Image at Current Position order always specifies the width and height of the image in increments of 1/144 in., not in drawing units.
2. By sending the image ordered (immediate) instead of unordered (deferred), the printer uses less storage.

Begin Image at Current Position

91	06	P1-P6
----	----	-------

Description: This order defines an image, with the top left corner of the image at the current graphics position. An image consists of a rectangular region with a resolution of one pel, defined in increments of 0.18 mm (0.007 in. [1/144 in.]). Each pel, therefore, represents one dot in the printed image. One or more Image Data orders follow the Begin Image at Current Position order. The Image Data orders contain the image data itself. The Begin Image at Current Position

order introduces a graphics image. Only Image Data, Comment, or No-op orders are valid between Begin Image and End Image orders.

Parameters P1 and P2 are always zero for this order. Parameters P3 and P4 form a two byte value that specifies the width of the image in increments of 0.18 mm (0.007 in. [1/144 in.]). Parameters P5 and P6 form a two byte value that specifies the height of the image in increments of 0.18 mm (0.007 in. [1/144 in.]).

The printer uses the current values of color and mix when drawing the image.

Note: The Begin Image at Current Position order always specifies the width and height of the image in increments of 0.18 mm (0.007 in. [1/144 in.]), not in drawing units.

Character String

C3	L1	P1-Pn
----	----	-------

Description: This order draws a character string starting at the specified location. A previous Set Character Set order specifies the font to use for drawing the character string. If no previous Set Character Set order was processed, the printer uses the drawing default character set.

The printer places the character cell of the first character in the string at the specified graphics position. The Set Character Cell, Set Character Angle, and Set Character Direction orders determine the character size, character angle, and character direction, respectively. The printer uses the current values of color, mix, background mix, and character precision when drawing the string.

L1 is a one-byte value that specifies the length of the parameter field that follows. L1 must be greater than or equal to four. If L1 equals four, the printer does not draw the character string, but the printer updates the graphics current position to the point specified by parameters P1 to P4.

Parameters P1 and P2 form a two byte value that specifies the X coordinate of the starting location. Parameters P3 and P4 form a two byte value that specifies the Y coordinate of the starting location. Parameters P5 to Pn, if present, are one-byte values that specify the code points of the character string, using the currently active character set.

This order updates the current graphics position to the coordinates of the last point.

Character String at Current Position

83	L1	P1-Pn
----	----	-------

Description: This order draws a character string, starting at the current graphics position. A previous Set Character Set order specifies the font to use for drawing the character string. If no previous Set Character Set order has been processed, the printer uses the drawing default character set.

The printer uses the current values of color, mix, background mix, and character precision when drawing the string. The Set Character Cell, Set Character Angle, and Set Character Direction orders determine the character size, character angle, and character direction, respectively.

L1 is a one-byte value that specifies the length of the character string. If L1 is zero, no character string is drawn.

Parameters P1 to Pn, the character string, are one-byte values that specify the code points (characters) of the character string to be drawn, using the currently active character set.

Comment

01	L1	P1...Pn
----	----	---------

Description: This order is a no-operation; it has no effect on the graphics medium presentation space or any attribute or any current parameter. This order can appear anywhere within the segment.

L1 is the length byte. This byte is a value between 1 and 255 and specifies the number of data bytes that follow. Parameters P1 to Pn are the data bytes. The printer ignores the data within the order. However, there must be at least one data byte within this order.

End Area

60	L1	P1-Pn
----	----	-------

Description: This order indicates the end of the boundary of an area specified with a Begin Area order. This order does not change any other graphics drawing attributes. However, orders between a Begin Area/End Area pair can update the current position.

L1 is the length of the data, P1 to Pn. If no data is present, the length is zero.

Parameters P1 to Pn are optional data bytes, and if present, must be zeros.

Within the area boundaries, one or more closed figures can exist. A figure ends either by an End Area order or by a order specifying a coordinate that implies the start of a new closed figure. These orders include a Line, Relative Line, Arc, Full Arc, Fillet, or Set Current Position order.

Each closed figure should close properly; its start and end points should be identical. If not, the figure closes arbitrarily with a straight line connecting the start and end points.

End Image

93	L1	P1-Pn
----	----	-------

Description: This order defines the end of an image. A Begin Image order and zero or more Image Data orders must precede the End Image order.

L1, the length, is a one-byte value that specifies the number of parameter bytes that follow. If no parameter bytes follow, L1 is zero.

Parameters P1 to Pn are optional. The printer does not use these parameters; if they are present, the printer discards them.

This order does not update the current graphics position.

End Prologue

3E	00
----	----

Description: This order ends the prologue section of a segment. It is only valid if the prologue flag bit is on in the Begin Segment Introducer (BSI). When the BSI prologue flag bit is on, only the following orders are valid before the End Prologue order:

- Comment
- No Operation
- Segment Characteristics
- All Set Attribute type orders.

End Segment Description

71	L1	P1...Pn
----	----	---------

Description: This order is for compatibility with existing products and is a No Operation order.

Fillet

C5	L1	P1-Pn
----	----	-------

Description: This order specifies a curved line, which the printer draws tangential to a specified set of connected, imaginary, straight lines.

The printer joins the points specified in the order by imaginary straight lines. The printer then fits a curve to the lines. The curve is tangent to the first line at the start point and is tangent to the last line at its end point. If there are intermediate lines, the curve is tangent to these lines at their center points.

L1 is a one-byte value that specifies the length of the following parameters. L1 must be a multiple of four and cannot equal zero. If L1 equals four, the printer does not draw the fillet, but the printer updates the graphics current position to the point specified by parameters P1 to P4.

Parameters P1 and P2 form a two byte value that specifies the X coordinate of the first point. Parameters P3 and P4 form a two byte value that specifies the Y coordinate of the first point. Parameters P5 to Pn, if present, form two byte values that specify the corresponding coordinate values for additional points. If only two points are specified, the printer draws a straight line.

The printer uses the current values of color, mix, line type, and line width when drawing the fillet.

This order updates the current graphics position to the coordinates of the last point.

Fillet at Current Position

85	L1	P1-Pn
----	----	-------

Description: This order specifies a curved line that the printer draws tangential to a specified set of connected, imaginary, straight lines. The printer uses the current graphics position for the first point and the parameter (or parameters) specifies additional points to use.

The printer joins the points specified by imaginary straight lines. The printer then fits a curve to the lines, as follows:

- The curve is tangent to the first line at the start point and to the last line at its end point.
- If there are intermediate lines, the curve is tangent to these lines at their center points.

L1 specifies the length of the parameter (or parameters) in this order. The value of L1 must be a multiple of four. A value of zero for L1 is invalid.

The first end point for the imaginary line specifying the fillet is the graphics current position. Parameters P1 to Pn form two byte values that specify additional X and Y coordinates. These coordinates are additional, sequential end points of the imaginary lines specifying the fillet.

The printer uses the current values of color, mix, line type, and line width when drawing the fillet.

This order updates the current graphics position to the coordinates of the last point.

Full Arc

C7	L1	P1-P6
----	----	-------

Description: This order specifies a full arc (circle or ellipse) with the center at the specified point. A previous Set Arc Parameters order determines the shape and orientation of the arc. If no previous Set Arc Parameters order was processed, the printer draws the arc using the graphics default arc parameters.

Parameters P1 and P2 form a two byte value that specifies the X coordinate for the center of the arc. Parameters P3 and P4 form a two byte value that specifies the Y coordinate for the center of the arc. Parameters P5 and P6 form a two byte, unsigned, floating point value that specifies the scale. P5 specifies the integer portion of the scale; P6 specifies the fractional portion of the scale. There is an implied decimal point between P5 and P6. Byte P6 represents the fraction given by the value of P6 divided by 256 (see "Full Arc at Current Position" on page 104).

The scale value acts as a multiplier for the arc parameters, as follows:

For a circle: The radius is $P5P6 \times r$. A previous Set Arc Parameters order specifies the value of r . For an ellipse: The major axis is $P5P6 \times a$ and the minor axis is $P5P6 \times b$.

A previous Set Arc Parameters order specifies the values for a and b . The printer uses the current values of color, mix, line type, and line width when drawing the arc.

This order does not update the current graphics position.

Full Arc at Current Position

87	L1	P1	P2
----	----	----	----

Description: This order specifies a full arc (circle or ellipse) with the center at the current graphics position. A previous Set Arc Parameters order determines the shape and orientation of the arc. If no Set Arc Parameters order has been received, then the printer draws an arc using the default values of the arc parameters.

Parameters P1 and P2 form a two byte value that specifies the scale. P1 specifies the integer portion of the scale; P2 specifies the fractional portion of the scale (P2 divided by 256). For example, if P2 equals X'40', the decimal value of P2 is 64. This value (64) divided by 256 equals the fraction one-fourth.

The scale value acts as a multiplier for the arc parameters. For a circle, the radius is $P1P2 \times r$. A previous Set Arc Parameters order specifies the value of r .

For an ellipse: The major axis is $P1P2 \times a$, the minor axis is $P1P2 \times b$, and a previous Set Arc Parameters order specifies the values for a and b .

The printer uses the current values of color, mix, line type, and line width when drawing the arc.

This order does not update the current graphics position.

Image Data

92	L1	P1-Pn
----	----	-------

Description: This order specifies the image data for all or part of an image introduced by a Begin Image order. A Begin Image order must precede an Image Data order.

L1 is a one-byte value that specifies the length (in bytes) of the image data that follows. Valid values for L1 are X'00' through X'FF'.

Parameters P1 to Pn are values that specify the image dot data, a zero indicating the absence of a dot, a one indicating the presence of a dot. The dots are 0.18 mm (0.007 in. [1/144 in.]) apart horizontally and vertically.

The image data is in the form of horizontal scan lines (rows), left to right. Each Image Data order specifies only one scan line (row) of the image. Therefore, the number of Image Data orders following a Begin Image order must be equal to the value specified in parameters P5 and P6 (the image height) of the Begin Image order.

Each of the parameters, P1 to Pn, of the Image Data order specifies eight dots. Therefore, parameter L1 of the Image Data order must equal the image width divided by eight. Parameters P3 and P4 of the Begin Image order specify the image width. If the image width is not a multiple of eight, the printer ignores any extra dots specified by bits in the last parameter, Pn.

Note: The image data specified in the Image Data Orders between a Begin Image and End Image pair must exactly fill the area specified by the width and height of the Begin Image order.

This order does not update the current graphics position.

Line

C1	L1	P1-Pn
----	----	-------

Description: This order specifies one or more connected lines.

L1 is a one-byte value that specifies the length of the parameter field that follows. The value of L1 must be a multiple of four and cannot be zero. If L1 equals four, no line is drawn, but the printer updates the graphics current position to the points specified by parameters P1 to P4.

Parameters P1 and P2 form a two byte value that specifies the first X coordinate point. Parameters P3 and P4 form a two byte value that specifies the first Y coordinate point. Parameters P5 to P8, if present, specify the second X and Y coordinate points. The printer draws a line from the point specified by the first pair of coordinates to the point specified by the second pair of coordinates. If additional coordinate pairs are present, the printer draws additional lines from the previous end point to the next coordinate pair.

This order uses the current values of color, mix, line type, and line width.

Following this order, the printer updates the graphics current position to the last end point specified in the order.

Line at Current Position

81	L1	P1-Pn
----	----	-------

Description: This order specifies one or more connected lines. The printer draws a line from the current graphics position to the points specified by the first set of X and Y coordinates in the parameters. The printer then draws additional lines from the previous end point to the next coordinate pair, if additional coordinates are present.

The printer uses the current attributes for color, mix, line type, and line width in drawing the lines.

L1, the length, specifies the number of bytes following this byte. The value of L1 must be a multiple of four. If L1 is zero, no line is drawn.

Parameters P1 to Pn, if present, form two byte values that specify the X and Y coordinates of the end points for a series of connected lines. This order updates the current graphics position to the last line end point. If the order does not specify any points, the current graphics position does not change. P1 and P2 form a two byte sequence that specifies the X coordinate of the second end point. P3 and P4 form a two byte sequence that specifies the Y coordinate of the second end point. Additional X and Y coordinates, if present, are specified in the remaining parameters, following the same format.

Marker

C2	L1	P1-Pn
----	----	-------

Description: This order specifies one or more marker symbols to place at the points specified by pairs of coordinates. The specified location is the center of the marker.

A previously specified Set Marker Symbol order determines the marker symbol the printer uses. If no previous Set Marker Symbol order was processed, the printer uses the current graphics default marker symbol. The printer uses the current values of color, mix, background mix, marker precision, marker set, and marker symbol when drawing the markers.

L1 is a one-byte value that specifies the length of the parameter field that follows. The value of L1 must be a multiple of four. If L1 equals zero, the printer does not draw a marker.

Parameters P1 and P2 form a two byte value that specifies the X coordinate point for the first marker. Parameters P3 and P4 form a two byte value that specifies the Y coordinate point for the first marker. Parameters P5 to Pn, if present, specify the X and Y coordinate points for additional markers.

This order updates the current graphics position to the coordinates of the last end point.

Note: The marker cell size is constant 3 mm (0.12 in. [17/144 in.]). The scaling factor used in defining a graphics area does not affect the size of the marker. If markers are used near the edge of a defined graphics area, scaling the graphics may result in the markers being clipped from the printable graphics area.

Marker at Current Position

82	L1	P1-Pn
----	----	-------

Description: This order specifies one or more marker symbols, which the printer places at the points specified by a pair of X and Y coordinates, beginning with the current graphics position. The Set Marker Symbol order determines the marker that prints.

L1, the length, specifies the number of bytes following this byte. The value of L1 must be a multiple of four. A value of zero for L1 is valid and results in only one marker symbol being drawn at the current graphics position.

Parameters P1 to Pn, if present, form two byte values that specify the X and Y coordinates for each additional marker symbol. The printer draws the first marker symbol at the current graphics position. P1 and P2 form a two byte value that specifies the second X coordinate. P3 and P4 form a two byte value that specifies the second Y coordinate. Any remaining parameters specify additional coordinate values for additional markers, using the same format.

The printer uses the current values of color, mix, background mix, marker, precision marker set, and marker symbol for drawing the marker.

This order updates the current graphics position to the value of the last point coordinates. If this order does not specify any points, the current graphics position will not change.

Note: The marker cell size is constant 3 mm (0.12 in. [17/144 in.]). The scaling factor used in defining a graphics area does not affect the size of the marker. If markers are used near the edge of a defined graphics area, scaling the graphics may result in the markers being clipped from the printable graphics area.

No Operation

00

Description: This order is a no-operation; it has no effect on the graphics medium presentation space or any attribute or any current parameter.

Relative Line

E1	L1	P1-Pn
----	----	-------

Description: This order specifies one or more connected straight lines, like the Line order, except that the end point of each line is an offset from the previous end point.

L1 is a one-byte value that specifies the length of the parameter field that follows. A value of zero for L1 is invalid; L1 must be a multiple of 2. If the value of L1 is two, the printer does not draw the line. However, the printer does update the graphics current position to the point specified by P1 and P2.

Parameters P1 to Pn are signed, twos-complement, one-byte values that specify the offset in drawing units. Parameters P1 and P2 form a two byte value that specifies the X coordinate of the first end point of the line. Parameters P3 and P4 form a two byte value that specifies the Y coordinate of the first end point of the line. Parameter P5 is a signed, twos-complement, one-byte value that specifies the X coordinate of the second end point as an offset from the first end point. Parameter P6 is a signed, twos-complement, one-byte value that specifies the Y coordinate of the second end point as an offset from the first end point. The remaining parameters, if present, specify additional X and Y coordinate values as offsets from the previous point, following the same format.

The printer draws the line in the current values of color, mix, line type, and line width.

This order updates the current graphics position to the coordinates of the last offset point. If there are no offset points with this order, the current graphics position does not change.

Relative Line at Current Position

A1	L1	P1-Pn
----	----	-------

Description: This order specifies one or more connected straight lines, like the Line at Current Position order. With this order, the end point of each line is an offset from the previous end point, rather than an absolute coordinate pair.

L1 is a one-byte value that specifies the length of the parameter field. L1 must be a multiple of two. The printer will not draw a line if L1 is zero.

Parameters P1 to Pn are signed, twos-complement, one-byte values that specify the offset, in drawing units. The first line end point is the graphics current

position. P1 specifies the X coordinate for the second point as an offset from the first point. P2 specifies the Y coordinate for the second point as an offset from the first point. The remaining parameters, if present, specify additional X and Y coordinate values, as offsets from each previous end point, following the same format.

The printer uses the current values of color, mix, line type, and line width when drawing the line.

This order updates the current graphics position to the coordinates of the last end point. If there are no offsets in this order, the current graphics position does not change.

Segment Characteristics

04	L1	P1...Pn
----	----	---------

Description: This order is for compatibility with existing products and is a No Operation order.

Set Arc Parameters

22	L1	P1-P8
----	----	-------

Description: This order specifies the parameters for a full arc (circle or ellipse), which the Full Arc orders use.

The center of this circle or ellipse is the origin (coordinate 0,0). The circle or ellipse is drawn in a counterclockwise direction. Parameters P1 to P8 form four two byte values that specify the coordinates of the major and minor axis ends, as follows:

- P1P2 - The X coordinate of the major axis end
- P3P4 - The Y coordinate of the minor axis end
- P5P6 - The X coordinate of the minor axis end
- P7P8 - The Y coordinate of the major axis end.

For an ellipse:

$$(P1P2) \times (P5P6) + (P3P4) \times (P7P8) = 0$$

For a circle of radius r , the parameters are:

$$P1P2 = P3P4 = r, P5P6 = P7P8 = 0$$

For an ellipse with major axis a and minor axis b , the parameters are:

$$P1P2 = a, P3P4 = b, P5P6 = P7P8 = 0$$

For the above ellipse, tilted at an angle A to the X axis, the parameters are:

$$\begin{aligned} P1P2 &= a \cos(A) \\ P3P4 &= b \cos(A) \\ P5P6 &= -b \sin(A) \\ P7P8 &= a \sin(A) \end{aligned}$$

This order does not change any other graphics drawing attributes.

Set Background Mix

0D	P1
----	----

Description: This order sets the value of the background mix. The background mix controls the way the printer combines the color of the background with the color of the graphics medium presentation space. Parameter byte P1 contains the value of the current mix attribute. The only valid values for this byte are:

Byte	Value	Description	Error Code
0	X '0D'	Order code	
1	X '00' X '05'	Background Mix Attribute Drawing default Leave Alone	X '0300..04' X '0300..0E'

Set Character Angle

34	L1	P1-P4
----	----	-------

Description: This order specifies the angle of the baseline of graphics character strings that print using subsequent character string orders. The non-graphics (for example, text) character angle does not change with this order. Angles of 0, 90, 180, and 270 degrees are valid. This order does not change any other graphics drawing order attributes.

Parameters P1 and P2 form a two byte value that specifies the X coordinate. Parameters P3 and P4 form a two byte value that specifies the Y coordinate. To meet the requirement that the angle be 0, 90, 180, or 270 degrees, either the X or the Y coordinate must equal zero, as follows:

Byte	Value	Description	Error Code
0	X '34'	Order code	
1	X '04'	Length	X '0300..03'
2-3	X '8000' -X '7FFF'	Xg Coordinate	X '0334..00'
4-5	X '8000' -X '7FFF'	Yg Coordinate	X '0334..00'

If Xg = 0 and Yg = 0 then the character angle is 0 degrees (default)

If Xg > 0 and Yg = 0 then the character angle is 0 degrees

If Xg = 0 and Yg > 0 then the character angle is 90 degrees

If Xg < 0 and Yg = 0 then the character angle is 180 degrees

If Xg = 0 and Yg < 0 then the character angle is 270 degrees

Note: Exception X '0334..00' applies when both Xg and Yg are non-zero values.

Set Character Cell

33	L1	P1-P4
----	----	-------

or

33	L1	P1-P8
----	----	-------

Description: This order specifies the size of the character cell for output characters with subsequent Character String orders. The character cell size for non-graphics (for example, text) does not change with this order. The Set Character Cell order does not change any other graphics drawing attributes.

There are two types of formats with this order. The first format has a length of 4 and has four parameter bytes. The second format has a length of 8 and has eight parameter bytes.

For both formats, parameters P1P2 form a two byte value that specifies the width of the character in drawing units. Parameters P3P4 form a two byte value that specifies the height of the character in drawing units.

For the second format, the width and height of the character cell contain both integer and fractional values. Parameters P5P6 form a two byte value that specifies the fractional portion of the width of the character in drawing units. Parameters P7P8 form a two byte value that specifies the fractional portion of the height of the character in drawing units. There is an implied decimal point between P1P2 and P5P6, and between P3P4 and P7P8.

The printer pads the standard graphics character cell with spaces to achieve the desired spacing. The printer also adjusts the character size within the specified cell in integer multiples of the standard size graphics character. The minimum character image (resulting from graphics mapping) is the standard size graphics character, even though the scaled character cell may be smaller. In this case, overlapping of characters may occur.

Note: The printer clips the expanded graphics representation of the last vertical column of a downloaded NLQ character (see Load Symbol Sets).

Set Character Direction

3A	P1
----	----

Description: This order sets the value of the character direction attribute. Subsequent strings that print using the Character String order will print in the direction specified relative to the character baseline angle. See "Set Character Angle" on page 109. The character direction for non-graphics (text) does not change with this order. This order does not change any other graphics drawing attributes.

Parameter P1 specifies the direction, as shown:

Hex	Line Type
00	Drawing Default
01	Left to Right
02	Top to Bottom

Hex	Line Type
03	Right to Left
04	Bottom to Top

Set Character Precision

39	P1
----	----

Description: This order sets the value of the current character precision attribute. Parameter P1 specifies the type of precision.

Byte	Value	Description	Error Code
0	X'39'	Order code	
1	X'00' X'01' X'02' X'03'	Precision Type Drawing default String Precision Character Precision Stroke Precision	X'0300..04' X'0300..0E'

Set Character Set

38	P1
----	----

Description: This order sets the value of the current character set attribute. The character set specified by this command must use an NLQ font if printing high-density graphics or a DP font if printing low-density graphics.

Parameter P1 specifies the local character set identifier. This local ID is mapped to a global font ID by the Load Font Equivalence command. See "Load Font Equivalence (LFE)" on page 34.

Byte	Value	Description	Error Code
0	X'38'	Order code	
1	X'00' X'01'-X'FE' X'FF'	Local Character Set ID (LCID) Drawing default Local ID (LCID) for Character Set Special Character Set	X'03C3..00'

Set Color

0A	P1
----	----

Description: This order sets the value of the current graphics color attribute. The color for non-graphics (for example, text) does not change with this order. The color attribute applies to all following graphics drawing orders until another Set Color order or Set Extended Color order occurs or until a new graphics segment initializes the graphics attributes. This order does not change any other graphics drawing attributes.

Graphics Command Set

Parameter P1 specifies the color as follows:

Byte	Value	Description	Error Code
0	X'0A'	Order code	
1	X'00' X'07' X'08'	Color Current default Printer default Color of Medium	X'0300..04'

If the color requested is not available, the printer uses black. If this occurs, the Exception Handling Control determines whether to report this condition. The EHC also determines whether to continue with the Write Graphics command.

For all color selections except the color of the medium, graphics prints in black. These selections overpaints previous graphics (if of a different color) by changing the color of the dots to print. For a color of medium selection, following graphics overpaints previous graphics by deleting (erasing) the dots to print.

Set Current Position

21	L1	P1-P4
----	----	-------

Description: This order sets the current graphics position for a subsequent drawing order. The position for non-graphics (for example, text) does not change.

Parameters P1 and P2 form a two byte value that specifies the X coordinate in drawing units. Parameters P3 and P4 form a two byte value that specifies the Y coordinate in drawing units. The printer resolves the coordinates to the nearest increment of 0.18 mm (0.007 in. [1/144 in.]).

Set Extended Color

26	L1	P1	P2
----	----	----	----

Description: This order functions the same as the Set Color order except that it specifies a length field and the color parameter contains two bytes. The color for non-graphics (for example, text) does not change with this order. This order does not change any other graphics drawing attributes.

This order aids graphics interchange compatibility.

Parameters P1 and P2 form a two byte value that specifies the color, as follows:

Byte	Value	Description	Error Code
0	X'26'	Order code	
1	X'02'	Length	X'0300..03'

Table 86 (Page 2 of 2). Set Extended Color

Byte	Value	Description	Error Code
2	X'0000' X'0007' X'0008' X'FF00' X'FF07' X'FF08'	Extended Color Drawing default White Black Drawing default Printer default (Black) Color of Medium	X'0300..04'

For all color selections except the color of the medium, graphics prints in the selected color. These selections overpaint previous graphics (if of a different color) by changing the color of the dots to be printed. For a color of medium selection, following graphics overpaints previous graphics by deleting (erasing) the dots to print.

Set Fractional Line Width

11	L1	P1	P2
----	----	----	----

Description: The Set Fractional Line Width order sets the line width attribute. This order changes only the line width attribute. The printer uses the last line width received, no matter which order, Fractional Line Width Order or Set Line Width, sets the line width. Parameters P1 and P2 form a two byte sequence that specifies the line width, as follows:

Table 87. Set Fractional Line Width

Byte	Value	Description	Error Code
0	X'11'	Order code	
1	X'02'	Length	X'0300..03'
2-3	X'0000' X'0001'-X'017F' X'0180'-X'FFFF'	Fractional Line Width Current default 1 Pel Wide 2 Pels Wide	X'0300..04' X'0300..0E'

This order aids graphics interchange capability. See also “Set Line Width” on page 114.

Set Line Type

18	P1
----	----

Description: The Set Line Type order sets the value of the current line type attribute. This order does not change any other graphics drawing order attributes.

Parameter P1 specifies the type of line for the graphics output. The following values are valid for P1:

Table 88 (Page 1 of 2). Set Line Type

Byte	Value	Description	Error Code
0	X'18'	Order code	

Table 88 (Page 2 of 2). Set Line Type

Byte	Value	Description	Error Code
1	X'00'	Line Type	X'0300..04' X'0300..0E'
	X'01'	Drawing default	
	X'02'	Dotted Line	
	X'03'	Short Dashed Line	
	X'04'	Dashed and Dotted Line	
	X'05'	Double Dotted Line	
	X'06'	Long Dashed Line	
	X'07'	Dashed Double Dotted Line	
	X'08'	Solid Line	
	X'08'	Invisible Line	

Set Line Width

19	P1
----	----

Description: The Set Line Width order specifies the line width for subsequent graphics. This order changes the fractional line width attribute only. The printer uses the last line width received, no matter which order, Set Fractional Line Width Order or Set Line Width, sets the line width. Parameter P1 specifies the width of the line for the graphics output. The following values are valid for P1:

Table 89. Set Line Width

Byte	Value	Description	Error Code
0	X'19'	Order code	
1	X'00'	Line Width	X'0300..04' X'0300..0E'
	X'01'	Drawing default	
	X'02'	1 Pel Wide (Thin)	
	X'02'-X'FF'	2 Pels Wide (Thick)	

Set Marker Precision

3B	P1
----	----

Description: This order sets the value of the current marker precision attribute. Parameter P1 specifies the type of precision. Precision 2 (character precision) is the only valid type of precision for this printer. P1 must equal 01 or 02.

Table 90. Set Marker Precision

Byte	Value	Description	Error Code
0	X'3B'	Order code	
1	X'00'	Marker Precision	X'0300..04' X'0300..0E'
	X'01'	Drawing default	
	X'02'	String Precision	
	X'03'	Character Precision	
	X'03'	Stroke Precision	

Set Marker Set

3C	P1
----	----

Description: This order sets the value of the current marker symbol set attribute. Parameter P1 specifies the local character set identifier. This printer only uses the default marker set. Thus, P1 must equal 00.

Set Marker Symbol

29	P1
----	----

Description: This order sets the value of the current marker symbol attribute for subsequent markers. See “Marker” on page 106 and “Marker at Current Position” on page 106 orders.

Parameter P1 specifies the marker symbol attribute value. This value determines which marker from the marker symbol set the printer uses for subsequent orders. The following are the marker symbol values:

Hex	Line Type
00	Drawing Default
01	Cross
02	Plus
03	Diamond
04	Square
05	Six Point Star
06	Eight Point Star
07	Filled Diamond
08	Filled Square
09	Dot
0A	Small Circle
40	Blank

Set Mix

0C	P1
----	----

Description: This order sets the value of the current mix attribute. The mix controls the way that the printer combines the color of the foreground with the color of the medium presentation space. Parameter byte P1 contains the value of the current mix attribute. The only valid values for this byte are:

Byte	Value	Description	Error Code
0	X '0C'	Order code	
1	X '00' X '02'	Mix Attribute Drawing default Overpaint	X '0300..04 ' X '0300..0E '

Bar Code Command Set

Set Pattern Set

08	P1
----	----

Description: This order sets the shading pattern attribute for subsequent area shading. For additional information, see “Begin Area” on page 98 and “End Area” on page 3-132.

Parameter P1 sets pattern attribute.

Byte	Value	Description	Error Code
0	X'08'	Order code	
1	X'00'	Drawing Default	X'0368..03'

Set Pattern Symbol

28	P1
----	----

Description: This order sets the value of the current shading pattern attribute for subsequent area shading. For additional information, see “Begin Area” on page 98 and “End Area” on page 3-132.

Parameter P1 specifies the pattern attribute value. This value determines which particular pattern from the pattern symbol set the printer uses to shade (fill) the interior of subsequent areas. The pattern attribute values are:

Byte	Value	Description	Error Code
0	X'28'	Order code	
1	X'00' X'01'-X'08' X'09' X'0A' X'0B' X'0C' X'0D' X'0E' X'0F' X'10' X'40'	Pattern Symbol ID Use Drawing default Decreasing Density Vertical Lines Horizontal Lines Diagonal Lines 1 (Bot L/Top R) Diagonal Lines 2 (Bot L/Top R) Diagonal Lines 1 (Top L/Bot R) Diagonal Lines 2 (Top L/Bot R) No Shading Solid Shading Blank	X'0368..04'

Bar Code Command Set

The bar code command set contains the commands and controls for presenting bar code information on a logical page, a page segment, or an overlay area on the physical medium. The following commands are the bar code command set:

Table 94. Bar Code Commands			
Name	Command	Sub-command	Description
Write Bar Code Control	X ' D680 '		See "Write Bar Code Control (WBCC)" on page 117
Bar Code Area Position		X ' AC6B '	See "Bar Code Area Position (BCAP)" on page 118
Bar Code Output Control		X ' A66B '	See "Bar Code Output Control (BCOC)" on page 120
Bar Code Data Descriptor		X ' A6EB '	See "Bar Code Data Descriptor (BCDD)" on page 121
Write Bar Code	X ' D681 '		See "Write Bar Code (WBC)" on page 126

Write Bar Code Control (WBCC)

Length	D680	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

BCAP	BCOC	BCDD
------	------	------

The Write Bar Code Control command causes the printer to enter the bar code object state in the current page, overlay, or page segment state. The parameters of this command define the size, placement, and orientation of the bar code object. Parameters in this command also establish the initial conditions for interpreting the bar code data.

Note: The quality of the bar code output is affected by the graphics and bar code density parameter values selected at the operator panel. For configuration settings, refer to your *Setup Guide*.

A bar code object contains one or more bar code symbols with or without human readable interpretation of the bar encoded information. Because an important application of bar code printing is printing bar code symbols on labels, means are provided in the command set to repeat symbols. The repeated symbols must be of the same type, but the length and content of the variable data can be different. General parameters applying to all the repeated symbols are in a single Write Bar Code Control command. Parameters that always change or can change from symbol to symbol are in the Write Bar Code command. A separate Write Bar Code command must be used with the variable bar code data for each symbol.

Upon receiving the Write Bar Code Control command, the printer enters the appropriate bar code object state. The printer then initializes control for processing bar code symbols in subsequent Write Bar Code commands. Receiving the End Code in the bar code object state terminates the processing of bar code data.

The Write Bar Code Control command data contains either two or three consecutive structured fields:

- Bar Code Area Position (BCAP)
- Bar Code Output Control (BCOC) (Optional)

Bar Code Command Set

- Bar Code Data Descriptor (BCDD).

Each structured field contains a two byte length field, then a two byte structured field ID, and finally a data field.

Bar Code Area Position (BCAP)

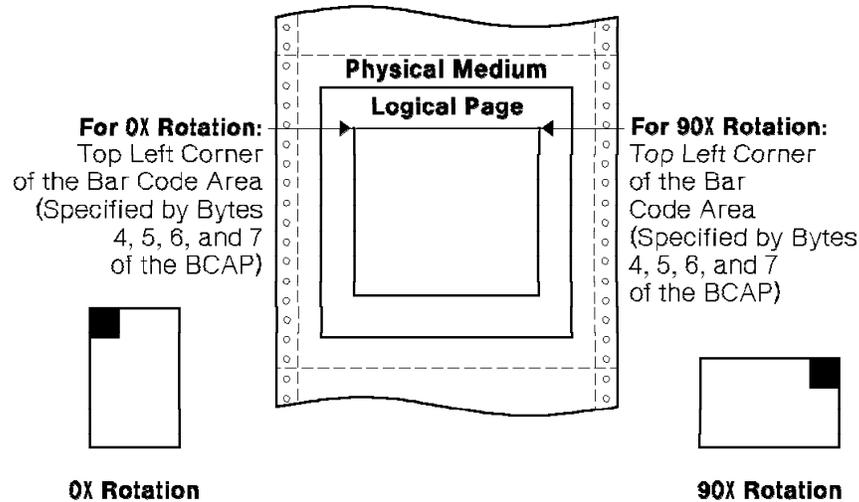
BCAP	BCOC	BCDD
------	------	------

Length	ID	Data
--------	----	------

The Bar Code Area Position Control structured field is the first structured field in the DATA portion of the Write Bar Code Control command. This field defines the origin and orientation of the bar code object relative to the reference coordinate system. The format of the BCAP field is:

Data Area	Value	Description	Error Code
0-1	X'000B'-X'xxxx'	Length of Bar Code Area Position (BCAP)	X'0202..05'
2-3	X'AC6B'	Structured Field ID	X'020B..05'
4-5	X'8000'-X'7FFF'	Bar Code Object Origin Xp, I, or I-Offset coordinate position (in 1440ths)	X'0411..00'
6-7	X'8000'-X'7FFF'	Bar Code Object Origin Yp, B, or B-Offset coordinate position (in 1440ths)	X'0411..00'
8-9	X'0000' X'2D00' X'5A00' X'8700'	Orientation Of Bar Code Object 0 degrees 90 degrees 180 degrees 270 degrees	X'0203..05'
10	X'00' X'20' X'40' X'60' X'A0'	Coordinate Reference System Absolute I, Absolute B Absolute I, Relative B Relative I, Absolute B Relative I, Relative B Page Xp, Yp	X'0204..05'
11-n		Ignored	

Figure 22 shows the BCAP field specifying the top left reference point, or origin, for the bar code object, relative to the logical page. The figure shows 0-degree and 90-degree rotations; the printers also support 180-degree and 270-degree rotations.



Area Position Field

Figure 22. Specifying the Bar Code Object Using the Bar Code

Byte 10 of the BCAP specifies the reference coordinate system. The reference coordinate system for determining the top left corner of the bar code area can be either the X,Y or the I,B coordinate system.

If byte 10 equals X'00', the absolute I and B coordinates determine the top left corner. BCAP bytes 4 and 5 specify the text inline coordinate. BCAP bytes 6 and 7 specify the text baseline coordinate.

If byte 10 equals X'20', the absolute I and relative B coordinates determine the top left corner. BCAP bytes 4 and 5 specify the text inline coordinate. BCAP bytes 6 and 7 add to the last text baseline coordinate position prior to bar codes.

If byte 10 equals X'40', the relative I and absolute B coordinates determine the top left corner. BCAP bytes 4 and 5 add to the last text inline coordinate position prior to bar codes. BCAP bytes 6 and 7 specify the text baseline coordinate.

If byte 10 equals X'60', the relative I and B coordinates determine the top left corner. BCAP bytes 4 and 5 add to the last text inline coordinate position prior to bar codes. BCAP bytes 6 and 7 add to the last text baseline coordinate position prior to bar codes.

If byte 10 equals X'A0', the current logical page X and Y coordinates determine the origin. When the object is within a page, BCAP bytes 4-7 specify the offset from the X-coordinate and Y-coordinate origin specified in a previously received LPP command (or from the printer default coordinates if no LPP command received). When the object is within an overlay that is invoked using an LCC command, BCAP bytes 4-7 specify the offset from the X_m-coordinate and Y_m-coordinate origin. When the object is within an overlay that is invoked using an IO command, BCAP bytes 4-7 specify the offset from the X-coordinate and Y-coordinate origin specified in the IO command.

Bar Code Output Control (BCOC)

BCAP	BCOC	BCDD
------	------	------

Length	ID	Data
--------	----	------

The Bar Code Output Control structured field is the second structured field in the DATA portion of the Write Bar Code Control command. This structured field specifies the mapping option for the bar code object. This structured field is optional and may not be present in the Write Bar Code Control command. The format of the BCOC field is:

<i>Table 96. Bar Code Output Control</i>			
Data Area	Value	Description	Error Code
0-1	X'0010' - X'xxxx'	Length of Bar Code Output Control (BCOC)	X'0202..05'
2-3	X'A66B'	Structured Field ID	X'020B..05'
4	X'00'	Unit Base (Measurement Units) Unit Base is 10 Inches	X'0205..05'
5-6	X'3840' X'0960'	L-Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0206..05'
7-8	X'0001' - X'7FFF' X'FFFF'	X Extent of Bar Code Object in L-units <i>See "Notation Conventions" on page 27</i> Use Logical Page Descriptor Value	X'0207..05'
9-10	X'0001' - X'7FFF' X'FFFF'	Y Extent of Bar Code Object in L-units <i>See "Notation Conventions" on page 27</i> Use Logical Page Descriptor Value	X'0207..05'
11	X'30'	Mapping Control Option (Position)	X'0208..05'
12-13	X'8000' - X'7FFF'	X Offset L-units <i>See "Notation Conventions" on page 27</i>	X'0209..05'
14-15	X'8000' - X'7FFF'	Y Offset L-units <i>See "Notation Conventions" on page 27</i>	X'0209..05'
16-n		Ignored	

Figure 23 shows the BCOC field specifying the size of the bar code object on the logical page.

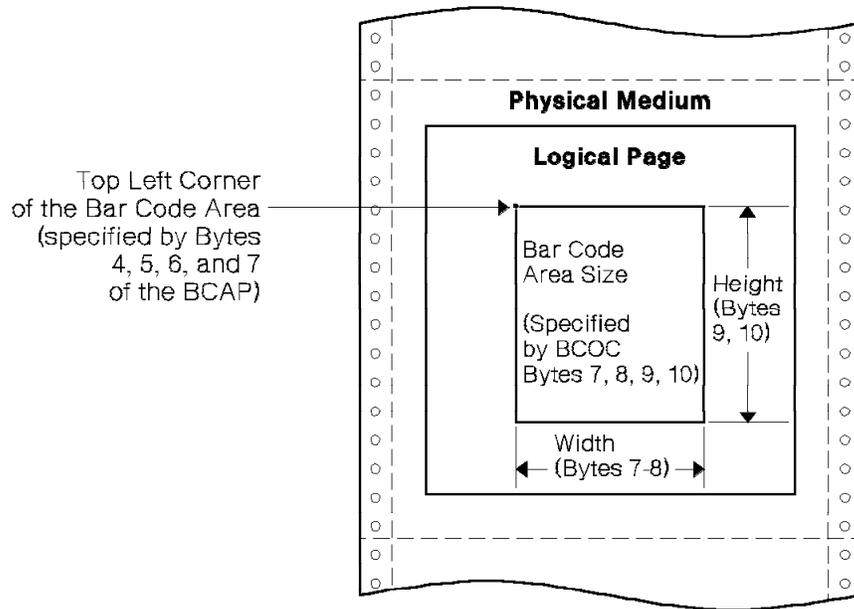


Figure 23. Specifying the Bar Code Object Size Using the Bar Code Output Control

Bar Code Data Descriptor (BCDD)

BCAP	BCOC	BCDD
------	------	------

Length	ID	Data
--------	----	------

The Bar Code Data Descriptor structured field is the last structured field in the Data portion of the Write Bar Code Control command. This field specifies the parameters that define the bar code symbols that prints. The format of the BCDD field is:

Table 97 (Page 1 of 2). Bar Code Data Descriptor			
Data Area	Value	Description	Error Code
0-1	X'001B' - X'xxxx'	Length of Bar Code Data Descriptor (BCDD)	X'0202..05'
2-3	X'A6EB'	Structured Field ID	X'020B..05'
4	X'00'	Unit Base (Measurement Units) Unit Base is 10 Inches	X'0205..05'
5	X'00'	Reserved	
6-7	X'3840' X'0960'	L-Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0206..05'
8-9	X'3840' X'0960'	L-Units per Unit Base 14400 L-units per 10 inches 2400 L-units per 10 inches	X'0206..05'
10-11	X'0001' - X'7FFF' X'FFFF'	X Extent of Bar Code Presentation Space in L-units. See "Notation Conventions" on page 27. Use BCOC X Extent	X'0207..05'

Bar Code Command Set

<i>Table 97 (Page 2 of 2). Bar Code Data Descriptor</i>			
Data Area	Value	Description	Error Code
12-13	X'0001' - X'7FFF' X'FFFF'	Y Extent of Bar Code Presentation Space in L-units. See "Notation Conventions" on page 27. Use BCOC Y Extent	X'0207..05'
14-15	X'0000'	Reserved	
16		Bar Code Type. See "Bar Code Type, Name, and Modifier Description and Values" on page 125	X'0403..00'
17		Bar Code Modifier. See "Bar Code Type, Name, and Modifier Description and Values" on page 125	X'040B..00'
18	X'01' - X'FE' X'FF'	Font Local ID Default Local Font ID (OCR-A, B or Code 128 determined by Bar Code Type - Byte 16) Note 1	X'0404..00'
19-20	X'0000' X'0008' X'FF00' X'FF07' X'FF08' X'FFFF'	Bar Code Color Printer Default (Black) Black Printer Default (Black) Printer Default (Black) Color of Medium Printer Default	X'0405..00'
Byte 21	X'11' X'15' X'19' X'23' X'26' X'31' X'36' X'3F' X'47' X'FF'	Unit Module Width 0.017" BCAP Orientation 0/90/180/270 0.021" BCAP Orientation 0/180 UPC only 0.025" BCAP Orientation 0/180 UPC only 0.035" BCAP Orientation 90/270 0.038" BCAP Orientation 0/180 0.049" BCAP Orientation 90/270 0.054" BCAP Orientation 0/180 0.063" BCAP Orientation 90/270 0.071" BCAP Orientation 0/180 Default (0.017 Inches)	X'0406..00' Note 2
Byte 22-23	X'0001' - X'7FFF' X'FFFF'	Element Height in L-units See "Notation Conventions" on page 27 Printer Default as specified by Bar Code Type in Byte 16	X'0407..00'
Byte 24	X'01'-X'FF'	Height multiplier	X'0408..00'
Bytes 25-26	X'0000' X'0002' X'0003' X'0014' to X'001E' X'00C8' to X'012C' X'FFFF'	Wide-To-Narrow Ratio (WE NE) WE NE Not Applicable Note 3 2:1 Note 4 3:1 2.0:1 - 3.0:1 2.00:1 - 3.00:1 Printer Default as specified by Bar Code Type (Byte 16) Note 5	X'0409..00'
Byte 27-end		Ignored	

Notes:

1. The Font Local ID specified in BCDD Byte 18 should be OCR-A, OCR-B or Code 128 dependent on the Bar Code Type specified in BCDD Byte 16. The default Font Local ID and Bar Code Type relationships are as follows:

Table 98. Bar Code Default Font ID

OCR-A	OCR-B	Code 128
Code 3 of 9 MSI 2 of 5 Industrial 2 of 5 Matrix 2 of 5 Interleaved Codabar	UPC-A UPC-E UPC 2-Digit Add-on UPC 5-Digit Add-on EAN-8 EAN-13 EAN 2-Digit Add-on EAN 5-Digit Add-on	Code 128

2. Error code X'0406..00' is specified for BCDD Byte 21 (Unit Module Width) only for selections which are not listed in the support table in "Unit Module Sizes for Normal (Non-Rotated) Bar Codes." UMW does not apply to Postnet.
3. Wide-to-Narrow Ratio (BCDD Bytes 25-26) is only valid for the following Bar Code Types:
 - X'01' 3 of 9
 - X'02' MSI
 - X'0A' 2 of 5 Industrial
 - X'0B' 2 of 5 Matrix
 - X'0C' Interleaved 2 of 5
 - X'0D' Codabar
4. WE|NE ratios given in the description are the requested values. See "Unit Module Sizes for Normal (Non-Rotated) Bar Codes" for the actual value granted by the printer.
5. Default wide-to-narrow ratio for the affected bar code is the smallest unit module width valid for the pel density being used.

Unit Module Sizes for Normal (Non-Rotated) Bar Codes

Table 99. Unit Module Sizes for non-Rotated Bar Codes

Unit Module Width	Narrow Element Width	Wide Element Width	WE NE Requested (BCDD Bytes 25-26)	WE NE Granted	Contrast
17	16.67	33.33	2.00	2.00	HL
17	16.67	41.67	2.50	2.50	H
17	16.67	50.00	3.00	3.00	HL
38	33.33	66.66	2.33	2.00	L
38	33.33	75.00	2.33	2.25	H
38	33.33	83.33	2.78	2.50	L
38	33.33	91.66	2.78	2.75	H
54	50.00	116.50	2.33	2.33	HL
54	50.00	127.00	2.54	2.50	H
54	50.00	150.00	2.85	3.00	HL
71	66.67	150.01	2.40	2.25	HL

Unit Module Sizes for Rotated Bar Codes

Note: H=120H x 72V PQC setting and L=60H x 72V PQC setting except for UPC type 90 and 270 degree orientations where both H and L=120H x 144V.

Unit Module Sizes for 90-Degree and 270-Degree Bar Codes

<i>Table 100. Unit Module Sizes for 90-degree and 270-degree orientation Bar Codes</i>					
Unit Module Width	Narrow Element Width	Wide Element Width	Wide-to-Narrow Ratio	Contrast	
17	17.36	38.19	2.20	H	
17	17.36	45.17	2.60	HL	
17	17.36	52.08	3.00	HL	
35	31.24	69.67	2.33	HL	
35	31.24	86.85	2.78	HL	
49	45.12	100.62	2.14	HL	
49	45.12	100.62	2.23	HL	
49	45.12	100.62	2.43	HL	
49	45.12	114.60	2.71	L	
49	45.12	121.37	2.71	H	
63	59.01	142.21	2.23	L	
63	59.01	142.21	2.23	H	

Unit Module Sizes for 0-Degree and 180-Degree Bar Codes

<i>Table 101. Unit Module Sizes for 0-degree and 180-degree orientation UPC type Bar Codes</i>						
Unit Module Width	1x	2x	3x	4x	Contrast	Rotation
17	16.67	33.33	50.00	66.67	LH	0, 180
25	25.00	50.00	75.00	100.00	H	0, 180
21	20.82	41.64	62.46	83.28	HL	90, 270

Notes:

1. The meaning of byte 17 (modifier byte) is dependent upon the bar code type. For the meaning of this byte, see “Bar Code Type, Name, and Modifier Description and Values” on page 125.
2. BCDD bytes 18 and 21-26 and WBC command byte 0 are not applicable to Postnet. The Postnet specification defines values for these parameters.
3. H=120H x 72V PQC setting and L=60H x 72V PQC setting.

Bar Code Type, Name, and Modifier Description and Values

The 4234 emulation accepts Bar Code 128 Character Set with modifier X'01'.
The meaning of the modifier byte is dependent upon the bar code type, as follows:

<i>Table 102 (Page 1 of 2). Bar Code Type and Modifier Description and Values</i>			
Bar Code Type (BCDD Byte 16)	Bar Code Name	Bar Code Modifier (Byte 17)	Description
X'01'	3 of 9 Code, AIM USS-39	X'01'	Print Bar Code with no Printer-Generated Check Character.
		X'02'	Generate Check Character and Print with Bar Code.
X'02'	MSI	X'01'	Print Bar Code with no Printer-Generated Check Character.
		X'02'	Print Bar Code with IBM Modulus 10 Check Digit Generated by Printer and Put at End of Data.
		X'03'	First check digit IBM Modulus 10.
		X'04'	First check digit NCR Modulus 11. Check digit equals remainder. Check digit of 10 equals error.
		X'05'	First check digit IBM Modulus 11. Check digit equals remainder. Check digit of 10 equals error.
		X'06'	First check digit NCR Modulus 11. Check digit equals 11 minus remainder. Check digit of 10 equals zero.
		X'07'	First check digit IBM Modulus 11. Check digit equals 11 minus remainder. Check digit of 10 equals error.
		X'08'	First check digit NCR Modulus 11. Check digit equals 11 minus remainder. Check digit of 10 equals error.
X'09'	First check digit IBM Modulus 11. Check digit equals 11 minus remainder. Check digit of 10 equals error.		
X'03'	UPC/CGPC Version A	X'00'	Generate check digit and Print standard symbol.
X'05'	UPC/CGPC Version E	X'00'	Print bar code. Six digits are encoded.
X'06'	UPC 2-Character Supplemental (Periodicals)	X'00'	Print the 2 supplemental digits (bar/space pattern and HRI) above the symbol.
X'07'	UPC 5-Character Supplemental (Paperbacks)	X'00'	Print the 5 supplemental digits (bar and space pattern and HRI) above the symbol.
X'08'	EAN-8 (JAN Short)	X'00'	Print bar code symbol. Input variable data is 7 digits (2 flag and 5 article ID digits).
X'09'	EAN-13 (JAN Standard)	X'00'	Print bar code symbol. Input variable data is 12 digits (2 flag and 10 article ID digits).
X'0A'	2 of 5 Industrial	X'01'	Print bar code with no printer-generated check character.
		X'02'	Generate check character and print with bar code.

Bar Code Command Set

<i>Table 102 (Page 2 of 2). Bar Code Type and Modifier Description and Values</i>			
Bar Code Type (BCDD Byte 16)	Bar Code Name	Bar Code Modifier (Byte 17)	Description
X'0B'	2 of 5 Matrix	X'01'	Print bar code with no printer-generated check character.
		X'02'	Generate check character and print with bar code.
X'0C'	Interleaved 2 of 5, AIM USS-I 2/5	X'01'	Print bar code with no printer-generated check character.
		X'02'	Generate check character and print with bar code.
X'0D'	Codabar, 2 of 7 Code, AIM USS-Codabar	X'01'	Print bar code with no printer-generated check character.
		X'02'	Generate check character and print with bar code.
X'11'	Code 128, AIM USS-128	X'02'	Generate check character and print with bar code.
X'16'	EAN 2 Digit Add-on	X'00'	Print the 2 digit add-on (bar/space pattern and HRI) above the symbol.
X'17'	EAN 5 Digit Add-on	X'00'	Print the 5 digit add-on (bar and space pattern and HRI) above the symbol.
X'18'	Postnet	X'00'	USPS Specification Print 5 digit Postnet "Zip Code" bar code with leading frame bar and trailing correction digit and frame. Print 9 digit Postnet "Zip + 4" bar code with leading frame bar and trailing correction digit and frame. Print 11 digit Postnet "ABC" bar code with leading frame bar and trailing correction digit and frame. Print variable length data Postnet bar code with leading frame bar and trailing correction digit and frame. Data length checking is not performed with modifier X'03'.
		X'01'	
		X'02'	
		X'03'	
X'19'	RM4SCC (Royal Mail 4 State Customer Code)	X'00'	Variable Length Data. Printer generates Start bit, Checksum Character, and Stop bit. Checksum algorithm is performed on the data characters only. Application software is responsible for 2mm quiet zone (all around) and proper sequencing of the Postal Code data which includes International Prefix, Outward Code, Inward Code, and Delivery Point Suffix.

Write Bar Code (WBC)

Length	D681	Flag	Correlation ID (Optional)	Data
--------	------	------	---------------------------	------

The Write Bar Code command transmits data that is processed into a bar code symbol and then outputs the symbol. This command contains parameters that locate the symbol reference point within the bar code object area. The WBC command also contains the variable bar code data for printing as bar/space patterns and information about printing the code in human readable form.

A flag byte contains information as to whether a human readable interpretation (HRI) is to print, whether the HRI is to be above or below the bar/space patterns, and for the 3 of 9 code, whether the HRI of the start/stop character (a star or asterisk) is to print or not.

The HRI code prints in the OCR-A or the OCR-B font, depending on the bar code type. The following bar codes print the HRI in OCR-A:

- Code 3 of 9
- MSI
- 2 of 5 Industrial
- 2 of 5 Matrix
- 2 of 5 Interleaved
- Codabar.

The following bar codes print the HRI in OCR-B:

- UPC-A
- UPC-E
- UPC Two Digit Add-On
- UPC Five Digit Add-On
- EAN-8
- EAN-13
- EAN Two Digit Add-On
- EAN Five Digit Add-On.

Code 128 prints Code 128 Character set

POSTNET bar codes have no HRI.

The Data field for the WBC command has the following format:

<i>Table 103. Write Bar Code</i>				
Data Area	Value	Description	Error Code	
0	Bit 0	0	HRI Printing	X'0410..00'
		1	No HRI	
	Bits 1-2	00	HRI Location Printer Default (Below symbol)	
		01	Below symbol (Except UPC/EAN with 2 or 5 digit add-on)	
10		Above symbol (Except UPC-A, UPC-E, EAN-8, and EAN-12)		
	Bit 3	0	Start/Stop HRI for 3 of 9 Code (Asterisk)	
		1	Do not print HRI for 3 of 9 Start/Stop pattern Print HRI for 3 of 9 Start/Stop pattern	
	Bits 4-7	Reserved for 4224 (PC ASCII version)		
	Bits 5-6	Reserved (Ignore)		
1-2	X'0001' - X'7FFF'	X Coordinate of the symbol Origin See "Notation Conventions" on page 27.	X'040A..00'	
1-2	X'0001' - X'7FFF'	Y Coordinate of the symbol Origin. See "Notation Conventions" on page 27.	X'040A..00'	
5-End		Data to be bar encoded	X'040C..00'	

Notes:

1. If bar codes with human readable interpretation (HRI) are placed too close to the page edges, the human readable characters may fall outside the physical medium boundaries. If the HRI falls outside the physical medium boundaries, the characters may not print.

To ensure that the human-readable characters print, choose X and Y parameter values that allow sufficient space for the characters to print.

Some guidelines are:

For bar code types UPC-A, UPC-E, EAN-8, and EAN-13, choose X and Y coordinates that place the bar code at least 1/6-inch. from both the top and left edges of the page.

For bar code types UPC Two Digit Add-On and UPC Five Digit Add-On, choose a Y coordinate that places the bar code at least 1/6-inch. from the top edge of the page.

For Codabar bar codes, the data must include the START and STOP characters.

For Code 128 bar codes, the table on the following page should be used to determine the hex value of the desired character.

2. The symbol reference point must be inside the bar code medium presentation space and must lie within the logical page.

Code 128 Character Set (EBCDIC)

HEX DIGITS 1ST → 2ND ↓	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0	NUL SE010000	DLE SE170000			(SP) SP010000	& SM030000	- SP100000					^ SD150000	{ SM110000	} SM140000	\ SM070000	0 ND100000
-1	SOH SE020000	DC1 SE180000					/ SP120000		a LA010000	j LJ010000	~ SD190000		A LA020000	J LJ020000		1 ND010000
-2	STX SE030000	DC2 SE190000	FS SE350000	SYN SE230000					b LB010000	k LK010000	s LS010000		B LB020000	K LK020000	S LS020000	2 ND020000
-3	ETX SE040000	DC3 SE200000							c LC010000	l LL010000	t LT010000		C LC020000	L LL020000	T LT020000	3 ND030000
-4									d LD010000	m LM010000	u LU010000		D LD020000	M LM020000	U LU020000	4 ND040000
-5	HT SE100000		LF SE110000						e LE010000	n LN010000	v LV010000		E LE020000	N LN020000	V LV020000	5 ND050000
-6		BS SE090000	ETB SE240000						f LF010000	o LO010000	w LW010000		F LF020000	O LO020000	W LW020000	6 ND060000
-7			ESC SE280000	EOT SE050000					g LG010000	p LP010000	x LX010000		G LG020000	P LP020000	X LX020000	7 ND070000
-8		CAN SE250000							h LH010000	q LQ010000	y LY010000		H LH020000	Q LQ020000	Y LY020000	8 ND080000
-9		EM SE260000						` SD130000	i LI010000	r LR010000	z LZ010000		I LI020000	R LR020000	Z LZ020000	9 ND090000
-A						! SP020000	:	SP130000					[SM060000		FN2 SE400000	FN3 SE410000
-B	VT SE120000				. SP110000	\$ SC030000	, SP080000	# SM010000] SM080000			
-C	FF SE130000			DC4 SE210000	< SA030000	* SM040000	% SM020000	@ SM050000								
-D	CR SE140000	GS SE360000	ENQ SE060000	NAK SE220000	(SP060000) SP070000	_ SP090000	' SP050000								
-E	SO SE150000	RS SE370000	ACK SE070000		+ SA010000	; SP140000	> SA050000	= SA040000					FN4 SE420000			
-F	SI SE160000	US SE380000	BEL SE080000	SUB SE270000	 SO130000		? SP150000	" SP040000	FN1 SE390000							DEL SE330000

Code Page 01303

Figure 24. Code 128 Character Set (EBCDIC)

Note: All START, STOP, SHIFT, and CODE characters are generated by the printer in order to produce the shortest bar code possible from the given data.

Overlay Command Set

The overlay command set contains the commands the printer uses to store, delete, and present information in the overlay memory of the printer. These commands are independent of any specific data types used in defining the overlay.

The overlay is contained between the Begin Overlay (BO) command and the End Page (EP) command and cannot contain itself. Overlays can be nested; that is, overlays can contain other overlays. The depth of the overlay nesting cannot exceed five levels.

Figure 25 shows an overlay nesting.

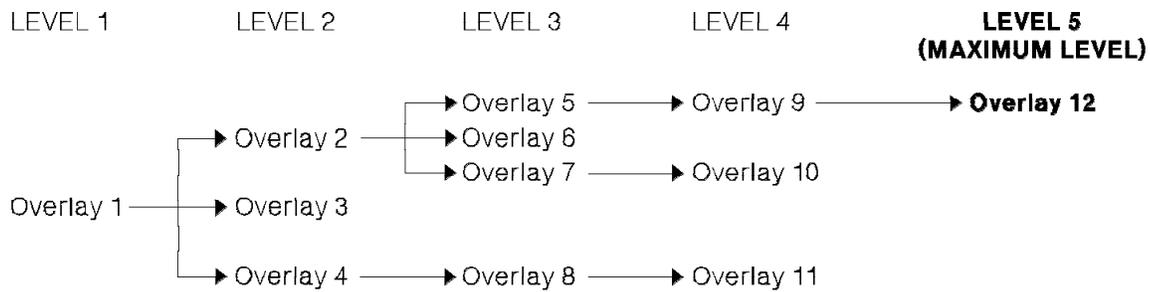


Figure 25. An Example of Overlay Nesting

The following commands are the overlay command set: The following pages describe the overlay command set commands.

Table 104. Overlay Command Set

Name	Command	Sub-command	Description
Begin Overlay	X 'D6DF'		
Deactivate Overlay	X 'D6EF'		
Include Overlay	X 'D67D'		

Notes:

- 64XX does not support Secure Overlay (value X '01' in byte 2 of Include Overlay is not supported).
- See "Notation Conventions" on page 27 regarding the notation convention for Include Overlay bytes 3-5 and 7-9.

Begin Overlay (BO)

Length	D6DF	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Begin Overlay command causes the printer to leave the home state and enter the overlay state. This command defines data that the printer saves for later use within an overlay. The printer later merges the stored overlay with ordinary printed pages by using the Include Overlay command or the Load Copy Control command. The current Logical Page Description, Load Font Equivalence, and Load Equivalence records, if any, become part of the definition of the overlay. The definition of the overlay terminates by an End Page command. The overlay itself is between the Begin Overlay and the End Page commands.

The Data field is one byte and it specifies the overlay ID. Valid values for this byte are decimal 1 through 254 (X'1' through X'FE'). If this value specifies an overlay identifier already loaded in the printer, an exception occurs.

Note: Because overlays use more than the normal amount of printer storage, use overlays only when data needs to be kept.

Delete Overlay (DO)

Length	D6EF	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Delete Overlay command deletes (clears) either a single overlay or all overlays from the printer memory.

The DATA field is one byte in length and can be any value between 0 and 254 (X'00' to X'FE'). This value is the overlay identifier, and it specifies the overlay to be deleted. If this value is zero, all overlays are deleted.

Include Overlay (IO)

Length	D67D	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Include Overlay command causes a previously-stored overlay to merge onto the current page at the specified presentation position. Following the inclusion and processing of an overlay, the current print position remains where it was prior to the overlay processing. The printer restores all page description values, font and suppression equivalences, and text control values to the values that existed for each at the time the overlay was processed.

The DATA field is 10 bytes in length, and contains the following:

<i>Table 105 (Page 1 of 2). Data Field-Include Overlay Command</i>		
Byte	Value	Description
0-1	0001 - 00FE	Overlay ID
2	00	Reserved

<i>Table 105 (Page 2 of 2). Data Field-Include Overlay Command</i>		
Byte	Value	Description
3-5	000000 - 007FFF FF8000 - FFFFFE FFFFFF	X Coordinate Positive Offset Value Relative to the Logical Page Negative Offset Value Relative to the Logical Page Use the Current Inline Text Position
6	00	Reserved
7-9	000000 - 007FFF FF8000 - FFFFFE FFFFFF	Y Coordinate Positive Offset Value Relative to the Logical Page Negative Offset Value Relative to the Logical Page Use the Current Baseline Text Position

Note: Negative values must be specified in twos-complement form.

Page Segment Command Set

The page segment command set contains the commands that the printer uses to store, delete, and present information in the page segment memory of the printer. These commands are independent of any specific data types defining the page segment. The following commands are the page segment command set:

<i>Table 106. Page Segment Command Set Commands</i>			
Name	Command	Sub-command	Description
Begin Page Segment	X 'D65F'		
Deactivate Page Segment	X 'D66F'		
Include Page Segment	X 'D67F'		

The following pages describe the page segment command set commands.

Begin Page Segment (BPS)

Length	D65F	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Begin Page Segment command causes the printer to enter the page segment state. This command is only valid in the home state. Receipt of an End Page command while in the page segment state causes the printer to return to the home state.

The Page Segment command defines a segment of page data to save within the printer for later printing. This printer later includes this segment when it receives the Include Page Segment command.

The DATA field is two bytes in length and can be any value between X'01' and X'7F'. This value is the page segment identifier. If this value specifies a page segment identifier already loaded in the printer, an exception occurs.

Note: Because page segments use more than the normal amount of printer storage, use page segments only when data needs to be kept.

Include Page Segment (IPS)

Length	D67F	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Include Page Segment command causes a previously stored set of commands to process in the input data stream as though they were just received from the host. The printer places the segment at the current presentation position and updates the presentation position as a result of this command.

The DATA field is two bytes in length and can be any value between X'01' and X'7F'. This value is the page segment identifier, and it specifies the page segment to include. A value specifying a page segment identifier that is not defined in the printer causes an exception to occur.

Delete Page Segment (DPS)

Length	D66F	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Delete Page Segment command deletes (clears) either a single page segment or all page segments from the printer memory.

The DATA field is two bytes in length and can be any value between X'00' and X'7F'. This value is the page segment identifier, and it specifies the page segment to delete. A value of zero deletes all segments.

Delete Font (DF)

Length	D64F	Flag	Correlation ID (Optional)	DATA
--------	------	------	---------------------------	------

The Delete Font command provides a means for the control unit to delete one or more fonts from the printer. The DATA field contains the following information:

Byte	Value	Description
0	11 1E 1F	Deletion Type Delete the Single Byte Font Specified in Bytes 1-2 Delete All Fonts Delete All Fonts
1-2	0001-7EFF	Loaded Font Identifier (Ignored if Deletion Type Equals 1E or 1F)
3	00	Reserved
4-5	0000	Reserved

Chapter 4. IPDS Command Differences

Under the IPDS Emulation Mode configuration menu, you can select either 4234 (default) or 6408. You select the 6408 mode when you are using this printer with IPDS and PSF/MVS. The following information describes how specific IPDS commands function differently when IPDS Emulation Mode is set to 6408.

For detailed information on all IPDS commands, please read Chapter 3, "IPDS Commands Reference" on page 23.

Load Font Equivalence

<i>Table 108. 4234 Emulation Load Font Equivalence X'D63F'</i>			
Data Area	Value	Description	Error Code
Byte 0	X'00' - X'FE' X'FF'	LOCAL-FONT ID	X'0218..02' X'0219..02'
Bytes 1-2	X'0001' - X'7EFF'	FONT HOST ASSIGNED ID	X'0218..02'
Bytes 3 - 4	X'0000' X'5A00'	FONT INLINE SEQUENCE 0 Degrees 180 Degrees	X'0247..02'
Bytes 5 - 6		GCSGID (Ignored)	
Bytes 7 - 8	X'xxxx' X'FFFF'	CPGID	X'021D..02'
Bytes 9 - 10	X'xxxx' X'FFFF'	FGID	X'021D..02'
Bytes 11 - 12	X'0000'	Reserved	
Byte 13	X'00'	Reserved	
Byte 14	Bit 0 0/1 Bit 1 00 Bit 2 00 Bit 3 0/1 Bit 4 0/1 Bit 5 0/1 Bit 6 0/1 Bit 7 0/1	FONT ATTRIBUTES Symbol Set Font present in Printer = 1 Reserved Double High = 1 Italicized = 1 Double Strike = 1 Bold = 1 Double Wide = 1	
Byte 15	X'00'	Reserved	
Bytes 16-n		Additional LFE ENTRIES	X'023A..02'

Sense Type and Model

Only the modified command set vector tables are described here. The changes are:

- Device and Model
- Loaded Font Command set vector (LF2 support) is not reported in the STM.

Table 109. Sense Type and Model

Special Data Area	Value	Description
Byte 0	X'FF'	System/370 convention
Bytes 1-2	X'64xx'	PRODUCT CODE
Byte 3	X'01'	MODEL CTA
Bytes 4-5	X'0000'	Reserved

XOH OPC Printable Area SDF

Table 110. Printable Area

Special Data Area	Value	Description
Bytes 0-1	X'0018'	LENGTH of this Self Defining Field
Bytes 2-3	X'0001'	PRINTABLE AREA Self Defining Field ID
Byte 4	X'00'	DEFAULT INPUT MEDIA SOURCE
Byte 5	X'00'	Reserved
Byte 6	X'00'	UNIT BASE 10 inches
Byte 7	X'00'	Reserved
Bytes 8-9	X'3840'	L-units per UNIT BASE
Bytes 10-11	X'13B0' - X'4C80'	WIDTH of the physical medium in L-units (+Xm direction) <i>Does NOT include width of carrier strip for continuous forms media.</i>
Bytes 12-13	X'000A' - X'7FFF'	LENGTH of the physical medium in L-units (+Ym direction)
Bytes 14-15	X'0000'	Xm OFFSET of the Printable Area in L-units
Bytes 16-17	X'0000'	Ym OFFSET of the Printable Area in L-units <i>All Forms Devices</i>
Bytes 18-19	X'13B0' - X'4A40'	Xm EXTENT of the Printable Area in L-units
Bytes 20-21	X'000A' - X'7FFF'	Ym EXTENT of the Printable Area in L-units
Bytes 22-23	Bit 0 0 Bit 1 01 Bit 2 01 Bit 3 1 Bit 4 0 Bit 5 0 Bit 6 0 Bits 7-15 00000000	INPUT MEDIA SOURCE CHARACTERISTICS 0 = Simplex 01 = Continuous Forms 1 = Bin Available 0 = Retired 0 = No Envelopes 0 = Auto Media Feed Reserved

XOH OPC RRL Resource Type and ID Format SDF

<i>Table 111. RRL Resource Type and ID Format</i>		
Special Data Area	Value	Description
Bytes 0-1	X'0008'	LENGTH of this Self Defining Field
Bytes 2-3	X'000A'	RRL RESOURCE TYPE Self Defining Field
Bytes 4-5	X'0100'	Singe byte LF2 coded fonts as Host Assigned Resource ID.
Bytes 6-7	X'FF00'	ALL RESOURCES as Host Assigned Resource ID.

XOH OPC Product Identifier SDF

<i>Table 112. Product Identifier Self Defining Field ID</i>		
Special Data Area	Value	Description
Bytes 0-1	X'003C'	LENGTH of this Self Defining Field
Bytes 2-3	X'0013'	PRODUCT IDENTIFIER Self Defining Field ID
Byte 4	X'38'	LENGTH of Self Defining Product ID Parameter
Bytes 5-6	X'0001'	PRODUCT IDENTIFIER Parameter ID
Bytes 7-12	X'F0F0F6F4FxFx'	64XX DEVICE TYPE
Bytes 13-15	X'C3E3C1'	MODEL NUMBER CTA
Bytes 16-18	X'C9C2D4'	MANUFACTURER
Bytes 19-20	X'0001'	PLANT (Endicott)
Bytes 21-32	12 Bytes	SEQUENCE NUMBER (All X'F0')
Bytes 33-34	X'0000'	TAG
Bytes 35-43	9 Bytes	EC LEVEL
Bytes 44-59	16 Bytes	All (X'00')

Appendix A. IPDS Exception Reporting Codes

The following tables contain the exception reporting codes, which the printer sends to the host in the NACK reply. These codes are in a three-byte format. The first byte, byte 0, is the error group. The remaining two bytes, bytes 1 and 2, are the individual error identifiers. Table 113 shows the error group meanings:

Byte 0	Error Type	Page
80	Command Reject	140
40	Intervention Required	140
10	Equipment Check	141
08	Data Check	141
04	Specification Check - Bar Codes	142
03	Specification Check - Graphics	145
02	Specification Check - General	150
01	Condition Requiring Host Notification	167

Command Reject: Indicates that the printer cannot recognize a received command.

Intervention Required: Indicates that the printer requires operator intervention.

Equipment Check: Indicates that a hardware error has occurred.

Data Check: Indicates that the printer detects a data error when receiving a logical unit from the application program or that the printer detects a data error while printing the page.

Specification Check: Indicates that the data parameters or values in a received command are invalid.

Condition Requiring Host Notification: Indicates that the printer has detected an error or condition that should be reported to the host computer.

Command Reject — X'80'

The following exception codes are the valid codes for a command reject condition:

X'800100' Invalid IPDS Command Code

Explanation:

1. The command code is not recognized. A error length on a previous command may have caused the current data to be processed as a command.
2. The command is not supported.

Alternate Exception Action: None.

X'800200' Invalid IPDS Command Sequence

Explanation: The printer state is invalid for the received command.

Alternate Exception Action: None.

Intervention Required — X'40'

The following exception codes are the valid codes for an intervention required condition and apply only to coax attachments:

X'400000' Printer Not Ready

Explanation: Incorrect forms device selection when in 4224 emulation mode.

Alternate Exception Action: None.

X'400100' Printer Out of Forms

Alternate Exception Action: None.

X'40E000' Forms Jam

Alternate Exception Action: None.

X'40E400' Cancel Print Key Pressed

Explanation: The **Cancel Print** key was pressed while the printer was receiving IPDS data.

Alternate Exception Action: None.

Equipment Check — X'10'

The following exception codes are the valid codes for an equipment check condition and apply only to coax attachments:

X'10F100' Permanent Error

Explanation:

1. There was a permanent hardware error.
2. The microcode detected an unrecoverable logic error.
3. The microcode detected a condition that should not have occurred.

Alternate Exception Action: None.

Data Check — X'08'

The following exception codes are the valid codes for a data check condition:

X'082100' Undefined Character

Explanation:

1. An undefined character code has been detected in Write Text data.
2. An undefined overstrike character code has been detected.
3. A character has been detected in Write Text Command data which is undefined at the quality level specified by the XOA-PQC command.
4. An undefined character code has been detected in Write Bar Code data.

Alternate Exception Action: For reasons 1-3, print the default character. For reason 4, there is no alternate exception action.

X'086000' Numeric Representation Precision Check

Explanation:

1. The print position cannot be represented within the printer.
2. The result of the calculation cannot be represented in the printer. This may result from the WGC GDD window limits being very close together.
3. There was a coordinate overflow while scaling.

Alternate Exception Action: None.

X'08C100' Position Check

Explanation: An attempt was made to print outside the valid printable area.

Alternate Exception Action: All physical printing outside the valid printable area is suppressed. All data and controls continue processing. The printer continues to print within the valid printable area to the greatest possible extent. For text, this may mean truncating text lines at the character boundary closest to the edge of the intersection. For graphics, this may mean truncating graphics pictures at the pel closest to the boundary. For image, this may mean truncating scan lines at the pel closest to the boundary, or alternatively, not printing any of the image if any part of the image falls outside the valid printable area.

Specification Check-Bar Code — X'04'

The following exception codes are the valid codes for a bar code specification check condition:

X'040300' Bar Code Type Requested Is Not Supported

Explanation: The bar code type requested in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: None.

X'040400' LCID Requested Is Not Supported

Explanation: The type style/font requested in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use printer default.

X'040500' Bar Code Color Requested Is Not Supported

Explanation: The color requested in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use printer default color.

X' 040600' Unit/Module Width Specified Is Not Supported

Explanation: The unit/module width specified in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use closest smaller width supported or the device default for those devices with only one fixed default value.

X' 040700' Element Height Specified Is Not Supported

Explanation: The element height specified in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use closest height supported.

X' 040800' Height Multiplier Specified Is Not Supported

Explanation: The height multiplier specified in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use closest multiplier supported.

X' 040900' Wide/Narrow Ratio Is Not Supported

Explanation: The wide/narrow ratio specified in the Write Bar Code Data Descriptor field is not supported.

Alternate Exception Action: Use the printer default wide element width. The default wide element width and the specified or default unit/module width should be such that a wide/narrow ratio of 2.50 or 3.00 results.

X' 040A00' Invalid Symbol Reference Point

Explanation: The symbol reference point given in the Write Bar Code command is not a valid or supported value.

Alternate Exception Action: None.

X' 040B00' Invalid Bar Code Modifier

Explanation: The bar code modifier, byte 17 of the Bar Code Data Descriptor structured field, is not a valid or supported value for the bar code type specified by byte 16 of the same structured field.

Alternate Exception Action: None.

X'040C00' Invalid Bar Code Data Length

Explanation: The length of the variable data (as given in bytes 5-n of the Write Bar Code command) to be bar-encoded/printed, plus any printer-generated check digits to be coded/printed, is not a valid or supported value.

Alternate Exception Action: None.

X'040E00' Check Digit Calculation Error

Explanation: A first check digit calculation resulting in a value of 10 is defined as an error in various of the modifier options (byte 17 of the Bar Code Data Descriptor structured field) for the MSI bar code.

Alternate Exception Action: None.

X'041000' HRI Location Not Supported

Explanation: HRI location specified in the FLAGS byte of the WBC command is not a supported location.

Alternate Exception Action: None.

X'041100' Attempt to Print Portion of Symbol Outside Object or VPA

Explanation:

1. A portion of the bar code presentation space, as mapped into the object, extends outside the bar code object boundaries, or a portion of the bar code object extends outside of the logical page (or current overlay).
2. An attempt is made to print a bar code symbol or HRI outside the physical page.
3. The symbol reference point lies outside the bar code object, presentation space, or logical page (or current overlay).

Alternate Exception Action: None

Specification Check-Graphics — X'03'

The following exception codes are the valid codes for a graphics specification check condition:

X'030001' Unallocated Graphic Order or Command Code

Explanation:

1. An attempt was made to execute an unallocated order code that is reserved for future use.
2. An attempt was made to execute an unallocated command code that is reserved for future use.

Alternate Exception Action: None.

X'030002' Reserved Byte Error or Invalid Default

Explanation:

1. A reserved byte in the graphic order is not set to zero.
2. The Set Current Defaults instruction attempts, in byte 2, to set an invalid or unsupported attribute.
3. An invalid default byte value was received in the GDD.

Alternate Exception Action: None.

X'030003' Incorrect Drawing Order Length

Explanation: A drawing order length is invalid.

Alternate Exception Action: None.

X'030004' Invalid Attribute Value

Explanation: An attribute value for a graphic order or for a WGC Set Current Default instruction is invalid.

Alternate Exception Action: Use the standard default value for that attribute.

X'030008' Truncated Order Error

Explanation: An order has been requested that is not a complete order. This order is one of the following:

1. A fixed 2-byte order and the second byte is not in the segment.
2. A long order and the length byte is not in the segment.
3. A long order and the number of bytes following the byte containing the length count to the end of the segment is less than the value of the length count.

Alternate Exception Action: None.

X'03000C' Segment Prologue Error

Explanation: A supported order that is not valid within a prologue was found in a prologue.

The end of a segment was reached without an End Prologue order.

Alternate Exception Action: None.

X'03000E' Unsupported Attribute Value

Explanation: An attribute value for a graphic order or for a WGC Set Current Default instruction is not supported.

Alternate Exception Action: Use the standard default value for that attribute.

X'030021' Invalid Default

Explanation: The Set Current Defaults instruction sets an invalid or unsupported default for an attribute.

Alternate Exception Action: None.

X'033400' Character Angle Value Not Supported

Explanation: The specific character angle requested is not supported.

Alternate Exception Action: Use the closest angle supported by the printer.

X'033E00' Invalid End Prologue

Explanation: An End Prologue was found outside the prologue section of a segment.

Alternate Exception Action: None.

X'036000' Area Bracket Error

Explanation: An End Area order has been executed without a Begin Area order having previously been executed.

Alternate Exception Action: None.

X'036800' Begin Area Received Incorrectly

Explanation: Begin Area order received while Begin Area is already in progress.

Alternate Exception Action: None.

X'036801' Area Truncation Error

Explanation: A Begin Area order has been executed in a segment, and the end of the segment is reached without an End Area order being executed. Area fill implementation results are printer dependent.

Alternate Exception Action: None.

X'036802' Supported Order Invalid in Area

Explanation: A supported order is detected that is not valid within an area.

Alternate Exception Action: None.

X'036803' Pattern Symbol Set Not Available

Explanation: The symbol set identified by the current Pattern Set is not available.

Alternate Exception Action: Use the standard default pattern symbol set.

X'036804' Undefined Pattern Symbol

Explanation: The current pattern symbol is undefined in the pattern symbol set.

Alternate Exception Action: Use the standard default pattern symbol.

X'037001' Invalid Repeat/Append Bit

Explanation: The Begin Segment Repeat/Append bit has a value of B'10' in chained immediate mode.

Alternate Exception Action: None.

X'037082' Invalid Repeat/Append Bit

Explanation: The Begin Segment Repeat/Append bit has a value of B'01'.

Alternate Exception Action: None.

X'0370C1' Invalid Begin Segment length

Explanation: The Begin Segment parameter length is invalid.

Alternate Exception Action: None.

X'039200' Graphic Image Order Sequence Error

Explanation: An Begin Image order was not executed before the Image Data order in this segment.

Alternate Exception Action: None.

X'039201' Image Data Discrepancy

Explanation: There are insufficient or too many bytes of data in the Image Data order.

Alternate Exception Action: None.

X'039300' Graphic Image Bracket Error

Explanation: An End Image order is executed without a Begin Image order having been previously executed.

Alternate Exception Action: None.

X'039301' Incorrect Number of Image Data Orders

Explanation: The number of Image Data orders between the Begin Image and End Image orders is not equal to the number of rows in the image (as given by the value of height in the Begin Image order).

Alternate Exception Action: None.

X'03C200' Marker Symbol Set Not Available

Explanation: The symbol set identified by the current Marker Set attribute is not available.

Alternate Exception Action: Use the standard default marker symbol set.

X'03C201' Undefined Marker Code

Explanation: A marker code point is undefined in the current marker symbol set.

Alternate Exception Action: Use the standard default marker symbol.

X'03C300' Character Symbol Set Not Available**Explanation:**

1. The symbol set identified by the current Character Set is not available.
2. The current character set specified in the Set Character Set order does not have the proper attributes to be printed in graphics mode.

Alternate Exception Action: Use the standard default character symbol set.

X'03C301' Undefined Graphics Character Code

Explanation: A code in a character string is undefined in the current character symbol set.

Alternate Exception Action: Use the standard default character symbol.

X'03C601' Arc Drawing Check

Explanation: The drawing processor has detected an exceptional condition which may prevent the drawing of the arc within the normal limits of pel accuracy.

Alternate Exception Action: The arc is drawn in an implementation-defined manner which may reduce to drawing straight lines.

X'03D100' Truncated Graphic Image Error

Explanation: A Begin Image order has been executed in a segment, and the end of the segment is reached without an End Image order having been executed.

Alternate Exception Action: None.

X'03D101' Invalid Order in Graphic Image

Explanation: A Begin Image order has been executed in a segment, and an order other than a Comment, Image Data, or End Image order is executed.

Alternate Exception Action: None.

X'03D102' Graphic Image Format Not Supported

Explanation: The value specified for the graphic image format parameter is not supported.

Alternate Exception Action: None.

X' 03D103' Image Width Greater Than Maximum Supported

Explanation: The Width value specified in the Begin Image order exceeds the maximum image width supported by the product.

Alternate Exception Action: The image width is truncated at the maximum width supported.

X' 03D104' Image Height Greater Than Maximum Supported

Explanation: The Height value specified in the Begin Image order exceeds the maximum image height supported by the product.

Alternate Exception Action: The image height is truncated at the maximum height supported.

X' 03E100' Relative Line Outside Coordinate Space

Explanation: The relative line starts inside the drawing order coordinate space but goes outside.

Alternate Exception Action: None.

Specification Check-General — X' 02'

The following exception codes are the valid codes for a general specification check condition:

X' 020001' Embedded Text Control Code Error

Explanation: Undefined text control code.

Alternate Exception Action: Ignore the control sequence.

X' 020201' End Suppression Text Control Error

Explanation: The active Begin Suppression ID within the current page, overlay, or page segment is not the same as that specified in the ES control.

There is no active suppression ID.

Alternate Exception Action: None.

X'020202' Invalid IPDS Command Length

Explanation: The length for a command is not within the allowed range.
 The length of a Request Resource List entry is not a valid or supported value.
 The length specified for a Request Resource List entry does not match the number of bytes received.

Alternate Exception Action: None.

X'020205' Invalid Data Structured Field Length

Explanation: A data structured field has been received in a WGC or WBCC command that is less than the minimum allowable length.

Alternate Exception Action: None.

X'020302' IPDS Command Header Length Too Small

Explanation: The length of the IPDS command header is too small.

Alternate Exception Action: None.

X'020401' End Page Encountered During Active Suppression

Explanation: The End Page control was encountered before a text suppression ended.

Alternate Exception Action: Process the object as if the corresponding End Suppression control sequence appeared at the end of the object. That is, all of the data following the Begin Suppression control sequence in the object is processed and suppressed.

X'020402' Acknowledge Reply Response Continuation Request is Invalid

Explanation: The printer received a command whose response continuation bit is on but there is no response to continue.

Alternate Exception Action: None.

X'020405' Area Position Reference System is Not Supported

Explanation: The reference system specified in the Area Position structured field of the WGC or WBCC command is not a valid or supported value.

Alternate Exception Action: None.

X'020501' Invalid Spanning Sequence

Explanation: A Write Text or Write Graphics command is required to complete a partial order, control, or double-byte character code and another command was received other than an XOA command.

Alternate Exception Action: None.

X'020502' Unsupported Baseline Move

Explanation: Unsupported advancement of the baseline coordinate toward the I-axis.

Alternate Exception Action: None.

X'020505' Structured Field Unit-Base Invalid

Explanation: The unit-base (measurement units) specified in the Output Control or the Data Descriptor structured field of the WGC or WBCC command is not a valid or supported value.

Alternate Exception Action: None.

X'020601' Begin Suppression Error

Explanation: Begin Suppression encountered in the same unit (page, segment or overlay) before previous suppression in that unit ended.

Alternate Exception Action: None.

X'020605' Structured Field Units Invalid

Explanation:

1. The units specified in the Output Control or the Data Descriptor structured field of the WGC or WBCC command is not a valid or supported value.
2. The result of the calculation cannot be represented in the printer. This may result from the WGC GDD window limits being very close together.
3. Coordinate overflow while scaling graphics. Possible if scaling coordinates require multiplication by a value greater than 1.

Alternate Exception Action: None.

X'020705' Structured Field Extents Not Supported

Explanation: The extents specified in the Output Control or Data Descriptor structured field of the WGC or WBCC command are not a valid or supported value.

The window values of the WGC GDD structured field are not consistent; therefore, the value of XL is larger than the value of XR or the value of YB is larger than the value of YT.

Alternate Exception Action: None.

X'020805' Invalid Mapping Option

Explanation: A mapping option specified in the Output Control structured field of the WGC or WBCC command is not a valid or supported value.

Alternate Exception Action: None.

X'020905' Invalid Axis Offsets

Explanation: The axis offsets specified in the Output Control structured field of the WGC or WBCC command are not valid or supported values.

Alternate Exception Action: None.

X'020B05' Invalid Structured Field Identifier

Explanation: A two-byte structured field identifier in a WGC or WBCC command is invalid or out of sequence.

Alternate Exception Action: None.

X'020F01' Invalid Text Orientation

Explanation: Baseline or Inline orientation specified in Set Text Orientation is not a valid or supported value.

Alternate Exception Action: Use an inline orientation of 0 degrees and a baseline orientation of 90 degrees.

X'021001' Invalid Margin

Explanation: The margin position is not a valid or supported value.

Alternate Exception Action: None.

X'021101' Invalid Baseline Increment

Explanation: The value of the baseline increment is not a valid or supported value.

Alternate Exception Action: None.

X'021201' Invalid Intercharacter Adjustment

Explanation:

1. The value of the intercharacter adjustment is not a valid or supported value.
2. The intercharacter adjustment direction is not a valid or supported value.

Alternate Exception Action:

1. Ignore the control sequence and continue presentation with the parameter values according to the hierarchy (the hierarchy is the last valid value received or if none received then use the LPD value).
2. Use direction = zero.

Note: In an LPD command, no Alternate Exception Action occurs.

X'021301' Invalid Absolute Move Baseline Value

Explanation: The Absolute Move Baseline parameter value is not a valid or supported value.

Alternate Exception Action: None.

X'021401' Invalid Absolute Move Inline Value

Explanation: The Absolute Move Inline parameter value is not a valid or supported value.

Alternate Exception Action: None.

X'021402' Font to be Deleted Not Found

Explanation: The single byte font specified by the Delete Font command is not in the machine.

Alternate Exception Action: None.

X'021502' Invalid DF Font

Explanation: The Loaded Font Identifier field is required in the Delete Font command; however, it is not present or its value is not a valid or supported value.

Alternate Exception Action: None.

X'021701' Invalid Variable Space Increment

Explanation: The value of the variable space increment as specified in a text control is not a valid or supported value.

Alternate Exception Action: None.

X'021702' Invalid DF Deletion Type

Explanation: The Deletion Type on a Delete Font command is not a valid or supported value.

Alternate Exception Action: None.

X'021802' Invalid Font ID

Explanation:

1. The two-byte Font Identifier on a Load Symbol Set or Load Font Equivalence command is not a valid or supported value.
2. The one-byte Font Identifier value on the Load Font Equivalence command is not a valid or supported value.
3. A font is referenced on a Set Font control, a Load Page Description, a Load Symbol Set, a Write Graphics, or Write Bar Code command, but the font has not been previously identified by the Load Font Equivalence command.
4. The font or symbol set referenced in a Load Page Description, Write Text, or Write Graphics command is defined within the current Load Font Equivalence but is not loaded in the printer.

Alternate Exception Action:

1. None.
2. None.
3. Substitute the active font for the specified local font and continue processing.
4. Substitute the active coded font for the specified local font and continue processing.

X'021901' Repeat String Length Error

Explanation: The Repeat String target string length is not a valid or supported value.

Alternate Exception Action: None.

X'021902' Multiple Occurrences of the Same LFE Local ID

Explanation: The one-byte Local Identifier value in the Load Font Equivalence command has been used more than once, making the Two-Byte Font Identifier reference ambiguous.

Alternate Exception Action: None.

X'021C01' Invalid Embedded Text Control Sequence

Explanation: A text control sequence contains a code other than X'D3' following X'2B'.

Alternate Exception Action: None.

X'021D02' Invalid LFE Identifier

Explanation: One or more of the following font parameters listed in the LFE or their combination is not valid or supported: Character Set ID, Code Page ID, Uniform Character Increment, and Proportional Increment Coefficient Table.

Alternate Exception Action: None.

X'021E01' Invalid Text Control Length

Explanation: The length of a text control is not valid.

Alternate Exception Action: None.

X'021E02' Mismatch Between Font and XOA Print Quality Control

Explanation:

1. The combination of parameters specified in LFE are not supported together with the quality indicated by XOA Print Quality Control.
2. The Font (Style) ID specified in the LFE is invalid or unsupported or is not valid with the other font parameters.

Alternate Exception Action: Choose "Best Fit" font.

Note: This error will be flagged when an attempt to present the font is processed.

X'021F01' Repeat String Length Error

Explanation: Repeat String control on a Write Text command has non-zero fill count but zero string length.

Alternate Exception Action: None.

X'021F02' Mismatch of LFE Two-Byte Loaded Font ID Parameters

Explanation: Two fonts have been assigned the same two-byte Loaded Font ID by the LFE command, but one or more of the following attributes differ: Character Set ID, Code Page ID, Font (Style) ID, Uniform Character Increment, Proportional Increment Coefficient Table.

Alternate Exception Action: None.

X'023101' Invalid LCC Number of Copies

Explanation: The Number of Copies value specified on the Load Copy Control command is not a valid or supported value.

Alternate Exception Action: Proceed as though the number of copies field stated 1.

X'023201' Invalid LCC Keyword in Group Entry

Explanation: There is an invalid or unsupported Load Copy Control keyword in the group entry.

Alternate Exception Action: None.

X'023401' Invalid LCC Copy Group Byte Count

Explanation:

1. The number of bytes in Load Copy Control group is not a multiple of two byte pairs.
2. The number of bytes in Load Copy Control group is not a valid or supported value.

Alternate Exception Action: None.

X'023601' Invalid or Unsupported Load Copy Control Simplex/Duplex Parameter

Explanation: The LCC command simplex/duplex parameter is invalid or unsupported.

Alternate Exception Action: If invalid, none. If unsupported, the printer prints simplex.

X'023F02' Font Index Not Loaded

Explanation:

1. The font inline sequence in Load Font Equivalence command is not supported or not supported with the current Text Orientation.
2. The Font Index specified in a Load Font Equivalence command called out by a Set Coded Font Local text control is not loaded.

Alternate Exception Action: None.

X'024201' WIC Pel Count < Minimum Required

Explanation: The Target or Source Pel Count value on the Write Image Control command is less than 1.

Alternate Exception Action: None.

X'024301' WIC Pel Count > Maximum Allowed

Explanation: The Target or Source Pel Count value on the Write Image Control command is greater than the valid or supported maximum.

Alternate Exception Action: None.

X'024401' WIC Scan Count < Minimum Required

Explanation: The Target or Source Scan Count value on the Write Image Control command is less than 1.

Alternate Exception Action: None.

X'024501' WIC Scan Count > Maximum Allowed

Explanation: The Target or Source Scan Count value on the Write Image Control command is greater than the valid or supported maximum.

Alternate Exception Action: None.

X'024601' Invalid WIC Source Image Format

Explanation:

1. The Compression Algorithm value (Byte 8) is not a valid or supported value.
2. The (Pel) Data Format value (Byte 9) in the Write Image Control command is not X'00'.

Alternate Exception Action: None.

X'024701' Invalid WIC Scale Factor Value**Explanation:**

1. The Pel Count Scale Factor value on the Write Image Control command is not a valid or supported value.
2. The Scan Count Scale Factor value on the Write Image Control command does not equal the Pel Count Scale Factor.

Alternate Exception Action: None.

X'024702' Invalid LFE Font Inline Sequence

Explanation: The Font Inline Sequence parameter in a Load Font Equivalence command is not a valid or supported value.

Alternate Exception Action: None.

X'024801' Invalid WIC Scan Line Direction

Explanation: The Scan Line Direction parameter value on the Write Image Control command is not a valid or supported value

Alternate Exception Action: None.

X'024901' Invalid WIC Scan Sequence Direction

Explanation: The Scan Line Sequence Direction value specified on the Write Image Control command is not plus ninety degrees from the Scan Line Direction value.

Alternate Exception Action: None.

Note: Plus ninety from 270, (X'8700') must be X'0000'.

X'024A01' Invalid WIC Coordinate Specification**Explanation:**

1. The Coordinate Definition value on the Write Image Control command is not a valid or supported value.
2. The First Pel Location (X or I Direction) value on the Write Image Control command is not a valid or supported value.
3. The First Pel Location (Y or B Direction) value on the Write Image Control command is not a valid or supported value.

Alternate Exception Action: None.

X'025301' Invalid WIC Color Value

Explanation: The Color value of the WIC command is not a valid or supported value.

Alternate Exception Action: Use printer default value

X'025803' Unsupported Color or Color Attribute

Explanation:

1. The text color is not a valid or supported value.
2. The text color precision is not a valid or supported value.

Alternate Exception Action: If the attribute value is not valid, ignore the control and continue presentation with the value that was in effect prior to this control sequence. If the attribute value is valid but unsupported for this printer, use the printer default color.

X'026002' Invalid LPD X Units/Unit-Base

Explanation: On the Load Page Description command, the X units per unit-base value is not a valid or supported value.

Alternate Exception Action: None.

X'026102' Invalid LPD Y Units/Unit-Base

Explanation:

1. On the Load Page Description command, the Y units per unit-base value is not a valid or supported value.
2. On the Set Media Size command, the units per unit-base value is not a valid or supported value.

Alternate Exception Action: None.

X'026202' Invalid LPD X-Extent

Explanation: On the Load Page Description command, the X-Extent is not a valid or supported value.

Alternate Exception Action: None.

X'026302' LPD Invalid Y-Extent

Explanation: On the Load Page Description command, the Y-Extent is not a valid or supported value.

Alternate Exception Action: None.

X'026402' Invalid LPD Unit-Base

Explanation: On the Load Page Description command, the unit-base is not a valid or supported value.

Alternate Exception Action: None.

X'026802' Invalid LPD Inline Direction

Explanation: On a Load Page Description command the Inline Sequence Direction value is not a valid or supported value.

Alternate Exception Action: Use an inline sequence direction of 0 degrees and a baseline sequence direction of 90 degrees.

X'026902' Invalid LPD Baseline Direction

Explanation: On a Load Page Description command the Baseline Sequence Direction value is not a valid or supported value.

Alternate Exception Action: Use an inline sequence direction of 0 degrees and a baseline sequence direction of 90 degrees.

X'026A01' Insufficient Source Image Data

Explanation: The number of source image bytes received < the number implied in the Write Image Control command.

Alternate Exception Action: None.

X'026A02' Invalid LPD Initial Inline Coordinate

Explanation: On a Load Page Description command, the initial inline coordinate value is not a valid or supported value.

Alternate Exception Action: None.

X'026B01' Excess Source Image Data

Explanation: The number of source image bytes received > the number implied in the Write Image Control command.

Alternate Exception Action: None.

X'026B02' Invalid LPD Initial Baseline Coordinate

Explanation: On a Load Page Description command, the initial baseline coordinate value is not a valid or supported value.

Alternate Exception Action: None.

X'027002' Invalid Units Value in an XOH SMS Command

Explanation: The units value in an XOH SMS command is invalid or unsupported.

Alternate Exception Action: None.

X'027202' Invalid SMS X-Extent

Explanation: On the Set Media Size command, the X-extent is not a valid or supported value.

Alternate Exception Action: None.

X'027302' Invalid SMS Y-Extent

Explanation: On the Set Media Size command, the Y-extent is not a valid or supported value.

Alternate Exception Action: None.

X'027402' Invalid SMS Unit Base

Explanation: On the Set Media Size command, the unit-base is not a valid or supported value.

Alternate Exception Action: None.

X'028101' Insufficient Storage for Overlay or Page Segment

Explanation: There is insufficient storage to process an overlay or page segment.

Alternate Exception Action: None.

X'028501' Invalid DO Parameter Value

Explanation: The Overlay Identifier on the Delete Overlay command is not a valid or supported value.

Alternate Exception Action: None.

X'028A01' Invalid DPS Parameter Value

Explanation: The Page Segment Identifier on the Delete Page Segment command is not a valid or supported value.

Alternate Exception Action: None.

X'029001' Overlay Number Outside Valid Range

Explanation:

1. The Overlay Identifier on the Begin Overlay command is not a valid or supported value.
2. The Overlay Identifier on the Include Overlay command is not a valid or supported value.
3. The Overlay Identifier on a Load Copy Control command is not a valid or supported value.

Alternate Exception Action: None.

X'029101' BO Overlay Number Already Loaded

Explanation: The host attempted to download an overlay from the Begin Overlay command that already exists in the printer.

Alternate Exception Action: None.

X'029102' Invalid Request Resource List Parameter

Explanation:

1. The Requested Ordering parameter of a Request Resource List order is not a valid or supported value.
2. The Entry Index parameter of a Request Resource List order is not a valid or supported value.
3. The Resource Qualifier parameter of a Request Resource List order is not a valid or supported value.
4. The Resource Type parameter on the Request Resource List order is not a valid or supported value.

Alternate Exception Action: None.

X'029201' Overlay Number Not Loaded

Explanation: The overlay identified by the Overlay Identifier on the Include Overlay, Delete Overlay or LCC command was not loaded or was already deleted prior to its attempted use.

Alternate Exception Action: None.

X'029202' Invalid Print Quality Control Parameter:

Explanation: The Print Quality Control parameter is X'00', which is a reserved value.

Alternate Exception Action: None.

X'029301' Recursive Overlay Invocation:

Explanation: An infinite nesting loop has occurred with the Include Overlay command (for example, an overlay has included itself)

Alternate Exception Action: None.

X'029401' Page Segment Number Outside Valid Range

Explanation:

1. The Page Segment Identifier on the Include Page Segment command is not a valid or supported value.
2. The Page Segment Identifier on the Begin Page Segment command is not a valid or supported value.

Alternate Exception Action: None.

X'029501' Page Segment Number Already Loaded

Explanation: The host attempted to download a page segment that already exists in the printer.

Alternate Exception Action: None.

X'029601' Page Segment Number Not Loaded

Explanation: The page segment identified by the Page Segment Identifier on the Include Page Segment or Delete Page Segment command was not loaded or was already deleted prior to its attempted use.

Alternate Exception Action: None.

X'029701' Overlay Nesting Limit Exceeded

Explanation: Depth of overlay nesting is greater than the maximum depth.

Alternate Exception Action: None.

X'029801' Suppression Number Outside Valid Range

Explanation:

1. On a Write Text command, the Begin Suppression number value is not a valid or supported value.
2. In a LCC command, the suppression number value is not a valid or supported value.

Alternate Exception Action:

1. Ignore the control sequence.
2. None.

X'029803' Temporary Baseline Move Error

Explanation:

1. The temporary baseline increment is not a valid or supported value.
2. The temporary baseline move direction is not a valid or supported value.
3. The temporary baseline move precision is not a valid or supported value.
4. Unsupported multiple offset temporary baseline move.
5. Unable to support temporary baseline move by printing full size characters.

Alternate Exception Action:

1. None for reasons 1 through 4.
2. For reason 5, present according to the substitution method.

X'02AC01' Insufficient Storage to Print the Sheet

Explanation: Page is too large for main storage.

Alternate Exception Action: None.

X'02AD01' Invalid Load Page Position Parameter

Explanation: The X Coordinate value on the Load Page Position command is not a valid or supported value.

The Y Coordinate value on the Load Page Position command is not a valid or supported value.

Alternate Exception Action: None.

X'02AE01' Invalid Include Overlay Position Parameter

Explanation:

1. The X-Coordinate value on the Include Overlay command is not a valid or supported value.
2. The Y-Coordinate value on the Include Overlay command is not a valid or supported value.

Alternate Exception Action: None.

X'02AF01' Insufficient storage to continue processing

Explanation: There is insufficient storage to continue processing. Make sure any fonts, overlays, and page segments that are not being used are deactivated. You could also attempt to increase your host storage space.

Alternate Exception Action: None.

X'02C101' Maximum Number of Simplex Keywords in an LCC Command

Explanation: More than one simplex operation keyword has been specified in an LCC command copy group.

Alternate Exception Action: None.

X'02C102' Load Equivalence Internal Value Not Unique

Explanation: The first two bytes of two or more list entries on the Load Equivalence command are not unique. Setting both external values to the same value will not prevent the error.

Alternate Exception Action: None.

X'02C602' Invalid Load Equivalence Mapping Type

Explanation: The Mapping Type on the Load Equivalence command is not X'0100'.

Alternate Exception Action: None.

X'02C801' An unsupported Input Media Source ID was Specified

Explanation: An unsupported Input Media Source ID was specified in an XOH-SIMS command.

Alternate Exception Action: Select an installed and available media source.

X'02C802' Invalid Internal/External Value on LE

Explanation: The Internal or External value on a Load Equivalence command is not a valid or supported value.

Alternate Exception Action: None.

Conditions Requiring Host Notification — X'01'**X'010100' Media Size or Input Media Source ID Changed****Explanation:**

1. The size of the media in one or more of the installed input media sources was changed.
2. The input media source ID of one or more of the installed input media sources was changed.

Alternate Exception Action: None.

Note: Not reported in 4234 Emulation Mode.

Appendix B. Summary of IPDS for Control Units

This appendix contains a summary of the SNA and DSC requirements for IPDS communications between this printer and the 3174 and 3274 Control Units or the 4361 Work Station Adapter (WSA).

System Attachment

This printer can operate with both SNA and non-SNA control units. For SNA control units, IPDS is only valid in LU-1 mode. For non-SNA control units, IPDS is only valid in DSC mode.

For SNA (LU-1), the attachment protocols are:

- Channel-attachment
- SDLC-attachment.

For Non-SNA (DSC), the attachment protocols are:

- Channel-attachment
- BSC-attachment.

Data Stream Summary

The following additions to LU-1 and DSC data streams are necessary for operation with IPDS printers.

LU-1 Mode

FM Header Type 1, subset 4

- This header contains a data stream profile (DSP) code. A DSP code of X'0D' selects IPDS mode of operation.

Data Stream Query Reply structured field

- This query reply indicates the valid data streams for the printer. A data stream indicator code of X'02' indicates that IPDS is valid in LU-1 mode. It is recommended that the programmer ask for a definite response when issuing an End-of-Chain (EOC) or an End-of-Bracket (EOB) command.

DSC Mode

Data Chain structured field

- This structured field (0F21) defines the data chaining function.

Select IPDS Mode structured field

- This structured field (0F83) defines the selection of IPDS mode.

Data Chaining Query Reply structured field

- This query reply structured field (with a Q code of 98) indicates data chaining is valid in DSC mode.

3270 IPDS Query Reply structured field

- This query reply structured field (with a Q code of 9A) indicates IPDS is valid in DSC mode. In addition, this query reply also specifies the maximum outbound transmission size that is allowable.

IPDS Application in LU-1 Mode

An application program can switch the printer from SCS to IPDS during an LU-1 session. The IPDS data stream is carried in the IPDS structured fields and is processed entirely by the printer.

Determining IPDS Capability

An application can determine the IPDS capability of a printer operating in LU-1 mode by issuing a Read Partition query or a Read Partition Query List structured field. The query list, if used, should contain a Q code of X 'A2' (data streams).

The printer returns a data stream query reply structured field containing a data stream identifier indicating IPDS (X '02'). This IPDS identifier is in addition to (and following) the base data stream identifier of SCS (X '00').

Both the read partition query (or query list) structured field and the query reply structured field are sent in a chain that begins with a function management header (FMH) of one. This header contains a destination select of Begin/End (DESSEL equals BEDS) along with a data stream profile of Structured Fields (DSP equals SF).

An FMH-1 that precedes a read partition query or query list has the following format:

0601000B6000

An FMH-1 that precedes a query reply has the following format:

0601008B6000

Inbound Structured Fields

When the printer is in LU-1 SCS mode, the query reply and the save are the only structured fields sent inbound. These fields are preceded with an FMH.

When the printer is in LU-1 mode with IPDS, an IPDS acknowledge reply is the only structured field sent inbound. This field that the printer sends without an FMH can be a STM, an OPC, an ACK, or a NACK.

It is also possible for the control unit to receive a solicited or unsolicited acknowledgment (ACK/NACK) reply from the printer when in LU-1 IPDS mode. When a NACK occurs, the information must be received after a change direction to allow data to flow inbound to the control unit.

Selecting and Terminating IPDS Mode of Operation

An application can select the IPDS mode of operation by sending an FMH-1 containing a destination select of Begin (DESSEL equals BDS) along with a data stream profile of IPDS (DSP equals IPDS). This FMH-1 must be sent as only-in-chain (OIC) and cannot have any accompanying data. An FMH-1 that selects IPDS mode has the following format:

```
0601300D4000
```

After the IPDS mode selection, IPDS structured fields in single or multi-element chains must not have the FMH-1.

An FMH BDS is valid only when the printer is not in IPDS mode. If the printer is in IPDS mode and receives a BDS, the response to the FMH order is:

- Order Complete
- Sense Data X'1008'
- Invalid FM Header.

To terminate IPDS mode, an application sends an FMH-1 containing a destination select of End (DESSEL equals EDS) along with a data stream profile of IPDS (DSP equals IPDS). This FMH-1 must be sent as only-in-chain (OIC) and cannot have any accompanying data. An FMH-1 that terminates IPDS mode has the following format:

```
0601300D2000
```

Terminating IPDS mode causes LU-1 to return to its default data stream of SCS.

An FMH EDS is valid only when the printer is in IPDS mode. If the printer is not in IPDS mode and receives an EDS, the response to the FMH order is:

- Order Complete
- Sense Data X'1008'
- Invalid FM Header.

Figure 26 on page 172 shows the LU-1 data stream modes.

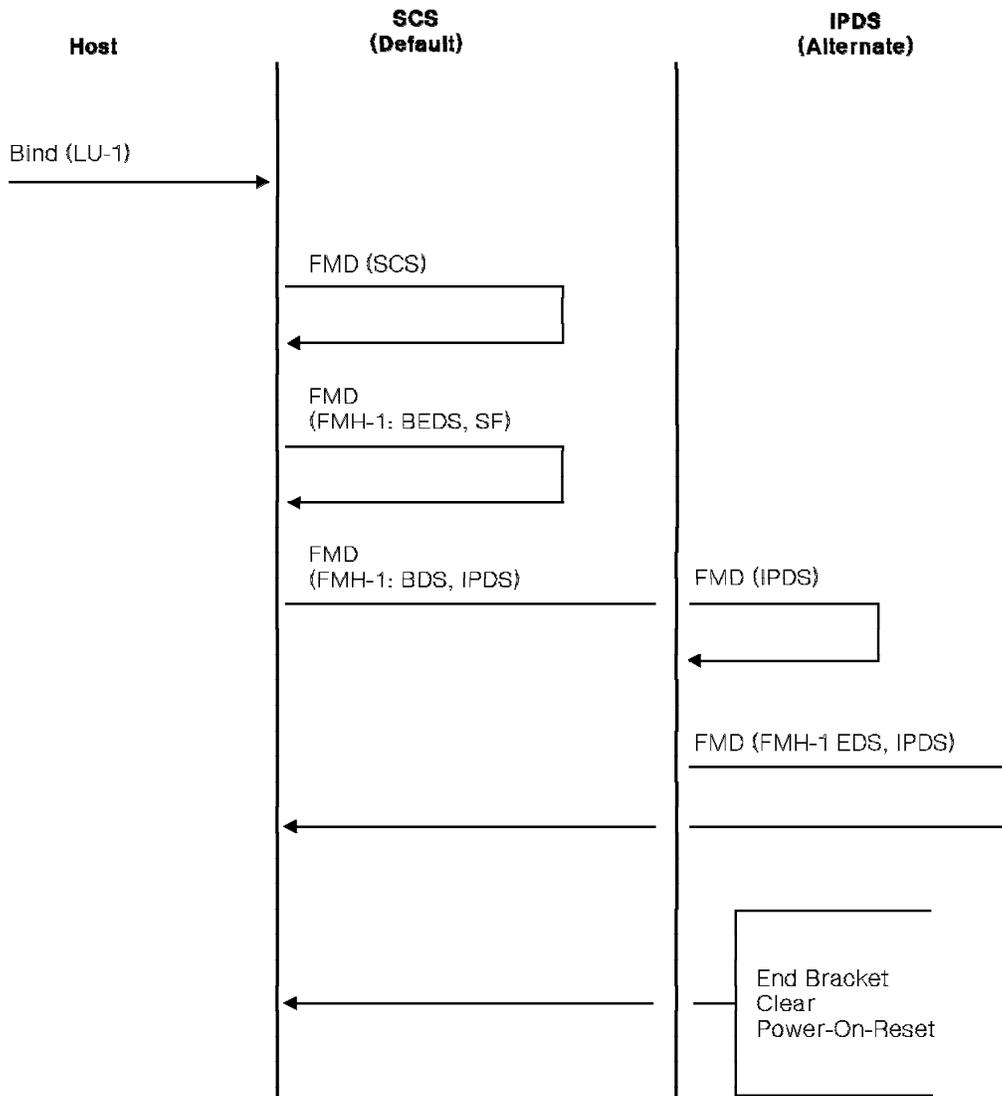


Figure 26. LU-1 Data Stream Modes

Implicit Termination of IPDS Mode

If IPDS mode is active, any of the following causes termination of the active destination selection and is an implicit termination of IPDS mode:

- A chain indicating End Bracket (EB)
- CLEAR
- Power-on-reset (POR).

Note: IPDS always returns to the home state upon termination.

Copy Considerations

Because an End Bracket is also an implicit termination of IPDS mode, between-bracket printer sharing can be used for either operator-initiated or host-initiated copy operations.

For improved throughput, the recommended procedure is to include the entire page within a chain.

Error Recovery in LU-1 IPDS Mode

The unit of error recovery for a spooled device is the entire print job. The unit of error recovery is a page boundary if the printer, while directly-attached:

- Receives only-in-chain data, or
- Receives a page of data by a sequence of begin, middle, and end chains.

An SNA chain is not a unit of error recovery.

To be certain of completion of all deferred printing, a complete chain of IPDS structured fields should end in the home state. The printer forces IPDS into the home state, if necessary, to force deferred printing to occur when IPDS terminates.

IPDS ACK/NACK Sequence in LU-1 Mode

When using IPDS print operations, the printer can have inbound ACK/NACK data to send to the host application. Inbound data may result from an Acknowledge Request required by a prior outbound transmission or from an error condition to be reported.

Recommended ACK/NACK Sequence in LU-1 Mode

When the printer operates in LU-1 mode with IPDS, and the printer has inbound data to send, the following is the recommended sequence:

1. The host application receives a Signal from the printer notifying the application that inbound data is available.
2. The host application issues a Change Direction to the printer.
3. The printer sends the NACK to the host application.

Note: If the printer receives an FMH EDS after sending a signal and before receiving Send State from the host, the printer returns Order Complete, Sense Data Available, and Sense X '1005' to indicate that an ACK/NACK was available but not read. In this case, the ACK/NACK is lost.

Figure 27 shows the recommended IPDS error reporting sequence in LU-1 mode.

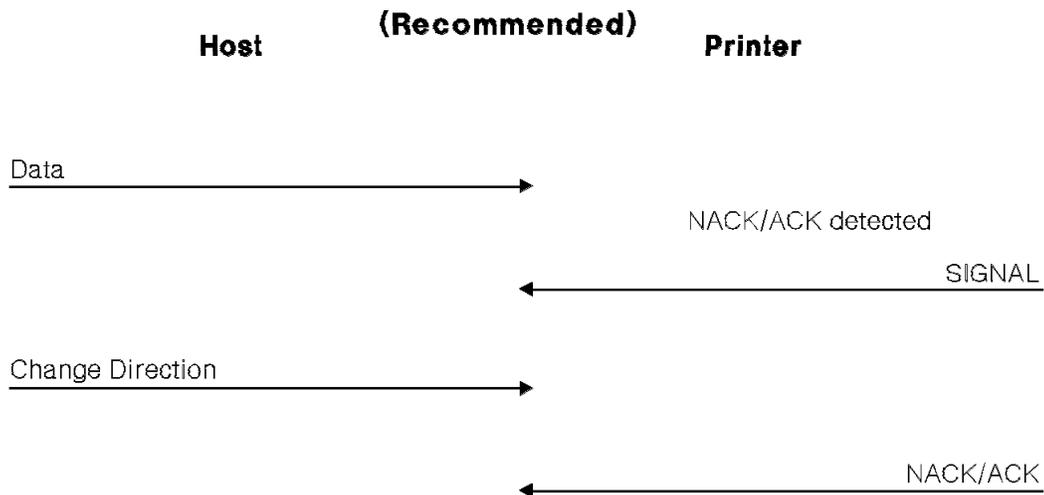


Figure 27. Reporting IPDS Errors Using the ACK Reply Structured Field in LU-1 Mode

If the ACK or NACK shown above is synchronous (ARQ equals 1), the host could send a Change Direction in the same transmission as the IPDS data (see Figure 28). This eliminates the need for the Signal from the printer.

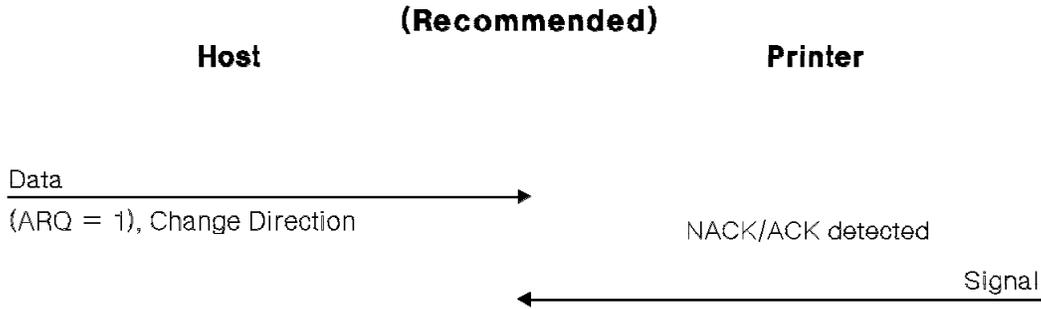


Figure 28. Synchronous ACK/NACK Reporting of IPDS Errors in LU-1 Mode. Recommended sequence.

Other Asynchronous/Synchronous Sequences in LU-1 Mode

The following charts show what can happen if a Change Direction is not issued by the host immediately after a Signal is received from the printer. These sequences are not recommended.

Asynchronous or Intervention Required NACK Sequences in LU-1 Mode: If the printer returns an Intervention Required (IR) or Equipment Check (EC) NACK, the NACK is asynchronous.

Note: In some programming environments, asynchronous NACKs may not be desired. To force all NACKs to be returned synchronously, set the ARQ bit in the IPDS flag byte to 1 in every command. IR or EC NACKs must be handled as if they are asynchronous, even if the IR or EC NACKs are returned as a result of ARQ equals 1. In LU-1 mode, the application must send each command only-in-chain. If the application forces synchronous NACKs, the printer processing slows. In LU-1 mode, an asynchronous NACK may cause one of the following sequences to occur. In Figure 29, a Change Direction from the host does not immediately follow the Signal from the printer. In Figure 30 and Figure 31, the host issues no Change Direction.

(NOT Recommended)

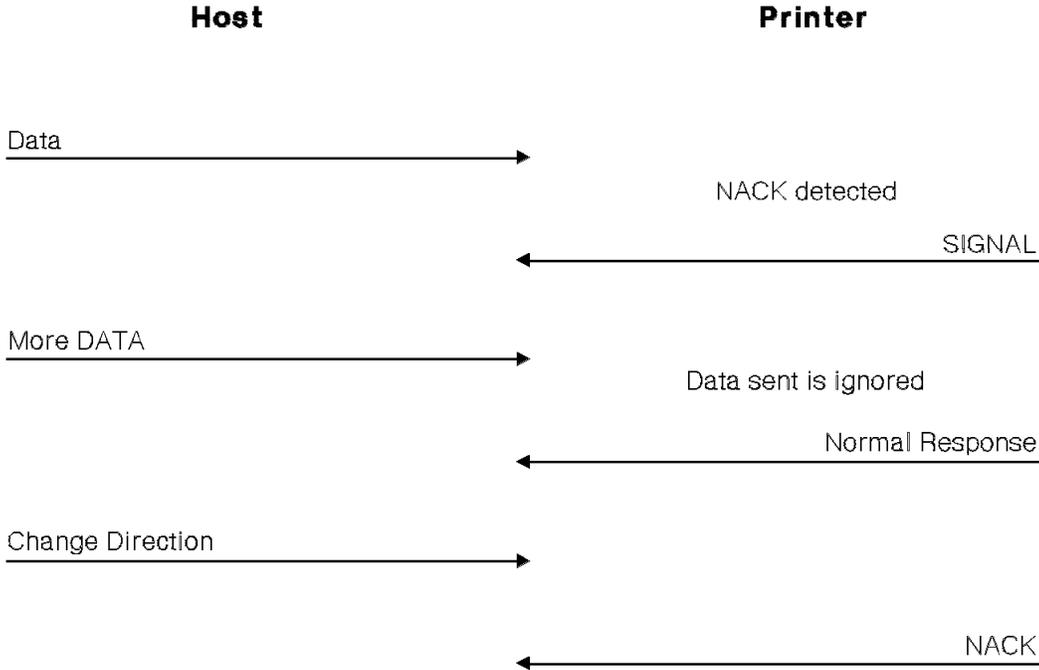


Figure 29. Asynchronous NACK in LU-1 Mode. Change Direction not issued immediately after signal.

In Figure 30, the host issues an End Destination Select and no Change Direction.

(NOT Recommended)

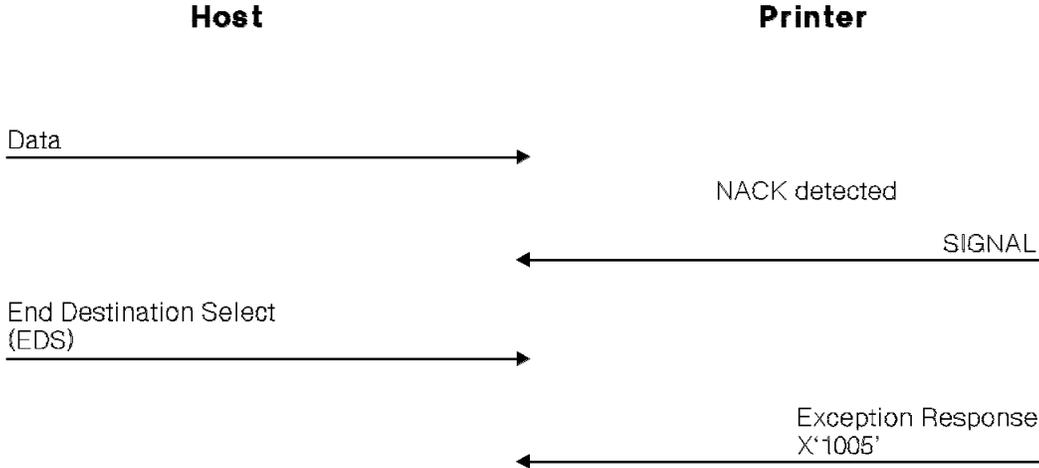


Figure 30. Asynchronous NACK in LU-1 Mode. EDS issued after Signal.

Note: At the end of this sequence, the printer is no longer in IPDS mode nor does the host read the NACK.

In Figure 31, the host issues an End Bracket with no EDS. The host issues no Change Direction.

(NOT Recommended)

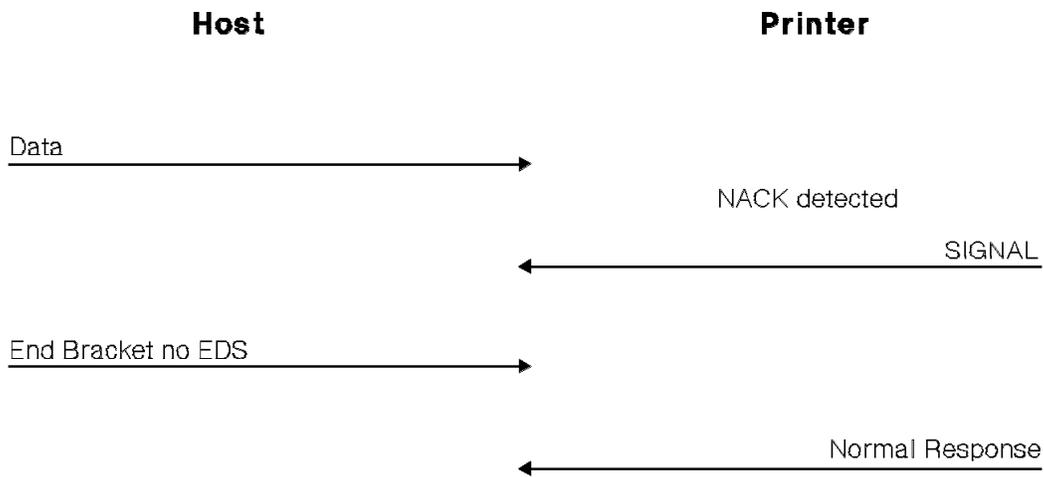


Figure 31. Asynchronous NACK in LU-1 Mode. End Bracket issued after Signal.

Notes:

1. At the end of this sequence, the printer is no longer in IPDS mode nor does the host read the NACK.
2. If the printer generates an Intervention Required (IR) or Equipment Check (EC) NACK, the printer sends the IR or EC status to the host in the next transmission. The IR or EC replaces the normal response transmission from the printer shown in Figure 31 above.

Synchronous or Non-Intervention Required NACK Sequences in LU-1 Mode: If the host application sets the Acknowledge Reply (ARQ) field of the flag byte to 1, the ACKs or NACKs from the printer are synchronous.

Note: Intervention Required (IR) or Equipment Check (EC) NACKs returned as a result of ARQ equals 1 are treated as asynchronous NACKs. In Figure 32, the host sends data immediately after the Signal from the printer. The host sends the Change Direction after the data. In Figure 33 and Figure 34, the host does not send a Change Direction.

(NOT Recommended)

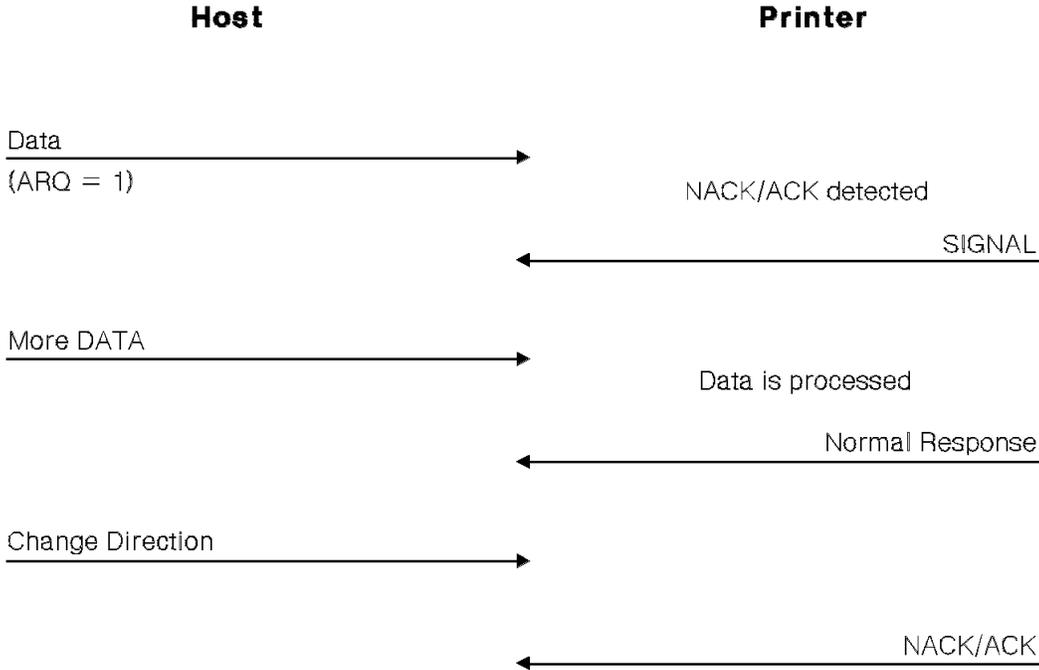


Figure 32. Synchronous ACK/NACK in LU-1 Mode. Change Direction not issued immediately after Signal.

Notes:

- 1. The printer processes the data sent by the host after the Signal.
- 2. After the host sends a Change Direction to the printer, the printer sends the ACK/NACK detected before the Signal.

In Figure 33, the host sends an End Destination Select (EDS) after the Signal sent by the printer. The host sends no Change Direction.

(NOT Recommended)

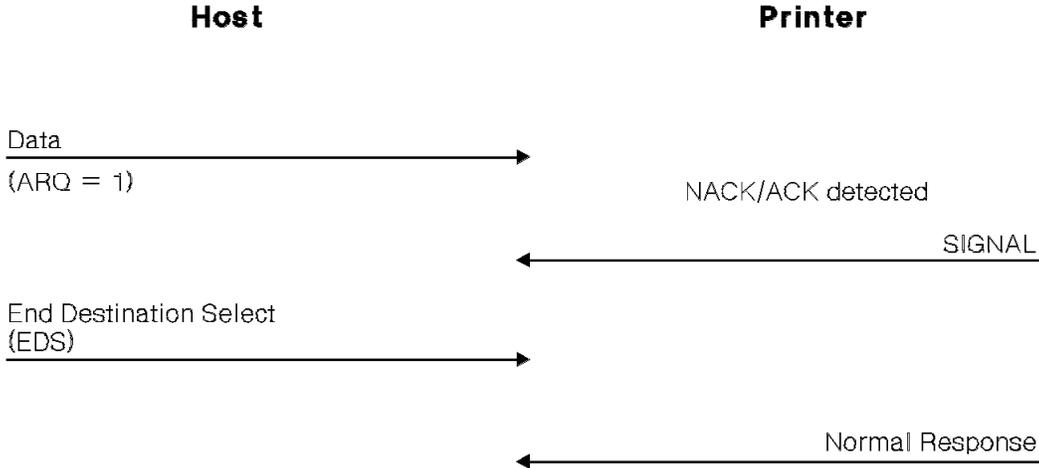


Figure 33. Synchronous ACK/NACK in LU-1 Mode. EDS issued after Signal.

Note: At the end of this sequence, the printer is no longer in IPDS mode nor does the host read the ACK/NACK.

In Figure 34 the host sends an End Bracket with no EDS. The host issues no Change Direction.

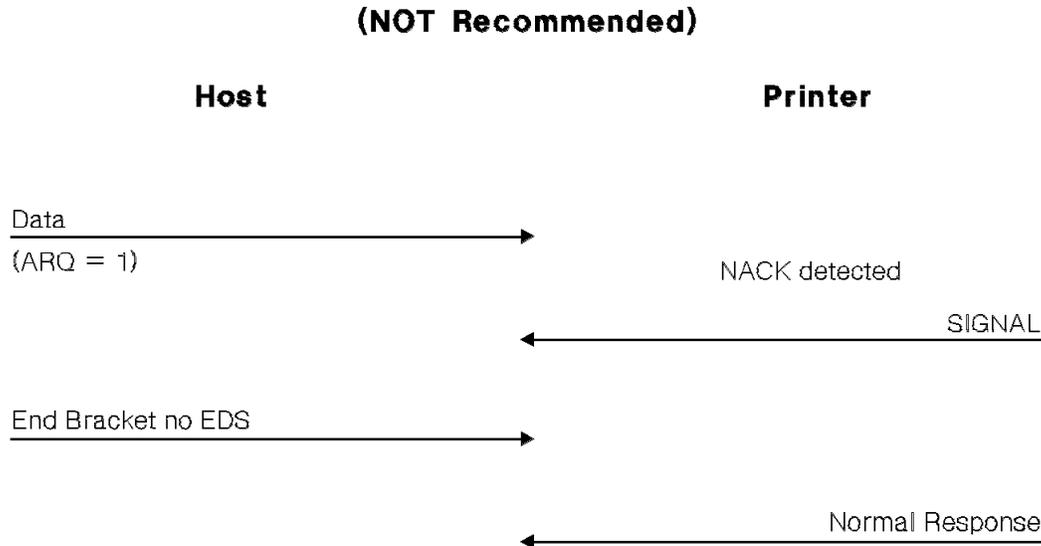


Figure 34. Synchronous NACK in LU-1 Mode. End Bracket issued after Signal.

Note: At the end of this sequence, the printer is no longer in IPDS mode nor does the host read the ACK/NACK.

IPDS Application in DSC Mode

An application program can switch the printer from 3270 to IPDS during a DSC session. The IPDS data stream is carried in the IPDS structured fields and is processed entirely by the printer. This differs from the 3270 data stream that processes the data in the control unit before sending the data to the printer.

Determining IPDS Capability

An application can determine the IPDS and data chain capability of a printer operating in DSC mode by issuing a Read Partition query or a Read Partition Query List structured field. The query list, if used, should contain a Q code of X'9A' (3270 IPDS) and a Q code of X'98' (data chaining).

The printer returns a 3270 IPDS query reply and a data chaining query reply.

In DSC mode, all outbound data streams containing structured fields are sent using the Write Structured Field (WSF) command. All inbound data streams containing structured fields begin with the AID code of X'88'.

Inbound Structured Fields

When the printer is in DSC mode with the 3270 data stream, the query reply is the only structured field sent inbound.

When the printer is in DSC mode with IPDS, Select IPDS Mode and IPDS acknowledge reply are the only structured fields sent inbound. The printer can only send a Select IPDS Mode structured field inbound if it has previously received an outbound IPDS structured field, and a reply is required with the acknowledge reply structured field. This field can be a STM, an OPC, an ACK, or a NACK.

Selecting and Terminating IPDS Mode of Operation

An application can select the IPDS mode of operation by sending a Select IPDS Mode structured field (X'0F83') at the beginning of each transmission containing IPDS structured fields. If the application is using data chaining, the select IPDS mode structured field must follow in the same transmission. A select IPDS mode structured field must not be sent with a continue or end chain.

The IPDS mode terminates at the end of the transmission containing the select IPDS mode structured field unless data chaining is in effect.

If the select IPDS mode structured field is preceded by a data chain structured field indicating Begin, then the IPDS mode remains in effect until the end of a transmission containing a data chain structured field indicating End is received.

When IPDS mode terminates, the application returns to the base data stream of 3270.

Note: For BSC-attached control units, a transmission is defined as the data delimited by Select and EOT. For channel-attached control units, a transmission is defined as the data transferred by a WSF command (that is, a CCW). Figure 35 shows the DSC data stream modes.

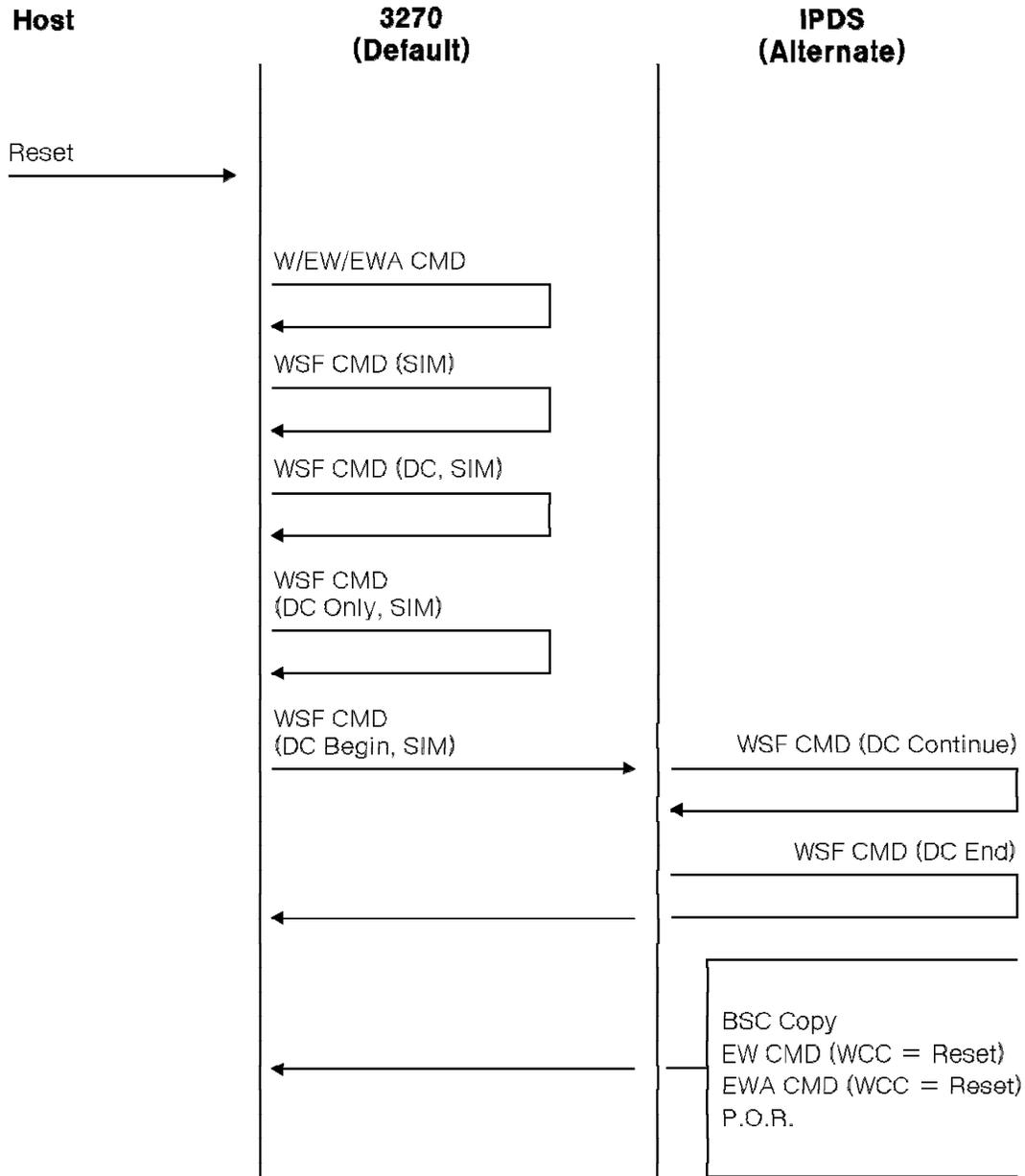


Figure 35. DSC Data Stream Modes

Implicit Termination of IPDS Mode

If IPDS mode is active across more than one transmission through the use of data chaining, any of the following causes termination of the in-chain state and is an implicit termination of IPDS mode:

- Copy (BSC)
- Erase Write (WCC equals Reset)
- Erase Write Alternate (WCC equals Reset)
- Power-on-Reset (POR).

Note: IPDS always returns to the home state upon termination.

Abnormal Termination of Printer Operation

Any of the following causes rejection of the transmission with a sense equals op check and cause the control unit to send an abort to the addressed printer:

- Receipt of a data chain structured field indicating continue or end when not in chain state
- Receipt of a data chain structured field indicating begin when already in chain state
- Receipt of any 3270 command except BSC Copy, Write Structured Field, Erase Write (WCC equals Reset), or Erase Write Alternate (WCC equals Reset) when in the chain state
- Receipt of a Write Structured Field command that does not contain a data chain structured field when in the chain state.

Copy Considerations

The printer is not available for an operator-initiated copy operation when in IPDS mode.

If a BSC Copy command is received when in IPDS mode, IPDS mode terminates and the BSC Copy operation occurs.

Note: It is required that an unordered page be contained within a chain.

Chaining and Error Recovery in 3270 IPDS Mode

A chain is a unit of error recovery. At the end of the chain, the printer delays sending operation-complete to the control unit until all the received data prints.

To make certain that all deferred printing completes, a chain of IPDS structured fields should end in the home state. The printer forces IPDS into the home state, if necessary, to force deferred printing to occur when a chain terminates.

If chaining is not used, each transmission should end in the home state. If necessary, the printer forces entry into the home state.

IPDS ACK/NACK Sequence in DSC Mode (Channel-Attached)

When using IPDS print operations, the printer can have inbound ACK/NACK data to send to the host application. Inbound data may result from an Acknowledge Request required by a prior outbound transmission or from an error condition to be reported.

Not Recommended NACK Sequence for Printers

When the printer operates in the DSC (channel-attached) mode with IPDS, and the printer has inbound data to send, the following sequence is not recommended:

1. The host application receives an Attention from the printer notifying the application that inbound data is available.
2. The host application issues a Read Modified to the printer.
3. The printer sends the NACK to the host application.
4. The host application issues an Erase/Write WCC equals Reset to the printer. This ends IPDS mode.

5. If an Intervention Required (IR) or Equipment Check (EC) NACK occurs, the printer returns an IR or EC response to the host. Otherwise, the printer returns a normal response.

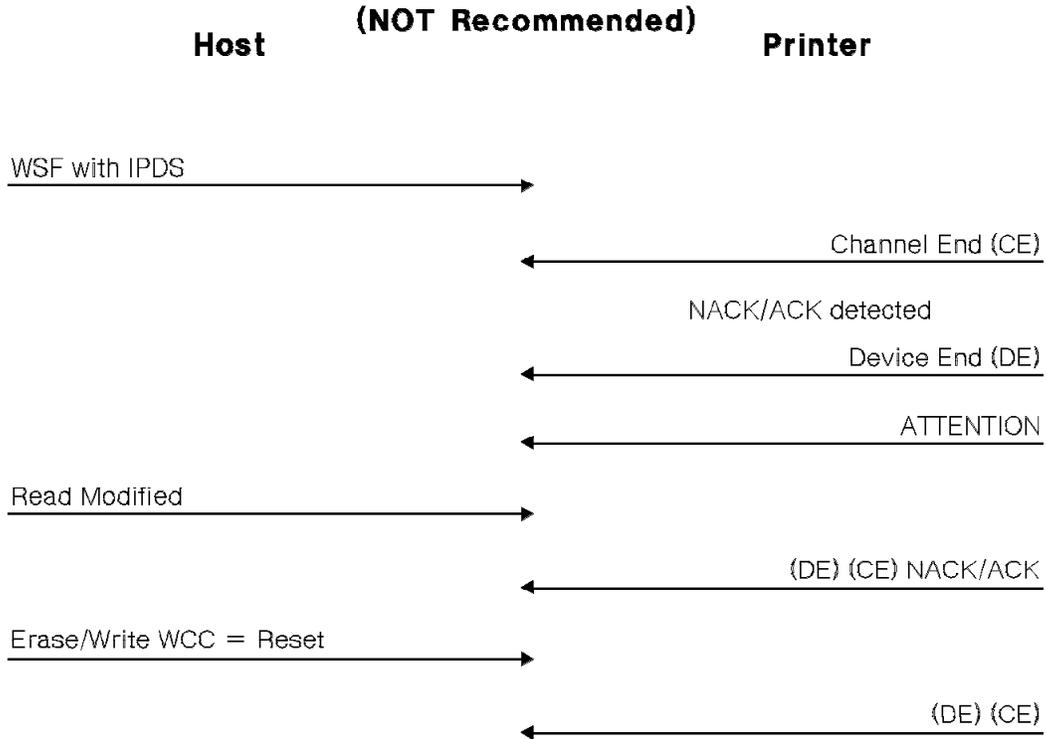


Figure 36. Reporting IPDS Errors with ACK Reply Structured Field in DSC Mode

Recommended NACK Sequence for Printers in DSC Mode (Channel-Attached)

1. The host application receives an Attention from the printer notifying the application that inbound data is available. The NACK structured field is sent inbound with the Persist bit active in the flag byte.
2. Any further IPDS data received is ignored by the printer until Step 3 is completed.
3. A valid IPDS command is received with a length less than 256 with the ARQ flag active. The NACK structured field is sent a final time, without the Persist flag bit active. The NACK reply sequence is now complete.
The printer remains in IPDS mode with IPDS in Home state.
4. If the NACK was due to a printer IR or EC error, the printer returns an IR or EC status response on the next 3270 command.

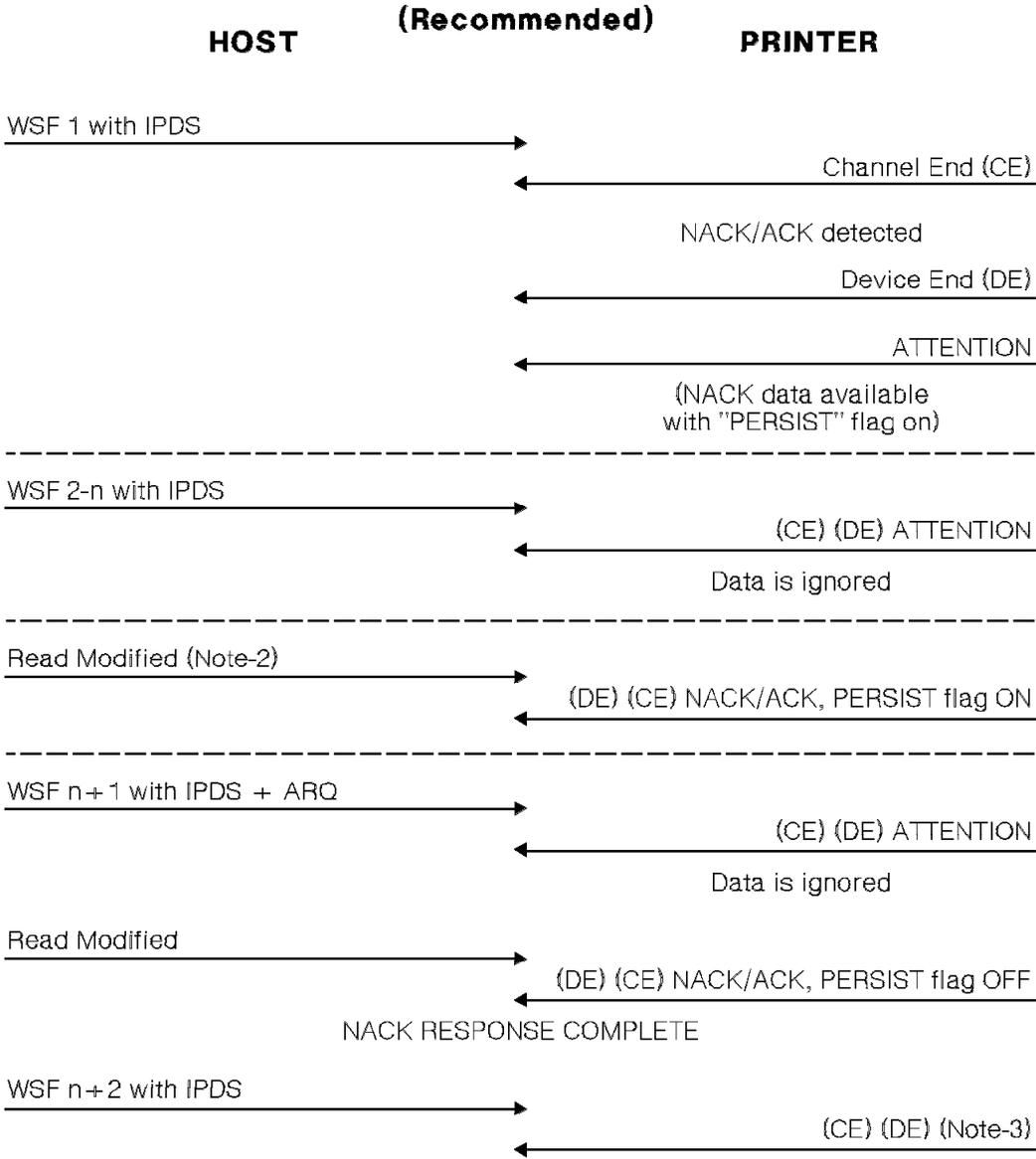


Figure 37. Asynchronous NACK in DSC (Channel-Attached) Mode. Recommended sequence.

Notes:

1. At the end of this sequence, the printer remains in IPDS mode if no End-of-Chain structured field has been received.
2. Zero or more WSF with IPDS data sequences may occur before the WSF with IPDS + ARQ flag is sent. Data is ignored and ATTENTION is repeated on these transmissions. The Read Modify occurs after the last command.
3. If the printer generates an Intervention Required (IR) or Equipment Check (EC) NACK, the (CE) (DE) transmission sent after the WSF n+2 command contains the IR or EC status.

Other Asynchronous/Synchronous Sequences in DSC (Channel-Attached) Mode

The following charts show what can happen if the host does not issue a Read Modified immediately after an Attention is received from the printer. These sequences are not recommended.

Asynchronous NACK Sequences in DSC (Channel-Attached) Mode: If the printer returns an Intervention Required (IR) or Equipment Check (EC) NACK, the NACKs are asynchronous.

Note: In some programming environments, asynchronous NACKs may not be desired. To force all NACKs to be returned synchronously, set the ARQ bit in the IPDS flag byte to 1 in every command. IR or EC NACKs must be handled as if they are asynchronous, even if the IR or EC NACKs are returned as a result of ARQ equals 1. In DSC mode, the application must send each command as a separate message. If the application forces synchronous NACKs, printer processing slows.

In Figure 38, the host sends data after receiving an Attention from the printer.

(NOT Recommended)

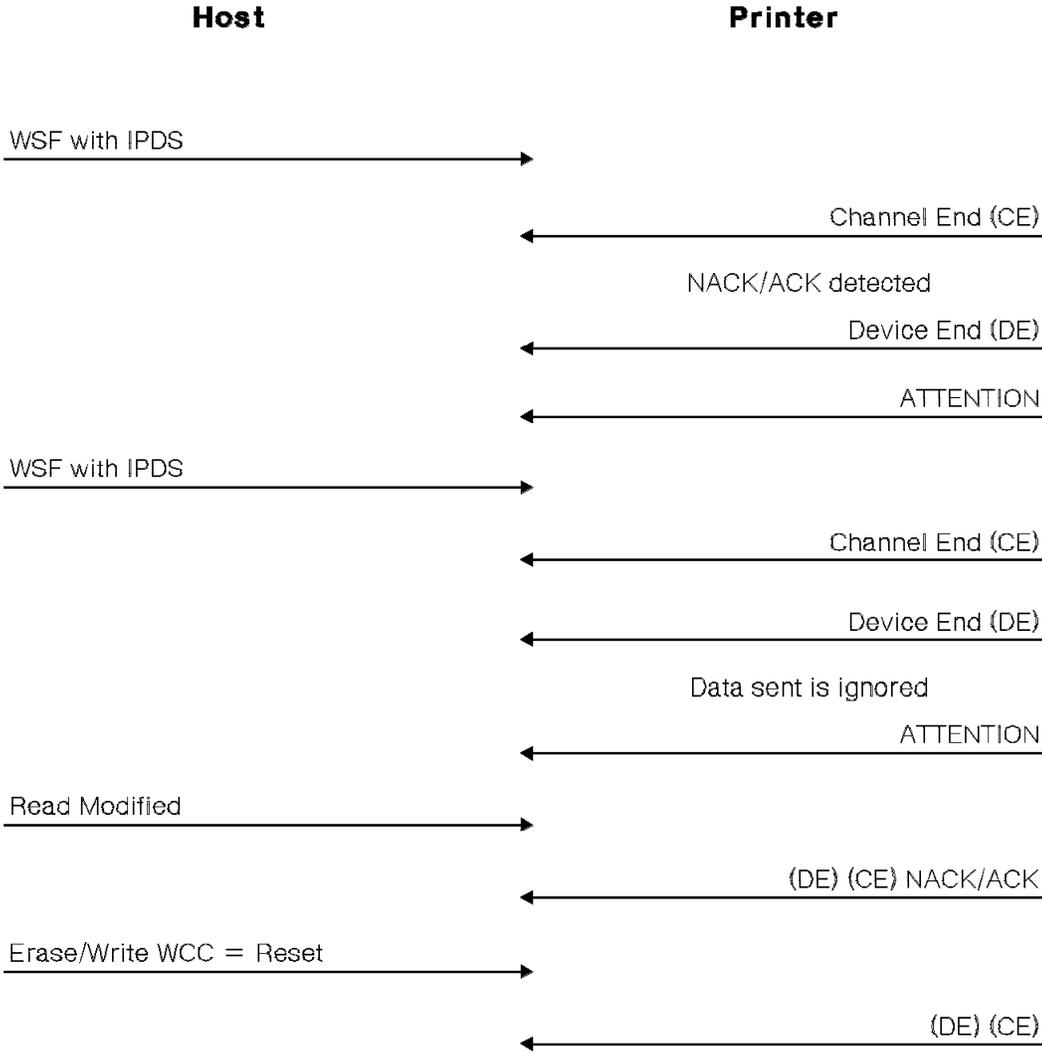


Figure 38. Asynchronous NACK in DSC (Channel-Attached) Mode. Not recommended sequence.

Notes:

1. At the end of this sequence, the printer is no longer in IPDS mode.
2. If the printer generates an Intervention Required (IR) or Equipment Check (EC) NACK, the (DC) (CE) transmission sent after the Erase/Write WCC equals Reset command contains the IR or EC status.

Synchronous NACK Sequences in DSC (Channel-Attached) Mode: If the host application sets the Acknowledge Reply (ARQ) field of the flag byte to 1, the ACKs or NACKs from the printer are synchronous.

Note: The printer treats Intervention Required (IR) or Equipment Check (EC) NACKs, returned as a result of ARQ equals 1, as asynchronous NACKs.

In Figure 39 on page 186, the host does not issue a Read Modified after receiving an Attention from the printer.

(NOT Recommended)

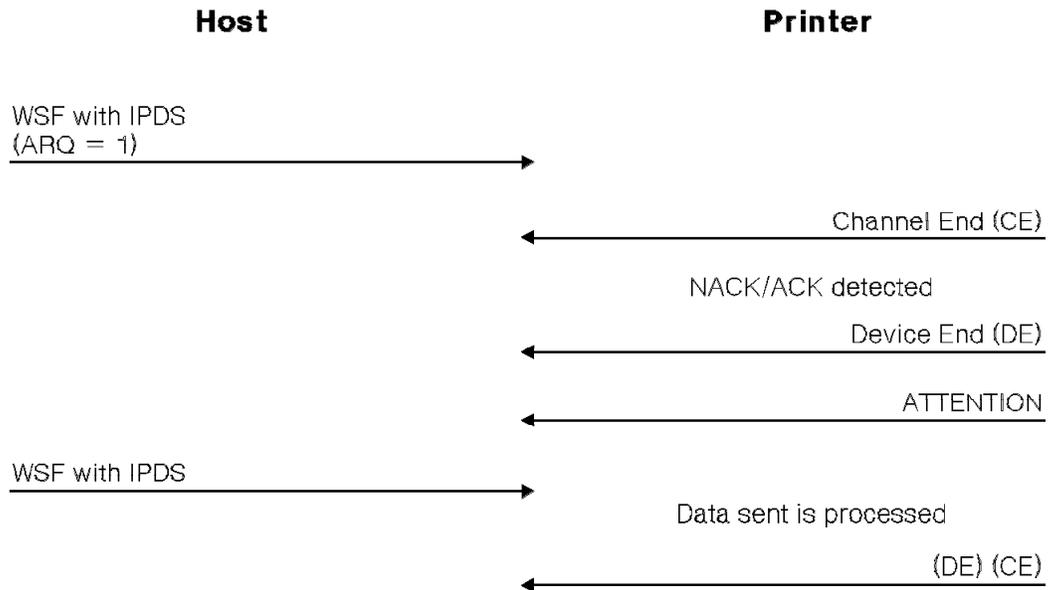


Figure 39. Synchronous ACK/NACK in DSC (Channel-Attached) Mode

Note: At the end of this sequence, the printer is still in IPDS mode. The printer does not send the ACK/NACK to the host.

IPDS ACK/NACK Sequence in DSC Mode (BSC-Attached)

When using IPDS print operations, the printer can have inbound ACK/NACK data to send to the host application. Inbound data may result from an Acknowledge Request required by a prior outbound transmission or from an error condition to be reported.

The first NACK sequence discussed below for use with printer is not desirable. The second NACK sequence for use with printer is recommended.

Not Recommended NACK Sequence for Printers in DSC Mode (BSC-Attached)

When the printer operates in the DSC (BSC-Attached) mode with IPDS and the printer has inbound data to send, the following is the recommended sequence:

1. The host application polls the printer.
2. The printer returns Device End to the host as a response to the poll.
3. The host application responds to the Device End with an acknowledgment.
4. The printer responds to the acknowledgment by sending the NACK to the host application.
5. The host application responds to the NACK by sending another acknowledgment.
6. The printer sends an End of Transmission to the host.

Recommended NACK Sequence for Printers in DSC Mode (BSC-Attached)

1. The host application receives an Attention from the printer notifying the application that inbound data is available. The NACK structured field is sent inbound with the Persist bit active in the flag byte.
2. Any further IPDS data received is ignored by the printer until Step 3 is completed.
3. A valid IPDS command is received with a length less than 256 with the ARQ flag active. The NACK structured field is sent a final time, without the Persist flag bit active. The NACK reply sequence is now complete.

Unlike printers that do not support the Persistent NACK sequence, the printer remains in IPDS mode with IPDS in Home state.

4. If the NACK was due to a printer IR or EC error, the printer returns an IR or EC status response on the next 3270 command.

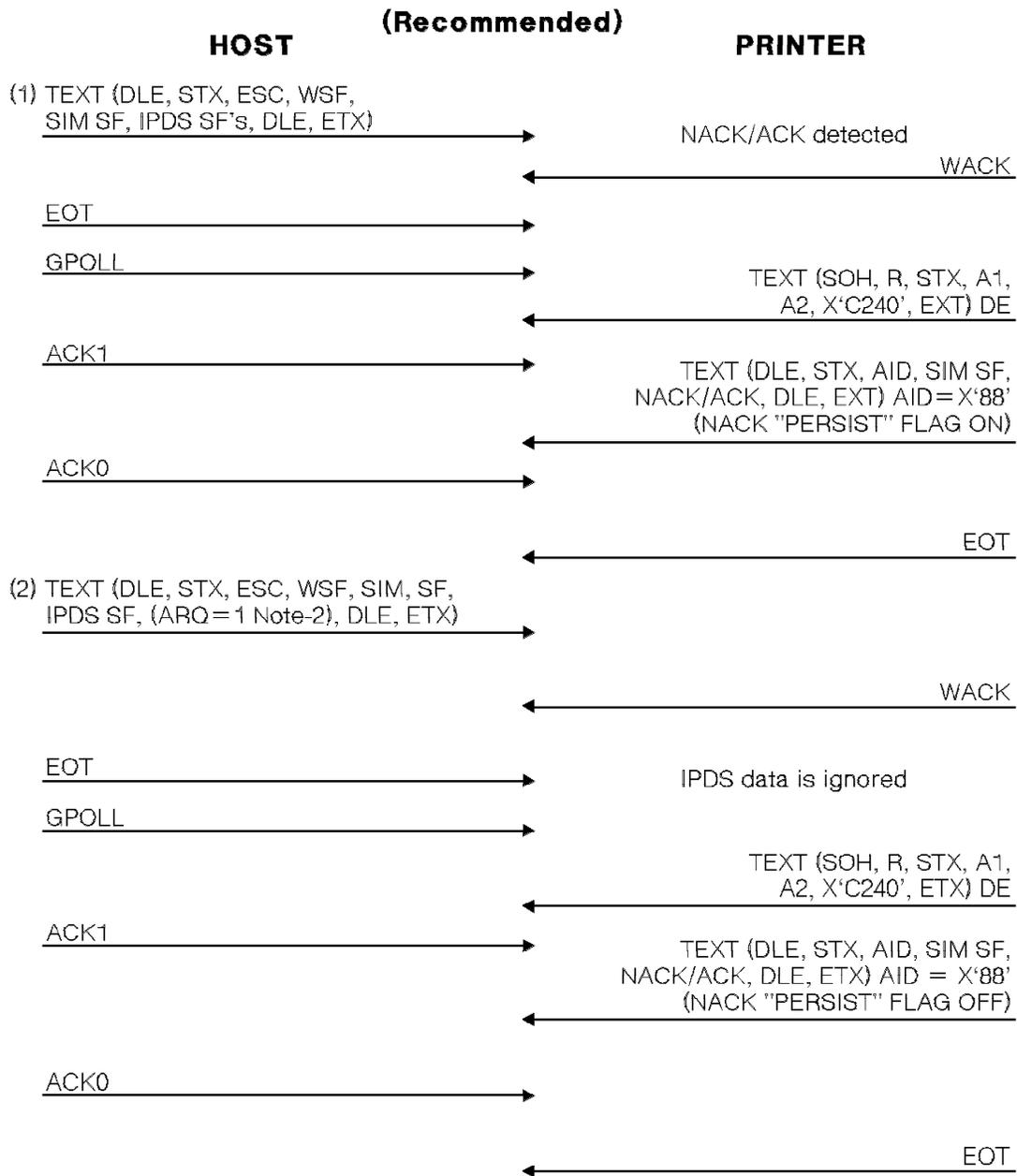


Figure 40. Reporting IPDS Errors in DSC (BSC-Attached) Mode

Notes:

1. At the end of this sequence, the printer remains in IPDS mode if no End-of-Chain structured field has been received.
2. Zero or more command sequences may occur without the ARQ flag being sent. These sequences repeat as in command sequence (1) except all data is ignored. After the ARQ flag is received, the NACK is sent a final time with the Persist bit off. This completes the NACK reply sequence.
3. If the printer generates an Intervention Required (IR) or Equipment Check (EC) NACK, the IR or EC status is returned in response to the next 3270 command.

Other Asynchronous/Synchronous Sequences in DSC (BSC-Attached) Mode

The following charts show what can happen if the host application issues a write type (Text) command after the printer sends a Device End. These sequences are not recommended.

Asynchronous NACK Sequences in DSC (BSC-Attached) Mode: In Figure 41, the host sends text to the printer after a Device End while the printer has an asynchronous NACK pending.

(NOT Recommended)

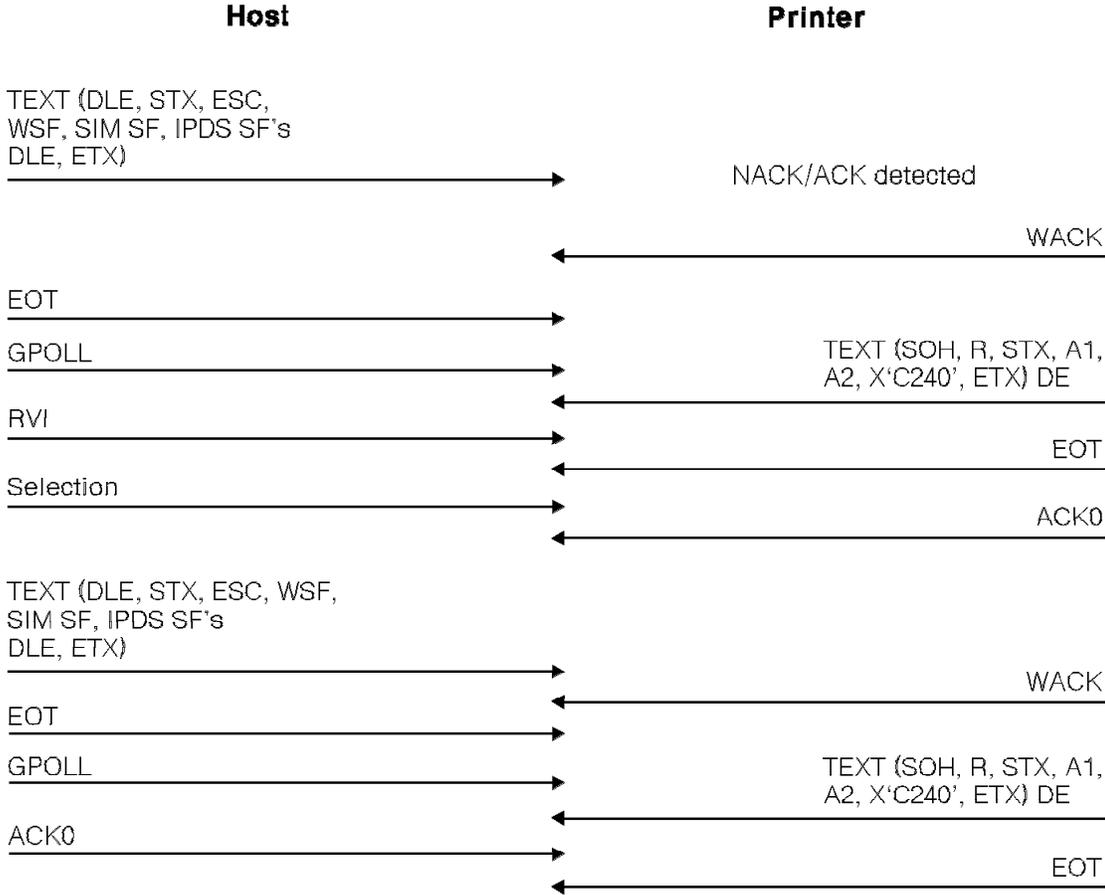


Figure 41. Asynchronous NACK in DSC (BSC-Attached) Mode

Note: If the first text section is the end-of-chain, and the host does not read the NACK before sending more text, then the printer loses the pending NACK and processes the second text section, as illustrated in Figure 41. If the first text section is not end-of-chain, the printer ignores the second text section sent by the host and resends the NACK.

Synchronous NACK Sequences in DSC (BSC-Attached) Mode: In Figure 42, the host sends text to the printer after a Device End while the printer has a synchronous NACK pending.

(NOT Recommended)

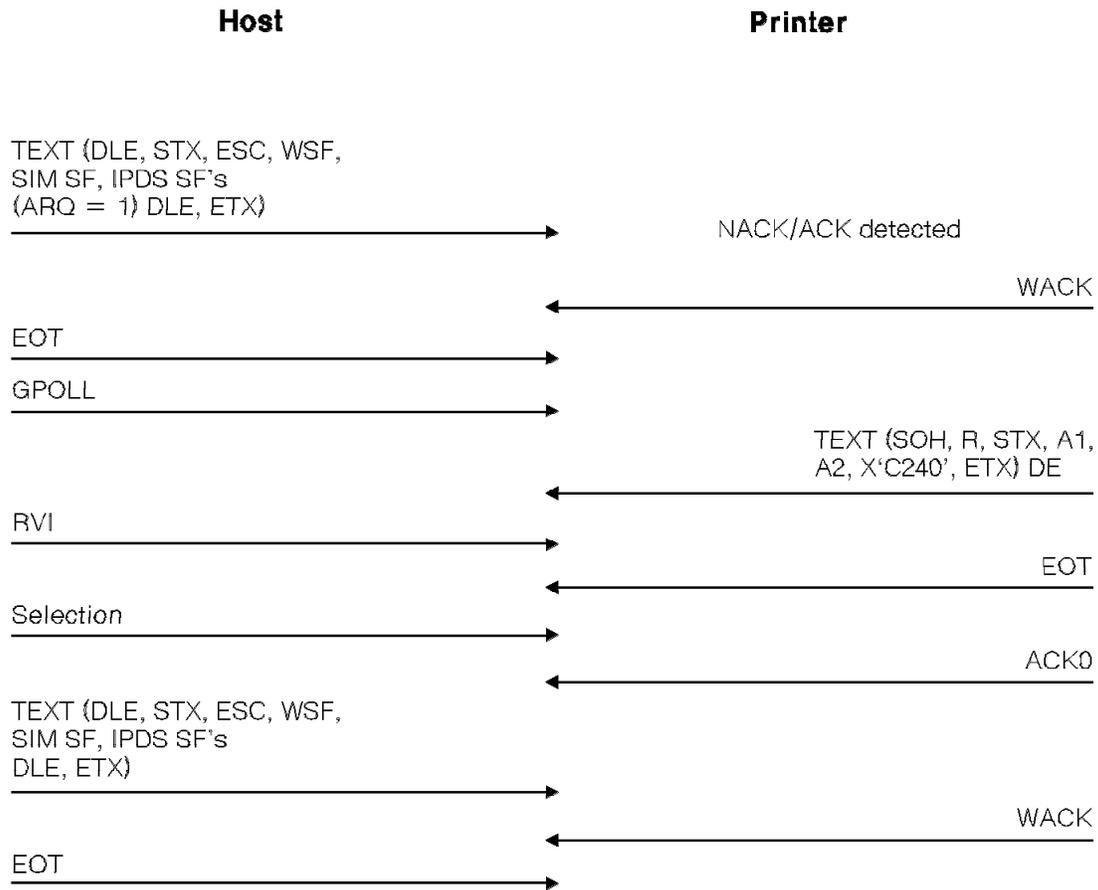


Figure 42. Synchronous ACK/NACK in DSC (BSC-Attached) Mode

Note: At the end of this sequence, the printer does not send the ACK/NACK to the host, and the ACK/NACK is lost.

Structured Field Descriptions

IPDS requirements include additional structured fields, as well as changes to existing fields. The following pages describe these structured fields.

LU-1 (SNA) Structured Fields

IPDS in the LU-1 environment requires the definition of a data stream identifier for the query reply data streams structured field. This field has the following format:

Byte	Value	Description
0-1	0006	Length
2	81	Type=Query Reply
3	A2	Data Streams Indicator
4-5	0002	List of Data Stream Identifiers

This query reply indicates the valid data streams for the printer. The structured field is an inbound field only.

DSC (Non-SNA) Structured Fields

IPDS in the DSC environment requires two structured fields. In addition, two Q codes for the query reply structured fields are required.

Data Chain Structured Field

This structured field provides a data-chaining function in the non-SNA environment. This is an outbound field only and must be the first structured field in the transmission. The format of this field is:

Byte	Value	Description
0-1	0006	Structured Field Length
2-3	0F21	Data Chain Indicator
4	Bit 0	Reserved
	Bit 1-2	Group 00 = Continue 01 = End 10 = Begin 11 = Only
	Bit 3-4	Inbound Control Always 00 (No Change) Inbound Data Chaining is Not Valid
	Bit 5-7	Reserved (Must be 000)
5	00	Reserved

Select IPDS Mode

This structured field selects IPDS in the non-SNA environment. If used with the data chain structured field, the select IPDS mode field must immediately follow the data chain structured field. If the data chain structured field is not used, the select IPDS mode structured field must be the first structured field in the transmission. This field is an inbound and an outbound field. The format of this field is:

Byte	Value	Description
0-1	0006	Structured Field Length
2-3	0F83	Select IPDS Mode
4-5	0000	Reserved

Data Chaining Query Reply

This query reply indicates that data-chaining is valid in the non-SNA environment. This is an inbound field only. The format of this field is:

Byte	Value	Description
0-1	0006	Structured Field Length
2	81	Query Reply
3	98	Data Chaining
4	80	Direction (to Device Only)
5	00	Reserved

3270 IPDS Query Reply

This query reply indicates that IPDS is valid in the non-SNA environment. This is an inbound field only. The format of this field is:

Byte	Value	Description
0-1	0008	Structured Field Length
2	81	Query Reply
3	9A	3270 IPDS
4-5	0000	Reserved
6-7	0FB0	Maximum Allowable Outbound Transmission Size

Programming Dependencies

The use of IPDS requires the following programming support outside of the 3174 and 3274 Control Unit.

BSC

The Write Structured Field (WSF) command sends IPDS data from the application program to the printer. This data (contained within structured fields) does not include a WCC. In IPDS mode, the start of printing depends on the content of the data stream and conditions within the printer.

Transmissions to a printer in IPDS mode can therefore receive either an ACK reply or a WACK reply from the control unit. The WACK reply is the only positive indication that BSC sense/status indicating device end subsequently is sent by the control unit.

MVS/CICS with VTAM in LU-1 Mode (Remote 3X74 Attachment)

The following examples represent some sample settings used with the printer in LU-1 mode with CICS* and VTAM*. Of the table settings listed below, the following are required: **TRMTYPE** = *SCSPRT*, **TRMSTAT** = *TRANSCEIVE*, and **FEATURE** = *EXTDS*.

TCT entries in CICS:

WEP1 DFHTCT

TYPE=*TERMINAL*,
TRMIDNT=*WEP1*,

Reference name for this TCT entry

NETNAME=*FA0C1A05*,
As defined by NCP

TRMTYPE=*SCSPRT*,

TRMTYPE is set to SCSPRT to describe the type of terminal used.

TRMMODL=*2*,
TCTUAL=*40*,**TIOAL**=*(256,5000)*,
RELREQ=*(YES,YES)*,
ACCMETH=*VTAM*,
CHNASSY=*YES*,
RUSIZE=*1042*,
GMMMSG=*NO*,
TRMSTAT=*TRANSCEIVE*,
PGESTAT=*AUTOPAGE*,
FEATURE=*EXTDS*,

FEATURE is set to *EXTDS* to allow the use of FMH's with a **TRMTYPE** of *SCSPRT*.

BUFFER=*1536*,

LOGMODE=*PRTIPDS1*

LOGMODE is set to *PRTIPDS1* (or any valid name) to point to the **MODEENT** entry of the Logon Mode table.

MODEENT entries for the Logon Mode Table in VTAM LU-1 Mode:

PRTIPDS1 MODEENT

LOGMODE=*PRTIPDS1*,
FMPROF=*X' 03'*,
TSPROF=*X' 03'*,
PRIPROT=*X' B1'*,
SECPROT=*X' 90'*,
COMPROT=*X' 7080'*,

COMPROT describes to VTAM the LU protocol that is used for the logon mode session. The value of *X' 7080'* allows the use of FM-1 headers.

```
RUSIZES=X' 85C7',  
PSNDPAC=X' 01',  
SRCVPAC=X' 01',  
PSERVIC=X' 01000000E10018500007E00 '
```

In conjunction with the above table entries, FMH-1 entries to begin and end IPDS are required. The FMH-1 to begin IPDS is placed before the IPDS data stream and the FMH-1 to end IPDS is placed after the IPDS data stream as shown below:

FMH-1 to begin IPDS:

```
X'0601300D4000 '
```

IPDS Data Stream:

Insert an IPDS data stream here.

FMH-1 to end IPDS:

```
X'0601300D2000 '
```

MVS/CICS with VTAM in DSC Mode (Local 3X74 Attachment)

The following examples represent some sample settings used with the printer in DSC (non-SNA) mode with CICS and VTAM. Of the table settings listed below, the following are required: **FEATURE** = *EXTDS*, **TRMSTAT** = *TRANSCEIVE*, and **FEATUR2** = *EDATS*.

TCT entries in CICS:

D72L032 DFHTCT

```
TYPE=TERMINAL,  
TRMIDNT=BL32,  
Reference name for this TCT entry
```

```
ACCMETH=VTAM,  
FEATURE=(COPY,COLOR,PS,EXTDS),  
RELREQ=(YES,YES),  
TIOAL=3000,  
TRMMODL=2,  
TRMSTAT=TRANSCEIVE,  
TRMTYPE=L3284,  
RUSIZE=256,  
NETNAME=D72L032,  
As defined by VTAM local table  
  
CLASS=(CONV,VIDEO),  
ALTSCRN=(32,80),  
ERRATT=NO
```

LOCAL entries for the Local Terminal table in VTAM:

D72L032 LOCAL

CUADDR=B9F,
TERM=3286,
FEATUR2=(MODEL2,EDATS),

The *EDATS* parameter allows the use of structured fields.

ISTATUS=ACTIVE,
USSTAB=PUBSERL,
MODETAB=TABMODE,
DLOGMOD=PRTIPDS2

DLOGMOD is set to *PRTIPDS2* (or any valid name) to point to the **MODEENT** entry of the Logon Mode table.

MODEENT entries for the Logon Mode table in VTAM in DSC Mode:

PRTIPDS2 MODEENT

LOGMODE=PRTIPDS2,
FMPROF=X' 02' ,
TSPROF=X' 02' ,
PRIPROT=X' 71' ,
SECPROT=X' 40' ,
COMPROT=X' 2000' ,

COMPROT describes to VTAM the LU protocol that is used for this logon mode session. The value *X'2000'* allows the use of structured fields.

PSERVIC=X' 00800000000018502B507F00 '

In addition to the above table entries, two structured fields are required. The Data Chain indicator and the Select IPDS mode structured fields precede the IPDS data stream as shown below:

Structured fields:

X'00060F216000 ' Data Chain indicator
 X'00060F830000 ' Select IPDS mode

IPDS Data Stream:

Insert an IPDS data stream here.

Note: To force synchronous processing using CICS, use the **CONVERSE** command with the ARQ bit on. The **CONVERSE** command is the equivalent of a **SEND** data, **WAIT** on terminal, **RECEIVE** response sequence. The printer sends a NACK as an *X'80'*.

Related Reading

- **CICS/VS**
 - *IBM Customer Information Control System/Virtual Storage (CICS/VS): Resource Definition Guide (Macro), Version 1 Release 7, SC33-0237*
 - *IBM Customer Information Control System/Virtual Storage (CICS/VS): Resource Definition Guide (Online), Version 1 Release 7, SC33-0186*
- **ACF for NCP**
 - *IBM Advanced Communications Function for Network Control Program and System Support Programs for 3705: Installation and Resource Definition Guide, Version 2, SC30-3167*
 - *IBM Advanced Communications Function for Network Control Program and System Support Programs for 3725: Installation and Resource Definition Guide, Version 2, SC30-3178*
 - *IBM Advanced Communications Function for Network Control Program and System Support Programs for 3705: Installation and Resource Definition Guide, Version 3, SC30-3224*
 - *IBM Advanced Communications Function for Network Control Program and System Support Programs for 3725: Installation and Resource Definition Guide, Version 3, SC30-3226*
- **ACF for VTAM**
 - *IBM Advanced Communications Function for VTAM: Installation and Resource Definition Guide, SC23-0111*
 - *IBM Advanced Communications Function for VTAM: Installation and Resource Definition Guide, Version 2 Release 2, SC27-0610*
 - *IBM Advanced Communications Function for VTAM Customization, Version 2 Release 2: MVS/VSE/OS/VSI, SC27-0613.*

Glossary of Abbreviations and Definitions

This glossary includes abbreviations and definitions from:

- The *Dictionary of Computing*, SC20-1699.
- The *American National Standard Dictionary for Information Systems*, ANSI X3.172-1990, copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018. Definitions are identified by the symbol (A) after the definition.
- The *ANSI/EIA Standard - 440A: Fiber Optic Terminology*, copyright 1989 by the Electronics Industries Association (EIA). Copies can be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue N.W., Washington, D.C. 20006. Definitions are identified by the symbol (E) after the definition.
- The *Information Technology Vocabulary*, developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions of published parts of this vocabulary are identified by the symbol (I) after the definition; definitions taken from draft international standards, committee drafts, and working papers being developed by ISO/IEC JTC1/SC1 are identified by the symbol (T) after the definition, indicating that final agreement has not yet been reached among the participating National Bodies of SC1.

The following cross-references are used in this glossary:

Contrast with. This refers to a term that has an opposed or substantively different meaning.

See. This refers the reader to multiple-word terms in which this term appears.

See also. This refers the reader to terms that have a related, but not synonymous, meaning.

Synonym for. This indicates that the term has the same meaning as a preferred term, which is defined in the glossary.

If you do not find the term that you are looking for, please refer to the *IBM Dictionary of Computing*, document number ZC20-1699.

The following definitions are provided as supporting information only, and are not intended to be used as a substitute for the semantics described in the body of this reference.

A

absolute coordinate. One of the coordinates that identify the location of an addressable point with respect to the origin of a specified coordinate system. Contrast with *relative coordinate*.

absolute move. A method used to designate a new presentation position by specifying the distance from the designated axes to the new presentation position. The reference for locating the new presentation position is a fixed position as opposed to the current presentation position.

Acknowledge Reply. A printer-to-host reply that returns printer information or reports exceptions. An Acknowledge Reply can be positive or negative. See also *Positive Acknowledge Reply* and *Negative Acknowledge Reply*.

active coded font. The coded font that is currently being used by a product to process text.

addressable position. A position in a presentation space or on a physical medium that can be identified by a coordinate from the coordinate system of the presentation space or physical medium. See also *picture element*. Synonymous with *position*.

all points addressable (APA). The capability to address, reference, and position data elements at any addressable position in a presentation space or on a physical medium. Contrast with character cell addressing, in which the presentation space is divided into a fixed number of character-size rectangles in which characters can appear. Only the cells are addressable. An example of all points addressability is the positioning of text, graphics, and images at any addressable point on the physical medium. See also *picture element*.

alternate exception action (AEA). In the IPDS architecture, a defined action that a printer can take when a clearly defined, but unsupported, request is received. Control over alternate exception actions is specified by an Execute Order Anystate Exception-Handling Control command.

American National Standards Institute (ANSI). An organization consisting of producers, consumers, and general interest groups. ANSI establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. It is the United States constituent body of the International Organization for Standardization (ISO).

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anamorphic scaling. Scaling an object differently in the vertical and horizontal directions. See also *scaling*, *horizontal font size*, and *vertical font size*.

ANSI. See *American National Standards Institute*.

append. In the MO:DCA architecture, an addition to or continuation of the contents of a document component. An example of an append is a string of text that is an addition to an existing string of text on a page.

application. (1) The use to which an information system is put. (2) A collection of software components used to perform specific types of work on a computer.

application program. A program written for or by a user that applies to the user's work.

arc. A continuous portion of the curved line of a circle or ellipse. See also *full arc*.

arc parameters. Variables that specify the curvature of an arc.

area. In GOCA, a set of closed figures that can be filled with a pattern or a color.

array. In FD:OCA, the conceptual model used to describe formatted data. An array describes a string of data fields in terms of dimensions. See also *dimension*.

article. The physical item that a bar code identifies.

A-space. The distance from the character reference point to the least positive character coordinate system X-axis value of the character shape. A-space can be positive, zero, or negative. See also *B-space* and *C-space*.

asynchronous exception. Any exception other than those used to report a synchronous data-stream defect (action code X'01' or X'1F') or synchronous resource-storage problem (action code X'0C'). Asynchronous exceptions occur after the received page station. An example of an asynchronous exception is a paper jam. See also *data-stream exception*. Contrast with *synchronous exception*.

attribute. A property or characteristic of one or more constructs. See also *character attribute*, *color attribute*, *current drawing attributes*, *default drawing attributes*, *line attributes*, *marker attributes*, and *pattern attributes*.

B

b_c. See *current baseline print coordinate*.

b_i. See *initial baseline print coordinate*.

B. See *baseline direction*.

+B. Positive baseline direction.

B_c. See *current baseline presentation coordinate*.

B_o. See *baseline presentation origin*.

background. (1) The part of a presentation space that is not occupied with object data. (2) In GOCA, that portion of a graphics primitive that is mixed into the presentation space under the control of the current values of the background mix and background color attributes. Contrast with *foreground*. (3) In GOCA, that portion of a character cell that does not represent a character. (4) In bar codes, the spaces, quiet zones, and area surrounding a printed bar code symbol.

background color. The color of a background. Contrast with *foreground color*.

background mix. (1) An attribute that determines how the color of the background of a graphics primitive is combined with the existing color of the graphics presentation space. (2) An attribute that determines how the points in overlapping presentation space backgrounds are combined. Contrast with *foreground mix*.

bar. In bar codes, the darker element of a printed bar code symbol. See also *element*. Contrast with *space*.

bar code. An array of parallel rectangular bars and spaces that together represent data elements or characters in a particular symbology. The bars and spaces are arranged in a predetermined pattern following unambiguous rules defined by the symbology. See also *bar code symbol*.

bar code command set. In the IPDS architecture, a collection of commands used to present bar code symbols in a page, page segment, or overlay.

bar code density. The number of characters per inch (cpi) in a bar code symbology. In most cases, the range is three to ten cpi. See also *character density*, *density*, and *information density*.

Bar Code Object Content Architecture (BCOCA). An architected collection of constructs used to interchange and present bar code data.

bar code presentation space. A two-dimensional conceptual space in which bar code symbols are generated.

bar code symbol. A combination of characters including start and stop characters, quiet zones, data characters, and check characters required by a particular symbology, that form a complete, scannable entity. See also *bar code*.

bar height In bar codes, the bar dimension perpendicular to the bar width. Synonymous with *bar length* and *height*.

bar length In bar codes, the bar dimension perpendicular to the bar width. Synonymous with *bar height* and *height*.

baseline. A conceptual line with respect to which successive characters are aligned. See also *character baseline*. Synonymous with *printing baseline* and *sequential baseline*.

baseline coordinate. One of a pair of values that identify the position of an addressable position with respect to the origin of a specified I,B coordinate system. This value is specified as a distance in addressable positions from the I axis of an I,B coordinate system. Synonymous with *B-coordinate*.

baseline direction (B). The direction in which successive lines of text appear on a logical page. Synonymous with *baseline progression* and *B-direction*.

baseline increment. The distance between successive baselines.

baseline progression (B). The direction in which successive lines of text appear on a logical page. Synonymous with *baseline direction* and *B-direction*.

B axis. The axis of the I,B coordinate system that extends in the baseline or B-direction. The B axis does not have to be parallel to the Y_p axis of its bounding X_p, Y_p coordinate space.

BCOCA. See *Bar Code Object Content Architecture*.

B-coordinate. One of a pair of values that identify the position of an addressable position with respect to the origin of a specified I,B coordinate system. This value is specified as a distance in addressable positions from the I axis of an I,B coordinate system. Synonymous with *baseline coordinate*.

B-direction (B). The direction in which successive lines of text appear on a logical page. Synonymous with *baseline direction* and *baseline progression*.

Begin Segment Introducer (BSI). An IPDS graphics self-defining field that precedes all of the drawing orders in a graphics segment.

BITS. A data type for architecture syntax, indicating one or more bytes to be interpreted as bit string information.

block or data block Deprecated terms for object area.

body. (1) On a printed page, the area between the top and bottom margins that can contain data. (2) In a book, the portion between the front matter and the back matter.

B-space. The distance between the character coordinate system X-axis values of the two extremities of a character shape. See also *A-space* and *C-space*.

C

Canadian Grocery Product Code (CGPC). The bar code symbology used to code grocery items in Canada.

CGPC. See *Canadian Grocery Product Code*.

character. (1) A member of a set of elements used for the organization, control, or representation of data. A character can be either a graphic character or a control character. See also *graphic character* and *control character*. (2) In bar codes, a single group of bars and spaces that represent an individual number, letter, punctuation mark, or other symbol.

character angle. The angle that is between the baseline of a character string and the horizontal axis of a presentation space or physical medium.

character attribute. A characteristic that controls the appearance of a character or character string.

character baseline. A conceptual reference line that is coincident with the X axis of the character coordinate system.

character box. A conceptual rectangular box with two sides parallel to the character baseline. A character's shape is formed within a character box by a presentation process, and the character box is then positioned in a presentation space or on a physical medium. The character box can be rotated before it is positioned.

character cell size. The size of a rectangle in a drawing space used to scale font symbols into the drawing space.

character code. An element of a code page or a cell in a code table to which a character can be assigned. The element is associated with a binary value. The assignment of a character to an element of a code page determines the binary value that will be used to represent each occurrence of the character in a character string.

character coordinate system. An orthogonal coordinate system that defines font and character measurement distances. The origin is the character

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reference point. The X axis coincides with the character baseline.

character density. The number of characters per inch (cpi) in a bar code symbology. In most cases, the range is three to ten cpi. See also *bar code density*, *density*, and *information density*.

character direction. In GOCA, an attribute controlling the direction in which a character string grows relative to the inline direction. Values are: left-to-right, right-to-left, top-to-bottom, and bottom-to-top. Synonymous with *direction*.

character increment. The distance from a character reference point to a character escapement point. For each character, the increment is the sum of a character's A-space, B-space, and C-space. A character's character increment is the distance the inline coordinate is incremented when that character is placed in a presentation space or on a physical medium. Character increment is a property of each graphic character in a font and of the font's character rotation.

character metrics. Measurement information that defines individual character values such as height, width, and space. Character metrics can be expressed in specific fixed units, such as pels, or in relative units that are independent of both the resolution and the size of the font. Often included as part of the more general term "font metrics". See also *character set metrics* and *font metrics*.

character precision. The acceptable amount of variation in the appearance of a character on a physical medium from a specified ideal appearance, including no acceptable variation. Examples of appearance characteristics that can vary for a character are shape and position.

character reference point. The origin of a character coordinate system. The X axis is the character baseline.

character rotation. The alignment of a character with respect to its character baseline, measured in degrees in a clockwise direction. Examples are 0°, 90°, 180°, and 270°. Zero-degree character rotation exists when a character is in its customary alignment with the baseline. Contrast with *rotation*.

character set. A finite set of different graphic or control characters that is complete for a given purpose. For example, the character set in ISO Standard 646, *7-bit Coded Character Set for Information Processing Interchange*.

character set attribute. An attribute used to specify a coded font.

character set metrics. The measurements used in a font. Examples are height, width, and character

increment for each character of the font. See also *character metrics* and *font metrics*.

character shear. The angle of slant of a character cell that is not perpendicular to a baseline. Synonymous with *shear*.

character string. A sequence of characters.

check character. In bar codes, a character included within a bar code message whose value is used to perform a mathematical check to ensure the accuracy of that message. Synonymous with *check digit*.

check digit. In bar codes, a character included within a bar code message whose value is used to perform a mathematical check to ensure the accuracy of that message. Synonymous with *check character*.

clear area. A clear space that contains no machine-readable marks preceding the start character of a bar code symbol or following the stop character. Synonymous with *quiet zone*. Contrast with *intercharacter gap* and *space*.

clipping. Eliminating those parts of a picture that are outside of a clipping boundary such as a viewing window or presentation space. See also *viewing window*. Synonymous with *trimming*.

Codabar. A bar code symbology characterized by a discrete, self-checking, numeric code with each character represented by a stand-alone group of four bars and the three spaces between them.

CODE. A data type for architecture syntax that indicates an architected constant to be interpreted as defined by the architecture.

Code 128. A bar code symbology characterized by a variable-length, alphanumeric code with 128 characters.

coded font. (1) A resource containing elements of a code page and a font character set, used for presenting text, graphics character strings, and bar code HRI. See also *code page* and *font character set*. (2) In FOCA, a resource containing the resource names of a valid pair of font character set and code page resources. The graphic character set of the font character set must match the graphic character set of the code page for the coded font resource pair to be valid. (3) In the IPDS architecture, a raster font resource containing code points that are directly paired to font metrics and the raster representation of character shapes, for a specific graphic character set. (4) In the IPDS architecture, a font resource containing descriptive information, a code page, font metrics, and a digital-technology representation of character shapes for a specific graphic character set.

coded graphic character set. A set of graphic characters with their assigned code points.

code page. (1) A resource object containing descriptive information, graphic character identifiers, and code points corresponding to a coded graphic character set. Graphic characters have been added over time; therefore, to specifically identify a code page, both a GCSGID and a CPGID should be used. See also *coded graphic character set*. (2) A set of assignments, each of which assigns a code point to a character. Each code page has a unique name or identifier. Within a given code page, a code point is assigned to one character. More than one character set can be assigned code points from the same code page. See also *code point* and *section*.

Code Page Global Identifier (CPGID). A unique code page identifier that can be expressed as either a two-byte binary or a five-digit decimal value.

code point. A unique bit pattern that can serve as an element of a code page or a site in a code table, to which a character can be assigned. The element is associated with a binary value. The assignment of a character to an element of a code page determines the binary value that will be used to represent each occurrence of the character in a character string. Code points are one or more bytes long. See also *code table* and *section*.

code table. A table showing the character allocated to each code point in a code. See also *code page* and *code point*.

color attribute. An attribute that affects the color values provided in a graphics primitive, a text control sequence, or an IPDS command. Examples of color attributes are foreground color and background color.

color image. Images whose image data elements are represented by multiple bits or whose image data element values are mapped to color values. Constructs that map image-data-element values to color values are look-up tables and image-data-element structure parameters. Examples of color values are screen color values for displays and color toner values for printers.

color of medium. The color of a presentation space before any data is added to it. Synonymous with *reset color*.

column. In FD:OCA, a subarray consisting of all elements that have an identical position within the low dimension of a regular two-dimensional array.

command. (1) In the IPDS architecture, a structured field sent from a host to a printer. (2) In GOCA, a data-stream construct used to communicate from the controlling environment to the drawing process. The command introducer is environment dependent. (3) A request for system action.

command set. A collection of IPDS commands.

command-set vector. Information that identifies an IPDS command set and data level supported by a printer. Command-set vectors are returned with an Acknowledge Reply to an IPDS Sense Type and Model command.

compression algorithm. An algorithm used to compress image data. Compression of image data can decrease the volume of data required to represent an image.

construct. An architected set of data such as a structured field or a triplet.

continuous-form media. Connected sheets. An example of connected sheets is sheets of paper connected by a perforated tear strip. Contrast with *cut-sheet media*.

control character. (1) A character that denotes the start, modification, or end of a control function. A control character can be recorded for use in a subsequent action, and it can have a graphic representation. See also *character*. (2) A control function the coded representation of which consists of a single code point.

controlled white space. White space caused by execution of a control sequence. See also *white space*.

control sequence. A sequence of bytes that specifies a control function. A control sequence consists of a control sequence introducer and zero or more parameters.

control sequence chaining. A method used to identify a sequential string of control sequences so they can be processed efficiently.

control sequence introducer. The information at the beginning of a control sequence. An unchained control sequence introducer consists of a control sequence prefix, a class, a length, and a function type. A chained control sequence introducer consists of a length and a function type.

coordinate system. A Cartesian coordinate system. An example is the image coordinate system that uses the fourth quadrant with positive values for the Y axis. The origin is the upper left-hand corner of the fourth quadrant. A pair of (x,y) values corresponds to one image point. Each image point is described by an image data element. See also *character coordinate system*.

coordinates. A pair of values that specify a position in a coordinate space. See also *absolute coordinate* and *relative coordinate*.

copy control. A method used to specify the number of copies for a presentation space and the modifications to be made to each copy.

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copy counter. Bytes in an Acknowledge Reply that identify the number of copies of a page that have passed a particular point in the logical paper path.

copy group. A set of copy subgroups that specify all copies of a sheet. In the IPDS architecture, a copy group is specified by a Load Copy Control command. In the MO:DCA architecture, a copy group is specified within a Medium Map. See also *copy subgroup*.

copy modification. The process of adding, deleting, or replacing data on selected copies of a presentation space.

copy subgroup. A part of a copy group that specifies a number of identical copies of a sheet and all modifications to those copies. Modifications include the media source, medium overlays to be presented on the sheet, text suppressions, the number of pages on the sheet, and either simplex or duplex presentation. In the IPDS architecture, copy subgroups are specified by Load Copy Control command entries. In the MO:DCA architecture, copy subgroups are specified by repeating groups in the Medium Copy Count structured field in a Medium Map. See also *copy group*.

correlation. (1) A method used in GOCA to determine if a picture defines any parts of a drawing that lie within a pick window. See also *pick window*. (2) A method used in the IPDS architecture to match exceptions with commands.

correlation ID. A two-byte value that specifies an identifier of an IPDS command. The correlation ID is optional and is present only if bit one of the command's flag byte is B'1'.

CPGID. See *Code Page Global Identifier*.

C-space. The distance from the most positive character coordinate system X-axis value of a character shape to the character's escapement point. C-space can be positive, zero, or negative. See also *A-space* and *B-space*.

current baseline coordinate. The baseline presentation position at the present time. The baseline presentation position is the summation of the increments of all baseline controls since the baseline was established in the presentation space. The baseline presentation position is established in a presentation space either as part of the initialization procedures for processing an object or by an Absolute Move Baseline control sequence. Synonymous with *current baseline presentation coordinate*.

current baseline presentation coordinate (B_c). The baseline presentation position at the present time. The baseline presentation position is the summation of the increments of all baseline controls since the baseline was established in the presentation space. The baseline presentation position is established in a

presentation space either as part of the initialization procedures for processing an object or by an Absolute Move Baseline control sequence. Synonymous with *current baseline coordinate*.

current baseline print coordinate (b_c). In the IPDS architecture, the baseline coordinate corresponding to the current print position on a logical page. The current baseline print coordinate is a coordinate in an I,B coordinate system. See also *I,B coordinate system*.

current drawing attributes. The set of attributes used at the present time to direct a drawing process. Contrast with *default drawing attributes*.

current drawing controls. The set of drawing controls used at the present time to direct a drawing process. Contrast with *default drawing controls*.

current logical page. The logical page presentation space that is currently being used to process the data within a page object or an overlay object.

current position. The position identified by the current presentation space coordinates. For example, the coordinate position reached after the execution of a drawing order. See also *current baseline presentation coordinate* and *current inline presentation coordinate*. Contrast with *given position*.

cut-sheet media Unconnected sheets. Contrast with *continuous-form media*.

D

data stream A continuous stream of data that has a defined format. An example of a defined format is a structured field.

data-stream exception. In the IPDS architecture, a condition that exists when the printer detects an invalid or unsupported command, order, control, or parameter value from the host. Data-stream exceptions are those whose action code is X'01', X'19', or X'1F'. See also *asynchronous exception* and *synchronous exception*.

decoder. In bar codes, the component of a bar code reading system that receives the signals from the scanner, performs the algorithm to interpret the signals into meaningful data, and provides the interface to other devices. See also *reader* and *scanner*.

default A value, attribute, or option that is assumed when none has been specified and one is needed to continue processing. See also *default drawing attributes* and *default drawing controls*.

default drawing attributes. The set of drawing attributes adopted at the beginning of a drawing process and usually at the beginning of each root

segment that is processed. See also *root segment*. Contrast with *current drawing attributes*.

default drawing controls. The set of drawing controls adopted at the start of a drawing process and usually at the start of each root segment that is processed. See also *root segment*. Contrast with *current drawing controls*.

density. The number of characters per inch (cpi) in a bar code symbology. In most cases, the range is three to ten cpi. See also *bar code density*, *character density*, and *information density*.

device-control command set. In the IPDS architecture, a collection of commands used to set up a page, communicate device controls, and manage printer acknowledgment protocol.

dimension. In FD:OCA, each successive level of partitioning. Dimensions allow the addressing of specific parts of an array. See also *partitioning* and *array*.

direction. In GOCA, an attribute that controls the direction in which a character string grows relative to the inline direction. Values are: left-to-right, right-to-left, top-to-bottom, and bottom-to-top. Synonymous with *character direction*.

document. (1) A machine-readable collection of one or more objects that represents a composition, a work, or a collection of data. (2) A publication or other written material.

document component. An architected part of a document data stream. Examples of document components are documents, pages, page groups, indexes, resource groups, objects, and process elements.

document content architecture. A family of architectures that define the syntax and semantics of the document component. See also *document component* and *structured field*.

document element. A self-identifying, variable-length, bounded record, which can have a content portion that provides control information, data, or both. An application or device does not have to understand control information or data to parse a data stream when all the records in the data stream are document elements. See also *structured field*.

downloaded resource. In the IPDS architecture, a resource in a printer that is installed and removed under control of a host presentation services program. A downloaded resource is referenced by a host-assigned name that is valid for the duration of the session between the presentation services program and the printer. Contrast with *resident resource*.

drawing order. In GOCA, a graphics construct that the controlling environment builds to instruct a drawing processor about what to draw and how to draw it. The order can specify, for example, that a graphics primitive be drawn, a change to drawing attributes or drawing controls be effected, or a segment be called. One or more graphics primitives can be used to draw a picture. Drawing orders can be included in a structured field. See also *order*.

drawing order coordinate space (DOCS). A two-dimensional conceptual space in which graphics primitives are drawn, using drawing orders, to create pictures.

drawing processor. A graphics processor component that executes segments to draw a picture in a presentation space. See also *segment*, *graphics presentation space*, and *image presentation space*.

drawing units. Units of measurement used within a graphics presentation space to specify absolute and relative positions.

duplex. A method used to print data on both sides of a sheet. Normal-duplex printing occurs when the sheet is turned over the Y_m axis. Tumble-duplex printing occurs when the sheet is turned over the X_m axis.

duplex printing. A method used to print data on both sides of a sheet. Contrast with *simplex printing*.

E

EBCDIC. See *Extended Binary-Coded Decimal Interchange Code*.

element. (1) A bar or space in a bar code character or a bar code symbol. (2) A structured field in a document content architecture data stream. (3) In GOCA, a portion of a segment consisting of either a single order or a group of orders enclosed in an element bracket, in other words, between a *begin* element and an *end* element. (4) In FD:OCA, each of the data fields in an array. (5) A basic member of a mathematical or logical class or set.

Em square. A square layout space used for designing each of the characters of a font.

escape sequence. (1) In the IPDS architecture, the first two bytes of a control sequence. An example of an escape sequence is X'2BD3'. (2) A string of bit combinations that is used for control in code extension procedures. The first of these bit combinations represents the control function Escape.

exception. One of the following:

1. An invalid or unsupported data-stream construct
2. In the IPDS architecture, a condition requiring host notification

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3. In the IPDS architecture, a condition that requires the host to resend data.

See also *data-stream exception*, *asynchronous exception*, and *synchronous exception*.

exception action. Action taken when an exception is detected.

exception condition. The condition that exists when a product finds an invalid or unsupported construct.

exchange. The predictable interpretation of shared information by a family of system processes in an environment where the characteristics of each process must be known to all other processes. Contrast with *interchange*.

expanded. A type width that widens all characters of a typeface.

Extended Binary-Coded Decimal Interchange Code (EBCDIC). A coded character set that consists of eight-bit coded characters.

extent In FD:OCA, one of the characteristics of a dimension. If all partitions of a dimension have the same number of subpartitions, then this number is called the extent of the next lower dimension. See also *local extent*.

external leading. The amount of white space, in addition to the internal leading, that can be added to interline spacing without degrading the aesthetic appearance of a font. This value is usually specified by a font designer. Contrast with *internal leading*.

F

FGID. See *Font Typeface Global Identifier*.

fillet A curved line drawn tangential to a specified set of straight lines. An example of a fillet is the concave junction formed where two lines meet.

FOCA See *Font Object Content Architecture*.

font. A set of graphic characters that have a characteristic design, or a font designer's concept of how the graphic characters should appear. The characteristic design specifies the characteristics of its graphic characters. Examples of characteristics are shape, graphic pattern, style, size, weight, and increment. Examples of fonts are fully described fonts, symbol sets, and their internal printer representations. See also *coded font* and *symbol set*.

font character set. A FOCA resource containing descriptive information, font metrics, and the digital representation of character shapes for a specified graphic character set.

Font Typeface Global Identifier (FGID) A unique font identifier that can be expressed as either a two-byte binary or a five-digit decimal value. The FGID is used to identify a type style and the following characteristics: posture, weight, and width.

font height (FH). (1) A characteristic value, perpendicular to the character baseline, that represents the size of all graphic characters in a font. Synonymous with *vertical font size*. (2) In a font character set, nominal font height is a font-designer defined value corresponding to the nominal distance between adjacent baselines when character rotation is zero degrees and no external leading is used. This distance represents the baseline-to-baseline increment that includes the font's maximum baseline extent and the designer's recommendation for internal leading. The font designer can also define a minimum and a maximum vertical font size to represent the limits of scaling. (3) In font referencing, the specified font height is the desired size of the font when the characters are presented. If this size is different from the nominal vertical font size specified in a font character set, the character shapes and character metrics might need to be scaled prior to presentation.

font index. (1) The mapping of a descriptive font name to a font member name in a font library. An example of a font member in a font library is a font resource object. Examples of attributes used to form a descriptive font name are typeface, family name, point size, style, weight, and width. (2) In the IPDS architecture, an LF1-type raster-font resource containing character metrics for each code point of a raster font or raster-font section for a particular font inline sequence. There can be a font index for 0 degree, 90 degree, 180 degree, and 270 degree font inline sequences. A font index can be downloaded to a printer using the Load Font Index command. An LF1-type coded font or coded-font section is the combination of one fully described font and one font index. See also *fully described font*.

font inline sequence. The clockwise rotation of the inline direction relative to a character pattern.

font metrics. Measurement information that defines individual character values such as height, width, and space, as well as overall font values such as averages and maximums. Font metrics can be expressed in specific fixed units, such as pels, or in relative units that are independent of both the resolution and the size of the font. See also *character metrics* and *character set metrics*.

font object A resource object that contains some or all of the description of a font.

Font Object Content Architecture (FOCA) An architected collection of constructs used to describe fonts and to interchange those font descriptions.

font width (FW). (1) A characteristic value, parallel to the character baseline, that represents the size of all graphic characters in a font. Synonymous with *horizontal font size*. (2) In a font character set, nominal font width is a font-designer defined value corresponding to the nominal character increment for a font character set. The value is generally the width of the space character and is defined differently for fonts with different spacing characteristics.

- For fixed-pitch, uniform character increment fonts: the fixed character increment, which is also the space character increment
- For PSM fonts: the width of the space character
- For typographic, proportionally spaced fonts: one-third of the vertical font size, which is also the default size of the space character.

The font designer can also define a minimum and a maximum horizontal font size to represent the limits of scaling. (3) In font referencing, the specified font width is the desired size of the font when the characters are presented. If this size is different from the nominal horizontal font size specified in a font character set, the character shapes and character metrics might need to be scaled prior to presentation.

foreground. (1) The part of a presentation space that is occupied by object data. (2) In GOCA, the portion of a drawing primitive that is mixed into the presentation space under the control of the current value of the mix and color attributes. See also *pel*. Contrast with *background*.

foreground color. A color attribute used to specify the color of the foreground of a primitive. Contrast with *background color*.

foreground mix. An attribute used to determine how the foreground color of data is combined with the existing color of a graphics presentation space. An example of data is a graphics primitive. Contrast with *background mix*.

form. A division of the physical medium; multiple forms can exist on a physical medium. For example, a roll of paper might be divided by a printer into rectangular pieces of paper, each representing a form. Envelopes are an example of a physical medium that comprises only one form. The IPDS architecture defines four types of forms: cut-sheets, continuous forms, envelopes, and computer output on microfilm. Each type of form has a top edge. A form has two sides, a front side and a back side. Synonymous with *sheet*.

format The arrangement or layout of data on a physical medium or in a presentation space.

full arc. A complete circle or ellipse. See also *arc*.

fully described font. In the IPDS architecture, an LF1-type raster-font resource containing font metrics,

descriptive information, and the raster representation of character shapes, for a specific graphic character set. A fully described font can be downloaded to a printer using the Load Font Control and Load Font commands. An LF1-type coded font or coded-font section is the combination of one fully described font and one font index. See also *font index*.

G

GCSGID. See *Graphic Character Set Global Identifier*.

given position. The coordinate position at which drawing is to begin. A given position is specified in a drawing order. Contrast with *current position*.

Global Identifier (GID). Any of the following:

- Code Page Global ID (CPGID)
- Graphic Character Global Identifier (GCGID)
- Font Typeface Global Identifier (FGID)
- Graphic Character Set Global Identifier (GCSGID)
- Coded Graphic Character Set Global Identifier (CGCSGID)
- In the MO:DCA architecture, an encoded graphic character string that provides a reference name for a document element.
- Global Resource Identifier (GRID)
- Object identifier (OID)
- Coded Character Set Identifier (CCSID).

global resource identifier (GRID) An eight-byte identifier that identifies a coded font resource. A GRID contains the following fields in the order shown:

1. GCSGID of a minimum set of graphic characters required for presentation. It can be a character set that is associated with the code page, or with the font character set, or with both.
2. CPGID of the associated code page
3. FGID of the associated font character set
4. Font width in 1440ths of an inch.

glyph. A member of a set of symbols that represent data. Glyphs can be letters, digits, punctuation marks, or other symbols. Synonymous with *graphic character*. See also *character*.

GOCA See *Graphics Object Content Architecture*.

graphic character. A member of a set of symbols that represent data. Graphic characters can be letters, digits, punctuation marks, or other symbols. Synonymous with *glyph*. See also *character*.

Graphic Character Set Global Identifier (GCSGID). A unique graphic character set identifier that can be

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expressed as either a two-byte binary or a five-digit decimal value.

graphics command set. In the IPDS architecture, a collection of commands used to present GOCA data in a page, page segment, or overlay.

graphics data. Data containing lines, arcs, markers, and other constructs that describe a picture.

graphics model space. A two-dimensional conceptual space in which a picture is constructed. All model transforms are completed before a picture is constructed in a graphics model space. Contrast with *graphics presentation space*. Synonymous with *model space*.

graphics object. An object that contains graphics data. See also *object*.

graphics object area. A rectangular area on a logical page into which a graphics presentation space window is mapped.

Graphics Object Content Architecture (GOCA) An architected collection of constructs used to interchange and present graphics data.

graphics presentation space. A two-dimensional conceptual space in which a picture is constructed. In this space graphics drawing orders are defined. The picture can then be mapped onto an output medium. All viewing transforms are completed before the picture is generated for presentation on an output medium. An example of a graphics presentation space is the abstract space containing graphics pictures defined in an IPDS Write Graphics Control command. Contrast with *graphics model space*.

graphics presentation space window. The portion of a graphics presentation space that can be mapped to a graphics object area on a logical page.

graphics segment. A set of graphics drawing orders contained within a Begin Segment command. See also *segment*.

GRID. See *global resource identifier*.

H

HAID. See *Host-Assigned ID*.

height. In bar codes, the bar dimension perpendicular to the bar width. Synonymous with *bar height* and *bar length*.

hexadecimal. A number system with a base of sixteen. The decimal digits 0 through 9 and characters A through F are used to represent hexadecimal digits. The hexadecimal digits A through F correspond to the decimal numbers 10 through 15,

respectively. An example of a hexadecimal number is X'1B', which is equal to the decimal number 27.

highlighting. The emphasis of displayed or printed information. Examples are increased intensity of selected characters on a display screen and exception highlighting on an IPDS printer.

home state. An initial IPDS operating state. A printer returns to home state at the end of each page, and after downloading a font, overlay, or page segment.

horizontal font size. (1) A characteristic value, parallel to the character baseline, that represents the size of all graphic characters in a font. Synonymous with *font width*. (2) In a font character set, nominal horizontal font size is a font-designer defined value corresponding to the nominal character increment for a font character set. The value is generally the width of the space character and is defined differently for fonts with different spacing characteristics.

- For fixed-pitch, uniform character increment fonts: the fixed character increment, which is also the space character increment
- For PSM fonts: the width of the space character
- For typographic, proportionally spaced fonts: one-third of the vertical font size, which is also the default size of the space character.

The font designer can also define a minimum and a maximum horizontal font size to represent the limits of scaling. (3) In font referencing, the specified horizontal font size is the desired size of the font when the characters are presented. If this size is different from the nominal horizontal font size specified in a font character set, the character shapes and character metrics might need to be scaled prior to presentation.

host. (1) In the IPDS architecture, a computer that drives a printer. (2) In IOCA, the host is the controlling environment.

Host-Assigned ID (HAID). A two-byte ID assigned by the host to a font, page segment, or overlay. This ID is used when loading a resource and to identify a resident font or page segment.

Host-Assigned Resource ID. The combination of a Host-Assigned ID with a section identifier, or a font inline sequence, or both. The section identifier and font inline sequence values are ignored for both page segments and overlays. See also *section identifier* and *font inline sequence*.

human-readable interpretation (HRI). The printed translation of bar code characters into equivalent Latin alphabetic characters, Arabic numeral decimal digits, and common special characters normally used for printed human communication.

I

i_c . See *current inline print coordinate*.

i_i . See *initial inline print coordinate*

I. See *inline direction*.

+I. Positive inline direction.

I_c . See *current inline presentation coordinate*.

I_o . See *inline presentation origin*.

I axis. The axis of an I,B coordinate system that extends in the inline direction. The I axis does not have to be parallel to the X_p axis of its bounding X_p, Y_p coordinate space.

I,B coordinate system. The coordinate system used to present graphic characters. This coordinate system is used to establish the inline and baseline directions for the placement of successive graphic characters within a presentation space. See also X_p, Y_p *coordinate system*.

I-direction. (1) The direction in which successive characters appear in a line of text. (2) In GOCA, the direction specified by the character angle attribute. Synonymous with *inline direction*.

image An electronic representation of a picture produced by means of sensing light, sound, electron radiation, or other emanations coming from the picture or reflected by the picture. An image can also be generated directly by software without reference to an existing picture.

image data. Rectangular arrays of raster information that define an image.

image object An object that contains image data. See also *object*.

Image Object Content Architecture (IOCA) An architected collection of constructs used to interchange and present images.

image presentation space (IPS). A two-dimensional conceptual space in which an image is generated.

image segment. Image content bracketed by Begin Segment and End Segment self-defining fields. See also *segment*.

IM image A migration image object that is resolution dependent, bilevel, and cannot be compressed or scaled. Contrast with *IO image*.

IM-image command set. In the IPDS architecture, a collection of commands used to present IM-image data in a page, page segment, or overlay.

immediate mode. The mode in which segments are executed as they are received and then discarded. Contrast with *store mode*.

information density. The number of characters per inch (cpi) in a bar code symbology. In most cases, the range is three to ten cpi. See also *bar code density*, *character density*, and *density*.

inline coordinate. The first of a pair of values that identifies the position of an addressable position with respect to the origin of a specified I,B coordinate system. This value is specified as a distance in addressable positions from the B axis of an I,B coordinate system.

inline direction (I). (1) The direction in which successive characters appear in a line of text. (2) In GOCA, the direction specified by the character angle attribute. Synonymous with *I-direction*.

inline margin. The inline coordinate that identifies the initial addressable position for a line of text.

inline presentation origin (I_o). The point on the I axis where the value of the inline coordinate is zero.

Intelligent Printer Data Stream (IPDS). An architected host-to-printer data stream that contains both data and controls defining how the data is to be presented.

interchange. The predictable interpretation of shared information in an environment where the characteristics of each process need not be known to all other processes. Contrast with *exchange*.

intercharacter adjustment. Additional distance applied to a character increment that increases or decreases the distance between presentation positions, effectively modifying the amount of white space between graphic characters. The amount of white space between graphic characters is changed to spread the characters of a word for emphasis, distribute excess white space on a line among the words of that line to achieve right justification, or move the characters on the line closer together as in kerning. Examples of intercharacter adjustment are intercharacter increment and intercharacter decrement.

intercharacter gap. In bar codes, the space between two adjacent bar code characters in a discrete code, for example, the space between two characters in Code 39. Synonymous with *intercharacter space*. Contrast with *clear area*, *element*, and *space*.

intercharacter space. In bar codes, the space between two adjacent bar code characters in a discrete code, for example, the space between two characters in Code 39. Synonymous with *intercharacter gap*. Contrast with *element* and *space*.

internal leading. A font design parameter referring to the space provided between lines of type to keep

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ascenders separated from descenders and to provide an aesthetically pleasing interline spacing. The value of this parameter usually equals the difference between the vertical font size and the font baseline extent. Contrast with *external leading*.

introducer. In GOCA, that part of the data stream passed from a controlling environment to a communication processor that indicates whether entities are to be processed in immediate mode or store mode. See also *immediate mode* and *store mode*.

IOCA. See *Image Object Content Architecture*.

IO image. An image object containing IOCA constructs. Contrast with *IM image*.

IO-image command set. In the IPDS architecture, a collection of commands used to present IOCA data in a page, page segment, or overlay.

IPDS. See *Intelligent Printer Data Stream*.

K

keyword. A two-part self-defining parameter consisting of a one-byte identifier and a one-byte value.

L

landscape. A presentation orientation in which the X_m axis is parallel to the long sides of a rectangular physical medium. Contrast with *portrait*.

language. A set of symbols, conventions, and rules that is used for conveying information. See also *pragmatics*, *semantics*, and *syntax*.

LCID. See *Local Character Set Identifier*.

leading. A printer's term for the amount of space between lines of a printed page. Leading refers to the lead slug placed between lines of type in traditional typesetting. See also *internal leading* and *external leading*.

line attributes. Those attributes that pertain to straight and curved lines. Examples of line attributes are line type and line width.

line type. A line attribute that controls the appearance of a line. Examples of line types are dashed, dotted, and solid. Contrast with *line width*.

line width. A line attribute that controls the appearance of a line. Examples of line width are normal and thick. Contrast with *line type*.

loaded-font command set. In the IPDS architecture, a collection of commands used to load font information into a printer and to deactivate font resources.

Local Character Set Identifier (LCID). A local identifier used as a character, marker, or pattern set attribute.

local extent. In FD:OCA, the number of subpartitions within any given partition.

local identifier (LID). An identifier that is mapped by the environment to a named resource.

location. A site within a data stream. A location is specified in terms of an offset in the number of structured fields from the beginning of a data stream, or in the number of bytes from another location within the data stream.

logical page. A presentation space. One or more object areas can be mapped to a logical page. A logical page has specifiable characteristics, such as size, shape, orientation, and offset. The shape of a logical page is the shape of a rectangle. Orientation and offset are specified relative to a medium coordinate system.

logical unit. A unit of linear measurement expressed with a unit base and units per unit-base value. For example, in MO:DCA and IPDS architectures, the following logical units are used:

- 1 logical unit = 1/1440 inch
(unit base = 10 inches,
units per unit base = 14400)
- 1 logical unit = 1/240 inch
(unit base = 10 inches,
units per unit base = 2400)

Synonymous with *L-unit*.

lowercase. Pertaining to small letters as distinguished from capital letters. Examples of small letters are *a*, *b*, and *g*. Contrast with *uppercase*.

L-unit. A unit of linear measurement expressed with a unit base and units per unit-base value. For example, in MO:DCA and IPDS architectures, the following L-units are used:

- 1 L-unit = 1/1440 inch
(unit base = 10 inches,
units per unit base = 14400)
- 1 L-unit = 1/240 inch
(unit base = 10 inches,
units per unit base = 2400)

Synonymous with *logical unit*.

M

marker. A symbol with a recognizable appearance that is used to identify a particular location. An example of a marker is a symbol that is positioned by the center point of its cell.

marker attributes. The characteristics that control the appearance of a marker. Examples of marker attributes are size and color.

marker cell. A conceptual rectangular box that can include a marker symbol and the space surrounding that symbol.

marker precision. A method used to specify the degree of influence that marker attributes have on the appearance of a marker.

marker set. In GOCA, an attribute used to access a coded font.

marker symbol. A symbol that is used for a marker.

meaning. A table heading for architecture syntax. The entries under this heading convey the meaning or purpose of a construct. A meaning entry can be a long name, a description, or a brief statement of function.

media Plural of medium. See also *medium*.

media destination. The destination to which sheets are sent as the last step in the print process. Contrast with *media source*.

media source. The source from which sheets are obtained for printing. Some printers support several media sources so that media with different characteristics (such as size, color, and type) can be selected when desired. Contrast with *media destination*.

medium. A two-dimensional conceptual space with a base coordinate system from which all other coordinate systems are either directly or indirectly derived. A medium is mapped onto a physical medium in a device-dependent manner. Synonymous with *medium presentation space*. See also *logical page*, *physical medium*, and *presentation space*.

medium presentation space. A two-dimensional conceptual space with a base coordinate system from which all other coordinate systems are either directly or indirectly derived. A medium presentation space is mapped onto a physical medium in a device-dependent manner. Synonymous with *medium*. See also *logical page*, *physical medium*, and *presentation space*.

mixing rule. A method for specifying the color attributes of the resulting foreground and background in areas where two presentation spaces intersect.

Mixed Object Document Content Architecture (MO:DCA). An architected, device-independent data stream for interchanging documents.

MO:DCA. See *Mixed Object Document Content Architecture*.

model space. A two-dimensional conceptual space in which a picture is constructed. All model transforms are completed before a picture is constructed in a graphics model space. Contrast with *graphics presentation space*. Synonymous with *graphics model space*.

model transform. A transform that is applied to drawing-order coordinates. Contrast with *viewing transform*.

module. In a bar code symbology, the nominal width of the smallest element of a bar or space. Actual bar code symbology bars and spaces can be a single module wide or some multiple of the module width. The multiple need not be an integer.

modulo-N check. A check in which an operand is divided by a modulus to generate a remainder that is retained and later used for checking. An example of an operand is the sum of a set of digits. See also *modulus*.

modulus. In a modulo check, the number by which an operand is divided. An example of an operand is the sum of a set of digits. See also *modulo-N check*.

N

NACK See *Negative Acknowledge Reply*.

name. A table heading for architecture syntax. The entries under this heading are short names that give a general indication of the contents of the construct.

Negative Acknowledge Reply (NACK). In the IPDS architecture, a reply from a printer to a host, indicating that an exception has occurred. Contrast with *Positive Acknowledge Reply*.

no operation (NOP). A construct whose execution causes a product to proceed to the next instruction to be processed without taking any other action.

O

object (1) A collection of structured fields. The first structured field provides a begin-object function, and the last structured field provides an end-object function. The object can contain one or more other structured fields whose content consists of one or more data elements of a particular data type. An object can be assigned a name, which can be used to reference the object. Examples of objects are text,

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font, graphics, image, and formatted data objects.
(2) Something that a user works with to perform a task.

object area. A rectangular area in a presentation space into which a data object is mapped. The presentation space can be for a page or an overlay. Examples are a graphics object area, an image object area, and a bar code object area. Formerly called block.

OCR-A. See *Optical Character Recognition-A*.

OCR-B. See *Optical Character Recognition-B*.

offline. A device state in which the device is not under the direct control of a host. Contrast with *online*.

offset. A table heading for architecture syntax. The entries under this heading indicate the numeric displacement into a construct. The offset is measured in bytes and starts with byte zero. Individual bits can be expressed as displacements within bytes.

online. A device state in which the device is under the direct control of a host. Contrast with *offline*.

Optical Character Recognition-A (OCR-A). A font containing the character set in ANSI standard X3.17-1981, that contains characters that are both human-readable and machine-readable.

Optical Character Recognition-B (OCR-B). A font containing the character set in ANSI standard X3.49-1975, that contains characters that are both human-readable and machine-readable.

order. (1) In GOCA, a graphics construct that the controlling environment builds to instruct a drawing processor about what to draw and how to draw it. The order can specify, for example, that a graphics primitive be drawn, a change to drawing attributes or drawing controls be effected, or a segment be called. One or more graphics primitives can be used to draw a picture. Orders can be included in a structured field. Synonymous with *drawing order*. (2) In the IPDS architecture, a construct within an execute-order command. (3) In IOCA, a functional operation that is performed on the image content.

ordered page. In the IPDS architecture, a logical page that does not contain any page segments or overlays, and in which all text data and all image, graphics, and bar code objects are ordered. The order of the data objects is such that physical pel locations on the physical medium are accessed by the printer in a sequential left-to-right and top-to-bottom manner, where these directions are relative to the top edge of the physical medium. Once a physical pel location has been accessed by the printer, the page data does not require the printer to access that same physical pel location again.

orientation. The angular distance a presentation space or object area is rotated in a specified coordinate system, expressed in degrees and minutes. For example, the orientation of printing on a physical medium, relative to the X_m axis of the X_m, Y_m coordinate system. See also *presentation space orientation* and *text orientation*.

origin. The point in a coordinate system where the axes intersect. Examples of origins are the addressable position in an X_m, Y_m coordinate system where both coordinate values are zero and the character reference point in a character coordinate system.

overlay. (1) A resource object that can contain text, image, graphics, and bar code data. Overlays define their own environment and are often used as electronic forms. (2) The final representation of such an object on a physical medium. Contrast with *page segment*.

overlay command set. In the IPDS architecture, a collection of commands used to load, deactivate, and include overlays.

overlay ID. A one-byte ID assigned by a host to an overlay. Overlay IDs are used in IPDS Begin Overlay, Deactivate Overlay, Include Overlay, and Load Copy Control commands.

overlay state. An operating state that allows overlay data to be downloaded to a product. For example, a printer enters overlay state from home state when the printer receives an IPDS Begin Overlay command.

overpaint. A mixing rule in which the intersection of part of a new presentation space P_{new} with an existing presentation space $P_{existing}$ keeps the color attribute of P_{new} . This is also referred to as "opaque" mixing. See also *mixing rule*. Contrast with *underpaint*.

overstrike. In PTOCA, the presentation of a designated character as a string of characters in a specified text field. The intended effect is to make the resulting presentation appear as though the text field, whether filled with characters or blanks, has been marked out with the overstriking character.

P

page. (1) A data stream object delimited by a Begin Page structured field and an End Page structured field. A page can contain presentation data such as text, image, graphics, and bar code data. (2) The final representation of a page object on a physical medium.

page counter. Bytes in an IPDS Acknowledge Reply that specify the number of pages that have passed a particular point in a logical paper path.

page segment. (1) In the IPDS architecture, a resource object that can contain text, image, graphics, and bar code data. Page segments do not define their own environment, but are processed in the existing environment. (2) The final representation of such an object on a physical medium. Contrast with *overlay*.

page-segment command set. In the IPDS architecture, a collection of commands used to load, deactivate, and include page segments.

page-segment state. An operating state that makes page-segment data available to a product. For example, a printer enters page-segment state from home state when it receives an IPDS Begin Page Segment command.

page state. In the IPDS architecture, an operating state that makes page data available to a product. For example, a printer enters page state from home state when it receives an IPDS Begin Page command.

parameter. (1) A variable that is given a constant value for a specified application. (2) A variable used in conjunction with a command to affect its result.

partition. (1) Dividing the medium presentation space into a specified number of equal-sized areas in a manner determined by the current physical media. (2) In FD:OCA, a conceptual subdivision of a string of data fields. A partition can be further divided into subpartitions. See also *dimension*.

partitioning. (1) A method used to place parts of a control into two or more segments or structured fields. Partitioning can cause difficulties for a receiver if one of the segments or structured fields is not received or is received out of order. (2) In FD:OCA, a conceptual division of a string of data fields into substrings. Each substring is called a partition. See also *partition*.

pattern. An array of symbols used to fill an area.

pattern attributes. The characteristics that specify the appearance of a pattern.

pattern set. An attribute in GOCA used to access a symbol set or coded font.

pattern symbol. The geometric construct that is used repetitively to generate a pattern. Examples of pattern symbols are dots, squares, and triangles.

pel. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Pels per inch is often used as a measurement of presentation granularity. Synonymous with *picture element* and *pixel*.

physical medium. A physical entity on which information is presented. Examples of a physical medium are a sheet of paper, a roll of paper, an envelope, and a display screen. See also *medium presentation space* and *sheet*.

physical printable area. A bounded area defined on a side of a sheet within which printing can take place. The physical printable area is an attribute of sheet size and printer capabilities, and cannot be altered by the host. The physical printable area is mapped to the medium presentation space, and is used in user printable area and valid printable area calculations. Contrast with *user printable area* and *valid printable area*.

pick window. A region of a graphics presentation space that is used for correlation. A pick window has specified characteristics. Examples of pick window characteristics are position in a graphics presentation space and size. See also *correlation*.

picture element. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Picture elements per inch is often used as a measurement of presentation granularity. Synonymous with *pel* and *pixel*.

pixel. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Picture elements per inch is often used as a measurement of presentation granularity. Synonymous with *pel* and *picture element*.

point (1) A unit of measure used mainly for measuring typographical material. There are seventy-two points to an inch. (2) In GOCA, a parameter that specifies the position within the drawing order coordinate space. See also *drawing order coordinate space*.

portrait. A presentation orientation in which the X_m axis is parallel to the short sides of a rectangular physical medium. Contrast with *landscape*.

position. A position in a presentation space or on a physical medium that can be identified by a coordinate from the coordinate system of the presentation space or physical medium. See also *picture element*. Synonymous with *addressable position*.

Positive Acknowledge Reply (ACK) In the IPDS architecture, a reply to an IPDS command that has its ARQ flag on and in which no exception is reported. Contrast with *Negative Acknowledge Reply*.

pragmatics. Information related to the usage of a construct. See also *semantics* and *syntax*.

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presentation position. An addressable position that is coincident with a character reference point. See also *addressable position* and *character reference point*.

presentation space. A conceptual address space with a specified coordinate system and a set of addressable positions. The coordinate system and addressable positions can coincide with those of a physical medium. Examples of presentation spaces are medium, logical page, and object area. See also *graphics presentation space*, *image presentation space*, *logical page*, *medium presentation space*, and *text presentation space*.

presentation space orientation. The number of degrees and minutes a presentation space is rotated in a specified coordinate system. For example, the orientation of printing on a physical medium, relative to the X_m axis of the X_m, Y_m coordinate system. See also *orientation* and *text orientation*.

presentation text object. An object that contains presentation text data. See also *object*.

Presentation Text Object Content Architecture (PTOCA). An architected collection of constructs used to interchange and present presentation text data.

print quality. In bar codes, the measure of compliance of a bar code symbol to the requirements of dimensional tolerance, edge roughness, spots, voids, reflectivity, PCS, and quiet zones defined within a bar code symbology.

printing baseline. A conceptual line with respect to which successive characters are aligned. See also *character baseline*. Synonymous with *baseline* and *sequential baseline*.

prolog. The first portion of a segment's data. Prologs are optional. They contain attribute settings and drawing controls. Synonymous with *segment prolog*.

PTOCA. See *Presentation Text Object Content Architecture*.

Q

quiet zone. A clear space that contains no machine-readable marks preceding the start character of a bar code symbol or following the stop character. Synonymous with *clear area*. Contrast with *intercharacter gap* and *space*.

R

range. A table heading for architecture syntax. The entries under this heading give numeric ranges applicable to a construct. The ranges can be expressed in binary, decimal, or hexadecimal. The range can consist of a single value.

raster pattern. A rectangular array of pels arranged in rows called scan lines.

reader. In bar code systems, the scanner or combination of scanner and decoder. See also *decoder* and *scanner*.

relative coordinate. One of the coordinates that identify the location of an addressable point by means of a displacement from some other addressable point. Contrast with *absolute coordinate*.

relative line. A straight line developed from a specified point by a given displacement.

relative metrics. Graphic character measurements expressed as fractions of a square, called the *Em-square*, whose sides correspond to the vertical size of the font. Because the measurements are relative to the size of the Em square, the same metrics can be used for different point sizes and different raster pattern resolutions. Relative metrics require defining the unit of measure for the Em square, the point size of the font, and, if applicable, the resolution of the raster pattern.

relative move. A method used to establish a new current position. Distance and direction from the current position are used to establish the new current position. The direction of displacement is inline along the I axis in the I-direction, or baseline along the B axis in the B-direction, or both.

repeat string. A method used to repeat the character content of text data until a given number of characters has been processed. Any control sequences in the text data are ignored. This method provides the functional equivalence of a Transparent Data control sequence when the given number of repeated characters is equal to the number of characters in the text data.

repeating group. A group of parameter specifications that can be repeated.

reserved. Having no assigned meaning and put aside for future use. The content of reserved fields is not used by receivers, and should be set by generators to a specified value, if given, or to binary zeros. A reserved field or value can be assigned a meaning by an architecture at any time.

reset color. The color of a presentation space before any data is added to it. Synonymous with *color of medium*.

resident resource. In the IPDS architecture, a resource in a printer or in a resource-caching intermediate device. A resident resource can be installed manually or can be captured by the device if it is intended for public use. A resident resource can not be removed by a presentation services program. A resident resource is referenced by a global ID that is valid for the duration of the resource's presence in the device. Contrast with *downloaded resource*.

resolution. (1) A measure of the sharpness of an input or output device capability, as given by some measure relative to the distance between two points or lines that can just be distinguished. (2) The number of addressable pels per unit of length.

resource. An object that is referenced by a data stream or by another object to provide data or information. Resource objects can be stored in libraries. In the MO:DCA architecture, resource objects can be contained within a resource group. Examples of resources are fonts, overlays, and page segments. See also *downloaded resource* and *resident resource*.

retired Set aside for a particular purpose, and not available for any other purpose. Retired fields and values are specified for compatibility with existing products and identify one of the following:

- Fields or values that have been used by a product in a manner not compliant with the architected definition
- Fields or values that have been removed from an architecture.

RM4SCC. See *Royal Mail 4 State Customer Code*.

root segment. A segment in the picture chain that is not called by any other segment. If a single segment that is not in a chain is drawn, it is treated as a root segment for the duration of the drawing process.

rotation. The orientation of a presentation space with respect to the coordinate system of a containing presentation space. Rotation is measured in degrees in a clockwise direction. Zero-degree rotation exists when the angle between a presentation space's positive X axis and the containing presentation space's positive X axis is zero degrees. Contrast with *character rotation*.

Royal Mail 4 State Customer Code (RM4SCC). A 2 dimensional bar code symbology developed by the United Kingdom's Royal Mail postal service for use in automated mail-sorting processes.

rule. A solid line of any line width.

S

sans serif. A type style characterized by strokes that end with no flaring or crossing of lines at the stroke-ends. Contrast with *serif*.

scaling. Making all or part of a picture smaller or larger by multiplying the coordinate values of the picture by a constant amount. If the same multiplier is applied along both dimensions, the scaling is uniform, and the proportions of the picture are unaffected. Otherwise, the scaling is anamorphic, and the proportions of the picture are changed. See also *anamorphic scaling*.

scan line. A series of picture elements. Scan lines in raster patterns form images. See also *picture element* and *raster pattern*.

scanner. In bar codes, an electronic device that converts optical information into electrical signals. See also *reader*.

section. A portion of a double-byte code page that consists of 256 consecutive entries. The first byte of a two-byte code point is the section identifier. A code-page section is also called a code-page ward in some environments. See also *code page* and *code point*.

section identifier. A value that identifies a section. Synonymous with *section number*.

section number. A value that identifies a section. Synonymous with *section identifier*.

secure overlay. An overlay that can be printed anywhere within the physical printable area. A secure overlay is not affected by an IPDS Define User Area command.

segment. (1) In GOCA, a set of graphics drawing orders contained within a Begin Segment command. See also *graphics segment*. (2) In IOCA, image content bracketed by Begin Segment and End Segment self-defining fields. See also *image segment*.

segment prolog. The first portion of a segment's data. Prologs are optional. They contain attribute settings and drawing controls. Synonymous with *prolog*.

segment transform. A model transform that is applied to a whole segment.

semantics. The meaning of the parameters of a construct. See also *pragmatics* and *syntax*.

sequential baseline. A conceptual line with respect to which successive characters are aligned. See also *character baseline*. Synonymous with *baseline* and *printing baseline*.

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serif. A short line angling from or crossing the free end of a stroke. Examples are horizontal lines at the tops and bottoms of vertical strokes on capital letters, for example, *I* and *H*, and the decorative strokes at the ends of the horizontal members of a capital *E*. Contrast with *sans serif*.

session. In the IPDS architecture, the period of time during which a presentation services program has sole control of a printer and has established two-way communication with the printer.

shade Variation of a color produced by mixing it with black.

shear. The angle of slant of a character cell that is not perpendicular to a baseline. Synonymous with *character shear*.

sheet A division of the physical medium; multiple sheets can exist on a physical medium. For example, a roll of paper might be divided by a printer into rectangular pieces of paper, each representing a sheet. Envelopes are an example of a physical medium that comprises only one sheet. The IPDS architecture defines four types of sheets: cut-sheets, continuous forms, envelopes, and computer output on microfilm. Each type of sheet has a top edge. A sheet has two sides, a front side and a back side. Synonymous with *form*.

side. A physical surface of a sheet. A sheet has a front side and a back side. See also *sheet*.

simplex printing. A method used to print data on one side of a sheet; the other side is left blank. Contrast with *duplex printing*.

single-byte coded font. A coded font in which the code points are one byte long.

slice. In FD:OCA, a subarray that consists of all elements that have an identical position within any given dimension of a regular *n*-dimensional array.

space. In bar codes, the lighter element of a printed bar code symbol, usually formed by the background between bars. See also *element*. Contrast with *bar*, *clear area*, *intercharacter gap*, and *quiet zone*.

spanning. In the IPDS architecture, a method in which one command is used to start a sequence of constructs. Subsequent commands continue and terminate that sequence. See also *control sequence chaining*.

special data area (SDA). The data area in an IPDS Acknowledge Reply that contains data requested by the host or generated by a printer as a result of an exception.

store mode. A mode in which segments are stored for later execution. Contrast with *immediate mode*.

stroke. A straight or curved line used to create the shape of a letter.

structured field. A self-identifying, variable-length, bounded record, which can have a content portion that provides control information, data, or both. See also *document element*.

subset. Within the base-and-towers concept, a portion of architecture represented by a particular level in a tower or by a base. See also *subsetting tower*.

subsetting tower. Within the base-and-towers concept, a tower representing an aspect of function achieved by an architecture. A tower is independent of any other towers. A tower can be subdivided into subsets. A subset contains all the function of any subsets below it in the tower. See also *subset*.

suppression. A method used to prevent presentation of specified data. Examples of suppression are the processing of text data without placing characters on a physical medium and the electronic equivalent of the "spot carbon," that prevents selected data from being presented on certain copies of a presentation space or a physical medium.

symbol. (1) A visual representation of something by reason of relationship, association, or convention. (2) In GOCA, the subpicture referenced as a character definition within a font character set and used as a character, marker, or fill pattern. A bitmap can also be referenced as a symbol for use as a fill pattern. See also *bar code symbol*.

symbol set. A coded font that is usually simpler in structure than a fully described font. Symbol sets are used where typographic quality is not required. Examples of devices that might not provide typographic quality are dot-matrix printers and displays. See also *character set*, *marker set*, and *pattern set*.

synchronous exception. In the IPDS architecture, a data-stream or resource-storage exception that must be reported to the host before a printer can return a Positive Acknowledge Reply or can increment the received-page counter for a page containing the exception. Synchronous exceptions are those with action code X'01', X'0C', or X'1F'. See also *data-stream exception*. Contrast with *asynchronous exception*.

syntax. The rules governing the structure of a construct. See also *pragmatics* and *semantics*.

Systems Application Architecture (SAA). A set of IBM software interfaces, conventions, and protocols that provide a framework for designing and developing applications that are consistent across systems.

T

temporary baseline. The shifted baseline used for subscript and superscript.

temporary baseline increment. A positive or negative value that is added to the current baseline presentation coordinate to specify the position of a temporary baseline in a presentation space or on a physical medium. Several increments might have been used to place a temporary baseline at the current baseline presentation coordinate.

text. A graphic representation of information. Text can consist of alphanumeric characters and symbols arranged in paragraphs, tables, columns, and other shapes. An example of text is the data sent in an IPDS Write Text command.

text command set. In the IPDS architecture, a collection of commands used to present PTOCA text data in a page, page segment, or overlay.

text orientation. A description of the appearance of text as a combination of inline direction and baseline direction. See also *baseline direction*, *inline direction*, *orientation*, and *presentation space orientation*.

text presentation. The transformation of document graphic character content and its associated font information into a visible form. An example of a visible form of text is character shapes on a physical medium.

text presentation space. A two-dimensional conceptual space in which text is generated for presentation on an output medium.

transform. A modification of one or more characteristics of a picture. Examples of picture characteristics that can be transformed are position, orientation, and size. See also *model transform*, *segment transform*, and *viewing transform*.

transparent data. A method used to indicate that any control sequences occurring in a specified portion of data can be ignored.

trimming. Eliminating those parts of a picture that are outside of a clipping boundary such as a viewing window or presentation space. See also *viewing window*. Synonymous with *clipping*.

triplet. A three-part self-defining variable-length parameter consisting of a length byte, an identifier byte, and one or more parameter-value bytes.

truncation. Planned or unplanned end of a presentation space or data presentation. This can occur when the presentation space extends beyond one or more boundaries of its containing presentation

space or when there is more data than can be contained in the presentation space.

type. A table heading for architecture syntax. The entries under this heading indicate the types of data present in a construct. Examples include: BITS, CHAR, CODE, SBIN, UBIN, UNDF.

type family. All characters of a single design, regardless of attributes such as width, weight, posture, and size. Examples are Courier and Gothic.

type style. The form of characters within the same font, for example, Courier or Gothic.

U

underpaint. A mixing rule in which the intersection of part of a new presentation space P_{new} with part of an existing presentation space $P_{existing}$ keeps the color attribute of $P_{existing}$. This is also referred to as "transparent" or "leave alone" mixing. See also *mixing rule*. Contrast with *overpaint*.

underscore. A method used to create an underline beneath the characters in a specified text field. An example of underscore is the line presented under one or more characters. Also a special graphic character used to implement the underscoring function.

unit base. A one-byte code that represents the length of the measurement base. For example, X'00' might specify that the measurement base is ten inches.

uppercase. Pertaining to capital letters. Examples of capital letters are *A*, *B*, and *C*. Contrast with *lowercase*.

user printable area (UPA). The portion of the physical printable area to which user-generated data is restricted. See also *logical page*, *physical printable area*, and *valid printable area*.

V

valid printable area (VPA). The intersection of a logical page with the area of the medium presentation space in which printing is allowed. If the logical page is a secure overlay, the area in which printing is allowed is the physical printable area. If the logical page is not a secure overlay and if a user printable area is defined, the area in which printing is allowed is the intersection of the physical printable area with the user printable area. If a user printable area is not defined, the area in which printing is allowed is the physical printable area. See also *logical page*, *physical printable area*, *secure overlay*, and *user printable area*.

variable space. A method used to assign a character increment dimension of varying size to space characters. The space characters are used to distribute white space within a text line. The white space is distributed by expanding or contracting the dimension of the variable space character's increment dependent upon the amount of white space to be distributed. See also *variable space character* and *variable space character increment*.

variable space character. The code point assigned by the data stream for which the character increment varies according to the semantics and pragmatics of the variable space function. This code point is not presented, but its character increment parameter is used to provide spacing. See also *variable space character increment*.

variable space character increment. The variable value associated with a variable space character. The variable space character increment is used to calculate the dimension from the current presentation position to a new presentation position when a variable space character is found. See also *variable space character*.

vertical font size. (1) A characteristic value, perpendicular to the character baseline, that represents the size of all graphic characters in a font. Synonymous with *font height*. (2) In a font character set, nominal vertical font size is a font-designer defined value corresponding to the nominal distance between adjacent baselines when character rotation is zero degrees and no external leading is used. This distance represents the baseline-to-baseline increment that includes the font's maximum baseline extent and the designer's recommendation for internal leading. The font designer can also define a minimum and a maximum vertical font size to represent the limits of scaling. (3) In font referencing, the specified vertical font size is the desired size of the font when the characters are

presented. If this size is different from the nominal vertical font size specified in a font character set, the character shapes and character metrics might need to be scaled prior to presentation.

viewing transform. A transform that is applied to model-space coordinates. Contrast with *model transform*.

viewing window. That part of a model space that is transformed, clipped, and moved into a graphics presentation space.

W

white space. The portion of a line that is not occupied by characters when the characters of all the words that can be placed on a line and the spaces between those words are assembled or formatted on a line. When a line is justified, the white space is distributed among the words, characters, or both on the line in some specified manner. See also *controlled white space*.

window. A predefined part of a graphics presentation space. See also *graphics presentation space window* and *pick window*.

X

X_{bc} extent. The size of a bar code presentation space in the X_{bc} dimension. See also *bar code presentation space*.

X_{bc}, Y_{bc} coordinate system. The bar code presentation space coordinate system.

X-dimension. In bar codes, the nominal dimension of the narrow bars and spaces in a bar code symbol.

X_g, Y_g coordinate system. In the IPDS architecture, the graphics presentation space coordinate system.

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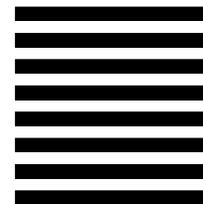
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