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Information Technology - SCSI-3 Graphic Commands (SGC)

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ABSTRACT

This standard specifies the functional requirements for the SCSI-3 Graphic Commands set (SGC). SGC permits SCSI-3 graphic logical units such as scanners, etc., to attach to computers and provides the definition for their use.

This standard does not contain material related to any service delivery subsystem that may be used to transport the commands, command parameter data, command response data, and status specified in this standard.

PATENT STATEMENT

Caution: The developers of this standard have requested that holder's of patents that may be required for the implementation of the standard, disclose such patents to the publisher. However neither the developers nor the publisher have undertaken a patent search in order to identify which, if any, patents may apply to this standard.

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Revision Information:

The following paragraphs summarize the editing work undertaken for each revision of this draft standard. Revisions are listed in reverse chronological order. This presumes that most reviewers are interested in the recent changes in this draft standard.

Revision 0 (08 April 1995)

This is the initial revision of the SGC document.

Contents

Figures

Tables

Foreword

The SCSI-3 Graphic Commands (SGC) standard is divided into seven clauses:

Clause 1 is the scope.

Clause 2 numerates the normative references that apply to this standard.

Clause 3 describes the definitions, symbols and abbreviations used in this standard.

Clause 4 provides an overview of the graphic logical unit class and the command set. This clause also specifies the conventions used throughout the standard.

Clause 5 describes the model for graphic logical units

Clause 6 provides the definitions of all commands unique to graphic logical units. This clause also provides references to the SPC standard for primary commands used with this logical unit class.

Clause 7 provides the definition of all parameters unique to graphic logical units.

Introduction

The SCSI command set is designed to provide efficient peer-to-peer operation of input/output logical units (disks, tapes, printers, etc.) by an operating system. The SCSI command set assumes an underlying command-response protocol. Action on SCSI commands shall not be deemed completed until a response is received. The response shall include a status that indicates the final disposition of the command.

The SCSI command set provides multiple operating systems concurrent control over one or more input/output logical units. However, the multiple operating systems must properly coordinate their actions or data corruption will result. The SCSI standard provides commands that assist with coordination between multiple operating systems. However, details of the coordination are beyond the scope of the SCSI command set.

This standard defines a logical unit model for SCSI-3 graphic logical units. Also defined are SCSI commands that may apply to SCSI-3 graphic logical units. The standard defines the SCSI commands that shall be implemented by SCSI-3 graphic logical units.

With any technical document there may arise questions of interpretation as new products are implemented. The X3 Committee has established procedures to issue technical opinions concerning the standards developed by the X3 organization. These procedures may result in SCSI Technical Information Bulletins being published by X3.

These Bulletins, while reflecting the opinion of the Technical Committee that developed the standard, are intended solely as supplementary information to other users of the standard. This standard, X3.***-199x, as approved through the publication and voting procedures of the American National Standards Institute, is not altered by these bulletins. Any subsequent revision to this standard may or may not reflect the contents of these Technical Information Bulletins.

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1 Scope

This standard defines the command set extensions to facilitate operation of SCSI-3 graphic logical units. The clause(s) of this standard pertaining to the SCSI-3 graphic logical unit class, implemented in conjunction with the applicable clauses of SCSI-3 Primary Commands, shall fully specify the standard command set available for SCSI-3 graphic logical units.

The objectives of the SCSI-3 Graphic Commands standard is to provide the following:

a) Permits an Application client to communicate with a logical unit that declares itself to be a SCSI-3 graphic logical unit (peripheral device type of 06-Graphic device) in the device type field of the INQUIRY command response data over a SCSI-3 service delivery subsytem.

b) Define commands unique to the class of SCSI-3 graphic logical unit.

c) Define control commands to manage the operation of SCSI-3 graphic logical unit.

Figure 1 is intended to show the relationship of this document to other SCSI-3 standards. The figure is not intended to imply a relationship such as a hierarchy, protocol stack, or system architecture. It indicates the applicability of a standard to the implementation of a given transport.

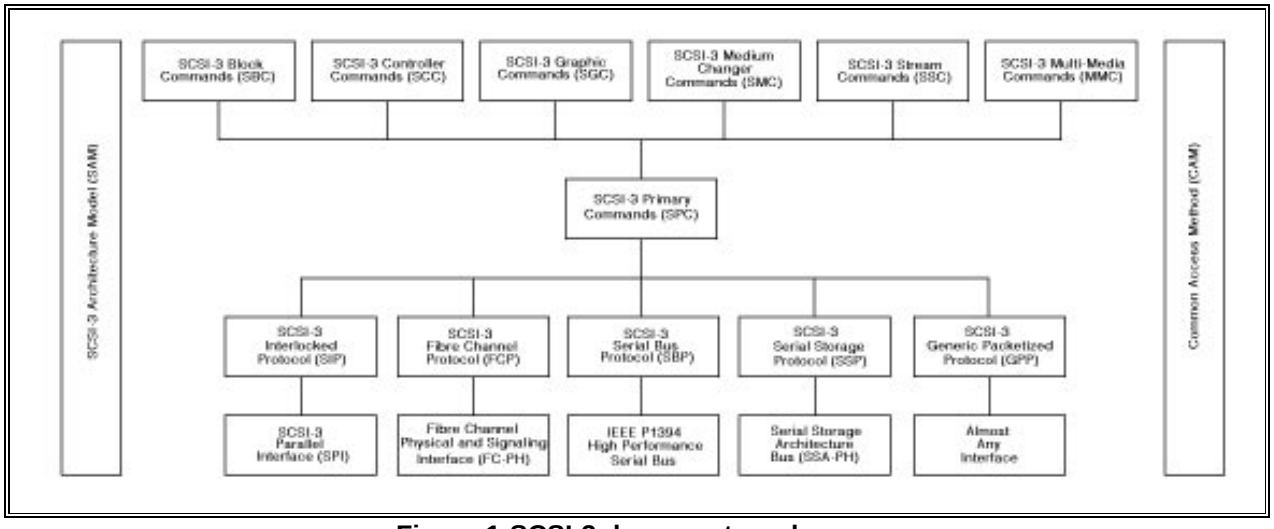

Figure 1-SCSI-3 document road map

The term SCSI is used wherever it is not necessary to distinquish between the versions of SCSI. The Small Computer System Interface-2 (X3.131-1994) is referred to herein as SCSI-2.

The term SCSI-3 refers collectively to the following documents that fall under the jurisdiction of X3T10:

SCSI-3 Parallel Interface [X3T10/855D]
SCSI-3 Interlocked Protocol [X3T10/856D]
SCSI-3 Fiber Channel Protocol [X3T10/993D]
SCSI-3 Serial Bus Protocol [X3T10/992D]
SCSI-3 Generic Packetized Protocol [X3T10/991D]
SCSI-3 Architecture Model [X3T10/994D]
SCSI-3 Primary Commands [X3T10/995D]
SCSI-3 Block Commands [X3T10/996D]
SCSI-3 Stream Commands [X3T10/997D]
SCSI-3 Graphic Commands [X3T10/998D]
SCSI-3 Medium Changer Commands [X3T10/999D]
SCSI-3 Controller Commands [X3T10/1047D]
SCSI-3 Fast-20 Parallel Interface [X3T10/????D]
Multimedia Command Set [X3T10/1048D]
Directly-Addressable Device Interface [X3T10/964D]
SCSI Common Access Method-2 [X3T10/990D]

2 Normative references

2.1 Corequisite standards

The following corequisite standards contain provisions which, through reference in this text, are provisions of this American National Standard. At the time of publication,the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standards are encouraged to investigate the possibility of applying the most recent editions of the following list of standards. Members of IEC and ISO maintain registers of currently valid International Standards. ANSI performs a similar function for American National Standards.

American Standard Code for Information Interchange (ASCII), ANSI X3.4-1977

SCSI-3 Architecture Model, X3T10/994D

SCSI-3 Primary Commands, X3T10/995D

2.2 Reference standards

Reference standards are listed to help implementers evaluate the complete operating environment for SGC logical units. These standards have no provisions which place requirements on SGC, but they may be useful.

SCSI Common Access Method-2 (CAM-2), X3T10/990-D

3 Definitions, symbols and abbreviations

3.1 Definitions specific to graphic logical units

3.1.1 base element line: An x-axis displacement equal to zero.

3.1.2 base line: An y-axis displacement equal to zero.

3.1.3 beginning-of-medium: A x-axis and y-axis of zero displacement. Alternatively this is being positioned at the intersection of the base and scan lines.

3.1.4 end-of-medium: The maximum x-axis and y-axis displacement.

3.1.5 image: The digital result of a scan.

3.1.6 object: The original or item being scanned.

3.1.7 pixel: Picture-element, which is the smallest photo sight in the array.

3.1.8 platen: The surface on which the target is positioned.

3.1.9 scan: An operation that generates a digital image from the reflected light of an object.

3.1.10 scan line: A y-axis displacement from the base line.

3.1.11 scanning range: The total area that a scanner can generate an image from. For two dimensional objects this may correspond to the largest object that can be scanned.

3.1.12 window: All or part of the scanning range of a scanner. A window defines the part of the object scanned.

3.4 Symbols and abbreviations

CDB	command descriptor block
e.g.	for example (illustrative)
i.e.	that is (additional explanation)
I/O	input/output
ID	identifier
LSB	least significant bit
MSB	most significant bit
SCSI	either SCSI-2 or SCSI-3
SCSI-2	the Small Computer System Interface-2 (ANSI X3.131-1994)
SCSI-3	the Small Computer System Interface-3
SPC	SCSI-3 Primary Command Set standard

4 General

4.1 Overview

SCSI-3 logical units which conform to this standard are referred to as SCSI-3 graphic logical units. This includes the category of logical units commonly referred to as scanners.

The common attribute of graphic logical units is that they are capable of transferring a visual representation of data to or from a computer.

This specification is intended to be used in conjunction with the SCSI-3 Architecture Model (SAM) and the SCSI-3 Primary Command Set (SPC) standards.

4.2 Conventions

Certain words and terms used in this International Standard have a specific meaning beyond the normal English meaning. These words and terms are defined either in clause 3 or in the text where they first appear.

Words have the normal technical English definition unless the word or phrase is defined in context or in the glossary, then that definition is used.

Numbered items in SGC do not represent any priority. Any priority is explicitly indicated.

Fields containing only one bit are usually referred to as the name bit instead of the name field.

Numbers that are not immediately followed by lower-case b or h are decimal values.

Numbers immediately followed by lower-case b (xxb) are binary values.

Numbers immediately followed by lower-case h (xxh) are hexadecimal values.

In all of the text and tables of this standard, the most significant bit of a binary quantity is shown on the left side and represents the highest algebraic value position in the quantity.

The word "shall" is used to indicate a mandatory requirement. If such a requirement is not followed, the results are unpredictable unless indicated otherwise. In addition, if such a requirement is not followed, the implementation is not in conformance with this standard. If a field is specified as not meaningful or it is to be ignored, the entity that receives the field shall not check that field.

If a conflict arises between text and tables, the order of precedence to resolve conflicts is text and then tables. Not all tables are fully described in text. Tables show data format and values. NOTEs and IMPLEMENTATION NOTEs do not constitute any requirements for implementors.

The ISO convention of numbering is used (i.e., the thousands and higher multiples are separated by a space and a comma is used as the decimal point as in 65 536 or 0,5).

5 SCSI-3 graphic logical unit model

5.1 Scanner logical unit model

Scanner devices generate a digital representation of two- or three- dimensional objects (e.g. a page of text, a photograph, or a piece of art). This is accomplished by sensing the amount of light reflected from the object and generating the digital data. The digital data can then be sent across the SCSI bus to an application client for further processing.

There are two types of scanners in use; in one type, the operations and functions of the scanner are fixed; in the other type, the operations and functions are programmable and need to be set up prior to being used for scanning objects.

The scanner device generates the data and transfers it in accordance with the commands received from the application client. The contents of the data is vendor-specific; therefore, the application client and the scanner must know how to use the contents of the data.

Scanners generate a digital image of an object in a two dimensional plane. The x-axis dimension is along the cross-scan direction that is perpendicular to the direction in which a scan occurs. The y-axis dimension is along the scan direction, and is parallel to the direction in which a scan occurs. The coordinates are measured from the upper left hand corner of the two dimensional plane. The x-axis measurement increases in a positive manner going from left to right. The left side of the two dimensional plane (i.e. where x equals zero) is called the base element line. The y-axis measurement increases in a positive manner going from top to bottom. The top side of the two dimensional plane (i.e. where y equals zero) is called the base line. The scanning range encompasses the area in which the scanner can operate, from the scan line and base line to the maximum x and y position. These conventions are adopted to aid in understanding the fields within the command descriptor blocks and parameters used for scanner devices. As such this is a conceptual model and may not accurately reflect the physical device.

The displacements used for positioning windows is independent of the resolution with which a window is scanned. The measurement of displacements is controlled by the scan measurement mode parameters.

In the event of a scanner automatic creation of sub-windows within a defined window (i.e. the auto bit in the DEFINE WINDOW parameters is one), one of the following responses is appropriate:

a) The application client may issue a GET WINDOW PARAMETERS command prior to any READ commands;
b) If the application client issues a READ command before issuing a GET WINDOW PARAMETERS command, the device server shall return CHECK CONDITION status. The ILI and valid bits in the sense data shall be set to one. The application client should then issue a GET WINDOW PARAMETERS command. This feature is useful when the scanner has the ability to distinguish between image and text data and to define windows accordingly.

It may occur that a scanner device temporarily does not have resources available to manage a data transfer from the application client or does not have data available to transfer to the application client. One of the following responses is appropriate in such a case:

a) A CHECK CONDITION status is returned and the sense key is set to NOT READY with the appropriate additional sense code. This response is applicable to a TEST UNIT READY command.
b) The device server disconnects until the resource or data are available, and then reconnects to resume the operation.
c) A BUSY status is returned.

If the scanner device determines that an error or exception condition has occurred while executing the SCSI command from the application client, a CHECK CONDITION status is returned. A REQUEST SENSE command can then be used to determine additional information regarding the error or exception condition.

6 Commands for graphic logical units

6.1 Commands for scanner logical units.

The commands for scanner logical units shall be as shown in table 1.

Table 1 - Commands for scanner logical units

Command name	Operation code	Type	Subclause
CHANGE DEFINITION	40h	O	SPC
COMPARE	39h	O	SPC
COPY	18h	O	SPC
COPY AND VERIFY	3Ah	O	SPC
GET DATA BUFFER STATUS	34h	O	6.1.1
GET WINDOW	25h	O	6.1.2
INQUIRY	12h	M	SPC
LOG SELECT	4Ch	O	SPC
LOG SENSE	4Dh	O	SPC
MODE SELECT(6)	15h	O	SPC
MODE SELECT(10)	55h	O	SPC
MODE SENSE(6)	1Ah	O	SPC
MODE SENSE(10)	5Ah	O	SPC
OBJECT POSITION	31h	O	6.1.3
PORT STATUS	11h	M[1]	SPC
READ	28h	M	6.1.4
READ BUFFER	3Ch	O	SPC
RECEIVE DIAGNOSTIC RESULTS	1Ch	O	SPC
RELEASE UNIT	17h	M	SPC
REQUEST SENSE	03h	M	SPC
RESERVE UNIT	16h	M	SPC
SCAN	1Bh	O	6.1.5
SEND	2Ah	O	6.1.6
SEND DIAGNOSTIC	1Dh	M	SPC
SET WINDOW	24h	M	6.1.7
TEST UNIT READY	00h	M	SPC
WRITE BUFFER	3Bh	O	SPC

Key: M = Command implementation is mandatory.
O = Command implementation is optional.
SPC = SCSI-3 Primary Commands

Notes: [1] Mandatory only if the dual port option is implemented.

All other operation codes for scanner logical units are reserved for future standardization.

6.1.1 GET DATA BUFFER STATUS command

The GET DATA BUFFER STATUS command (see table 2) provides a means for the application client to get information about the data buffer. Information is returned only for window identifiers for which a SCAN command has been received (see 6.1.5).

Table 2 - GET DATA BUFFER STATUS command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (34h)							
1	Reserved							Wait
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	(MSB) Allocation length							
8								(LSB)
9	Control							

A wait bit of zero indicates that the device server shall respond immediately. A wait bit of one indicates that the device server shall wait for image data to be available before returning scan status data.

The data buffer status data format is defined in table 3.

Table 3 - Data buffer status format

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB) Data buffer status length							
1								
2								(LSB)
3	Reserved							Block
	Data buffer status descriptor(s)							
0	Window identifier							
1	Reserved							
2	(MSB) Available data buffer							
3								
4								(LSB)
5	(MSB) Filled data buffer							
6								
7								(LSB)

The data buffer status length indicates the length, in bytes, of the following scan status data that is available to be transferred during the DATA IN phase. The data buffer status length does not include itself. The data buffer status data transferred to the application client includes zero or more data buffer status descriptors. Each descriptor returns information for the window specified by the window identifier.

The block bit specifies the buffering capabilities of the scanner. A block bit of one indicates that the data buffer is full and all image data must be transferred to the application client before the scan operation resumes. A block bit of zero indicates that the data buffer is not full and scan operations can continue with the available data buffer space.

The available data buffer field indicates, in bytes, the amount of buffer available for transfers from the application client. This field is valid only in scanners with the ability to accept data from an application client for processing.

The filled data buffer field indicates the amount of image data in bytes available for transfer to the application client.

6.1.2 GET WINDOW command

The GET WINDOW command (see table 4) provides a means for the application client to get information about previously defined windows.

Table 4 - GET WINDOW command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (25h)							
1	Reserved							Single
2	Reserved							
3	Reserved							
4	Reserved							
5	Window identifier							
6	(MSB)							
7	Transfer length							
8								(LSB)
9	Control							

A single bit of one specifies that a single window descriptor shall be returned for the specified window identifier. A single bit of zero specifies that window descriptors be returned for all window identifiers that were defined by a SET WINDOWS command or by the device server, if the automatic bit was set to one.

The GET WINDOW data shall consist of a header (see table 5) followed by one or more window descriptors. Each window descriptor specifies the location, size, and scanning method used for a window.

Table 5 - Get window data header

Bit / Byte	7	6	5	4	3	2	1	0
0	(MSB)							
1	Window data length							(LSB)
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Window descriptor length							(LSB)

The window data length specifies the length in bytes of the following data that is available to be transferred. The window data length does not include itself. If the allocation length is not sufficient to return all the get window data, the window data length shall not be adjusted to reflect the truncation data.

The window descriptor length specifies the length in bytes of a single window descriptor. Each descriptor shall be of equal length. The first forty-eight bytes are defined in this International Standard and the remaining bytes in each descriptor are vendor-specific.

The window descriptors are defined in table 6.

Table 6 - Window descriptor bytes

Byte \ Bit	7	6	5	4	3	2	1	0
0	Window identifier							
1	Reserved							Auto
2	(MSB)							
3	X-Axis resolution							(LSB)
4	(MSB)							
5	Y-Axis resolution							(LSB)
6	(MSB)							
9	X-Axis upper left							(LSB)
10	(MSB)							
13	Y-Axis upper left							(LSB)
14	(MSB)							
17	Window width							(LSB)
18	(MSB)							
21	Window length							(LSB)
22	Brightness							
23	Threshold							
24	Contrast							
25	Image composition							
26	Bits per pixel							
27	(MSB)							
28	Halftone pattern							(LSB)
29	RIF	Reserved				Padding type		
30	(MSB)							
31	Bit ordering							(LSB)
32	Compression type							
33	Compression argument							
34	Reserved							
39								
40	Vendor-specific parameter byte(s)							
n								

The window identifier specifies the window defined by the window descriptor. A window is referenced by the window identifier during data transfers and parameter updates.

When used with the SET WINDOW command, an automatic (auto) bit of one indicates that the device server is allowed to create sub-windows within the window specified. An auto bit of zero indicates that the device server is not allowed to create sub-windows.

When used with the GET WINDOW command, an auto bit of zero indicates that the window was defined directly by the SET WINDOW command. A value of one indicates that the window was defined by the device server. This is a sub-window within a window defined by a SET WINDOW command.

The window identifiers assigned by the device server shall be unique and shall not be currently in use. The parameters for the sub-windows may be retrieved using the GET WINDOW command.

The x-axis resolution field specifies the resolution in the scan line direction. The unit of measure is picture elements (pixels) per inch. A value of zero specifies the default resolution.

The y-axis resolution field specifies the resolution in the base line direction. The unit of measure is scan lines per inch. A value of zero specifies the default resolution.

The x-axis upper left field specifies the x-axis coordinate of the upper left corner of the window. This coordinate is measured from the scan line using the device server's current measurement unit divisor (see 7.1.3.1).

The y-axis upper left field specifies the y-axis coordinate of the upper left corner of the window. This coordinate is measured from the base line using device server's current measurement unit divisor (see 7.1.3.1).

The window width field specifies the width of window in the scan line direction. The window width is measured using the device server's current measurement unit divisor (see 7.1.3.1).

The window length field specifies the length of the window in the base line direction. The window length is measured using the device server's current measurement unit divisor (see 7.1.3.1).

The brightness field specifies the level of brightness used to scan the object. A value of zero specifies the default brightness or automatic brightness control, if it is supported. Any other value indicates a relative brightness setting, with 255 being the highest setting, one being the lowest setting, and 128 being the nominal setting.

The threshold field specifies the threshold at which scan data is converted to binary data. A value of zero specifies the default threshold or automatic threshold control if it is supported. Any other value indicates relative threshold setting, with 255 being the highest setting, one being the lowest setting, and 128 being the nominal setting.

The contrast field specifies the level of contrast used to scan the object. A value of zero specifies the default contrast or automatic contrast control, if it is supported. Any other value indicates a relative contrast setting, with 255 being the highest setting, one being the lowest setting, and 128 being the nominal setting.

The halftone field specifies the level of halftone at which the scan data is converted to binary data. The values in this field are vendor- specific. The halftone field is used in conjunction with the image composition field.

The image composition field specifies the type of scan operation requested. The image composition is defined as shown in table 7.

Table 7 - Image composition codes

Code	Description
00h	Bi-level black & white
01h	Dithered/halftone black & white
02h	Multi-level black & white (gray scale)
03h	Bi-level RGB colour
04h	Dithered/halftone RGB colour
05h	Multi-level RGB colour
06h - FFh	Reserved

The bits per pixel field specifies the number of bits used to represent the intensity of a single colour.

A reverse image format (RIF) bit of zero indicates that white pixels are indicated by zeros and black pixels are indicated by ones. A RIF bit of one indicates that white pixels are to be indicated by ones and black pixels are to be indicated by zeros. The RIF bit is applicable only for images represented by one bit per pixel.

The padding type field specifies how the device server shall pad the image data transmitted to the application client if it is not an integral number of bytes. The padding type is defined in table 8.

Table 8 - Padding types

Code	Description
00h	No padding
01h	Pad with 0's to byte boundary
02h	Pad with 1's to byte boundary
03h	Truncate to byte boundary
04h - FFh	Reserved

The bit ordering field specifies the order in which data is transferred to the host from the window. The bit ordering specifies the direction of pixels in a scan line, the direction of scan lines within a window and the image data packing within a byte. The values in this field are vendor-specific.

The compression type and compression argument fields specify the compression technique to be applied to the image data (see table 9).

Table 9 - Compression types and arguments

Compression code	Description	Compression argument
00h	No compression	Reserved
01h	CCITT group III, 1 dimensional	Reserved
02h	CCITT group III, 2 dimensional	K factor
03h	CCITT group IV, 2 dimensional	Reserved
04h - 0Fh	Reserved	Reserved
10h	Optical character recognition (OCR)	Vendor-specific
11h - 7Fh	Reserved	Reserved
80h - FFh	Vendor-specific	Vendor-specific

6.1.3 OBJECT POSITION command

The OBJECT POSITION command (see table 10) provides positioning functions. Absolute as well as relative positioning is provided. A device server shall return CHECK CONDITION status and set the sense key to ILLEGAL REQUEST if a positioning function is requested that is not supported.

Table 10 - OBJECT POSITION command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (31h)							
1	Reserved					Position function		
2	(MSB)							
3	Count							
4								(LSB)
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9	Control							

The position function field specifies the requested function (see table 11).

Table 11 - Position function

Position function	Description
000b	Unload object
001b	Load object
010b	Absolute positioning
011b	Relative positioning
100b	Rotate object
101b	Reserved
110b	Reserved
111b	Reserved

a) *Unload object.* This position function specifies that the object shall be positioned for removal. If upon receipt of this command there is no object loaded, the device server shall return a GOOD status. This condition shall not be considered as an error. If the device server is unable to unload the object (i.e. paper jam or mis-feed condition), the device server shall return CHECK CONDITION status and set the sense key sense to MEDIUM ERROR.

b) *Load object.* This position function specifies that the object is to be loaded and positioned to the base line. If upon receipt of this command there is a object already loaded, the device server shall returns GOOD status. This condition shall not be considered as an error. If an object is not loaded and the device server is unable to load an object, the device server shall return CHECK CONDITION status and set the EOM bit to one and the sense key to MEDIUM ERROR.

c) *Absolute positioning.* This position function specifies that the object is to be positioned at a y-axis displacement from the base line. The y-axis displacement is determined using the count field and the device server's current measurement unit divisor (see 7.1.3.1). A count field of zero positions the object at the base line.

Any other value in the count field shall cause the device server to position the object that number of units in the scan line direction. If there is no object loaded or if the specified y-axis displacement is not achieved, the device server shall return CHECK CONDITION status and set the EOM bit to one and the sense key to MEDIUM ERROR.

d) *Relative positioning.* This position function specifies that the object is to be positioned at a y-axis displacement relative to the current position. The y-axis displacement is determined using the count field and the device server's current measurement unit divisor (see 7.1.3.1). A count field of zero causes no change in position of the object.

A positive value in the count field shall cause the device server to position the object that number of units in the scan line direction. If the scan range is exceeded, the device server shall return CHECK CONDITION status. The EOM bit is set to one, the ILI bit is set to one, and the sense key is set to MEDIUM ERROR. The valid bit is set to one and the information bytes are set to the difference (residue) between the requested count and the actual number of units moved.

A negative value (e.g. twos complement notation) in the count field shall cause the device server to position the object that number of units toward the base line. If there is no object loaded or if the specified y-axis displacement is not achieved, the device server shall return CHECK CONDITION status and set the EOM bit to one and the sense key to MEDIUM ERROR. If the base line is encountered, the device server shall position the object at the base line and return CHECK CONDITION status. The ILI bit is set to one and the sense key is set to MEDIUM ERROR. The valid bit is set to one and the information bytes are set to the difference (residue) between the requested count and the actual number of units moved.

e) *Rotate object.* This position function specifies that the object is rotated in an anti-clockwise direction expressed in thousandths of a degree. The count field specifies the number of units that the object is to be moved.

The count field is used with the position function to specify the displacement of the object.

6.1.4 READ command

The READ command (see table 12) requests that the device server transfer data to the application client.

Table 12 - READ command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (28h)							
1	Reserved							
2	Data type code							
3	Reserved							
4	(MSB)			Data type qualifier				
5								(LSB)
6	(MSB)							
7				Transfer length				
8								(LSB)
9	Control							

The transfer data type distinguishes between the different types of data that may be transferred between the application client and the device server. The types of transfers are specified in table 13.

Table 13 - Data type codes

Code	Description
00h	Image
01h	Vendor-specific
02h	Halftone mask
03h	Gamma function
04h - 7Fh	Reserved
80h - FFh	Vendor-specific

The data type qualifier field provides a means to differentiate data transfers of the same data type code. The values used in this field are vendor-specific.

The transfer length specifies the number of blocks the device server shall transfer to the application client during the DATA IN phase. The block size is the current block size in the mode parameters block descriptor (see SPC). A transfer length of zero is not considered an error and no data shall be transferred.

If the device server transfers less than transfer length blocks, a CHECK CONDITION status shall be returned. The ILI bit is set to one, the valid bit is set to one, and the information bytes are set to the difference (residue) between the requested transfer length and the actual number of blocks transferred.

This command shall be terminated with a status of RESERVATION CONFLICT if any reservation access conflict (see 10.2.10) exists, and no data shall be transferred.

6.1.5 SCAN command

The SCAN command (see table 14) requests the device server begin a scan operation.

Table 14 - SCAN command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (1Bh)							
1	Reserved							
2	Reserved							
3	Reserved							
4	Transfer length							
5	Control							

The transfer length specifies the length in bytes of the window identifier list that shall be sent during the DATA OUT phase. A transfer length of zero indicates that no data shall be transferred. This condition shall not be considered an error.

The window identifier list consists of zero or more window identifiers, each of which specifies a window to be scanned.

6.1.6 SEND command

The SEND command (see table 15) transfers data from the application client to the device server.

Table 15 - SEND command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (2Ah)							
1	Reserved							
2	Data type code							
3	Reserved							
4	(MSB) Data type qualifier							
5								(LSB)
6	(MSB) Transfer length							
7								
8								(LSB)
9	Control							

The data type code and data type qualifier are defined in the READ command (see 6.1.4).

The transfer length specifies the number of blocks the device server shall transfer from the application client during the DATA OUT phase. The block size is the current block size in the mode parameters block descriptor (see SPC). A transfer length of zero is not considered an error and no data shall be transferred.

This command shall be terminated with a status of RESERVATION CONFLICT if any reservation access conflict (see SPC) exists, and no data shall be transferred.

6.1.7 SET WINDOW command

The SET WINDOW command (see table 16) provides a means for the application client to specify one or more windows within the scanning range of the device.

Table 16 - SET WINDOW command

Bit / Byte	7	6	5	4	3	2	1	0
0	Operation code (24H)							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Transfer length							
8								(LSB)
9	Control							

The transfer length specifies the length, in bytes, of the data that shall be sent during the DATA OUT phase. A transfer length of zero indicates that no window parameters data shall be transferred. This condition shall not be considered an error.

The window parameters data shall consist of a header followed by one or more window descriptors. Each window descriptor specifies the location, size, and scanning method used for a window.

The set window data header is defined in table 17.

Table 17 - Set window data header

Bit / Byte	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB)							
7	Window descriptor length							(LSB)

The window descriptor length specifies the length, in bytes, of a single window descriptor. Each descriptor shall be of equal length. The first 48 bytes are defined in this International Standard and the remaining bytes in each descriptor are vendor-specific.

See table 6 for the definition of a window descriptor.

7 Parameters for graphic logical units

7.1 Parameters for scanner logical units

7.1.1 Diagnostic parameters

This subclause defines the descriptors and pages for diagnostic parameters used with scanner devices.

The diagnostic page codes for scanner devices are defined in table 18.

Table 18 - Diagnostic page codes

Page code	Description	Subclause
00h	Supported diagnostic pages	SPC
01h - 7Fh	Reserved	
80h - FFh	Vendor-specific pages	

7.1.2 Log parameters

This subclause defines the descriptors and pages for log parameters used with scanner devices.

The log page codes for scanner devices are defined in table 19.

Table 19 - Log page codes

Page code	Description	Subclause
01h	Buffer over-run/under-run page	SPC
03h	Error counter page (read) page	SPC
07h	Last n error events page	SPC
06h	Non-medium error page	SPC
00h	Supported log pages	SPC
08h - 2Fh	Reserved	
3Fh	Reserved	
30h - 3Eh	Vendor-specific pages	

7.1.3 Mode parameters

This subclause defines the descriptors and pages for mode parameters used with scanner devices.

The mode parameter list, including the mode parameter header and mode block descriptor, is defined in the SPC.

The medium-type code field is contained in the mode parameter header (see SPC). This field is reserved for scanners devices.

The device specific parameter field is contained in the mode parameter header (see SPC). This field is reserved for scanner devices.

The density code field is contained in the mode parameter block descriptor (see SPC). This field is reserved for scanner devices.

The mode page codes for scanner devices are defined in table 20.

Table 20 - Mode page codes

Page code	Description	Subclause
0Ah	Control mode page	SPC
02h	Disconnect-reconnect page	SPC
03h	Measurement units page	7.1.3.1
09h	Peripheral device page	SPC
01h	Reserved	
03h - 08h	Reserved	
0Bh - 1Fh	Reserved	
00h	Vendor-specific (does not require page format)	
20h - 3Eh	Vendor-specific (page format required)	
3Fh	Return all pages (valid only for the MODE SENSE command)	

7.1.3.1 Measurement units page

The measurement units page (see table 21) specifies the units of measurement used for calculating the displacement of window and for positioning an object.

The measurement units are independent of the horizontal and vertical scan resolutions.

Table 21 - Measurement units page

Bit Byte	7	6	5	4	3	2	1	0
0	PS	Reserved			Page code (03h)			
1					Parameter length (06h)			
2					Basic measurement unit			
3					Reserved			
4	(MSB)							
5					Measurement unit divisor			(LSB)
6					Reserved			
7					Reserved			

The parameters savable (PS) bit is only used with the MODE SENSE command. This bit is reserved for the MODE SELECT command. A PS bit of one indicates that the device server is capable of saving the page in a non-volatile vendor-specific location.

The basic measurement unit field is defined in table 22. Device servers shall use inches as the default basic measurement unit.

Table 22 - Basic measurement units

Code	Description
00h	Inch
01h	Millimetre
02h	Point
03h - FFh	Reserved

The measurement unit divisor specifies the number of units needed to equal one basic measurement unit. Device servers shall use 1 200 as the default measurement unit divisor. If a value of zero is specified the device server shall return CHECK CONDITION status and set the sense key to ILLEGAL REQUEST.

NOTE 1 A device server that does not implement this page or only supports default values uses twelve hundredths (1/1200) of an inch as the unit of measure.