



High Volume Scanner Family

SCSI Command Set

Revision 3.2

EASTMAN KODAK COMPANY

RESTRICTED INFORMATION

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Revision History

Date	Author	Revision	Description
08/01/2000	Dan Williams	1.0	Initial Revision.
11/21/2000	Terry Novak	1.1	Updates to Inquiry, Request Sense, Read Image Header. Moved Section 7 to a separate document.
11/28/00	Terry Novak	1.2	Changes to Inquiry, Set Window, Color Dropout Calibration. Changes to Scanner Configuration Command for IA and Image Order (Out). Added Patch/IA/Batch information. Changes to Read Image Header and SC command for UNICODE characters.
12/11/00	Terry Novak	1.3	Changes to Set Window (missing Error Diffusion definition, fixed image composition/halftone chart), Inquiry (to conform with SCSI-2 Spec), changes to Scanner Configuration (Added PF Keys, combined some fields) & added fields to Read Image Header. Added IA Overflow Condition to Sense Keys.
12/27/00	Kevin Hammond	1.4	Added Feature Patch field to Image Header (and removed feature patch from Image Address Level field)
4/1/01	M. Beth Schmidt	1.5	
4/3/01	M. Beth Schmidt	1.6	
4/4/01	M. Beth Schmidt	1.7	
6/5/01	M. Beth Schmidt	1.9	This version will be used to sync with FW release 1.0.11 for the scanner. Once this version of the SCSI spec has final review, it will become version 2.0 which will be the first official release to the enablers.
6/11/01	M. Beth Schmidt	2.0	Starting version for enabler integration.
6/14/01	Dan Williams	2.1	Fixed numbering in some commands. Format now consistent. Updated TOC. Removed reserved bytes on end of command data.
7/30/2001	Bill Clare	2.2	Changed JPEG Quantization command

09/04/01	Kevin Hammond	2.3	<p>Changed bit 4 of byte 96 in Inquiry command from reserved to reflect maximum transport speed so that an i810 can be distinguished from an i830.</p> <p>Fixed byte numbering problem in Set Window command.</p> <p>Clarified byte order for characters in UNICODE strings (first of 2 bytes for each character is MSB). This affects image headers and scanner configuration.</p> <p>Clarified UNICODE strings being NULL filled, not NULL terminated.</p> <p>Changed last byte of Scanner Configuration data to unused from PF Key 4 definition. This is because the scanner has only 3 available keys to be programmed.</p> <p>Formatting clean-up, added the Read 12 Command, added supported resolution table, and updated the default power-up JPEG Quantization table. (Williams)</p> <p>Removed the None (00) option for batch level. Batching is disabled by putting 0 in the Batch mode/count field (enabled with >0 in that field).</p>
09/13/01	Kevin Hammond	2.5	<p>Changed max length for length checking in SC command to 30.5" from 30" (36600).</p> <p>Minor change to default window length for bitonal and color in Set Window command.</p> <p>Removed the multifeed detected sense code. No check condition is generated on a multifeed detection.</p> <p>Changed lamp timeout default to 20 minutes (from 10).</p> <p>Clarified overscan is added to window length in Set Window command to determine actual image length. Further, indicated that overscan + window length can't exceed 30" (26" in case of 400dpi bitonal image).</p>
11/3/01	Kevin Hammond	2.6	<p>Clarification around transfer patch recognition in Scanner Config command.</p>
2/12/03	Bill Bauman	2.7	<p>Added Spectrum additions</p>

2/28/2003	Bill Bauman	2.9	Added the following for Spectrum: 2.2.5 - Multi-page paper feed detected 2.3.3, 2.3.4 - Toggle Patch, iThresholding, Fine Auto-cropping 2.8.5, 2.8.6 - iThresholding 2.8.6 - Additional entry for cropping 3.2.3, 3.2.4 - Toggle Patch 3.2.4 - Additional entry for Multi-page paper detection response
3/3/2003	Dan Williams	2.10	Added Write Buffer command.
3/3/2003	P. Hutkowski	2.11	Clarify Toggle Patch, Write Buffer commands
3/17/2003	Bill Bauman	2.12	Updated spec per review Moved iThresholding in SetWindow from byte 29 to byte 47
3/19/2003	Bill Bauman	2.13	Moved iThresholding in SetWindow to byte 44, bit 7
4/15/2003	Bill Bauman	2.14	Changed Inquiry byte 96, bit 2, from VBLR to Multi-feed disable allowed
4/22/2003	Bill Bauman	2.15	Changed Inquiry byte 96, bit 2, back to VBLR Changed Inquiry bytes 38/39, bit 4 to Multi-feed disable allowed
4/23/2003	Bill Bauman	2.16	Changed multi-feed disable allowed to byte 38/bit 7
4/2/2004	Bill Clare	2.17	CR659 Added #images to end of job sense code.
5/11/2004	Bill Clare	2.18	CR191 Added grayscale to Inquiry data, window data. CR462 Added options for 180 fonts to Inquiry data, scanner configuration command.
5/11/2004	Bill Clare	2.19	Fixed previous version based on review with Mark Byers.
5/13/2004	Bill Clare	2.20	Moved location of disable gamma correction in Set Window command after review with Huong Nguyen
5/19/2004	Bill Clare	2.21	Removed the changes put into revision 2.20 after review with Mark Byers. This version is the same as 2.19.
6/7/2004	Bill Clare	2.22	Added configuration for checkdigit.
6/21/2004	Bills Bauman and Clare	2.23	Left change bars from previous release on. Fixed Scanner Configuration Command.
6/22/2004	Bill Clare	3.0	Identical to 2.23, except that ALL changes from 2.17 to 2.23 inclusive are noted in this version.
7/20/2004	Bill Bauman	3.1	Section 2.3.3, change front/rear grayscale to compressed grayscale and uncompressed grayscale.
7/21/2004	Bill Bauman	3.2	Section 2.3.3, added the change to the data definition section.

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1 Command Implementation Requirements

1.1 SCSI bus

When two SCSI devices communicate on the SCSI bus, one acts as an initiator and the other acts as a target. The initiator originates an operation and the target performs the operation. A SCSI device usually has a fixed role as an initiator or target, but some devices may be able to assume either role. In terms of this document, the scanner is the target and the host computer is the initiator.

SCSI devices connected to the bus must use unique identification addresses, each one with one ID bit assigned to it. The SCSI device ID is used during the Arbitration and Selection phases of each command. Higher IDs have higher priority. On the WIDE SCSI bus in SCSI-3, the low-byte IDs have higher priority over high-byte IDs. This is to allow 8-bit devices to be always recognized by all other devices. Since this scanner is a 16-bit device, it supports SCSI IDs from 0 to 15.

SCSI does not specify which ID should be assigned to Initiators or Targets. However, in most systems it works best with Initiators using the highest IDs and the Targets using the lowest IDs (e.g., the host computer would have a SCSI ID of 7 and the scanner would have a SCSI ID of 8 (0 on a 8-bit bus)).

1.2 Command Descriptor Block

A command is communicated by sending a command descriptor block to the target. For several commands, the command descriptor block is accompanied by a list of parameters sent during the DATA OUT phase. See the specific commands for detailed information. The command descriptor block always has an operation code as its first byte and a control byte as its last byte. For all commands, if there is an invalid parameter in the command descriptor block, then the target shall terminate the command without altering the medium.

1.2.1 Operation Code field

The first byte of all SCSI commands shall contain an operation code as defined in this International Standard.

1.2.2 Reserved field

Reserved bits, fields, bytes, and code values are set aside for future standardization. Their use and interpretation may be specified by future extensions to this standard. A reserved bit, field, or byte shall be set to zero, or in accordance with a future extension to this standard. A target that receives a reserved bit, field, or byte that is not zero or receives a reserved code value shall terminate the command with CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST. It shall also be acceptable for a target to interpret a bit, field, byte, or code value in accordance with a future extension to this International Standard.

1.2.3 Logical Unit Number field

This scanner device assumes that there is only one logical unit. The Logical Unit Number field shall be set to 0. A target that receives a Logical Unit Number field that is not zero shall terminate the command with CHECK CONDITION status and the sense key shall be set to LOGICAL UNIT NOT SUPPORTED. However, in response to an INQUIRY command, the target shall return the INQUIRY data with the first byte set to 7Fh (i.e., peripheral qualifier set to 011b and peripheral device type set to 1Fh).

1.2.4 Control field

The control field is the last byte of every command descriptor block. The control field shall be set to 0 for this scanner device. A target that receives a control field that is not zero shall terminate the command with CHECK CONDITION status and the sense key shall be set to ILLEGAL REQUEST.

2 Supported SCSI Commands

This section lists the SCSI commands that this scanner supports. The following table is a summary of the commands.

SCSI Command	Command Op Code	SCSI-2 Specification Section
Test Unit Ready	00h	8.2.16
Request Sense	03h	8.2.14
Inquiry	12h	8.2.5
Reserve Unit	16h	10.2.10
Release Unit	17h	10.2.9
Scan	1Bh	15.2.5
Send Diagnostic	1Dh	8.2.15
Set Window	24h	15.2.7
Get Window	25h	15.2.2
Read	28h	15.2.4
Send	2Ah	15.2.6

2.1 Test Unit Ready Command

The *Test Unit Ready Command* provides a means to check if the logical unit is ready. This is not a request for a self-test. If the logical unit would accept an appropriate medium-access command without returning CHECK CONDITION status, this command shall return a GOOD status. If the logical unit cannot become operational or is in a state such that an initiator action is required to make the unit ready, the target shall return CHECK CONDITION status with a sense key of NOT READY.

2.1.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (00h)							
1	Logical unit number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Control							

2.1.2 Command Definitions

Descriptor	Value	Definition
Operation code	00h	Test Unit Ready Command ID

2.1.3 Data Format

N/A

2.1.4 Data Definitions

N/A

2.2 Request Sense Command

The *Request Sense Command* requests that the target transfer sense data to the initiator.

2.2.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (03h)							
1	Logical unit number			Reserved				
2	Reserved							
3	Reserved							
4	Allocation length							
5	Control							

2.2.2 Command Definitions

Descriptor	Value	Definition
Operation code	03h	Request Sense Command ID
Allocation length	12h	Number of bytes transferred in data phase

2.2.3 Data Format

byte bit	7	6	5	4	3	2	1	0
0	Valid	Error code						
1	Segment number							
2	Filemark	EOM	ILI	Reserved	Sense key			
3	(MSB) Information (LSB)							
4								
5								
6								
7	Additional sense length							
8	(MSB) Command specific information (LSB)							
9								
10								
11								
12	Additional sense code							
13	Additional sense code qualifier							
14	Field replaceable unit code							
15	SKSV							
16	Sense key specific (LSB)							
17								

2.2.4 Data Definitions

Descriptor	Value	Definition
Valid	1b	information field contains valid information
Error code	70h 71h	current errors deferred errors
Segment number	00h	Not Used
Filemark	0b	Reserved (non sequential-access device)
EOM	0b	Reserved (non sequential-access device)
ILI	0b 1b	requested logical block length did match actual requested logical block length did not match actual
Sense key	0h 2h 4h 5h 6h Dh	no sense not ready hardware error illegal request unit attention volume overflow
Information	residue	difference between the requested bytes and the the actual bytes of data received (when ILI is 1)
Additional sense length	10d	additional sense fields in bytes to follow
Command specific information	00000000h	not used
Additional sense code	*	further detail describing the sense key
Additional sense code qualifier	*	further detail to the additional sense code
Field replaceable unit code	00h	not used
SKSV	0b	not used
Sense key specific	000000h	not used

* see the following Request Sense Table for the supported sense keys and codes

2.2.5 Request Sense Table

Sense Key	Additional Sense Code	Additional Sense Code Qualifier	Description
0h	00h	00h	No additional information
2h	00h	00h	Not ready
2h	80h	#images	End of job. #images is the number of images sent to the host in the entire batch.
4h	44h	00h	Hardware error
4h	3Bh	05h	Paper Jam
4h	3Bh	80h	Multi-page paper feed detected
5h	20h	00h	Invalid command operation code
5h	24h	00h	Invalid field in CDB
5h	25h	00h	Logical unit not supported
5h	26h	00h	Invalid field in parameter list
5h	3Dh	00h	Invalid bits in identify message
5h	60h	00h	Lamp failure
5h	83h	00h	Command failed, check log
5h	8Fh	00h	No image available
6h	29h	00h	Power-On, Reset, or Bus Device Reset occurred
9h	80h	00h	Image Address Field Overflow
Dh	80h	00h	Image buffer full

2.2.6 Additional Information

2.2.6.1 Start of Job Processing

The scanner is enabled via the 'Scan' command. Once the scanner has been enabled, scanning of pages can be initiated via either the 'Start' button on the Operator Control Panel, or the receipt of the SS (Start) command. It is recommended that before enabling the scanner, that a Test Unit Ready, Inquiry and then an End of Job Command are sent to the scanner.

2.2.6.2 End of Job Processing

The Host should continue to request images until it receives the 'End of Job' Sense Bytes.

The 'End of Job' Sense Bytes are returned whenever scanning has been 'disabled' AND the last image has been read from the buffer. The scanner will only disable itself under the following conditions:

- On errors that cause the scanner to 'stop'
- When the 'End of Job' button is pressed on the Operator Control Panel
- The Host sends the 'GX' (End of Job) command
- On a transport timeout, IF the scanner has been configured to disable itself on transport timeouts
- The scanner will not generate a GX (End of Job) for a jam or multi-feed detect condition, therefore the scanner will remain enabled when these conditions occur.

The 'No Image Available' Sense Bytes are returned whenever a Read Request (image or header) has been received AND there are no images in the buffer AND the scanner is still enabled.

2.3 Inquiry Command

The *Inquiry Command* requests that information regarding parameters of the target and its attached peripheral device(s) be sent to the initiator. An option allows the initiator to request additional information about the target or logical unit.

2.3.1 Command Format

byte	bit	7	6	5	4	3	2	1	0
0		Operation code (12h)							
1		Logical unit number			Reserved				EVPD
2		Page code							
3		Reserved							
4		Allocation length							
5		Control							

2.3.2 Command Definitions

Descriptor	Value	Definition
Operation code	12h	Inquiry Command ID
EVPD	0b	Standard INQUIRY data returned
Page code	00h	Standard INQUIRY data returned
Allocation length	0d to 98d	If > 98, only 98 bytes are transferred

2.3.3 Data Format

byte	bit	7	6	5	4	3	2	1	0
0		Peripheral qualifier			Peripheral device type				
1		RMB	Device Type			qualifier			
2		ISO version	ECMA version			ANSI approved version			
3		AENC	TrmIOP	Reserved		Response data		format	
4					Additional Length				
5					Reserved (SCSI-2 Spec)				
6					Reserved (SCSI-2 Spec)				
7		RelAdr	WBus32	WBus16	Sync	Linked	Reserved	CmdQue	SftRe
8...		(MSB)			Vendor Identification*				
...15							(LSB)		
16...		(MSB)			Product Identification*				
...31							(LSB)		
32...		(MSB)			Product Revision		level**		
...35									(LSB)
36..		(MSB)			Product Build		number**		
..37									(LSB)
38		Multi-feed disable allowed	Checkdigit allowed	Front Side Accessories	Compressed Grayscale	Toggle patch	DP1	Color	ATP
39		DP1 180 Font	Reserved	Rear Side Accessories	Uncompressed Grayscale	Toggle patch	DP1	Color	ATP
40		(MSB)		Minimum bitonal	DPI resolution				
41						(LSB)			
42		(MSB)		Maximum bitonal	DPI resolution				
43						(LSB)			
44		(MSB)		Minimum color	DPI resolution				
45						(LSB)			
46		(MSB)		Maximum color	DPI resolution				
47						(LSB)			
48..		(MSB)		Maximum Image	Width				
..51						(LSB)			
52..		(MSB)		Maximum Image	Length				
..55						(LSB)			
56...					Reserved (SCSI-2 Spec)				
..95									
96		Fine (Aggressive) Auto-Crop	iThresh olding	Transport speed	ECD	VBLR	Elevator	RelCrop	
97		CDeskew	IA	Patch	Null Mode	SABRE	LDDDS	UDDDS	Fixed Gap

* ASCII data fields shall contain only graphic codes (i.e. code values 20h through 7Eh). Left-aligned fields shall place any unused bytes at the end of the field (highest offset) and the unused bytes shall be filled with space characters (20h). All ASCII data fields are left aligned.

** Unused bytes shall be filled with '0' (30h).

2.3.4 Data Definitions

Descriptor	Value	Definition
Peripheral qualifier	000b	data is always valid
Peripheral device	06h	scanner device
RMB	0b	remove medium not removable
Device type modifier	02h	duplex image capable (front and rear)
ISO version	00b	No compliance claims of SCSI (ISO 9316)
ECMA version	000b	No compliance claims of SCSI (ECMA-111)
ANSI version	010b	ANSI X3T9.2 Compliant
AENC	0b	does not support asynchronous event notification
TrmIOP	0b	does not support TERMINATE I/O PROCESS message
Response data format	2h	ANSI X3T9.2 Compliant
Additional length	93d	additional parameter fields in bytes to follow
RelAdr	0b	does not support relative addressing
WBus32 *	0b	does not support 32-bit wide transfers
WBus16 *	1b	supports 16-bit wide transfers
Sync	1b	supports synchronous data transfer
Linked	0b	does not support linked commands
CmdQue	0b	does not support tagged command queuing
SftRe	0b	responds to RESET condition with the hard alternative
Vendor identification	KODAK	name of the product's vendor
Product identification	800b Scanner	name of the product
Product revision level	4 ASCII characters	current product firmware version; first 2 ASCII characters are major revision; next 2 ASCII characters are minor revision
Product build number	2 ASCII Characters	current product firmware build number
Multi-feed disable allowed	0b 1b	Disable with multi-feed detect (end of job) not allowed Disable with multi-feed detect (end of job) allowed
Checkdigit allowed	0b 1b	Image Address Checkdigit functionality not available. Image Address Checkdigit functionality available.
DP1 180 Font	0b 1b	180 degree rotated printer fonts not available 180 degree rotated printer fonts available
Compressed Grayscale	0b 1b	Compressed grayscale and ungammaed grayscale not available Compressed grayscale and ungammaed grayscale available
Toggle patch (front-side) ¹	0b 1b	toggle patch detection not available toggle patch detection available
DP1 (front-side)	0b 1b	printer not available printer available
Color (front-side)	0b 1b	color not available color available
ATP (front-side)	0b 1b	adaptive threshold processor not available adaptive threshold processor available
Uncompressed Grayscale	0b 1b	Uncompressed grayscale, ungammaed grayscale, and uncompressed color not available Uncompressed grayscale, ungammaed grayscale, and uncompressed color available
Toggle patch (rear-side) ¹	0b 1b	toggle patch detection not available (DEFAULT) toggle patch detection available
DP1 (rear-side)	0b 1b	printer not available printer available
Color (rear-side)	0b	color not available

	1b	color available
ATP (rear-side)	0b 1b	adaptive threshold processor not available adaptive threshold processor available
Minimum bitonal DPI resolution		minimum DPI bitonal resolution of the model
Maximum bitonal DPI resolution		maximum DPI bitonal resolution of the model
Minimum color DPI resolution		minimum DPI color resolution of the model
Maximum color DPI resolution		maximum DPI color resolution of the model
Maximum image width		maximum width of an image in 1/1200 inch units
Maximum image length		maximum length of an image in 1/1200 inch units

* **Note that since this scanner has a 16-bit SCSI bus, there is a possibility that the low-level drivers may copy odd-byte sized command data with an extra byte. It is recommended to make sure all odd-byte sized command data structures are padded to a 16-bit boundary (e.g., the “SS” command is 5 bytes in length, make sure you pad your structure an extra byte at the end to handle the 16-bit bus).**

(Continued)

Descriptor	Value	Definition
Fine (Aggressive) Auto-cropping	0b	fine auto-cropping not available
	1b	fine auto-cropping available
iThresholding	0b	iThresholding not available
	1b	iThresholding available
Transport speed	00b	Maximum transport speed of 21 inches per second
	01b	Maximum transport speed of 28 inches per second
	10b, 11b	Reserved
ECD	0b	electronic color dropout not available
	1b	electronic color dropout available
VBLR	0b	vertical black line removal not available
	1b	vertical black line removal available
Elevator	0b	elevator not available
	1b	elevator available
RelCrop	0b	relative cropping not available
	1b	relative cropping available
CDeskew	0b	color deskew cropping not available
	1b	color deskew cropping available
IA	0b	image addressing not available
	1b	image addressing available
Patch	0b	patch reader not available
	1b	patch reader available
Null Mode	0b	scanner has been configured
	1b	scanner has not been configured
SABRE	0b	SABRE functionality not available
	1b	SABRE functionality available
LDDDS	0b	length double document detection system not available
	1b	length double document detection system available
UDDDS	0b	ultrasonic double document detection system not available
	1b	ultrasonic double document detection system available
Fixed Gap	0b	fixed gap not available
	1b	fixed gap available

¹ Spectrum (Prism+) only offers toggle patch reading on the front side. The data structure allows for future expansion of the rear side, but it is unsupported for Spectrum. The following options should be used based on where the toggle patch option can be detected:

Toggle patch detected on Front only:

- **Toggle front only image**
- **Toggle front and rear image**

2.4 Reserve Unit Command

The *Reserve Unit Command* is used to reserve logical units for the exclusive use of the requesting initiator, or if it is a third-party reservation, to another specified SCSI device.

Note: This command will always pass and shall return a GOOD status. It will not reserve the unit.

2.4.1 Command Format

byte	bit	7	6	5	4	3	2	1	0
0		Operation code (16h)							
1		Logical	unit	number	3rdPty	Third	party	device ID	Reserved
2		Reserved							
3		Reserved							
4		Reserved							
5		Control							

2.4.2 Command Definitions

Descriptor	Value	Definition
Operation code	16h	Reserve Unit Command ID
3rdPty	0b	third-party reservation not requested
Third party device ID	000b	third-party reservation not requested

2.4.3 Data Format

N/A

2.4.4 Data Definitions

N/A

2.5 Release Unit Command

The *Release Unit Command* is used to release logical units for the exclusive use of the requesting initiator, or if it is a third-party reservation, to another specified SCSI device.

Note: This command will always pass and shall return a GOOD status. It will not release the unit.

2.5.1 Command Format

byte	bit	7	6	5	4	3	2	1	0	
0		Operation code (17h)								
1		Logical	unit	number	3rdPty	Third	party	device ID	Reserved	
2		Reserved								
3		Reserved								
4		Reserved								
5		Control								

2.5.2 Command Definitions

Descriptor	Value	Definition
Operation Code	17h	Release Unit Command ID
3rdPty	0b	third-party release not requested
Third party device ID	000b	third-party release not requested

2.5.3 Data Format

N/A

2.5.4 Data Definitions

N/A

2.6 Scan Command

The *Scan Command* requests the target to begin a scan operation. This command enables the scanner. All parameters previously sent to the scanner will be verified and be used to configure the scanner in preparation for the upcoming Start and Stop commands/buttons.

2.6.1 Command Format

byte	bit	7	6	5	4	3	2	1	0
0		Operation code (1Bh)							
1		Logical unit number			Reserved				
2		Reserved							
3		Reserved							
4		Transfer length							
5		Control							

2.6.2 Command Definitions

Descriptor	Value	Definition
Operation Code	1Bh	Scan Command ID
Transfer length	00h	no data shall be transferred

2.6.3 Data Format

N/A

2.6.4 Data Definitions

N/A

2.7 Send Diagnostic Command

The *Send Diagnostic Command* requests the target to perform diagnostic operations on itself, on the logical unit, or on both. The only mandatory implementation of this command is the self-test feature with the parameter list length of zero.

This command is only valid when the scanner is disabled. When it receives this command, the scanner will perform the same actions it takes at power up.

2.7.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (1Dh)							
1	Logical unit number		PF	Reserved	SelfTest	DevOfI	UnitOfI	
2	Reserved							
3	(MSB) Parameter list length							
4								
5	(LSB) Control							

2.7.2 Command Definitions

Descriptor	Value	Definition
Operation code	1Dh	Send Diagnostic Command ID
PF	1b	diagnostic page format
SelfTest	1b	perform self-test
DevOfI	0b	not used
UnitOfI	0b	not used
Parameter List Length	0000h	total bytes transferred in data phase

2.7.3 Data Format

N/A

2.7.4 Data Definitions

N/A

2.8 Set Window Command

The *Set Window Command* provides a means for the initiator to specify one or more windows within the scanning range of the device.

2.8.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (24h)							
1	Logical unit number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB) Transfer length (LSB)							
7								
8								
9	Control							

2.8.2 Command Definitions

Descriptor	Value	Definition
Operation code	24h	Set Window Command ID
Transfer length	55d	header plus one set window descriptor (8 plus 47)
	102d	header plus two set window descriptors (8 plus 94)
	149d	header plus three set window descriptors (8 plus 141)
	196d	header plus four set window descriptors (8 plus 188)

2.8.3 Set Window Header Data Format

byte bit	7	6	5	4	3	2	1	0
0	Reserved							
1	Reserved							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB) Window descriptor length (LSB)							
7								

2.8.4 Set Window Header Data Definitions

Descriptor	Value	Definition
Window descriptor length	47	length of a single window descriptor

2.8.5 Set Window Data Format

byte	bit	7	6	5	4	3	2	1	0	
0		Window				identifier				
1		Reserved								Auto
2	(MSB)	X-Axis				resolution				
3										(LSB)
4	(MSB)	Y-Axis				resolution				
5										(LSB)
6...	(MSB)	X-Axis				upper left *				
...9										(LSB)
10...	(MSB)	Y-Axis				upper left *				
...13										(LSB)
14...	(MSB)	Window				width *				
...17										(LSB)
18...	(MSB)	Window				length *				
...21										(LSB)
22		Brightness								
23		Binary				Threshold				
24		Binary				Contrast				
25		Image				composition				
26		Bits per				pixel				
27	(MSB)	Halftone				Pattern				
28										(LSB)
29	RIF	Reserved				(SCSI2 Spec)	Padding			type
30	(MSB)	Bit				ordering				
31										(LSB)
32		Compression				type				
33		Compression				argument				
34...		Reserved				(SCSI2 Spec)				
...39										
40		Noise				filter			Allow zero	VBLR
41	(MSB)	Image				overscan				
42										(LSB)
43	IS	DF	BR	BF	ED	HR	Cropping			
44	iThresholding	Reserved	Reserved	Disable Gamma Correction	Color	Dropout		Color		
45	Color				Dropout	Background	Value			
46	Color				Dropout	Threshold	Value			

* The default unit of measure is 1/1200 inch or 0.0212 mm.

2.8.6 Set Window Data Definitions

Descriptor	Value	Definition
Window identifier	01h	front side bitonal
	02h	rear side bitonal
	03h	front side color
	04h	rear side color
Auto	0b	auto windows not supported
X-Axis resolution	100,150,200 240,300,400	(DPI) dots per inch (200 dpi DEFAULT)
Y-Axis resolution	100,150,200 240,300,400	must be same as X-Axis resolution (200 dpi DEFAULT)
X-Axis upper left	0d to 14304d*	0 to 11.92 inches (0 to 302.3 mm) (0 DEFAULT)
Y-Axis upper left	0d to 31104d*	0 to 25.92 inches (0 to 658.4 mm) (0 DEFAULT)
Window width	96d to 14400d*	0.08 to 12 inches (2 to 304.8 mm) (12 DEFAULT)
Window length	96d to 31200d*	0.08 to 26 inches (2 to 660.4 mm) – 400 dpi restriction Bitonal default = 11 inches (13200) Color default = 10.96 inches (13152)
	96d to 36000d*	0.08 to 30 inches (2 to 762 mm) (26 DEFAULT)
Brightness	00h	automatic brightness not supported
Binary Threshold**	0d to 255d	(90 DEFAULT)
Binary Contrast**	0d to 255d	(62 DEFAULT)
Image composition	00h**	Bi-level black & white (DEFAULT)
	01h**	Dithered/halftone black & white
	02h-04h	Reserved
	05h	Multi-Level RGB Color
Bits per pixel	1d	Bitonal
	8d	Grayscale (only valid if Grayscale is enabled in Inquiry data)
	24d	Color
Halftone Pattern**	00h***	ATP On (DEFAULT)
	01h***	Dither / 64 level 45° Clustered Dot Screen
	02h***	Dither / 64 level Dispersed Dot Screen
	03h***	Dither / 64 level Bayer
RIF**	0d	a white pixel is represented by a binary zero and a black pixel is represented by a binary one (DEFAULT)
	1d	a white pixel is represented by a binary one and a black pixel is represented by a binary zero
iThresholding**	00h	iThresholding off
	01h	iThresholding on (DEFAULT)
Padding type**	00h	The target shall NOT pad the image data transmitted to the initiator if it is not an integral number of bytes.
Bit ordering**	01h	Always scans left to right, top to bottom. Data Data packing within a byte is fixed. msb/left/bit 7 is first pixel and lsb/right/bit 0 is eighth pixel
Compression type	00h**	no compression
	01h**	TSS Group III, 1-dimensional
	02h**	TSS Group III, 2-dimensional
	03h**	TSS Group IV (DEFAULT for bitonal)

	80h	JPEG (DEFAULT for color)
Compression argument**	0d to 255d	K-factor value for TSS Group III, 2-dimensional (0 DEFAULT)
Noise filter**	00h 01h 02h	no filter (DEFAULT) Remove lone pixels majority rule
Allow zero**	00h 01h	zero in threshold/contrast sets default value zero in threshold/contrast interpreted as zero (DEFAULT)
VBLR**	0b	vertical black line removal disabled (DEFAULT)
Image overscan	0d to 450d*	image area to capture prior to page lead edge and following page trail edge (fixed cropping only). This is in addition to specified window length. (0 DEFAULT)
IS ****	0b 1b	image sharpening disabled (DEFAULT) image sharpening enabled
DF	0b 1b	deskew disabled (DEFAULT) deskew enabled
BF**	0b 1b	border framing disabled (DEFAULT) border framing enabled
ED**	0b 1b	error diffusion disabled (DEFAULT) error diffusion enabled
BR**	0b 1b	border removal disabled (DEFAULT) border removal enabled
HR**	0b 1b	halftone removal disabled (DEFAULT) halftone removal enabled
Cropping	00b 01b 10b 11b	auto-cropping (DEFAULT)**** fixed cropping relative to scanner edge fixed cropping relative to upper left document corner fine (aggressive) Auto-cropping
Disable Gamma Correction	00h 01h	Gamma correction enabled (DEFAULT) Gamma correction disabled
Color Dropout Color**	00h 01h 02h 04h 05h to 0Fh	color dropout disabled (DEFAULT) RED color dropout enabled GREEN color dropout enabled BLUE color dropout enabled Reserved
Color Dropout Background Value**	0d to 255d	background greyscale value used to fill areas that have been 'dropped out' (160 DEFAULT)
Color Dropout Threshold Value**	0d to 255d	color threshold used with color dropout, such that any pixel greater than this value shall be replaced by the Color Dropout Background Value specified above (155 DEFAULT)

* Measurement unit for scan region parameters is 1/1200 inch (0.0212mm)

** Only applicable to Bitonal Windows

*** Image Composition / Halftone Chart

Image Composition	Halftone Pattern
00	00
01	1-3
02	0-3
05	not applicable to color

**** Auto-cropping will take place using 1 bit alignment.

***** IS (Image sharpening) is only applicable to Color Windows

- For all zones, the width (x) must be an integer multiple of 32 pixels at the selected resolution. For color windows, the total length must be an integer multiple of 8 lines at the selected resolution based on this formula:

$$\left(\text{integer portion of } \left(\frac{(\text{length} + (2 * \text{overscan})) * \text{resolution}}{1200} \right) \right) / 8$$

2.8.7 Set Window rules

1. For all zones, the width (x) must be an integer multiple of 32 pixels at the selected resolution.
2. X and Y resolutions must be the same
3. Overscan and deskew can not be enabled at the same time
4. The upper left X plus the width can not be more than 12 inches
5. Bits per pixel must be 24 for color images and 1 for bitonal images
6. If Auto Cropping is enabled then values for X Axis Upper Left, Y Axis Upper Left, Window Width and Window Length do not matter.
7. Overscan + window length is not allowed to exceed 30" (26" at 400 dpi).

BITONAL:

1. When using 400dpi, the upper left y plus the length can not be more than 26 inches (in all other cases, the maximum length is 30 inches)
2. For bitonal windows $(width * X \text{ resolution}) / 1200 \% 32 = 0$
3. Bitonal windows must not have image composition set to Multi Level RGB
4. For bitonal images, if the image composition is bi-level black and white then halftone pattern must be ATP on
5. If bitonal image and halftone pattern is selected then image composition must be dithered
6. For bitonal image, if halftone option is zero (ATP on) the image composition must be zero (bi-level black and white)
7. Bitonal image compression must be G3, G3 2D, G4 or none
8. Compression Argument is only used for G3 2D, for all other compression types the argument is zero
9. A bitonal image with a halftone pattern selected must have error diffusion (ED), Vertical Black Line Removal (VBLR) and color dropout disabled.

COLOR:

1. For color windows, the total length must be an integer multiple of 8 lines at the selected resolution based on this formula: $(\text{integer portion of } (((length + (2 * overscan)) * resolution) / 1200)) / 8$
2. For color windows $(width * X \text{ resolution}) / 1200 \% 8 = 0$
3. Color windows must have Image Composition set to Multi Level RGB.
4. If image sharpening is enabled then compression must be enabled
5. Color settings must have JPEG compression on .

2.8.8 Supported Resolution Table

Transport Speed (ips)	Bitonal Resolution (dpi)	Color Resolution (dpi)
28	200	200, 150, 100
21	200	200, 150, 100
18.67	300, 240	300, 200, 150, 100
18.67	400	300, 200
14	300, 240	200, 150, 100
14	400	200

2.9 Get Window Command

The *Get Window Command* provides a means for the initiator to get information about previously defined windows.

2.9.1 Command Format

byte	bit	7	6	5	4	3	2	1	0	
0		Operation code				(25h)				
1		Logical unit number		Reserved						Single
2		Reserved								
3		Reserved								
4		Reserved								
5		Window identifier								
6	(MSB)					Transfer length				(LSB)
7										
8										
9		Control								

2.9.2 Command Definitions

Descriptor	Value	Definition
Operation code	25h	Get Window Command ID
Single	0b	all window descriptors will be returned
	1b	a single window descriptor will be returned
Window identifier	00h	all window descriptors will be returned (Single=0)
	01h	front-side bitonal (Single=1)
	02h	rear-side bitonal (Single=1)
	03h	front-side color (Single=1)
	04h	rear-side color (Single=1)
Transfer length	8d	allows initiator to request only the get window header
	55d	header plus one window descriptor (8 plus 47)
	196d	header plus four window descriptors (8 plus 188)

2.9.3

2.9.4 Get Window Header Data Format

byte	bit	7	6	5	4	3	2	1	0	
0	(MSB)	Window data				length				
1										(LSB)
2		Reserved								
3		Reserved								
4		Reserved								
5		Reserved								
6	(MSB)	Window descriptor				length				
7										(LSB)

2.9.5 Get Window Header Data Definitions

Descriptor	Value	Definition
Window data length	47d	one window descriptor
	188d	four window descriptors
Window descriptor length	47d	length of a single window descriptor

2.9.6 Get Window Data Format

See Set Window Data Format section.

2.9.7 Get Window Header Definitions

See Set Window Data Definitions section.

2.10 Read Command

The *Read Command* requests that the target transfer data to the initiator.

2.10.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (28h)							
1	Logical unit number			Reserved				
2	Data type code							
3	Reserved							
4	(MSB) Data type qualifier (LSB)							
5								
6	(MSB) Transfer length (LSB)							
7								
8								
9	Control							

2.10.2 Command Definitions

Descriptor	Value	Definition
Operation code	28h	Read Command ID
Data type code	00h 81h 80h	image data image header scanner-unique (see sections 3, 4, and 5)
Data type qualifier		command id (valid when Data type code=80h)
Transfer Length	0-253d 254d >0000h	target only sends the requested portion of the image header and does NOT delete the previous image data (Data type code = 81h) target sends the image header AND deletes the previous image header and data (Data type code = 81h) number of image bytes to transfer(Data type code=00h)

2.10.3 Image Data Format (**Data type code = 00h**)

byte bit	7	6	5	4	3	2	1	0
0...	Image data							
...N*								

* N is equal to the Transfer length field in the Read Command. Image Data will be returned on 32 bit boundaries. This means that N+1 must be an even number.

2.10.4 Image Data Definitions (**Data type code = 00h**)

N/A

2.10.5 Image Header Format (Data type code = 81h)

byte bit	7	6	5	4	3	2	1	0
0...3	(MSB)	Header			length			(LSB)
4...7	(MSB)	Image			length			(LSB)
8		Image			identifier			
9	(MSB)	Resolution						(LSB)
10								
11...14	(MSB)	X-Axis			upper left *			(LSB)
15...18	(MSB)	Y-Axis			upper left *			(LSB)
19...22	(MSB)	Width *						(LSB)
23...26	(MSB)	Length*						(LSB)
27		Bits per			pixel			
28		Compression			type			
29		Reserved			RIF	ID	DE	
30	(MSB)	Skew			angle **			(LSB)
31								
32		Image			address	level		
33...92	(MSB)	Image			address ***			(LSB)
93...172	(MSB)	Print			string ***			(LSB)
173...176	(MSB)	Sequential			Counter			(LSB)
177		IA			Field 1	Definition		
178...195	(MSB)	IA			Field 1	Value ***		(LSB)
196		IA			Field 2	Definition		
197...214	(MSB)	IA			Field 2	Value ***		(LSB)
215		IA			Field 3	Definition		
216...233	(MSB)	IA			Field 3	Value ***		(LSB)
234		IA			Field 4	Definition		
235...252	(MSB)	IA			Field 4	Value ***		(LSB)
253		Patch			Type			

* The default unit of measure is pixels.

** The default unit of measure is 1/10 of a degree.

2.10.6 *** UNICODE fields are left justified and padded with null characters (i.e., 0000h). This means that if the full number of bytes within a field is used, there is no null terminator. For example, the starting IA value fields are all 18 bytes (9 characters) wide. If the starting value for one of those fields is < 9 characters, then the balance of the string is filled with nulls. However, if the starting value is 9 characters long, there will be no null characters in the string. For strings in UNICODE fields, the first character

of the string is in the lowest two bytes of the field and subsequent characters follow. For each character (two bytes), the first byte is the most significant byte, the second is the least significant byte.

Image Header Definitions (Data type code = 01h)

Descriptor	Value	Definition
Header length	254d	length in bytes of the image header
Image length		length of image data in bytes
Image identifier	01h 02h 03h 04h	front side bitonal rear side bitonal front side color rear side color
Resolution		dots per inch
X-Axis upper left		X-Axis pixel offset to upper left corner of image*
Y-Axis upper left		Y-Axis pixel offset to upper left corner of image*
Width		width of image in pixels (line length)
Length		length of image in lines (page length)
Bits per pixel	1d 8d 24d	bitonal grayscale* color
Compression type	00h 01h 02h 03h 80h	no compression TSS Group III, 1-dimensional TSS Group III, 2-dimensional TSS Group IV JPEG
RIF	0b 1b	white pixels are indicated by zeros white pixels are indicated by ones
DE	0b 1b	deskew disabled deskew enabled
ID	0b 1b	image not deskewed image deskewed
Skew angle		calculated skew angle (in 1/10 th s of a degree)
Image address level	01h 02h 03h 00h	Level 1 Level 2 Level 3 Level 0
Image Address		30 (2-byte) UNICODE values representing the Image Address string for this document
Print string		40 (2-byte) UNICODE values representing the string printed on this document
sequential counter		current counter value
IA Field 1 Definition	00h 01h 02h 03h	Fixed Field Level 1 Level 2 Level 3
IA Field 1 Value	9 (2-byte) UNICODE values	current value of this IA field
IA Field 2 Definition	00h 01h 02h 03h	Fixed Field Level 1 Level 2 Level 3
IA Field 2 Value	9 (2-byte) UNICODE) values	current value of this IA field

(Continued)

IA Field 3 Definition	00h 01h 02h 03h	Fixed Field Level 1 Level 2 Level 3
IA Field 3 Value	9 (2-byte) UNICODE values	current value of this IA field
IA Field 4 Definition	00h 01h 02h 03h	Fixed Field Level 1 Level 2 Level 3
IA Field 4 Value	9 (2-byte) UNICODE values	current value of this IA field
Patch Type	00h 01h 02h 03h 04h 05h 06h 99h	None – No patch found on document Patch Type 1 found on document Patch Type 2 found on document Patch Type 3 found on document Patch Type 4 found on document Patch Type 5 found on document Patch Type 6 found on document Patch Type T found on document (DOCUMENTS WITH PATCH TYPES 1,4,5,6 OR T WOULD RETURN LEVEL 0 IN THE IMAGE ADDRESS LEVEL FIELD ABOVE. NOTHING WILL BE PRINTED ON THESE DOCUMENTS. PATCH TYPE 2 WILL RETURN LEVEL 2 AND PATCH TYPE 3 WILL RETURN LEVEL 3. PRINTING CAN OCCUR ON DOCUMENTS WITH PATCH TYPES 2 AND 3.)

* For relative cropping, X and Y upper left offsets are relative to the autocropped document's upper left corner. This would allow reconstruction of an image from an auto-cropped bitonal image and a zone cropped color image. For auto-cropping, these values are set to 0. For fixed cropping, they are set to the X,Y upper left corner offset values specified in the Set Window command.

2.10.7 Scanner-Unique Data Format (Data type code = 80h)

See Section 3/4/5. Scanner-Unique Commands

2.10.8 Scanner-Unique Data Definitions (Data type code = 80h)

See Section 3/4/5. Scanner-Unique Commands

2.11 Read 12 Command

The *Read 12 Command* requests that the target transfer image data to the initiator. Note that you can do the same request with the *Read Command*. This command is added to try and increase throughput on the host computer (i.e., it may increase the maximum block size transferred for a Read Image Command).

2.11.1 Command Format

byte bit	7	6	5	4	3	2	1	0
0	Operation code (A8h)							
1	Logical unit number			Reserved				
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	(MSB) Transfer length (LSB)							
7								
8								
9								
10	Reserved							
11	Control							

2.11.2 Command Definitions

Descriptor	Value	Definition
Operation code	A8h	Read 12 Command ID
Transfer Length	>0000h	number of image bytes to transfer

2.11.3 Image Data Format

byte bit	7	6	5	4	3	2	1	0
0...	Image data							
...N*								

* N is equal to the Transfer length field in the Read Command. Image Data will be returned on 32 bit boundaries. This means that N+1 must be an even number.

2.11.4 Image Data Definitions

N/A

2.12 Send Command

The *Send Command* transfers data from the initiator to the target.

2.12.1 Command Format

byte	bit	7	6	5	4	3	2	1	0	
0		Operation code (2Ah)								
1		Logical unit number				Reserved				
2		Data type code								
3		Reserved								
4	(MSB)					Data type qualifier				(LSB)
5										
6	(MSB)					Transfer length				(LSB)
7										
8										
9		Control								

2.12.2 Command Definitions

Descriptor	Value	Definition
Operation code	2Ah	Send Command ID
Data type code	80h	scanner-unique (see sections 3, 4, and 5)
Data type qualifier		scanner-unique command
Transfer length		number of bytes to transfer during the DATA OUT phase

2.12.3 Data Format

See **Section 3/4/5. Scanner-Unique Commands**

2.12.4 Data Definitions

See **Section 3/4/5. Scanner-Unique Commands**

2.13 Write Buffer Command

The *Write Buffer Command* is used for downloading color correction tables (with their corresponding gamma table).

2.13.1 Command Format

Byte bit	7	6	5	4	3	2	1	0
0	Operation code (3Bh)							
1	Logical Unit number			Reserved		Mode		
2	Buffer ID							
3	(MSB) Buffer Offset (LSB)							
4								
5								
6	(MSB) Parameter List Length (LSB)							
7								
8								
9	Control							

2.13.2 Command Definitions

Descriptor	Value	Definition
Operation code	3Bh	Write Buffer Command ID
Mode	101b 110b 111b	download file and save for both sides download file and save for front-side scanning only download file and save for rear-side scanning only
Buffer ID	00h 01h	data block last data block
Buffer Offset		Destination offset of data
Parameter List Length		Length of data in DATA-OUT phase

This command is used to send a color table to the scanner. Since the color tables can be large (~512KB), the ability to send parts of the table is supported. The usage of the command is as follows:

1. Specify what side the color table is for (front vs. rear), and set the Mode accordingly.
2. Send down sequential “chunks” of the table, setting the buffer id to 0x00, and adjusting the buffer offset based on where the chunk should reside.
3. Send down final “chunk” of image, setting buffer id to 0x01. This informs the scanner to “process” the final table.

For example, suppose the color table is 510KB, and the “chunk” size is 64KB. Here is the series of WRITE BUFFER commands that would download the table.

Sequence Number	Buffer ID	Buffer Offset	Parameter List Length
1	0x00	0x000000	0x010000
2	0x00	0x010000	0x010000
3	0x00	0x020000	0x010000
4	0x00	0x030000	0x010000
5	0x00	0x040000	0x010000
6	0x00	0x050000	0x010000
7	0x00	0x060000	0x010000
8	0x01	0x070000	0x00F800

3 Scanner-Unique Configuration Commands

The following table is a summary of the scanner-unique configuration commands.

Description	Data Type Qualifier	Available with command:	
		Send	Read
JPEQ quantization configuration	"JQ"	Yes	Yes
Scanner configuration	"SC"	Yes	Yes
Current Color Table	"CT"	No	Yes

3.1 JPEG Quantization Command

The *JQ Command* allows the initiator to set or read the JPEG quantization tables for use during JPEG compression.

3.1.1 Command Format

See *Read Command* or *Send Command*.

3.1.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data Type Qualifier	"JQ"	JPEG Quantization Command
Transfer Length	133d	number of bytes of data: front table only
	262d	Both tables

3.1.3 Data Format

byte	bit	7	6	5	4	3	2	1	0
0...	(MSB)	JQ				length			
...3		(LSB)							
4		Window				identifier			
5		Luminance				0			
6		Luminance				1			
7		Luminance				2			
.....								
68		Luminance				63			
69		Chrominance				0			
70		Chrominance				1			
71		Chrominance				2			
.....								
132		Chrominance				63			
133		Window				identifier			
134		Luminance				0			
135		Luminance				1			
136		Luminance				2			
.....								
197		Luminance				63			
198		Chrominance				0			
199		Chrominance				1			
200		Chrominance				2			
.....								
261		Chrominance				63			

3.1.4 Data Definitions

Descriptor	Value	Definition
JQ length	262	Size of this structure
Window identifier	03h	front side color
	04h	rear side color
Luminance		Q Table Value
Chrominance		Q Table Value

3.1.5 Default power-up table

	Y	CbCr		Y	CbCr		Y	CbCr		Y	CbCr
1	11	11	17	11	11	33	14	26	49	23	54
2	11	11	18	11	14	34	15	27	50	24	54
3	11	11	19	14	15	35	18	30	51	29	59
4	11	11	20	15	20	36	24	35	52	35	65
5	14	12	21	18	23	37	30	41	53	45	74
6	18	15	22	23	27	38	38	50	54	57	87
7	23	18	23	29	32	39	45	60	55	71	107
8	29	21	24	35	36	40	53	74	56	87	131
9	11	11	25	11	18	41	18	38	57	29	78
10	11	11	26	12	18	42	20	38	58	30	80
11	11	12	27	15	21	43	23	41	59	35	84
12	12	14	28	20	26	44	29	47	60	42	92
13	15	15	29	24	32	45	38	54	61	53	104
14	20	18	30	29	36	46	47	65	62	68	122
15	24	21	31	35	45	47	57	80	63	87	146
16	30	26	32	42	53	48	68	98	64	111	179

3.2 Scanner Configuration Command

The *SC Command* provides a means for the initiator to get and set the scanner's configuration.

3.2.1 Command Format

See *Read Command* or *Send Command*.

3.2.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"SC"	scanner configuration command
Transfer length	429d	number of bytes transferred in data phase

3.2.3 Data Format

byte	bit	7	6	5	4	3	2	1	0	
0...		(MSB)				Configuration	length			
...	3								(LSB)	
4						Image	Order 1			
5						Image	Order 2			
6						Image	Order 3			
7						Image	Order 4			
8						Reserved				
9						Reserved				
10						Gap	Mode			
11						Lamp	timeout			
12						Transport	speed			
13		(MSB)				Transport	timeout			
14									(LSB)	
15						Transport	timeout	response		
16						Ultrasonic	detection	mode		
17		(MSB)				Length	detection	length *		
18									(LSB)	
19						Multi-page	paper	detection	response	
20						Toggle	Patch			
21						Reserved				
22		(MSB)				Page on	demand	mode/count		
23									(LSB)	
24		(MSB)				Batch	mode/count			
25									(LSB)	
26						Batch	level			
27						Start of	batch	function		
28						End of	batch	function		
29						Patch	confirmation	tone		
30		T6 Patch	T5 Patch	T4 Patch	T3 Patch	T2 Patch	T1 Patch	Transfer	Patch	
31...		(MSB)				IA field A	Starting	Value ***		
...	48								(LSB)	
49...		(MSB)				IA field B	Starting	Value ***		
...	66								(LSB)	
67...		(MSB)				IA field C	Starting	Value ***		
...	84								(LSB)	
85...		(MSB)				IA field D	Starting	Value ***		
...	102								(LSB)	

(Continued)

byte bit	7	6	5	4	3	2	1	0	
103				IA field A	definition				
104				IA field B	definition				
105				IA field C	definition				
106				IA field D	definition				
107				IA	level to	follow	level 3		
108				IA	level to	follow	level 2		
109				IA	level to	follow	level 1		
110...	(MSB)				DP1	Position *			(LSB)
...113									
114				DP1	font				
115				DP1	orientation				
116				DP1	IA	format			
117				DP1	date	format			
118				DP1	date	delimiter			
119...	(MSB)				DP1	starting	sequential	count	
...122								(LSB)	
123				DP1	sequential	count	format		
124				DP1	sequential	count	print	width	
125...	(MSB)				DP1	message 1***			(LSB)
...164									
165...	(MSB)				DP1	message 2***			(LSB)
...204									
205...	(MSB)				DP1	message 3***			(LSB)
...244									
245...	(MSB)				DP1	message 4***			(LSB)
...284									
285...	(MSB)				DP1	message 5***			(LSB)
...324									
325...	(MSB)				DP1	message 6***			(LSB)
...364									
365...	(MSB)				DP1	level 1	print ****	template	
...384								(LSB)	
385...	(MSB)				DP1	level 2	print ****	template	
...404								(LSB)	
405...	(MSB)				DP1	level 3	print ****	template	
...424								(LSB)	
425				User	Defined	Function	Key	1	
426				User	Defined	Function	Key	2	
427				User	Defined	Function	Key	3	
428	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	CE	

* The default unit of measure is 1/1200 inches.

*** UNICODE data field that is left aligned and null filled (i.e., 0000h). This means that if the full number of bytes within a field is used, there is no null terminator. For example, the starting IA value fields are all 18 bytes (9 characters) wide. If the starting value for one of those fields is < 9 characters, then the balance of the string is filled with nulls. However, if the starting value is 9 characters long, there will be no null characters in the string.

**** The ASCII print templates are made up of print descriptors with a maximum of 20 descriptors. See the following Print Template Descriptor Table below for a definition. The print template is left aligned and null filled (i.e., 00h).

3.2.4 Data Definitions

Descriptor	Value	Definition
Configuration length	429d	number of bytes of this structure
Image Order – 1 *	00-04h	1 st Image sent to Host (01 DEFAULT)
Image Order – 2 *	00-04h	2 nd Image sent to Host (02 DEFAULT)
Image Order – 3 *	00-04h	3 rd Image sent to Host (03 DEFAULT)
Image Order – 4 *	00-04h	4 th Image sent to Host (04 DEFAULT)
Gap Mde	00h	gap mode disabled (DEFAULT)
	01h	gap mode enabled – fixed gap
Lamp timeout **	0d	lamp timeout disabled
	1d to 30d	lamp timeout in minutes (DEFAULT=20)
Transport speed	00h	18.67 inches per second - slow
	01h	28 inches per second – fast (DEFAULT)
Transport timeout	0d	transport timeout disabled
	5d-300d	transport timeout in seconds (DEFAULT=10)
Transport timeout response	00h	stop feeder and transport (DEFAULT)
	01h	end job
Ultrasonic detection mode	00h	ultrasonic detection disabled (DEFAULT)
	01h	ultrasonic detection enabled – low sensitivity
	02h	ultrasonic detection enabled – medium sensitivity
	03h	ultrasonic detection enabled – high sensitivity
Length detection	0d	length detection disabled (DEFAULT)
	3000d to 36600d	length of document
Multi-page paper detection response (applies to length & ultrasonic detection)	00h	beep, display on operator control panel, stop feeder and halt transport after all documents have exited (DEFAULT)
	01h	beep, display on operator control panel, and continue scanning
	02h	beep, display on operator control panel, stop feeder, halt transport after all documents have exited, disable scanner, return Multi-page paper feed detected request sense
Toggle Patch	00h	toggle patch disabled (DEFAULT)
	01h	toggle patch toggles both front and rear
	02h	toggle patch toggles front side
	03h-FFh	reserved
Page on demand mode/count ***	00h	page on demand mode disabled (DEFAULT)
	01h-FFFFh	number of documents to scan then stop
Batch mode/count	00h	batch mode disabled (DEFAULT)
	01h-FFFFh	number of documents in a batch
Batch level	01h	Level 1 (DEFAULT)
	02h	Level 2
	03h	Level 3
Start of batch function	00h	Do Nothing (DEFAULT)
	01h	go to level 1
	02h	go to level 2
	03h	go to level 3
End of batch function	00h	Do Nothing (DEFAULT)
	01h	stop feeder
	02h	stop feeder and transport
	03h	continue and begin a new batch

Patch confirmation tone	00h	beep disabled (DEFAULT)
	01h	beep enabled
T6 Patch	0d	Do not recognize type 6
	1d	Recognize type 6

(Continued)

T5 Patch	0d 1d	Do not recognize type 5 Recognize type 5
T4 Patch	0d 1d	Do not recognize type 4 Recognize type 4
T3 Patch	0d 1d	Do not recognize type 3 Recognize type 3
T2 Patch	0d 1d	Do not recognize type 2 Recognize type 2
T1 Patch	0d 1d	Do not recognize type 1 Recognize type 1
Transfer patch definition	00h 02h 03h	Not defined – do not recognize Type 2 (DEFAULT) Type 3
IA Field A Starting Value	9 (2-byte) UNICODE values	Starting Value for Field A
IA Field B Starting Value	9 (2-byte) UNICODE values	Starting Value for Field B
IA Field C Starting Value	9 (2-byte) UNICODE values	Starting Value for Field C
IA Field D Starting Value	9 (2-byte) UNICODE values	Starting Value for Field D
IA field A definition	00h 01h 02h 03h	fixed field (DEFAULT) level 1 level 2 level 3
IA field B definition	00h 01h 02h 03h	fixed field level 1 level 2 level 3 (DEFAULT)
IA field C definition	00h 01h 02h 03h	fixed field level 1 level 2 (DEFAULT) level 3
IA field D definition	00h 01h 02h 03h	fixed field level 1 (DEFAULT) level 2 level 3
IA level to follow level 3	01h 02h 03h	auto-calculates IA Level 1 (DEFAULT) auto-calculates IA Level 2 auto-calculates IA Level 3
IA level to follow level 2	01h 02h 03h	auto-calculates IA Level 1 (DEFAULT) auto-calculates IA Level 2 auto-calculates IA Level 3
IA level to follow level 1	01h 02h 03h	auto-calculates IA Level 1 (DEFAULT) auto-calculates IA Level 2 auto-calculates IA Level 3
DP1 position	00 600-???	Printer disabled offset from the lead edge of page must be at least ½”

(Continued)

DP1 font	00h 01h	small font (DEFAULT) large font
DP1 orientation	00h 01h 02h 03h	rotated 0 degrees (DEFAULT) rotated 90 degrees rotated 180 degrees rotated 270 degrees
IA Display format ****	00h 01h 02h	suppress (DEFAULT) Display compress
DP1 date format	00h 01h 02h	MMDDYYYY (DEFAULT) DDMMYYYY YYYYMMDD
DP1 date delimiter	00h 01h 02h 03h 04h	no delimiter '/' (DEFAULT) '-' '.' blank space
starting sequential count	0 – 999,999,999	initial value of the sequential counter (DEFAULT=0)
DP1 sequential count format	00h 01h 02h	suppress (DEFAULT) display compress
DP1 sequential count width	1d to 9d	number of right-most digits in sequential counter to be printed (DEFAULT=9)
DP1 message 1	20 (2-byte) UNICODE values	text string that can be printed
DP1 message 2	20 (2-byte) UNICODE values	text string that can be printed
DP1 message 3	20 (2-byte) UNICODE values	text string that can be printed
DP1 message 4	20 (2-byte) UNICODE values	text string that can be printed
DP1 message 5	20 (2-byte) UNICODE values	text string that can be printed
DP1 message 6	20 (2-byte) UNICODE values	text string that can be printed
DPI level 3 print template	20 bytes as described in section 3.2.5	level 3 print format description
DPI level 2 print template	20 bytes as described in section 3.2.5	level 2 print format description
DPI level 1 print template	20 bytes as described in section 3.2.5	level 1 print format description

(Continued)

User Defined Function Key 1	00h 01h 02h 03h 04h 05h 06h	No Scanner Functionality (DEFAULT) Scanner End-of-Job Terminate Batch Omit Multifeed Detection on Next Document Omit Printing on Next Document Omit Patch Reading on Next Document Lower Elevator
User Defined Function Key 2	00h 01h 02h 03h 04h 05h 06h	No Scanner Functionality (DEFAULT) Scanner End-of-Job Terminate Batch Omit Multifeed Detection on Next Document Omit Printing on Next Document Omit Patch Reading on Next Document Lower Elevator
User Defined Function Key 3	00h 01h 02h 03h 04h 05h 06h	No Scanner Functionality (DEFAULT) Scanner End-of-Job Terminate Batch Omit Multifeed Detection on Next Document Omit Printing on Next Document Omit Patch Reading on Next Document Lower Elevator
CE Checkdigit Enable	0b 1b	Checkdigit Disabled (Default) Checkdigit Enabled

* Image Order Specified as follows:

- 00h – No Image
- 01h – front bitonal
- 02h – rear bitonal
- 03h – front color
- 04h – rear color

** Lamp Timeout starts countdown only when scanner is disabled.

*** Page on demand is not valid when batching is enabled

**** IA display format applies to both printing and Operator Control Panel

3.2.5 Scanner Configuration rules

1. No embedded zeros in the image order (e.g., 3 4 0 0[good], 1 0 2 0[bad]).
2. No duplicates in the image order (e.g., 1 2 3 4[good], 1 1 1 1[bad]).
3. IA Field width – each field can be a maximum of 9 UNICODE (2-byte) values. However, overall maximum size of an IA = 27 UNICODE values + a maximum of 3 delimiters = 30 UNICODE values. Also note that it is not valid to define an image address using the same level more than once. It is valid to define more than one fixed field. Starting Image address must agree with field definitions and field widths.
4. All levels specified in “level to follow” fields must be defined in IA field definitions.
5. DPI print template for levels 1, 2 and 3 must have the appropriate level defined in the IA field definitions.
6. Non-Fixed IA field cannot have a width of zero.
7. Image overscan must be set to 0 when fixed gap is enabled. See Set Window Command.
8. Note that in order to use transfer patches, you must set the T5 Patch field to recognized (1) AND select a transfer patch definition in the Transfer Patch Definition field.

3.2.6 Print Template Descriptor Table

Descriptor	Value	Definition
print template descriptor	' '	blank space
	'A'	IA field A
	'B'	IA field B
	'C'	IA field C
	'D'	IA field D
	'S'	sequential document count
	'T'	time as HH:MM with 24-hour format
	'Y'	date
	'1'	message 1
	'2'	message 2
	'3'	message 3
	'4'	message 4

NOTE: An example of a print template is the following:

“Y T 1 S”

If the message 1 string is set to “Kodak”, the date delimiter is set to ‘/’, the date is January 2, 2001, the date format is MMDDYYYY, the time is 2:00 PM, the sequential count is 332, the sequential count width is 4, and the sequential count format is display, the string printed on the document would be the following:

“01/02/2001 14:00 Kodak 0332”

3.2.7 Patch / Image Address Information

Patch reading provides the ability to change the Image Address (IA) information for a document, on the fly, without any Host PC or Operator Control Panel intervention. All documents with patch codes shall be imaged, and will not be automatically deleted by the scanner.

3.2.7.1 Types of Patch Codes

A patch code can change the IA level of the document that the patch code occurs on (or the following document in the case of a transfer patch). These changes then override the IA calculated using the Level to Follow Level Rules.

3.2.7.1.1 Type 3 Patch Code

When a Type 3 patch code is detected on a document, then that document is considered a Level 3 document, and the Image Header will reflect this. The IA for that document is recalculated by incrementing the Level 3 field and setting the Level 2 and Level 1 fields to 0 (if the Level 2 and 1 fields are defined as having field width > 0).

3.2.7.1.2 Type 2 Patch Code

When a Type 2 patch code is detected on a document, then that document is considered a Level 2 document, and the Image Header will reflect this. The IA for that document is recalculated by incrementing the Level 2 field and setting the Level 1 field to 0 (if the Level 1 field is defined as having field width > 0).

3.2.7.1.3 Transfer Patch Code

When a Transfer patch code is detected, then that document is considered a Level 0 document. The image header will reflect that this is a Transfer Patch document. The IA level for the next document following the Transfer patch will be assigned to whatever level (Level 2 or Level 3) that has been set up above. The scanner shall not print on documents containing Transfer Patches. Transfer Patch is patch type 5.

3.2.7.1.4 Feature Patch Codes

Feature Patch Codes enable the host to implement any type of work flow dependent processing that it wishes to based on the insertion of these Feature Patches into the document stack. Feature patches are patch types 1, 4 and 6.

When a Feature Patch is detected, then this document is considered a Level 0 document and will not cause the IA to change. The image header will reflect that this is a Feature Patch document. The scanner shall not print on documents containing feature patches.

3.2.7.1.5 Toggle Patch Codes

Toggle Patch Codes enable the type of image being sent to the host to be toggled between bitonal and color. Toggle patch is patch type 4.

3.2.8 Batching

Batching provides a means to cause the scanner to perform a specific function after scanning a designated number of documents at a particular IA Level.

Batching can be enabled and disabled. If enabled, the number of documents remaining in the batch is displayed on the operator control panel. Batching is disabled by putting 0 in the Batch mode/count field (enabled with >0 in that field).

The 'Start of Batch' function determines what happens whenever a new batch is started. This can be set up to go to either Level 1, 2 or 3, which will then cause the IA to be recalculated.

The 'End of Batch' function determines what happens when the batch count has been satisfied. The options are to stop the feeder, stop both the feeder and transport, or continue and begin a new batch.

3.3 CT – Color Table Command

The CT Command retrieves the checksums for the default color table as well as the current loaded color table for both front and rear.

3.3.1 Command Format

See *Read Command*.

3.3.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"CT"	Color Table Command
Transfer length	52d	number of bytes transferred in data phase

3.3.3 Data Format

byte bit	7	6	5	4	3	2	1	0
0... ...3	(MSB)			Current color table	length			(LSB)
4... ...19	(MSB)			Default color table	checksum			(LSB)
20... ...35	(MSB)			Front color table	checksum			(LSB)
36... ...51	(MSB)			Rear color table	checksum			(LSB)

3.3.4 Data Definitions

Descriptor	Value	Definition
Current color table length	52d	Number of bytes of this structure
Default color table checksum		16-byte checksum value
Front color table checksum		16-byte checksum value
Rear color table checksum		16-byte checksum value

4 Scanner-Unique Control Commands

The following table is a summary of the scanner-unique control commands.

Description	Data Type Qualifier	Available with command:	
		Send	Read
clear image buffers	"CB"	Yes	No
end of job	"GX"	Yes	No
local clock	"LC"	Yes	Yes
scanner start/stop	"SS"	Yes	Yes

4.1 Clear Image Buffer Command

The *CB Command* provides a means for the initiator to clear the image buffer on the scanner. This command is only valid when the scanner is disabled.

4.1.1 Command Format

See *Send Command*.

4.1.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"CB"	clear image buffer command
Transfer length	0d	number of bytes transferred in data phase

4.1.3 Data Format

N/A

4.1.4 Data Definitions

N/A

4.2 End of Job Command

The *GX Command* provides a means for the initiator to disable the scanner. Disabling the scanner includes turning off the feeder, flushing the transport, and turning off the transport.

4.2.1 Command Format

See *Send Command*.

4.2.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"GX"	end of job command
Transfer length	0d	number of bytes transferred in data phase

4.2.3 Data Format

N/A

4.2.4 Data Definitions

N/A

4.3 Local Clock Command

The *LC Command* provides a means for the initiator to get and set the scanner's local clock.

4.3.1 Command Format

See *Send and Read Command*.

4.3.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"LC"	local clock command
Transfer length	10d	number of bytes transferred in data phase

4.3.3 Data Format

byte bit	7	6	5	4	3	2	1	0
0...	(MSB)			Local	clock	length		(LSB)
...3								
4				Local	hour			
5				Local	minute			
6				Local	month			
7				Local	day			
8	(MSB)			Local	year			
9								(LSB)

4.3.4 Data Definitions

Descriptor	Value	Definition
Local clock length	10d	number of bytes of this structure
Local hour	0d to 23d	Local hours
Local minute	0d to 59d	Local minutes
Local month	1d to 12d	Local month
Local day	1d to 31d	Local day
Local year	2000d to 2100d	Local year

4.4 Start/Stop Scanner Command

The SS *Command* provides a means for the initiator to remotely start and stop the scanner's transport and feeder. This command has the same functionality as the "Start" and "Stop" buttons on the operator control panel on the scanner.

4.4.1 Command Format

See *Send and Read Command*.

4.4.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"SS"	start/stop scanner command
Transfer length	5d	number of bytes transferred in data phase

4.4.3 Data Format

byte bit	7	6	5	4	3	2	1	0
0...	(MSB)			Start/Stop	length			(LSB)
...3								(LSB)
4	Command							

4.4.4 Data Definitions

Descriptor	Value	Definition
Start/Stop length	5d	number of bytes of this structure
Command	00h	stop feeder and transport
	01h	start feeder and transport

5 Scanner-Unique Calibration Commands

The following table is a summary of the scanner-unique calibration commands.

Description	Data Type Qualifier	Available with command:	
		Send	Read
calibration	"IC"	Yes	No

5.1 Calibration Command

The *IC Command* provides a means for the initiator to calibrate the scanner.

5.1.1 Command Format

See *Send Command*.

5.1.2 Command Definitions (Scanner-Unique Descriptors)

Descriptor	Value	Definition
Data type qualifier	"IC"	calibration command
Transfer length	0d	number of bytes transferred in data phase

5.1.3 Data Format

N/A

5.1.4 Data Definitions

N/A