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IT8 ACCREDITED STANDARDS COMMITTEE

Secretariat:
National Printing Equipment and Supply Association, Inc.
1899 Preston White Drive
Reston, Virginia 22091-4326
Telephone: 703/264-7200
Telex: 90 1753 NPES MCLN
Fax: 703/620-0994

NPES

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Mr. John Lohmeyer
Chairman X3T9.2
NCR Corporation
3718 N. Rock Road
Wichita, KS 67226

I am pleased to report that IT8 has finalized work on IT8.4 entitled "Device Exchange Format For The On-Line Transfer of Color Proofs From Electronic Prepress Systems To Direct Digital Color Proofing Systems" which is based on SCSI-1. Enclosed is a copy of the document which was recently sent to ANSI for public review.

It seems appropriate that your subcommittee assign a block of device types for the use of ASC IT8. We would like the following two devices:

- o Graphic Arts Output Device
- o Graphic Arts Host Device

These device types will be used by ASC IT8 in its development of on-line interfaces for the graphic art/prepress industry.

Sincerely,

William K. Smythe
Secretary IT8

WKS:dkj

cc: Robert Strum
Chris Goldsmith

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DEVICE EXCHANGE FORMAT FOR THE ON-LINE TRANSFER OF COLOR PROOFS FROM ELECTRONIC PREPRESS SYSTEMS TO DIRECT DIGITAL COLOR PROOFING SYSTEMS

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DEVICE EXCHANGE FORMAT FOR THE ON-LINE TRANSFER OF COLOR PROOFS FROM ELECTRONIC PREPRESS SYSTEMS TO DIRECT DIGITAL COLOR PROOFING SYSTEMS

1 Introduction

This standard, IT8.4, is the first in a series of Device Exchange Formats to enable prepress components to transfer data in an on-line environment. Future work is intended to include other devices (including peer-to-peer transfer), other data types and other on-line media appropriate to the Graphic Arts / Prepress industry.

1.1 Purpose

The purpose of this standard is to define mechanical, electrical, protocol and data format characteristics to allow on-line transfer of digital color proof data between Color Electronic Prepress Systems (CEPS) and Direct Digital Color Proofing (DDCP) systems. A format and protocol for transfer of color proof data is defined in a transport independent manner. The mechanical, electrical, and transport level protocol is also defined for one medium of transfer, namely the Small Computer System Interface (SCSI).

1.2 Reference

The data formats are modeled on ANSI standards IT8.1-1988 ("User Exchange Format for the Exchange of Color Picture Data Between Electronic Prepress Systems via Magnetic Tape") and IT8.2-1988 ("User Exchange Format for the Exchange of Line Art Data Between Electronic Prepress Systems via Magnetic Tape"). The transport definition is implemented via the ANSI X3.131-1986 standard for the Small Computer System Interface (SCSI).

E 1.2 ASC X3T9.2 is developing an enhancement to the SCSI specification, known as SCSI-2. This document may be consulted for clarification on SCSI implementation details.

If a conflict between this specification and IT8.1-1988, IT8.2-1988, or X3.131-1986 exists, this document takes precedence.

1.3 Specification Organization

This specification is organized to separate the data format and transfer protocol used at the application level from that used at the transport level. A primary reason for this distinction is the desire to ease the adaptation of this specification to transport mechanisms other than SCSI.

Section 2 includes some definitions. Sections 3 and 4 describe the application level protocol for proof transfer and the data format at the application level. These sections will remain valid for CEPS to DDCP connections that might use other transport media.

Section 5 describes the SCSI transport medium as it is used for CEPS to DDCP communication in this specification. Section 6 describes each of the SCSI commands as they are used to implement this specification.

2 Definitions

2.1 DEF

DEF is an acronym for Device Exchange Format, and consists of the IT8 standards activity for on-line device interfaces. This standard initially addresses on-line interfaces between CEPS and DDCP devices, but does not preclude further development of the standard to address other on-line interfaces within the Graphic Arts area.

2.2 SCSI Implementation

The mechanical, electrical and transport protocol considerations for this standard are defined in ANSI X3.131-1986 and further restricted or enhanced by the present document.

2.3 Contone (Color Picture) Data

The picture data to be interchanged consists of a rectangular array of picture elements ("pixels"). A pixel is represented by a set of values corresponding to its color components and for a four color picture consists of four eight bit bytes, representing cyan ("C"), magenta ("M"), yellow ("Y"), and black ("K") process colors.

2.4 Line Art Data

The line art files to be interchanged consist of a rectangular array of picture elements, each of which holds one of a limited number of colors. The colors may be defined in a color palette table, which specifies the values of the color separation components for each entry in the palette. The line art image is further characterized by having contiguous areas of many pixels of the same palette entry, and not simulating a greater range of colors by "dithering" or "error diffusion" techniques. The spatial information is therefore amenable to run length encoding techniques, which may reduce file size and allow for faster processing. As a clarification, consider a line art file as characterized by a limited number of colors out of a larger domain, raster data rather than geometric description data, a rectangular array, and no object placement information.

2.5 Vendor Specific Data

The vendor specific files to be interchanged consist of whatever the vendor chooses to send. However, the number of data bytes sent must be a multiple of 128.

3 Application Level Protocol for Proof Transfer

A proof is defined as a single sheet of output medium that may contain one or more image sets. Each image set covers a rectangular area with sides parallel to the edges of the media. No two image sets may overlap.

Each image set may optionally consist of a contone picture file, a line art file, and a vendor specific file. At least one of these files must exist, and no more than one of each type can comprise an image set. When both a line art file and a picture file are present within an image set, the line art file takes precedence (ie: the transparency or opacity of the line art data determines the visibility of the underlying picture data). All files within an image set must have identical placement, orientation, and size.

There are twelve types of data descriptors used for proof transfer; seven are used to describe the information sent from the CEPS to the DDCP, and five are used to describe the information sent from the DDCP to the CEPS.

The descriptors for transfer to the DDCP are Job Descriptor, Separation Descriptor, Image Set Descriptor, Contone Picture File Descriptor, Line Art File Descriptor, Vendor Specific File Descriptor, and Set Device Feature Descriptor.

Example 3.0-1 shows the order in which the descriptors and data are sent for a proof consisting of two image sets, the first containing both contone and line art data and the second containing contone data only.

The descriptors for transfer from the DDCP are Job Status Response, Device Status Response, Device Capability Response, Current Feature Response, and Error Response.

```
Job Descriptor
Separation Descriptor (Sep. 1)
Separation Descriptor (Sep. 2)
Separation Descriptor (Sep. 3)
Separation Descriptor (Sep. 4)
Image Set Descriptor (Set 1)
   Contone Picture File Descriptor
   Contone Picture File DATA
   Line Art File Descriptor
   Color Definition Table
   Line Art DATA
Image Set Descriptor (Set 2)
   Contone Picture File Descriptor
   Contone Picture File DATA
```

Example 3.0-1: Sample Sequence of Data Transfer

3.1 Application Level Commands

The following commands are defined for communication with the transport level: SEND JOB, STOP JOB, GET JOB STATUS, GET DEVICE STATUS, GET DEVICE CAPABILITY, SET DEVICE FEATURE, GET CURRENT FEATURE, and REPORT STATUS. The first four are always used and must be implemented. The last four are used to support the optional "spontaneous status report" feature. Additionally, GET DEVICE CAPABILITY may be implemented without supporting the "spontaneous status report" option.

The responses to commands are either GOOD or ERRCR. If the response is GOOD, processing continues. If the response is ERROR, the error response data structure contains error information. The error response data structure is described in section 4.12.

The manner in which the transport layer implements these application level commands is dependent on the particular transport medium used. A SCSI implementation is described in Section 5.5.

3.1.1 SEND JOB

A job is started by sending the following information, in the order described, from the CEPS to the DDCP:

- Job Descriptor (Section 4.1),
- The first Separation Descriptor (Section 4.2),
- Other separation descriptors,
- The first Image Set Descriptor, (Section 4.3),
- The first Contone Picture Descriptor (Section 4.4) and Contone Picture Data (if it exists),
- The first Line Art Descriptor (Section 4.5), Color Table (Section 4.5.2) and Line Art Data (if it exists),
- The first Vendor Specific Descriptor (Section 4.6) and Vendor Specific Data (if it exists),
- Other image set descriptors, file descriptors and data.

3.1.2 STOP JOB

A job that is currently transferring data to or executing on the DDCP can be aborted by sending the STOP JOB command. The CEPS may send this command at any time.

3.1.3 GET JOB STATUS

The status of a job can be determined by sending the GET JOB STATUS command. The job status response data is described in Section 4.8.

3.1.4 GET DEVICE STATUS

The status of the DDCP device can be determined by sending the GET DEVICE STATUS command. The device status response data is described in Section 4.9.

3.1.5 GET DEVICE CAPABILITY

The capability of the DDCP device can be determined by sending the GET DEVICE CAPABILITY command. The device capability response data is described in Section 4.10.

3.1.6 SET DEVICE FEATURE

Selectable features of the DDCP can be set by sending the SET DEVICE FEATURE command. The Set Device Feature Descriptor is described in Section 4.7.

3.1.7 GET CURRENT FEATURE

The current status of selectable features of the DDCP can be determined by sending the GET CURRENT FEATURE command. The response is described in section 4.11.

3.1.8 REPORT STATUS

The DDCP uses this optional command to spontaneously report the job status. The use of this feature must be explicitly enabled by the CEPS (via the SET DEVICE FEATURE command) after determining that the capability is supported (via the GET DEVICE CAPABILITY command). The job status response data is described in Section 4.8.

3.2 Command Sequence

A typical sequence of application level commands is shown in Figure 3.2-1.

GET DEVICE CAPABILITY will be used on "power-up" and optionally during systems operation to determine specific characteristics and capabilities of the device.

The normal sequence for passing data to a device will begin with a GET DEVICE STATUS command. If the ERROR condition is returned, no further data will be sent until the condition has been cleared. If the status returned is GOOD, then the SEND JOB command is sent. This process can then repeat for all jobs that need to be sent to the device. Optionally, the GET JOB STATUS command may be used to determine the status of a particular job by PROOF ID.

The STOP JOB command may be used to stop a job that is currently running. When this command is used, the device may continue until it reaches an acceptable stopping point.

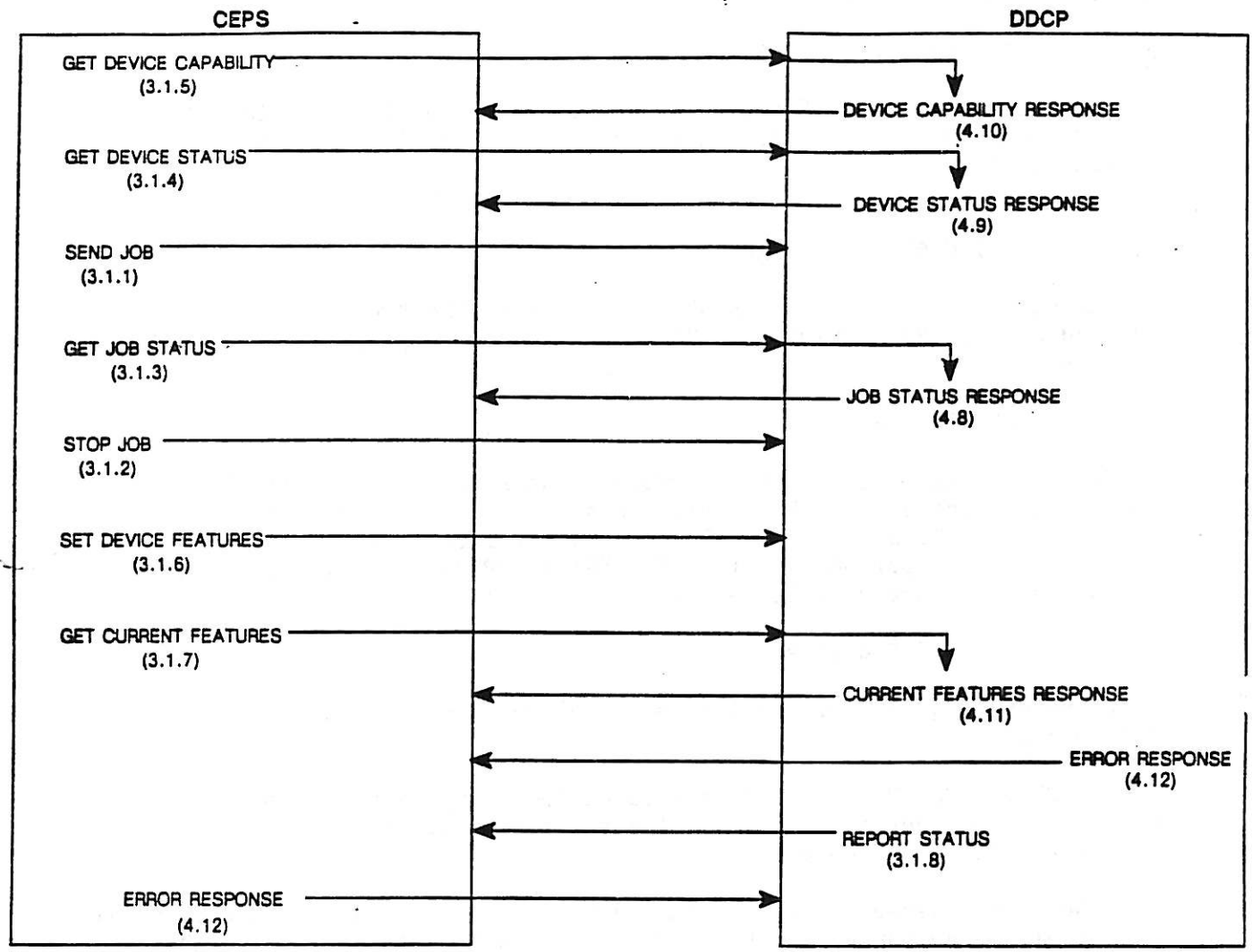

Figure 3.2-1 Graphic Arts Device Command Sequence
Application Level

4 Application Level Data Formats for Proof Transfer

All values in the descriptors are in ASCII representation. The term "decimal point notation" means an ASCII coded decimal with optional decimal point. Numeric fields are right aligned and zero(0) padded, and alphanumeric fields are left aligned and padded with blanks(b). The (b) symbol denotes an ASCII space character. The asterisk (*) symbol denotes multiple occurrences.

4.1 The Job Descriptor

There is one job descriptor for each job. The job descriptor is the first block of data sent for a job transfer from the CEPS. The job descriptor is 512 bytes in length. Figure 4.1-1 describes the contents of the job descriptor.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	job descriptor identifier	"JOBPRF"	00-05
1	compliance level	"1"	06
6	proof ID		07-12
40	job name		13-52
40	originating vendor name		53-92
40	originating site name		93-132
1	job type flag	"T","N","V"	133
1	output device type	"H"	134
4	number of proofs requested		135-138
40	paper name		139-178
40	ink set name		179-218
6	vertical scaling factor (decimal point notation)		219-224
6	horizontal scaling factor (decimal point notation)		225-230
2	file disposition		231-232
2	number of separations		233-234
16	color sequence		235-250
4	value for 0% dot		251-254
4	value for 100% dot		255-258
2	format of contone data		259-260
2	format of line art data		261-262
2	number of image sets		263-264
123	reserved for IT8 use		265-387
124	reserved for vendor use		388-511

Figure 4.1-1: Job Descriptor

4.1.1 Compliance Level

Compliance level specifies which version of the specification is used by the job. A value of "0" means no compliance is specified; a value of "1" means compliance with this version of the specification.

4.1.2 Proof ID

Proof id is a unique identifier assigned to each proof and is the primary reference to the proof. The CEPS is responsible for insuring the uniqueness of this identifier in a multi-unit environment.

4.1.3 Job Name

Job name is a string identifier associated with some logical collection of proofs.

4.1.4 Originating Equipment Vendor Name and Site Name

Originating equipment vendor name and site name are provided for convenience.

4.1.5 Job Type Flag

Job type flag specifies "N" for normal, "T" for test, and "V" for vendor specific jobs. Zero is valid for "number of separations" and "number of image sets" only if the "job type flag" is not "N". For test pictures the DDCP may print the user data and include DDCP vendor defined test indicators.

4.1.6 Output Device Type

Output device type identifies the type of proofing device. The only value currently defined is "H"; it means that halftoned data is expected by the proofing device, and hence, the Separation Descriptor information is meaningful.

4.1.7 Number of Proofs

The number of proofs is the number of copies to be printed.

4.1.8 Paper Name and Ink Set Name

Space is provided for the naming of the paper and ink set to be used. Valid names will be provided by the DDCP vendor.

4.1.9 Scaling Factors

The vertical and horizontal scaling factors specify the desired scaling of the output image size as a percentage of the provided image size. Each field will be 6 bytes in length and will range from 1 - 999 with resolution of 0.01. The value of 100 is the default value, and its occurrence will mean no resizing is required in that direction.

4.1.10 File Disposition

File disposition will determine what to do with the data after it has been proofed. The default value is zero meaning delete the data on the DDCP ; a value of 1 means to save the data. Use and disposition of saved data is a DDCP responsibility.

4.1.11 Number of Separations

Number of separations is the number of individual color separations. Valid entries in the "number of color separations" field, bytes 233-234, are "01" for one color to "16" for sixteen colors. The value "00" is valid if the job type flag is not "N"; it means there are no Separation Descriptors.

4.1.12 Color Sequence

The sequence of colors (up to 16 colors in a variety of sequences) is defined in bytes 235-250. Valid entries in the "sequence of color" field are, in any sequence:

"Y" "M" "C" "K" = Yellow, magenta, cyan and black inks.
"R" "G" "B" = Red, green, blue light intensity.
"1" through "9" = User definable colors or separations; such as pink, varnish, etc.
"Q" = no color attributes implied.

Color descriptors are to be contiguous, left justified, and blank padded.

4.1.13 Color Values

The scaling of the color values contained in the data is linear with respect to printing dot percent. The bytes are unsigned, and any values from 0 through 255 may be found. The relationship between byte values and color values (step size, direction of slope, and intercept) is at the discretion of the originator of the file, but must be identical for all color separations in one file. It is defined by expressing the byte values corresponding to 0% dot and 100% dot in ASCII characters as numeric fields in bytes 251-254 and 255-258 respectively.

Figure 4.1-2 describes further the color values for the case where 0% dot is the value 20 and 100% dot is the value 220.

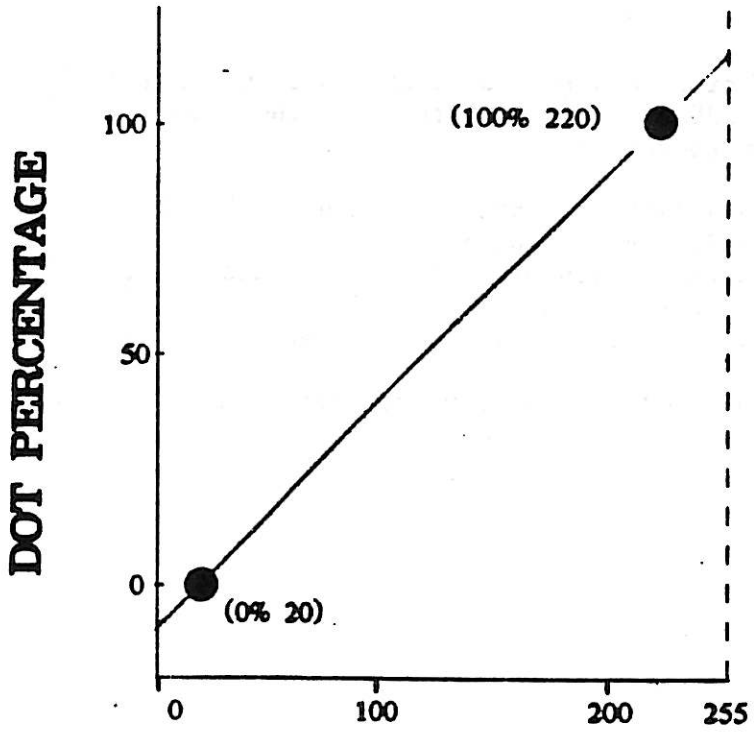

Fig. 4.1-2 Color Value vs Percent Dot

4.1.14 Format of Contone Data

There are three formats for interleaving the picture data: pixel interleaving, line interleaving and color interleaving. Bytes 259-260 contain the following values:

"00" Pixel Interleaving
"01" Line Interleaving
"02" Color Interleaving

4.1.14.a Pixel Interleaving

A row of alternating color pixels (sets of n colors of n separations) forms a line of the picture, and a sequence of these lines forms the breadth of the picture.

Note: If the number of color separations and the number of pixels/line are both odd, there will be one redundant byte at the end of each line.

4.1.14.b Line Interleaving

One line of a color is followed by that line of the next color ("n" lines of "n" color separations).

Note: If the number of pixels/line is odd, then there will be one redundant byte at the end of each line.

4.1.14.c Color Interleaving

All lines of one color are followed by all lines of the next color ("n" images of "n" color separations).

Note: If the number of pixels/line is odd, then there will be one redundant byte at the end of each line.

4.1.15 Format of Line Art Data

Bytes 261-262 contain the following values for the format of data entries:

"30" Colored line art data

4.1.16 Number of Image Sets

Number of image sets is the number of non-overlapping rectangular areas to be placed on the output page. Valid entries in the "number of image sets" field, bytes 263-264, are "01" to "99". The value "00" is valid if the job type flag is not "N"; it means there are no Image Set Descriptors.

4.2 The Separation Descriptor

There is a separation descriptor for each separation specified in the job descriptor. The separation descriptor is 128 bytes in length. Figure 4.2 describes the contents of the separation descriptor

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
4	separation descriptor identifier	"SEP "	00-03
2	separation number	"01" - "16"	04-05
2	dot gain table reference identifier		06-07
4	solid area density		08-11
1	units of screen ruling	"I" or "M"	12
	"I" = lines/in, "M" = lines/mm		
6	screen ruling		13-18
	(decimal point notation)		
5	screen angle		19-23
	(decimal point notation)		
20	dot shape		24-43
2	trap table reference identifier		44-45
38	reserved for IT8 use		46-83
44	reserved for vendor use		84-127

Figure 4.2: Separation Descriptor

4.2.1 Dot Gain Table Reference Identifier

The dot gain table reference identifier is passed to the DDCP from the CEPS and provides a reference to the particular dot gain table, contained in the DDCP, to be used for the separation.

4.2.2 Solid Area Density

Solid area density is the densitometric value of a solid patch of the particular ink. The value range is 0.00 - 5.00.

4.2.3 Screen Ruling

Screen ruling is the number of lines (or dots) per unit (inch or mm) on a halftone screen. The value range is 0 - 500 with resolution of 0.01.

4.2.4 Screen Angle

Screen angle (in degrees) is the angle at which the halftone screens are intended to be placed with respect to a common reference line (the horizontal axis of the image set) measured counter clockwise. The value range is 0 - 360 with a resolution of 0.1.

4.2.5 Dot Shape

Dot shape is a name description of the shape of the dot. Valid names will be provided by the DDCP vendor.

4.2.6 Trap Table Reference Identifier

The trap table reference identifier is passed to the DDCP from the CEPS and provides a reference to the particular trap table, contained in the DDCP, to be used for the separation.

Note: Trap is a measure of the efficiency of transfer of one ink printed on top of another ink compared to that same ink printed on a plain substrate.

4.3 The Image Set Descriptor

There is an image set descriptor for each image set. The image set descriptor is 128 bytes long. Figure 4.3-1 describes the contents of an image set descriptor.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
4	image set descriptor identifier	"IMG "	00-03
2	image set number	"01" - "99"	04-05
10	relative horizontal placement of picture (decimal point notation in mm.)		06-15
10	relative vertical placement of picture (decimal point notation in mm.)		16-25
2	orientation		26-27
10	length of line (decimal point notation in mm.)		28-37
10	breadth of area (decimal point notation in mm.)		38-47
1	CPF exists	"Y" or "N"	48
1	LAF exists	"Y" or "N"	49
1	VSF exists	"Y" or "N"	50
27	reserved for IT8 use		51-77
50	vendor-specific information		78-127

Figure 4.3-1: Image Set Descriptor

4.3.1 Horizontal Placement

Relative horizontal placement is the horizontal placement of the top left corner of the image set relative to the top left corner of the proof image area.

4.3.2 Vertical Placement

Relative vertical placement is the vertical placement of the top left corner of the image set relative to the top left corner of the proof image area.

4.3.3 Orientation, Length, and Breadth

The definition of length and breadth of a picture as specified in bytes 28-47 and the relationship of these parameters to orientation is depicted in Figure 4.3-2. Here the direction of the line is the first row of pixels or line of color from the file. Length refers to the length of the first line of data in the picture file, while breadth refers to distance over which the lines are spread.

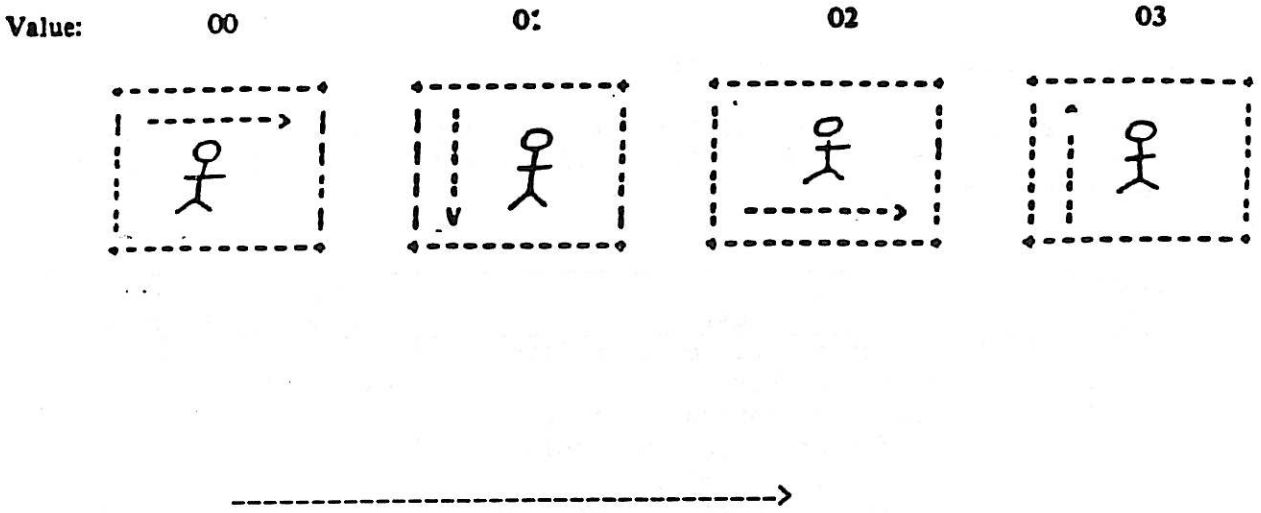

Figure 4.3-2: Relationship Between First Line of Data, Image Orientation, and Orientation code.

The orientation is specified as follows:

00 = Load from top left, horizontally
01 = Load from top left, vertically
02 = Load from bottom left, horizontally
03 = Load from bottom left, vertically

4.3.4 Existence Fields

The existence fields indicate whether or not the contone picture, line art, or vendor specific files are part of this image set.

4.4 The Contone Picture File Descriptor

The contone picture file descriptor always precedes a contone picture file. It is 128 bytes in length. Figure 4.4-1 describes the contents of the contone picture file descriptor.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
4	contone picture file descriptor identifier	"CPF "	00-03
2	corresponding image set number	"01" - "99"	04-05
6	number of pixels per line		06-11
6	number of lines (breadth)		12-17
1	units of resolution of line * "I" = pixels/in, "M" = pixels/mm		18
1	units of resolution of breadth* "I" = lines/in, "M" = lines/mm		19
6	resolution of line * (decimal point notation)		20-25
6	resolution of breadth * (decimal point notation)		26-31
46	reserved for IT8 use		32-77
50	vendor-specific information		78-127

* these items are optional

Figure 4.4-1: Contone Picture File Descriptor

4.4.1 Resolution

Bytes 18-31 are optional fields that allow the specification of resolution, in both the length and breadth directions.

4.5 The Line Art File Descriptor

The line art file descriptor always precedes a line art file (color tables and run length encoded data, as defined in IT8.2-1988). It is 128 bytes in length. Figure 4.5-1 describes the contents of the line art file descriptor.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
4	line art file descriptor identifier	"LAF "	00-03
2	corresponding image set number	"01" - "99"	04-05
6	number of pixels per line		06-11
6	number of lines		12-17
1	units of resolution of line *		18
	"I" = pixels/in, "M" = pixels/mm		
1	units of resolution of breadth*		19
	"I" = lines/in, "M" = lines/mm		
6	resolution of line *		20-25
	(decimal point notation)		
6	resolution of breadth *		26-31
	(decimal point notation)		
4	last valid color number used		32-35
4	number of bits for color number	"0008"	36-39
4	number of bits for short run	"0008"	40-43
4	number of bits for extended run	"0000"or "0016"	44-47
30	reserved for IT8 use		48-77
50	vendor-specific information		78-127

* these items are optional

Figure 4.5-1: Line Art File Descriptor

4.5.1 Resolution

Bytes 18-31 are optional fields that allow the specification of resolution, in both the length and breadth directions.

4.5.2 Color Table

The color table establishes the connection between the color numbers in the data entries and the color values assigned to those color numbers. It consists of from two to 256 twenty-byte entries as shown in Figure 4.5-2.

TABLE ENTRY	COLOR NUMBER	DESCRIPTION OF USE
1	0	reserved for transparency
2-256	1-255	discrete color descriptions

Fig. 4.5-2 Color Table Format

Color number zero is always a transparent color. For color number zero, or any color identified as transparent, the values indicated in the color table are reserved for vendor (system) use only and treated as non-printing colors.

Each color number must be in proper sequence from 1-255, and in its proper location in the color table, i.e., color number 1 is the second entry, color number 10 is the eleventh entry, etc. Color numbers not used must be padded with zeros in bytes 0-19. Each twenty byte entry in the color table consists of a sequence of binary numbers, organized as shown in Figure 4.5-3

BIT / BYTE	7 6 5 4 3 2 1 0
0	Reserved for future IT8 use.
1	Color number, see note 1.
2 3	Transparency indicator for 1 to 16 separations, see note 2.
4 : : 19	Color values in the sequence defined by bytes 233-248 of the Job Descriptor

Fig. 4.5-3 Color Table Entry Format

Note 1: Color number, used to link run lengths in the data with specific color values. The color number is a binary value from 0-255, representing color numbers 0-255.

Note 2: Bits 0 through 15 of byte 2 and 3 combined are used as a transparency indicator to signify which separations, if any, are transparent. A binary "1" indicates that the flagged separations are transparent. Figure 4.5-4 illustrates this application for color numbers 1 through 255.

BYTE	TWO	THREE	
BIT	15 8	7 0	
	0000 0000	0000 0000	signifies non-transparency color
	0000 0000 : : 1111 1111	0000 0001 : : 1111 1110	signifies that one or more of the defined separations will be transparent
	1111 1111	1111 1111	signifies that all separations are transparent

Fig. 4.5-4 Transparency Indicators

4.5.2.a Transparent Colors

A transparent color is used to distinguish a clear run, where no color is present and the underlying image (if any) is allowed to show through from the color "white", which signifies no underlying image should show through, only the underlying substrate (paper). Transparency can be used as a run length offset indicator to allow movement within an image from the edge of an image rectangle to the start of image, or from one defined printing color to another defined printing color within an image without overlaying whatever may be underneath.

Color number zero and the value hex "FFFF" in byte 2 and 3 of color numbers 1-255 are reserved to signify a fully transparent color. The value hex "FFFF" will always be loaded in color number 0. Any color values in bytes 2-17 of fully transparent color number entries are reserved for vendor use and treated as non-printing colors. All fields should be padded with binary zeros to fill fields as required.

The values hex "0001" - hex "FFFE" in bytes 2 and 3 of the color table for color numbers 1-255 signify that one or more of the defined separations will be transparent. The bit mask defined by the value specified defines which separations are transparent according to the color sequence specified in bytes 237-252 of the job descriptor such that the least significant bit of the defined bit mask corresponds to the first separation defined by the color sequence. For example:

The value hex "0001" (bit mask: 0000 0000 0000 0001) signifies that "Y" would be transparent where the color sequence defined is "YMCK". The value hex "0006" (bit mask: 0000 0000 0000 0110) signifies the second and third separations are transparent ("M" and "Y" where the color sequence defined is "CMYK").

The value hex "0000" indicates that all separations are non-transparent colors. Transparency indicators for any unused separations will be set to binary one.

4.5.3 Run Length Encoding

There are two formats for encoding run lengths; a short form (16 bits long) for encoding run lengths up to 255 pixels long, and a long form (32 bits long) for encoding run lengths up to 65535 pixels long. Both forms may be freely mixed within a file, as the long form is encoded as a special case of the short form. There is no obligation to write both forms, since long runs may be encoded with repetitions of the short form. However, applications must be capable of reading both forms.

The short form consists of a two byte entry with the first eight bits a binary number representing the color number in the color table with a value from zero to 255, and the second eight bits a binary number representing the run length from 01 to 255 as follows:

byte:	0	1
value:	color#	runlength

The long form consists of a four byte entry with the first eight bits a binary number representing the color number in the color table with a value from zero to 255, and the second eight bits always equal zero to signify the long form. The next 16 bits are a binary number representing the run length from 1 to 65535. In the event the long form is used to encode a run length of less than 256, byte 2 will be binary zero, and the run length will be found in byte 3. The long form looks as follows:

byte:	0	1	2 and 3
value:	color#	00	run length

Each line of data (whose orientation to the image is defined in the image set descriptor) is initiated by two zero bytes and terminated by two zero bytes.

If the number of pixels in an encoded line does not equal the declared number of pixels per line of the image, or the number of encoded lines of data does not equal the number of lines in the image, an error exists and continued processing is left to the discretion of the processing system.

Run lengths of zero are specifically excluded as valid run length entries in both the long form and the short form as this would conflict with other indicators.

4.5.3.a Line Repeat Code

Within the data encoding structure a four byte binary line repeat code may be used to signify that the previous line will be repeated the number of times specified by the first byte of the line repeat code (up to 255 times). The second, third and fourth bytes are always zero, to indicate that this is a line repeat code. Each line repeat code will begin and end with a line terminator, so that the line repeat code is always a line by itself. For image runs that exceed 255 the line repeat code may be repeated as often as necessary until the cumulative total of line repeat codes minus one (for the original line) equal the number of lines in the repeated section of the image.

For example:

	LINE BEGIN CODE	DATA WITHIN THE LINE	LINE END CODE
Line 1:	00	(coding for line to be repeated)	00
Line 2:	00	255 0 0 0	00
Line 3:	00	55 0 0 0	00

indicates that the line of data encoded by line 1 will be repeated 311 times: once for the initial time the line is encountered (line 1), plus 255 times for the line count indicator in line 2, plus 55 times for the line count indicator in line 3.

There is no obligation to encode an image with line repeat codes as images can be encoded by repeating an encoded line the required number of times. However, applications must be capable of reading line repeat codes.

4.6 The Vendor Specific File Descriptor

The vendor specific file descriptor is described in Figure 4.6-1.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
4	vendor specific file descriptor identifier	"VSF "	00-03
2	corresponding image set number	"01" - "99"	04-05
10	number of bytes of vendor specific descriptor information (X bytes)		06-15
10	number of bytes of vendor specific data to follow		16-25
X	vendor specific descriptor info		26 - 25+X
102-X	pad to 128 bytes		26+X - 127

Figure 4.6-1: Vendor Specific File Descriptor

X must be a multiple of 4

4.7 The Set Device Feature Descriptor

Figure 4.7-1 describes the contents of the set device feature descriptor.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	device features response identifier	"SETDEV"	00-05
2	number of features		06-07
10	feature name	"SPONSTATUS"	08-17
1	feature existence	"Y"	18
1	feature enabled	"Y" or "N"	19
168	reserved for IT8		20-187
68	vendor-specific information		188-255

Figure 4.7-1 Set Device Feature Descriptor

SPONSTATUS is the feature which allows the DDCP to spontaneously (i.e. without explicit request from the CEPS) send a status response to the CEPS when a job is finished.

SPONSTATUS is the only feature currently defined. As others are defined, they will follow sequentially in the space reserved for IT8.

4.8 The Job Status Response

Figure 4.8-1 describes the contents of the job status response.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	job status response identifier	"STATUS"	00-05
6	proof identification		06-11
40	job name		12-51
10	proof status		52-61
	"COMPLETE "		
	"INPROGRESS"		
	"STOPPED "		
	"ERRORxxxxx"		
3	proof number		62-64
48	reserved for IT8 use		65-112
15	vendor specific information		113-127

Figure 4.8-1: Job Status Response

This information is returned in response to the GET JOB STATUS command (Par. 3.1.3, 5.5.3) and the REPORT STATUS command (Par. 3.1.8, 5.5.8).

4.9 The Device Status Response

Figure 4.9-1 describes the contents of the device status response.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	device status response identifier	"DEVSTA"	00-05
20	device status "IDLE "		06-25
	"BUSY-SEND DATA "		
	"BUSY-HOLD DATA "		
	"NOT READY-ERROR "		
102	Reserved for IT8 use		26-127

Figure 4.9-1: Device Status Response

4.10 The Device Capability Response

Figure 4.10-1 describes the contents of the device capability response.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	device capability response identifier	"DEVCAP"	00-05
1	compliance level (4.1.1)	"1"	06
40	vendor identification (4.1.4)		07-46
40	product identification (4.10.1)		47-86
40	product revision level (4.10.1)		87-126
1	output device type (4.1.6)	"H"	127
6	maximum vertical scaling (4.1.9)		128-133
6	minimum vertical scaling (4.1.9)		134-139
6	maximum horizontal scaling (4.1.9)		140-145
6	minimum horizontal scaling (4.1.9)		146-151
2	maximum number of separations (4.1.11)		152-153
16	preferred color sequence (4.10.2)		154-169
1	alternate sequence accepted (4.10.2)	"Y" or "N"	170
4	preferred value for 0% dot (4.10.3)		171-174
4	preferred value for 100% dot (4.10.3)		175-178
1	alternate values accepted (4.10.3)	"Y" or "N"	179
1	interleave support (inclusive or) (4.10.4)		180
	"1" color		
	"2" line		
	"4" pixel		
2	maximum number of image sets (4.1.16)		181-182
4	maximum solid density (4.2.2)		183-186
10	maximum line length (mm.) (4.3.3)		187-196
10	maximum page breadth (mm.) (4.3.3)		197-206
2	orientation support (inclusive or) (4.10.5)		207-208
	"01" 00		
	"02" 01		
	"04" 02		
	"08" 03		
8	buffer size in bytes (hex) (4.10.6) "00000000" - "FFFFFFFF"		209-216
1	spontaneous status response (4.10.7)	"Y" or "N"	217
16	reserved for IT8		218-233
22	vendor-specific information		234-255

Figure 4.10-1: Device Capability Response

Ranges and units for these values are as described for corresponding entries in the descriptors of Sections 4.1, 4.2, and 4.3.

4.10.1 Product Identification and Revision Level

The vendor shall provide appropriate strings in these fields.

4.10.2 Preferred Color Sequence and Acceptability of Alternatives

The vendor preferred color sequence is provided here. If other sequences are accepted, the value "Y" is specified.

4.10.3 Preferred Dot Values and Acceptability of Alternatives

The vendor preferred values for 0% dot and 100% dot are provided here. if other values are accepted, the value "Y" is specified.

4.10.4 Interleave Support

The vendor indicates which interleaving modes are supported. For example, if only color interleave is supported, the value shall be "1". If both color interleave and line interleave are supported, the value shall be "3"; and if all three interleave modes are supported, the value shall be "7".

4.10.5 Orientation Support

The vendor indicates which orientations are supported. For example, if only orientation 00 is supported, the value shall be "01". If orientations 00 and 02 are supported, the value shall be "05"; and if all four orientations are supported, the value shall be "15".

4.10.6 Buffer Size

The vendor indicates the size of the input buffer of the device.

4.10.7 Spontaneous Status Response

This value shall be set to "Y" if the device can support the spontaneous status response feature as described in Section 4.7.

4.11 The Current Feature Response

Figure 4.11-1 describes the contents of the current feature response.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	device features response identifier	"DEVFEA"	00-05
2	number of features		06-07
10	feature name	"SPONSTATUS"	08-17
1	feature existence	"Y" or "N"	18
1	feature enabled	"Y" or "N"	19
168	reserved for IT8		20-187
68	vendor-specific information		188-255

Figure 4.11-1 Current Feature Response

SPONSTATUS is the feature which allows the DDCP to spontaneously (i.e. without explicit request from the CEPS) send a status response to the CEPS when a job is finished.

SPONSTATUS is the only feature currently defined. As others are defined, they will follow sequentially in the space reserved for IT8.

4.12 The Error Response

Figure 4.12-1 describes the contents of the error response.

LENGTH (bytes)	CONTENTS	DEF VALUE	BYTE
6	error response identifier	"ERRRSP"	00-05
2	sense key	"01"-"16"	06-07
3	additional sense code	"001"-"255"	08-10
3	sense code qualifier	"001"-"255"	11-13
40	ASCII string		14-53
40	reserved for IT8		54-93
34	vendor-specific information		94-127

Figure 4.12-1 Error Response

"Sense key" is the decimal ASCII representation of the SENSE KEY value defined in Figure 6.3-3.

"Additional sense code" is the decimal ASCII representation of the ADDITIONAL SENSE CODE defined in Figure 6.3-4.

"Sense code qualifier" is the decimal ASCII representation of the SENSE CODE QUALIFIER value which may identify the separation or image set in which the error occurred.

5 SCSI as the Transfer Mechanism

5.1 Physical Characteristics

This standard follows the electrical and mechanical (physical) characteristics of SCSI devices, as defined in Section 4 of the ANSI X3.131-1986 standard, with the following restrictions:

The CEPS/DDCP cabling must support the differential cabling option (differential drivers and receivers) as described in Section 4 of X3.131-1986. Cabling between external devices will use shielded connectors as described in Alternative 2 of Appendix D of ANSI X3.131-1986.

Pin assignments, and the input and output characteristics of the signals conform to ANSI X3.131-1986.

Parity is always generated; parity detection is optional.

Nothing in this standard precludes the support of multiple CEPS and DDCP devices in addition to other devices on one SCSI bus.

5.2 Logical Characteristics

This standard follows the logical characteristics of SCSI devices, as defined in Section 5 of ANSI X3.131-1986, with the following clarifications:

The CEPS and the DDCP will each operate as a single logical unit.

Both devices support bus arbitration.

When the SCSI Bus RESET condition is recognized, the SOFT reset option will be executed.

Synchronous data transfer (through SYNCHRONOUS DATA TRANSFER REQUEST message) is an option.

E 5.2 If implemented, synchronous data transfer will be in accordance with SCSI-2, Revision 5, August 9, 1988, or later.

The DDCP and CEPS devices are unique "Graphic Arts / Prepress" devices that are similar in many respects to SCSI processor devices.

5.3 Supported SCSI Commands

Figure 5.3-1 tabulates the SCSI commands for DDCP devices. Some of these commands are used to tailor the SCSI standard for the CEPS to DDCP device requirements in the Graphic Arts industry. The device-specific data formatting requirements are addressed through special descriptor information passed during data transfer between the two devices.

OP CODE (HEX)	TYPE	GROUP	DESCRIPTION
00	O	0	Test Unit Ready
03	M	0	Request Sense
12	M	0	Inquiry
15	O	0	Mode Select
16	O	0	Reserve Unit
17	O	0	Release Unit
18	O	0	Copy
1A	O	0	Mode Sense
1C	O	0	Receive Diagnostic Results
1D	O	0	Send Diagnostic
28	M	1	Receive
2A	M	1	Send

Figure 5.3-1: SCSI Commands for DDCP Devices

TYPE KEY: M: Command implementation is Mandatory
O: Command implementation is Optional

NOTE: The CEPS may initiate any of these commands. If the "spontaneous status response" option is supported, the DDCP may initiate the SEND and REQUEST SENSE commands only. If this option is not supported, the DDCP may not initiate any commands.

A summary of these commands follows:

The REQUEST SENSE, INQUIRY, RECEIVE and SEND commands are mandatory.

The TEST UNIT READY, MODE SELECT and MODE SENSE commands are optional.

The RESERVE and RELEASE commands are optional commands under this specification, since they are implemented at the choice of the vendor. They are patterned after the Direct Access Device types. If these commands are used, they should be implemented exactly as specified in X3.131-1986, Section 8.1.8, and 8.1.9. The intent of RESERVE/RELEASE is to allow one CEPS to retain control of a DDCP for sending consecutive proofs and to prevent multiple CEPSs from sending proofs to one DDCP concurrently.

The COPY, RECEIVE DIAGNOSTIC RESULTS, and SEND DIAGNOSTIC are optional commands, and by their very nature their use and effect are vendor-specific. These commands are not discussed any further in this standard, but may be implemented by specific CEPS and DDCP vendors in a mutually satisfactory manner, as long as their implementation meets the X3.131-1986 standard; and as long as their implementation is not required to successfully operate the DDCP device.

The REQUEST SENSE, INQUIRY, RECEIVE and SEND commands are necessary and sufficient to allow proof data transfer between CEPS and DDCP devices. The optional MODE SELECT, MODE SENSE and TEST UNIT READY. commands provide further flexibility.

The SEND, RECEIVE, REQUEST SENSE, INQUIRY, MODE SELECT and MODE SENSE commands are discussed within this standard. Implementation of all other commands must conform to ANSI X3.131-1986.

Support for linked commands may be implemented at the option of the DDCP.

5.4 Supported SCSI Messages

This standard uses the following messages as defined in Section 5 of ANSI X3.131-1986.

The following messages are mandatory:

- COMMAND COMPLETE
- SAVE DATA POINTER
- RESTORE POINTERS
- DISCONNECT
- MESSAGE REJECT
- IDENTIFY

If LINKED commands are implemented, the following messages must be supported

- LINKED COMMAND COMPLETE
- LINKED COMMAND COMPLETE (WITH FLAG)

5.5 Transport Level Protocol for Proof Transfer

The application level commands are implemented via SCSI commands for communication between the CEPS and the DDCP. The transport level returns either GOOD or ERROR to the application level for each command. Each application level command is implemented as described below. If a particular SCSI command causes the CHECK CONDITION to be returned by the target, the initiator shall send a REQUEST SENSE and the resulting data will be available via the Error Response data structure. A typical sequence of commands is shown in Figure 5.5-1.

5.5.1 SEND JOB

The SEND command is used to send the job descriptor and the separation descriptors as separate data types. SEND is also used to send each image set descriptor.

SEND commands are also used to send file descriptor and data. A separate set of SEND commands is used for each contone picture, line art, and vendor specific files. The sequence of commands for a job having four separations with a contone picture file and a line art file is as follows:

SEND with data type 01H for job descriptor.

SEND with data type 02H for first separation descriptor.
SEND with data type 02H for second separation descriptor.
SEND with data type 02H for third separation descriptor.
SEND with data type 02H for fourth separation descriptor.

SEND with data type 03H for the first image set descriptor.
SEND with data type 04H for the first contone picture file descriptor.
SEND with data type 24H for the first contone picture data.
SEND with data type 05H for the first line art file descriptor.
SEND with data type 15H for the first line art color table.
SEND with data type 25H for the first line art data.

SEND with data type 03H for the second image set descriptor.
SEND with data type 04H for the second contone picture file descriptor.
SEND with data type 24H for the second contone picture data.
SEND with data type 05H for the second line art file descriptor.
SEND with data type 15H for the second line art color table.
SEND with data type 25H for the second line art data.

Other image sets as needed.

The SEND command is described in Section 6.1.

5.5.2 STOP JOB

The job currently executing on the DDCP may be stopped by using the SEND command with data type 81H. The data transferred is the 6-byte proof ID, the 40-byte job name, and 18 spaces to pad the data length to 64 bytes.

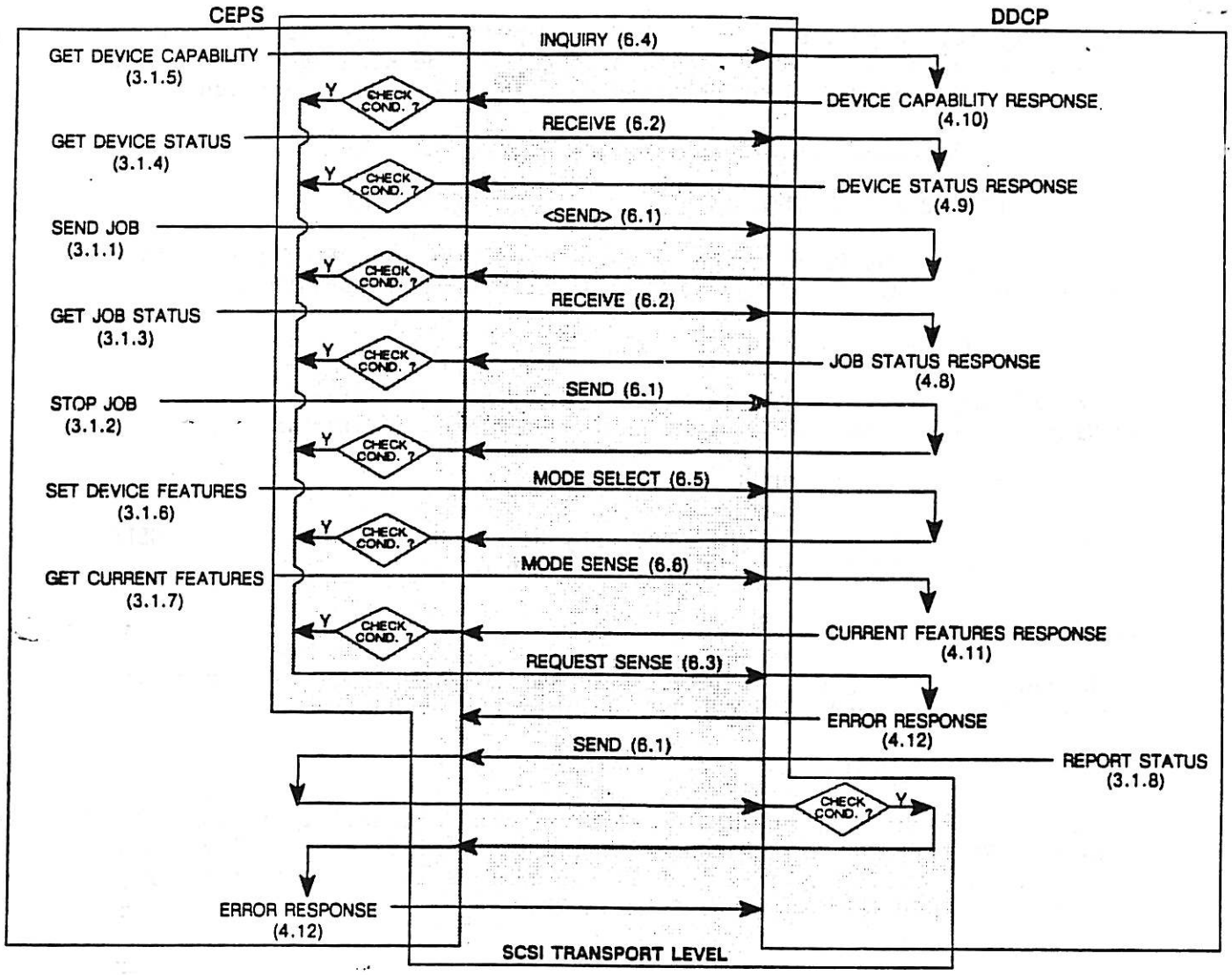

Figure 5.5-1 Graphic Arts Device Command Sequence Including SCSI Transport Level

5.5.3 GET JOB STATUS

The DDCP may be polled from the CEPS for proof status, during the time the proof data is being converted to hard copy. The RECEIVE command is used with a data type of 01H. The returned data is described in Section 4.8.

The RECEIVE command is defined in Section 6.2.

5.5.4 GET DEVICE STATUS

The status of the DDCP device is determined with the RECEIVE command with a data type of 11H. The returned data is described in Section 3.8.

5.5.5 GET DEVICE CAPABILITY

The CEPS may determine the capabilities of the DDCP device via the INQUIRY command. The INQUIRY command is described in Section 6.4.

5.5.6 SET DEVICE FEATURES

The selectable features of the DDCP may be set by sending the MODE SELECT command. MODE SELECT is described in Section 6.5.

5.5.7 GET CURRENT FEATURES

The current setting of the selectable features may be determined by sending the MODE SENSE command. MODE SENSE is described in Section 6.6.

5.5.8 REPORT STATUS

When the optional "spontaneous status response" capability is implemented (via the SET DEVICE FEATURES command), the DDCP initiates a SEND command with data type C1H. The data sent is the same as the data returned by the GET JOB STATUS command (see Section 4.8).

6 SCSI Commands
6.1 SEND Command

The CDB of the SEND command is ten bytes in length and is defined in Figure 6.1-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (2AH)							
1	LOGICAL UNIT NUMBER				RESERVED (00H)			
2	TRANSFER DATA TYPE							
3	RESERVED (00H)							
4	RESERVED (0000H)							
5								
6	(MSB) TRANSFER LENGTH (BYTES)							
7								
8								(LSB)
9	CONTROL BYTE							

Figure 6.1-1: SEND Command

	Data Types	Transfer Length
01H	Job Descriptor	512 (000200H)
02H	Separation Descriptor	128 (000080H)
03H	Image Set Descriptor	128 (000080H)
04H	Contone Picture File Descriptor	128 (000080H)
05H	Line Art Picture File Descriptor	128 (000080H)
06H	Vendor Specific File Descriptor	128 (000080H)
15H	Line Art Color Table	padded with zeros to a multiple of 128
24H	Contone Picture Data	"
25H	Line Art Data	"
26H	Vendor Specific Data	"
81H	Stop Job	64 (000040H)
C1H	Spontaneous Status Response (initiated only by the DDCP if this option is supported)	128 (000080H)
F0H - FFH	Reserved for Vendor Use	

All other values are reserved for IT8 use.

6.2 RECEIVE Command

The CDB of the RECEIVE command is ten bytes in length and is defined in Figure 6.2-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (28H)							
1	LOGICAL UNIT NUMBER				RESERVED (00H)			
2	TRANSFER DATA TYPE							
3	RESERVED (00H)							
4	RESERVED (0000H)							
5								
6	(MSB) TRANSFER LENGTH (BYTES)							
7								
8								(LSB)
9	CONTROL BYTE							

Figure 6.2-1: RECEIVE Command

Data Types		Transfer Length
01H	Job Status	128 (000080H)
11H	Device Status	128 (000080H)

FOH - FFH Reserved for Vendor Use

All other values are reserved for IT8 use.

The data from the Job Status RECEIVE maps to the Job Status Response of Section 4.8.

The data from the Device Status RECEIVE maps to the Device Status Response of Section 4.9.

6.3 REQUEST SENSE Command

The CDB of the REQUEST SENSE command is six bytes in length and is defined in Figure 6.3-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (03H)							
1	LOGICAL UNIT NUMBER				RESERVED (00H)			
2	RESERVED (00H)							
3	RESERVED (00H)							
4	ALLOCATION LENGTH (= 128)							
5	CONTROL BYTE							

Figure 6.3-1: REQUEST SENSE Command

The REQUEST SENSE command is sent by the initiator on a CHECK CONDITION status to a previous command. See ANSI X3.131-1986 for further details.

The response from the DDCP device is defined in Figure 6.3-2. This data is mapped to the Error Response of Section 4.12.

BYTE	BIT 7	6	5	4	3	2	1	0
0	Valid (1H)	Error Code (70H)						
1	(00H)							
2	0	0	ILI	0	SENSE KEY			
3-6	INFORMATION BYTES (00H)							
7	ADDITIONAL SENSE LENGTH (06 TO 166)							
8-11	COMMAND SPECIFIC INFORMATION (00H)							
12	ADDITIONAL SENSE CODE							
13	SENSE CODE QUALIFIER							
14-173	OPTIONAL ASCII STRING DESCRIBING THE ERROR WHICH CAN BE DISPLAYED ON CEPS OPERATOR CONSOLE (DDCP VENDOR-SPECIFIED)							

Figure 6.3-2: Request Sense Response from DDCP

The error code of 70H defines a current error. The extended sense data format is always used.

The ILI (Incorrect Length Indicator) bit is set if a transfer length value in a SEND command from the CEPS is incorrect.

The SENSE key values are defined in Figure 6.3-3.

The Additional SENSE Code is defined in Figure 6.3-4. See ANSI X3.131-1986 for additional details.

The SENSE code qualifier identifies the separation or image set in which the error occurred.

SENSE KEY VALUE (4 bits)	DESCRIPTION
00H	NO FURTHER SENSE INFORMATION; OK TO SEND LAST COMMAND WAS SUCCESSFUL.
01H	RECOVERED ERROR, BUT SUCCESSFUL COMPLETION ADDITIONAL SENSE BYTE DEFINES TYPE OF ERROR.
02H	DDCP DEVICE IS NOT READY, OPERATOR INTERVENTION MAY BE REQUIRED.
04H	HARDWARE ERROR, SEE ADDITIONAL SENSE BYTE
05H	ILLEGAL REQUEST; ILLEGAL PARAMETER IN HEADER BLOCK OF SEND PROOF COMMAND. SEE ADDITIONAL SENSE BYTE
06H	UNIT ATTENTION. DDCP HAS BEEN RESET.
09H	IDLE NOTHING TO DO
0AH	ERROR IN DESCRIPTOR / DATA SEQUENCE
0BH	ABORTED COMMAND. DDCP HAS ABORTED COMMAND, CEPS MAY RECOVER WITH A RETRY.
0DH	VOLUME OVERFLOW

Figure 6.3-3: Sense Key Values in CEPS/DDCP Application

For additional information on the Sense Key refer to ANSI X3.131-1986.

SENSE CODE VALUE	DESCRIPTION
80H	NO FURTHER SENSE INFORMATION
81H	BUFFER OVERFLOW; MORE DATA WAS SENT IN A SEND COMMAND BY THE CEPS THAN DDCP CAN HANDLE.
82H	OUT OF PAPER
83H	OUT OF INK
84H	PAPER LOW
85H	INK LOW
86H	NONEXISTENT FEATURE
87-8FH	RESERVED FOR DDCP SPECIFIC ERRORS
90-9FH	RESERVED FOR TRANSPORT SPECIFIC ERRORS
A0H	ILLEGAL VALUE IN DESCRIPTOR IDENTIFICATION
A1H	ERROR IN TEST FLAG
A2H	ERROR IN NUMBER OF PROOFS REQUIRED
A3H	ERROR IN VERTICAL SCALING FACTOR
A4H	ERROR IN HORIZONTAL SCALING FACTOR
A5H	ILLEGAL FILE DISPOSITION
A6H	ILLEGAL NUMBER OF SEPARATIONS
A7H	ERROR IN SEQUENCE OF COLORS
A8H	ILLEGAL VALUE FOR 0% DOT
A9H	ILLEGAL VALUE FOR 100% DOT
AAH	ILLEGAL FORMAT OF CONTONE DATA
ABH	ILLEGAL FORMAT OF LINE ART DATA
ACH	ILLEGAL NUMBER OF IMAGE SETS
AD-AFH	RESERVED FOR JOB SPECIFIC ERRORS

Figure 6.3-4: Additional Sense Codes

SENSE CODE VALUE	DESCRIPTION
B0H	ILLEGAL VALUE IN DESCRIPTOR IDENTIFICATION OR NUMBER
B1H	ILLEGAL DOT GAIN TABLE REFERENCE
B2H	ILLEGAL SOLID DENSITY
B3H	ILLEGAL SCREEN RULING
B4H	ILLEGAL SCREEN ANGLE
B5H	ILLEGAL TRAP TABLE REFERENCE
B6-BFH	RESERVED FOR SEPARATION SPECIFIC ERRORS
C0H	ILLEGAL VALUE IN DESCRIPTOR IDENTIFICATION OR NUMBER
C1H	ILLEGAL VERTICAL PLACEMENT VALUE
C2H	ILLEGAL HORIZONTAL PLACEMENT VALUE
C3H	ILLEGAL ORIENTATION
C4H	ERROR IN LENGTH OF LINE
C5H	ERROR IN BREADTH OF AREA
C6H	ILLEGAL EXISTENCE VALUE
C7-CFH	RESERVED FOR IMAGE SET SPECIFIC ERRORS
D0H	ILLEGAL VALUE IN DESCRIPTOR IDENTIFICATION OR NUMBER
D1H	ERROR IN NUMBER OF PIXELS PER LINE
D2H	ERROR IN NUMBER OF LINES
D3H	ILLEGAL RESOLUTION UNITS
D4H	ERROR IN RESOLUTION
D5-DFH	RESERVED FOR CONTONE SPECIFIC ERRORS

Figure 6.3-4: Additional Sense Codes (Continued)

SENSE CODE VALUE	DESCRIPTION
E0H	ILLEGAL VALUE IN DESCRIPTOR IDENTIFICATION OR NUMBER
E1H	ERROR IN NUMBER OF PIXELS PER LINE
E2H	ERROR IN NUMBER OF LINES
E3H	ILLEGAL RESOLUTION UNITS
E4H	ERROR IN RESOLUTION
E5H	ERROR IN LAST VALID COLOR NUMBER
E6H	ILLEGAL NUMBER OF BITS FOR COLOR NUMBER
E7H	ILLEGAL NUMBER OF BITS FOR SHORT RUN
E8H	ILLEGAL NUMBER OF BITS FOR EXTENDED RUN
E9H	ERROR IN COLOR VALUES IN COLOR TABLE
EA-EFH	RESERVED FOR LINE ART SPECIFIC ERRORS
F0-FFH	VENDOR SPECIFIC ERRORS

Figure 6.3-4: Additional Sense Codes (Continued)

6.4 INQUIRY Command

The CDB of the INQUIRY command is six bytes in length and is defined in Figure 6.4-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (12H)							
1	LOGICAL UNIT NUMBER				RESERVED (00H)			
2	RESERVED (00H)					DESIRED DATA FORMAT		
3	RESERVED (00H)							
4	ALLOCATION LENGTH (=255)							
5	CONTROL BYTE							

Figure 6.4-1: INQUIRY Command

The DDCP sends a response back to the CEPS system in the DATAIN phase of the command, which is defined in Figure 6.4-2. This response is mapped to Device Capability Response of Section 4.10.

BYTE	BIT 7	6	5	4	3	2	1	0
0	PERIPHERAL DEVICE TYPE (1FH)							
1	ZERO VALUE (00H)							
2	ANSI VERSION (01H)							
3	RESERVED (00H)				RESPONSE DATA FORMAT (00H)			
4	ADDITIONAL LENGTH (=255)							
5-7	RESERVED (00H)							
8	COMPLIANCE LEVEL							
9-48	VENDOR IDENTIFICATION (E.G. "ULTIMATE PROOF INC")							
49-88	PRODUCT IDENTIFICATION							
89-128	PRODUCT REVISION LEVEL							

Figure 6.4-2: Inquiry Response from DDCP

129	OUTPUT DEVICE TYPE
130-135	MAXIMUM VERTICAL SCALING
136-141	MINIMUM VERTICAL SCALING
142-147	MAXIMUM HORIZONTAL SCALING
148-153	MINIMUM HORIZONTAL SCALING
154-155	MAXIMUM NUMBER OF SEPARATIONS
156-171	PREFERRED COLOR SEQUENCE
172	ALTERNATE SEQUENCES ACCEPTED
173-176	PREFERRED VALUE FOR 0 % DOT
177-180	PREFERRED VALUE FOR 100 % DOT
181	ALTERNATE VALUES ACCEPTED
182	INTERLEAVE SUPPORTED (INCLUSIVE OR)
183-184	MAXIMUM NUMBER OF IMAGE SETS
185-188	MAXIMUM SOLID DENSITY
-198	MAXIMUM LINE WIDTH (MM.)
199-208	MAXIMUM PAGE BREADTH (MM.)
209-210	ORIENTATION SUPPORTED (INCLUSIVE OR)
211-218	BUFFER SIZE (BYTES)
219	SPONTANEOUS STATUS RESPONSE SUPPORT
220-235	RESERVED FOR IT8
236-255	VENDOR-SPECIFIC INFORMATION

Figure 6.4-2: Inquiry Response from DDCP (Continued)

6.5 MODE SELECT Command

The Command Data Block (CDB) of the MODE SELECT command is six bytes in length and is defined in Figure 6.5-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (15H)							
1	LOGICAL UNIT NUMBER				RESERVED=0			
2	RESERVED = 0							
3	RESERVED = 0							
4	PARAMETER LIST LENGTH							
5	CONTROL BYTE							

Figure 6.5-1: MODE SELECT Command

Parameter lists consists of 12-byte sets of features. Each set consists of a 10-byte feature name, a 1-byte feature existence flag (always "Y"), and a 1-byte feature enable state.

LENGTH (bytes)	DESCRIPTION
10	feature name
1	feature existence flag -- "Y"
1	feature enable state -- "Y" or "N"

The only currently defined feature is "SPONSTATUS", the spontaneous status response.

This data is derived from the Set Device Feature Descriptor of Section 4.7.

6.6 MODE SENSE Command

The Command Data Block (CDB) of the MODE SENSE command is six bytes in length and is defined in Figure 6.6-1.

BYTE	BIT 7	6	5	4	3	2	1	0
0	OPERATION CODE (1AH)							
1	LOGICAL UNIT NUMBER				RESERVED=0			
2	RESERVED = 0							
3	RESERVED = 0							
4	ALLOCATION LENGTH (=255)							
5	CONTROL BYTE							

Figure 6.6-1: MODE SENSE Command

The data returned consists of a 1-byte header followed by a parameter list consisting of 12-byte sets of features. The header is a byte count of the parameter list size. Each set consists of a 10-byte feature name, a 1-byte feature existence flag, and a 1-byte feature enable state.

LENGTH (bytes)	DESCRIPTION
10	feature name
1	feature existence flag -- "Y" or "N"
1	feature enable state -- "Y" or "N"

The only currently defined feature is "SPONSTATUS", the spontaneous status response.

This data is mapped to the Current Features Response of Section 4.11.