M3097DG
Image Scanner
OEM Manual
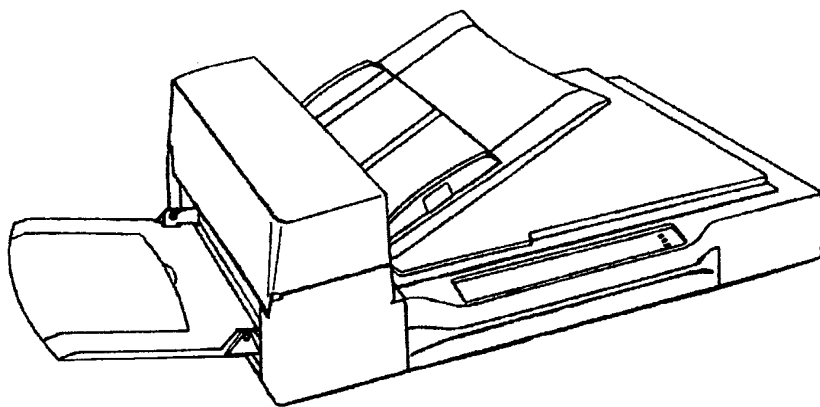
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CONTENTS

Chapter 1 General

1.1   General description

M3097DG image scanner is an ideal input device for Electric filling systems, Facsimiles, optical character readers (OCR), computer aided design (CAD) systems, and automatic publishing systems.

M3097DG is basically the scanner which have the duplex scanning feature with the basis of M3097G+ and with the interface compatibility to M3097G+ and M3093DG. The features of the scanner are focused on as follows.

(1)   Duplex reading

This scanner can read duplex document with one scanning to reduce the scanning workload.

(2)   Excellent paper-handling

This scanner can scan various kind of the document such as the size from A3 to A6.

(3)   Fast reading

This scanner scans with the following scanning speed.

Simplex, A4, 200 dpi: 36 PPM (A4,200 dpi)

Duplex, A4, 200 dpi: 60 IPM (A4,200 dpi)

(4)   High quality image

This scanner reads the documents with 400 dpi basic resolution.

(5)   Image processing

This scanner basically supports dither and error diffusion. Various image processing is available when supported IPC option.

(6)   New functions

Following functions are available for instance.

- Double feed detection
- Easy setting for some documents (IPC pre-setting function)
- Manual feed mode

1.2 Appearance and parts name

Appearance and parts name is shown in Fig. 1.1.
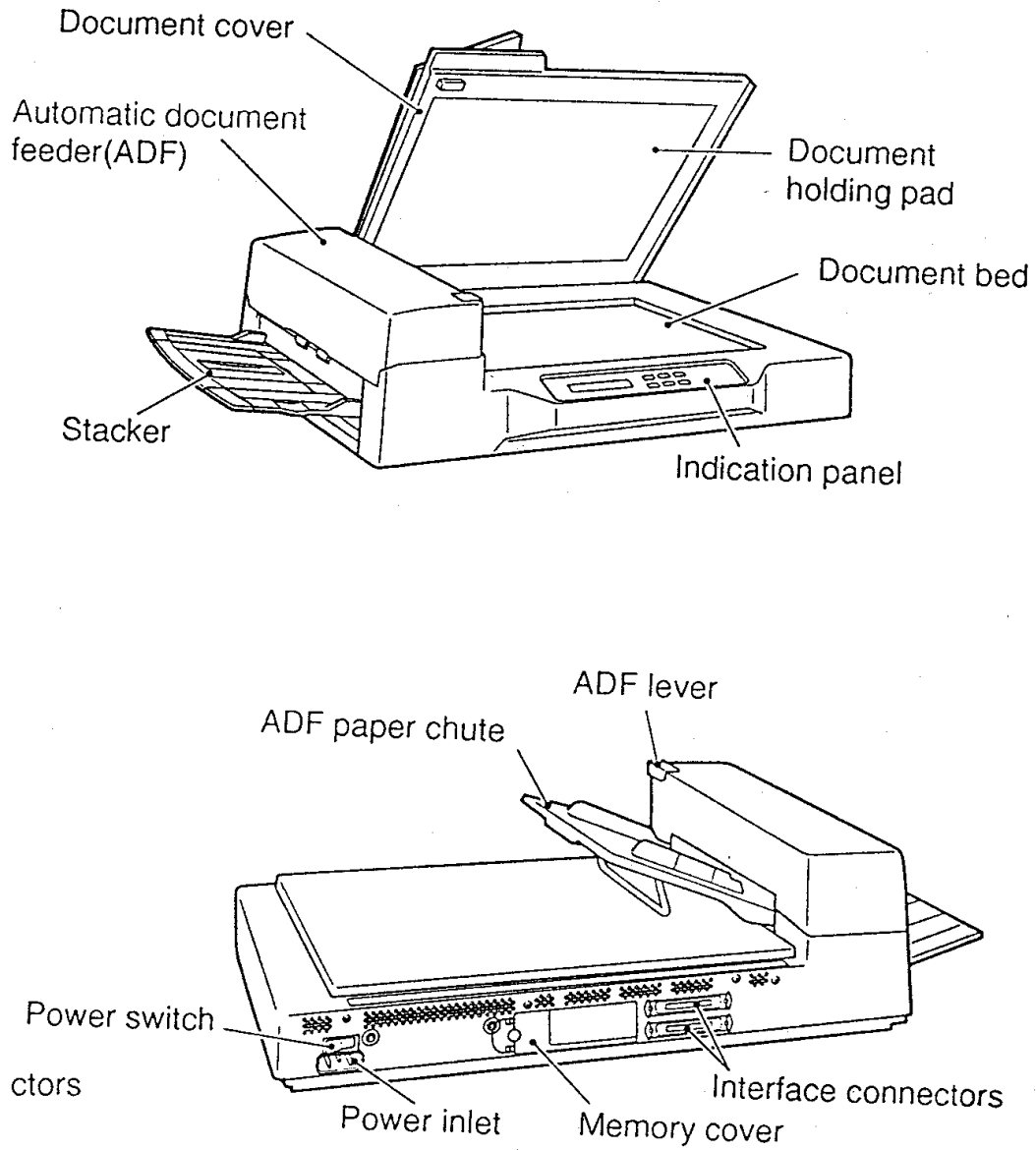
Figure 1.1 Part name of M3097DG

Chapter 2 Specifications

2.1 Basic specifications

Basic specifications of M3097DG are shown in Table 2.1.

Table 2.1 Basic Specifications of M3097DG

	Item		M3097DG	Remarks
1	Operating method		Flatbed and ADF	
2	Image sensor		CCD	
3	Light source		Xe Discharge tube (green)	
4	Document size	Minimum	A6	
		Maximum	A3 or DL	
5	Basic resolution		400 dpi	
6	Output resolution		100/150/200/240/300/400/600 dpi	See section 2.3
7	Zooming of IPC option		50 to 800dpi	
8	Scanning speed	FB, A4,400 dpi	2.4 sec.	
		FB, A4,200 dpi	1.2 sec.	
		ADF, Simplex	36 PPM	A4, 200 dpi
		ADF, Duplex	60 IPM	
9	Halftone patterns		Dither/Error diffusion	
10	Compression (MH, MR, MMR)		No option required	
11	Capacity of ADF		100 sheets	A4, 64g/m^2 See section 2.6.3
12	Interface		SCSI-2	
13	Video output		Binary / Halftone / Grayscale	
14	Power requirements		100 to 120VAC, 50/60 Hz 200 to 240VAC, 50/60 Hz	
15	Operating environment		Temperature : 5°C to 35°C Relative humidity : 20 to 80%	
16	Basic memory		16 MB	
17	Option	IPC	IPC-2D or IPC-3D	
		Memory	16 MB	See section 2.3
18	Scanner size		234H x 696W x 497D (mm)	
19	Scanner weight		20 kg	

2.2 Option specifications

Following options are available for this scanner.

Table 2.2 Option of the scanner

Name	Parts Number	When the option required?	Remarks
IPC-2D	CA01952-0192	- When the image processing of Section 3.3 required.	Either IPC-2D or IPC-3D can be installed at a time.
IPC-3D	CA02919-0511		
Memory	TBD	- When reading 601 dpi or more (See section 2.3)	One memory option can be installed per scanner. 16 Mbyte, 72 pin, EDO SIMM 60 ns, non-parity
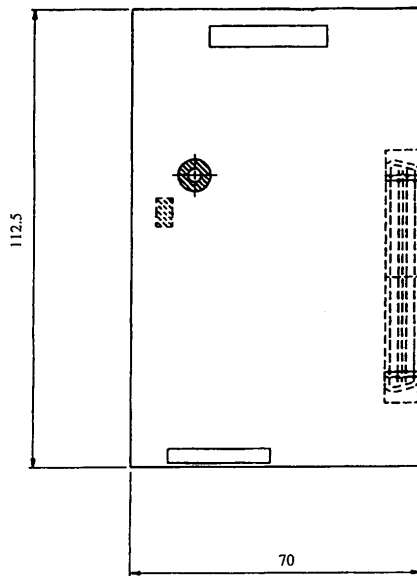
Figure 2.1 IPC-2D/3D option
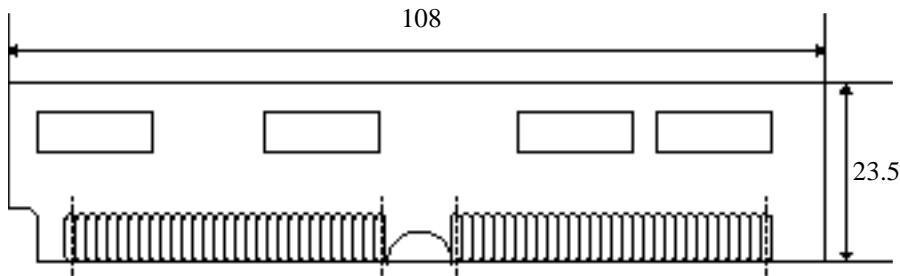
Figure 2.2 Extended memory option

2.3 Reading limitation depending on the memory installed

M3097DG have the limitation of reading depending on the memory installed as shown in Table 2.3 and 2.4.

Table 2.3 The reading limitation of M3097DG without option

Output resolution	Binary		Grayscale	
	Simplex	Duplex	Simplex	Duplex
100/150/200 dpi	Supported (No additional memory)			
300/400 dpi				
600 dpi			Not supported *2	Not supported *2

*2 Setting itself may be rejected.

Table 2.4 The reading limitation of M3097DG at zooming of IPC-2D or IPC3D option

Zooming	Binary		Grayscale	
	Simplex	Duplex	Simplex	Duplex
50 to 200 dpi	Supported (No additional memory)			
201 to 400 dpi				
401 to 600 dpi			Not supported *2	Not supported *2
601 to 800 dpi	Supported *1			

*1 Memory option required, otherwise the possibility of Image transfer error exists.

*2 Setting itself may be rejected.

2.4   Physical specifications

Table 2.5 Physical specifications

No.	Item		M3097DE/DG
1	Dimensions (mm)	Height	234 (9.2 in.)
		Width	696 (27.4 in.)
		Depth	497 (19.6 in.)
2	Weight (Kg)		20 (44.2 lb)
3	Power requirements	Voltage (VAC)	100 to 120, 200 to 240 VAC ±10%
		Phase	Single
		Frequency	50/60 Hz +2% -4%
4	Power consumption (VA)		120
5	Heat capacity		78 kcal (312 BTU/H)
6	Surge current (A)		30
7	Momentary power failure		100 % 0.5 Hz
8	Leakage current (mA)		0.75 or less
9	Dielectric strength		AC 1.5 KV or more for one minute or more (between FG and AC lines)
10	AC line noise		Voltage 1.2 KV pulse duration 5 μs
11	Temperature (°C)	Operating	+5 to +35
		Non operating	-20 to +60
12	Relative humidity (%)	Operating	20 to 80 (No condensation)
		Non operating	8 to 95 (No condensation)
13	Vibration (G)	Operating	0.2
		Non operating	0.4
14	Indication (degree)	Operating	5
		Non operating	10
15	ESD (KV)		8 or more
16	Acoustic noise (dBA)	Operating	53 or less (ISO DIS 9296)
		Non operating	40 or less (ISO DIS 9296)

2.5   Regulation conformity

Table 2.6 Regulation conformity

Item	Conformed regulation	Regulation mark on the scanner	Remarks
Safety	UL 1950	Yes, CSA NRTL-C mark	
	CSA 22.2 950		
	EN60950 1992/A1:1993/A2:1993	Yes, GS mark by TUV	
EMI etc.	FCC Part15 Class A	Yes	
	EN55022 1994 Class B	Yes, CE mark	EMI
	EN50082-1 1992		Immunity
	EN61000-3-2 1995		Harmonic emission
	EN61000-3-3 1995		Voltage variation

2.6   Document specifications

When using the flatbed, any condition of the paper can be read except paper size and ground color specification.

2.6.1   Paper size
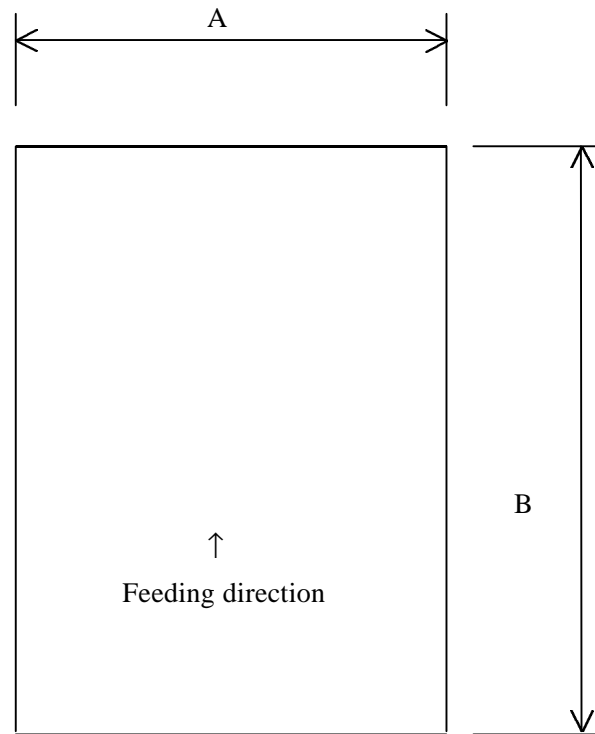
(Unit : mm)

Maximum		Minimum	
A	B	A	B
297	432	148	105
		105	148

Figure 2.3 Paper size

Paper size conversion table

Category	Dimensions	Category	Dimensions
Letter	8.5 x 11 in (216 x 279 mm)	A3	11.7 x 16.54 in (297 x 420 mm)
Legal	8.5 x 14 in (216 x 356 mm)	A4	8.3 x 11.7 in (210 x 297 mm)
Ledger	11 x 17 in (279 x 432 mm)	A5	5.83 x 11.7 in (148 x 210 mm)
Executive	7.25 x 10.5 in (184 x 267 mm)	B4	10.1 x 14.3 in (257 x 364 mm)
		B5	7.2 x 10.1 in (183 x 257 mm)

2.6.2 Paper conditions

1) Paper type

- Woodfree paper

- PPC paper, Specified by XEROX Corporation

When using another paper, check that it is successfully fed by ADF before performing a scanning operation.

2) Paper weight

13.9 lbs ($52g/m^2$) to 27.8 lbs ($104g/m^2$)

3) Items to avoid

- The following documents may be hard to read by ADF.

   Before you start the large quantity reading, check that the document is read appropriately. If the ADF reading is not appropriate, read them by flatbed.

   - Paper with a clip or staple
   - Paper that has ink which is not dry.
   - Paper thickness is not constant, such as an envelope.
   - Paper that has large rumples or curl. (See Note 3)
   - Paper that has folds or tears.
   - Tracing paper
   - Coating paper
   - Carbon paper.
   - Paper size that is out of standard.
   - Items other than paper, such as clothes, metal sheet, or OHP film.
   - Photographic paper
   - Paper that has notches on its side.
   - Paper that has a shape other than square.
   - Paper that is very thin.

Note 1:

The important document which shall not be torn must be read by flatbed.

Note 2:

Carbon-less papers have the chemical composition which damages the pad pick roller. Therefore, note the following remarks

Cleaning: If the miss pick occurs frequently, clean the pad and pick roller in accordance with the Operator's guide.

Replacement of parts: The life of the pad and the pick roller may be shorter than the case that PPC document is fed.

Replacement cycle of the pad and the pick roller may be around 100,000 sheets depending on the paper quality and cleaning cycle.

Note 3:

Paper should be straightened to fit the condition below.
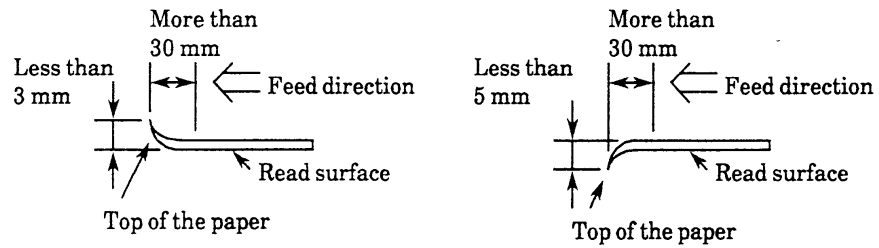
2.6.3 ADF capacity

The number of pages that can be loaded into ADF chute depends on the paper size and ream weight. This information is shown in the following Figure:
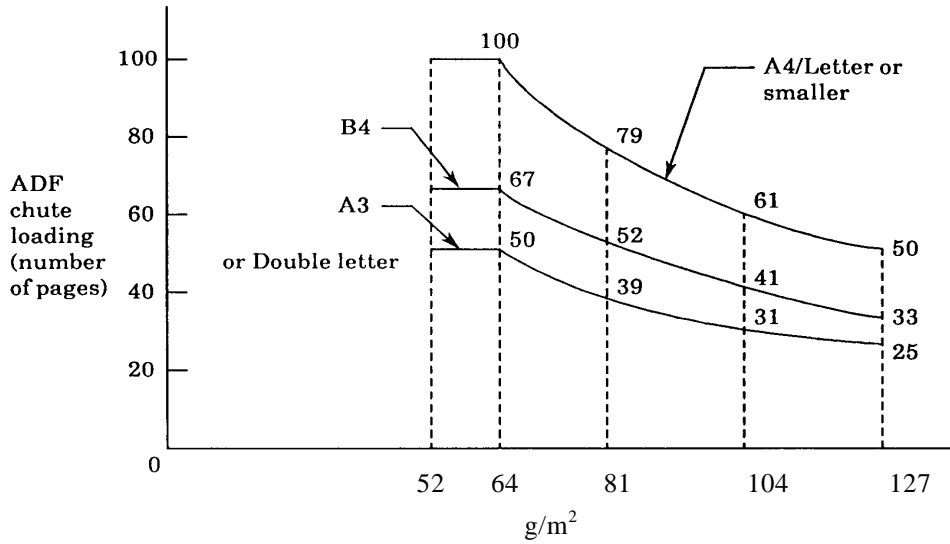
Figure 2.4 ADF capacity

Paper weight conversion table

Country	Unit	Conversion						
Japan	Kg/ream	45	55	64.6	77.5	90	109.8	135
USA	lb	13.9	17	20	24	27.9	34	41.8
Europe	g/m^2	52	64	75	90	104	127	157

2.6.4 Areas that must not be perforated (for ADF reading only)

Perforations in the shaded areas may cause Jam error. If you must read data from such paper, use the flatbed
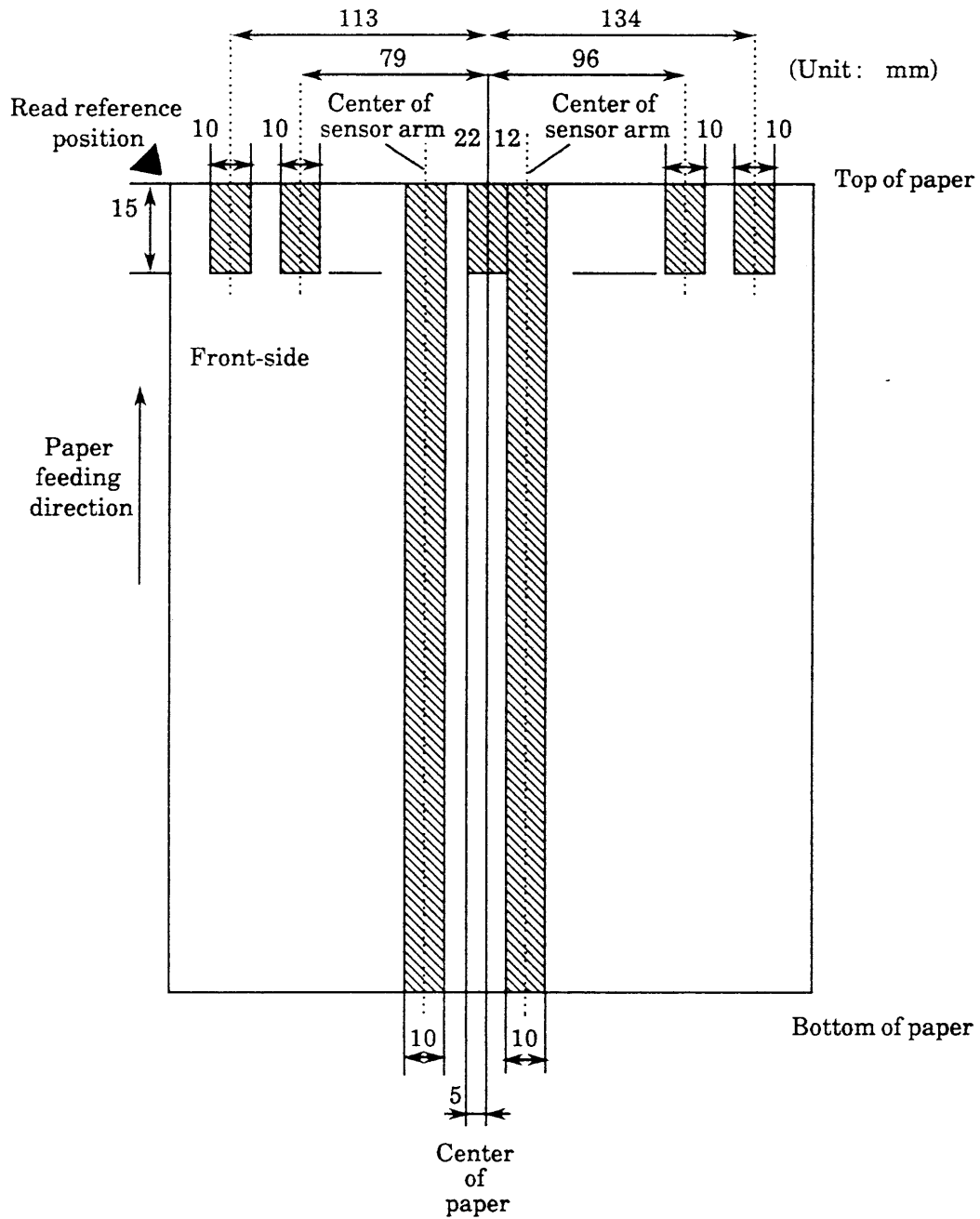
Figure 2.5 Areas that must not be perforated

2.6.5   Grounding color area

The color of the shaded area shown in Figure 2.6 should be paper grounding color (white) or drop-out color. If not, set White level following OFF (Photograph) before reading.

Grounding color (white) or drop-out color area

Main scanning direction

Lead of reading

3

Front-side or Back-side.

432

Subscanning direction

297

(Unit : mm)
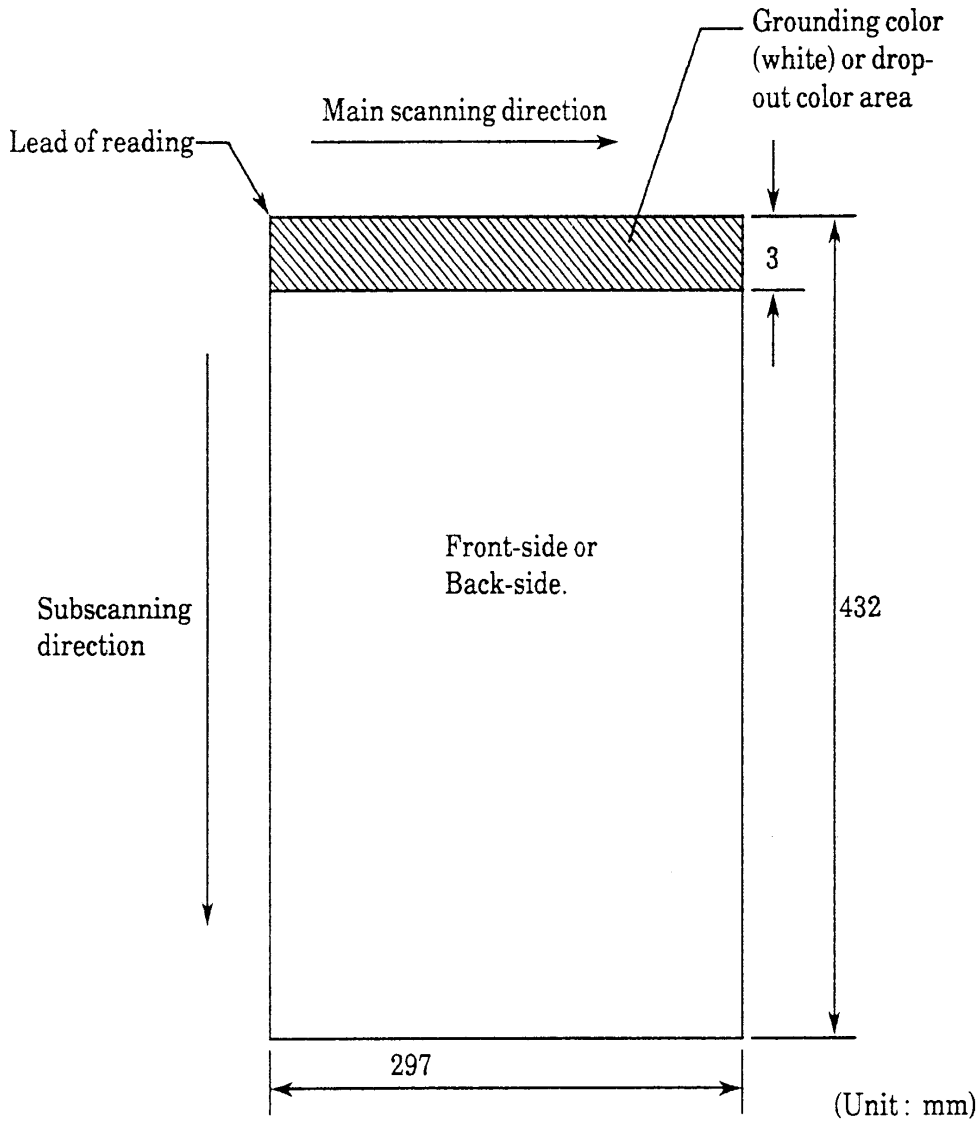
Figure 2.6 Grounding color area

2.6.6   Job separation sheet

The following figure shows the basic shape of the Job separation sheet. When Job separation sheet is scanned, the scanner can detect and inform it to the Host computer (See section A.4.11 READ command/Detected paper information).

Paper condition is such that described in section 2.6.1 or 2.6.2. And the paper size must be A4 or larger (210 mm or wider)

15

15

Reading
direction

Center of paper   (Unit : mm)

more than 210 mm
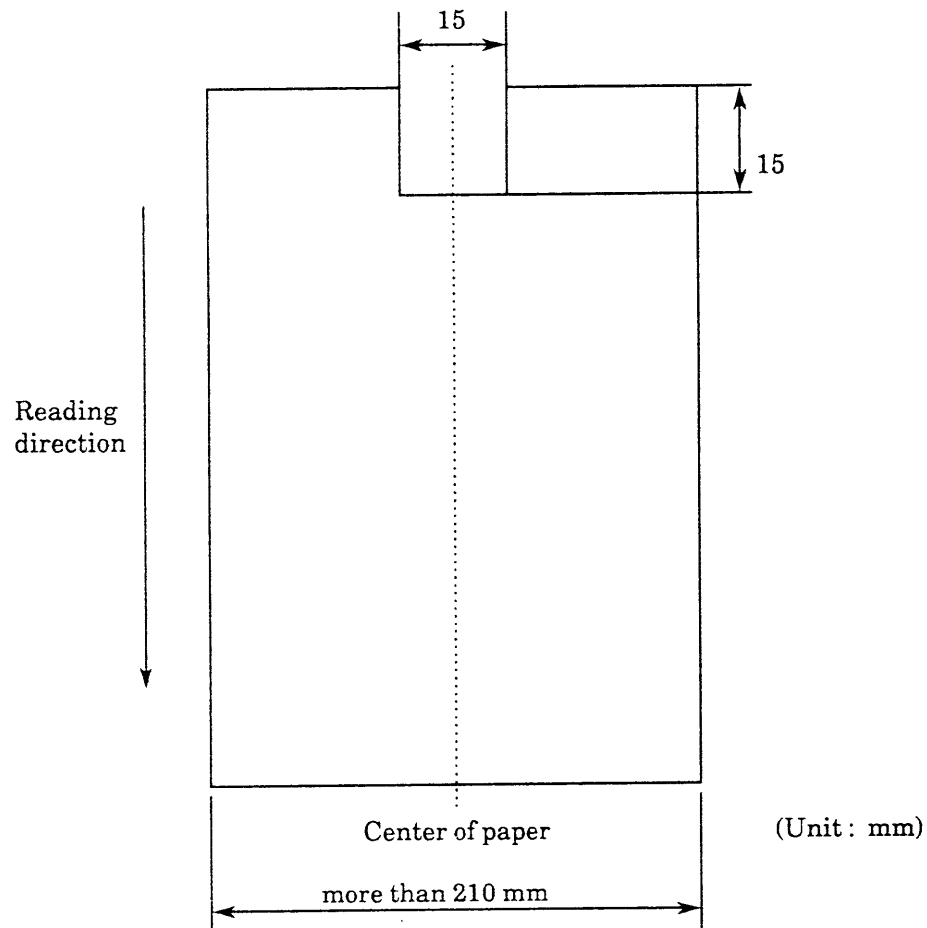
Figure 2.7   Job separation sheet

Chapter 3 Image Functions

3.1 Overview of the image functions

The image functions of this scanner are summarized in Table 3.1 and Table 3.2.

Table 3.1 Image functions

Section No. and Image function		Selectable parameters		
		No IPC option	with IPC-2D option	With IPC-3D option
3.2.1 Output resolution		100/150/200/240/300/400/600 dpi		
3.2.2 Main Window clipping	(1) Offset and size	See section 3.3.2 (1)		
	(2) Page end detection	ON/OFF		
3.2.3 Binary reading		Density		
		Contrast		
		White level following ON/OFF		
3.2.4 Halftone reading	(1) Dither	Four built-in patterns		
	(2) Error diffusion	ON/OFF		
3.2.5 Grayscale reading		Contrast		
3.2.6 Compression		MH/MR/MMR		
3.3.1 DTC mode *1 *2	(1) Pre-filter	N/A	Ordinary/Ball-point Pen	
	(2) Gradation	N/A	High Contrast /Ordinary	Ignored *3
	(3) Dynamic threshold curve	N/A	8 types (Darkness)	8 steps (Sensitivity) *2
	(4) Equal to white	N/A	ON/OFF	
	(5) Noise Removal	N/A	OFF / 2x2 / 3x3 / 4x4 / 5x5	
	(6) Smoothing	N/A	Image/OCR	
3.3.2 IPC mode *1	Simplified Dynamic Threshold *2 *5	N/A	7 steps (variance rate)	7 steps (Sensitivity) *4
	IPC-2 like Simplified Dynamic Threshold *5	N/A	N/A	7 steps (Sensitivity) High/Mid/Low
	(1) Image Emphasis	N/A	High/Mid/Low	
	Image Emphasis (smooth)	N/A	Smooth	Background Removal *7
	(2) Outline Extraction	N/A	ON/OFF	
	(3) Automatic Separation	N/A	ON/OFF *6	
	(4) Mirror image	N/A	ON/OFF	
	(5) Black and White reverse	N/A	ON/OFF	
3.3.3 Sub window		N/A	Max. 4	Ignored *8
3.3.4 Zooming		N/A	See Table 2.4	
3.3.5 Dither downloading		N/A	Max. 8 patterns	
3.3.6 Gamma downloading		N/A	Max. 5 patterns	

*1 DTC and IPC mode functions are exclusive.

*2 In IPC-3D, DTC and IPC mode Simplified DTC use the same algorithm.

*3 In IPC-3D, The Gradation parameter is ignored.

*4   In IPC-3D, a seven step parameter is used like as with the Simplified Dynamic Threshold but the algorithm is different.

*5   In IPC-3D, if both Simplified DTC and Image Emphasis are specified, the Simplified DTC algorithm is activated. At that time, both the Simplified Dynamic Threshold and Image Emphasis High/Mid/Low parameters are in affect.

*6   In IPC-3D, if Automatic Separation is specified, then Simplified Dynamic Threshold and Image Emphasis/Smoothing are ignored.

*7   In IPC-3D, if Smoothing is specified, then Background Removal is applied. Rhis effect is similar to IPC-2D Smoothing.

*8   In IPC-3D, Sub-windows are not available and are ignored if specified.

Table 3.2 Functions which are available for main window and sub-window

Image composition / Item	00 Binary black and white Main window	00 Binary black and white Sub-window	01 Dithering Main window	01 Dithering Sub-window	01 Error diffusion Main window	01 Error diffusion Sub-window	02 Gray scale Main window
X, Y resolution	o	x	o	x	o	x	o
Upper left X, Y	o	o	o	o	o	o	o
Width, length	o	o	o	o	o	o	o
Threshold	o	o	▲	▲	▲	▲	□
Brightness	▲	▲	o	o	o	o	□
Contrast	o	o	o	o	o	o	o
Bit per pixel	01	01	01	01	01	01	08
Halftone pattern	▲	▲	o	o	o	o	□
Compression	o	x	o	x	o (*5)	x	x
Subwindow list	o	x	o	x	o	x	x
Paper specification	o	x	o	x	o	x	o
DTC — DTC (*1)	o	x	o (*2)	x	o (*2)	x	□
IPC — Outline emphasis	o	o	o	o	o	o	□
IPC — Outline extraction	o (*3)	o (*3)	□	□	□	□	□
IPC — Automatic separation	o (*4)	o (*4)	o (*4)	o (*4)	o (*4)	o (*4)	□
IPC — Simplified DTC	o (*4)	o (*4)	□	□	□	□	□
IPC — RIF (reverse image format)	o	o	o	o	o	o	o (*6)
IPC — Mirror image	o	x	o	x	o	x	□

o: Can be specified.

x: Cannot be specified.

▲:   Enabled if automatic separation is specified, otherwise ignored.

❑   Can be specified but not enabled.

*1   If DTC is specified, IPC can be specified but not enabled.

*2   The image is not guaranteed.

*3   Can be specified but not enabled if Image Emphasis is also specified.

*4   Can be specified but not enabled if Outline Extraction is also specified.

*5   Not recommended because the compression is inefficient.

3.2   Basic image functions

The command and data name in [ ] beneath the section title shows the location for the reference in Appendix A.

3.2.1   Output resolution

[A.4.7 SET WINDOW command/X,Y resolution]

Selectable output resolution is shown in Table 2.3. The default is 400 dpi.

The output resolutions of 100/150/200/240/300/600 dpi are converted from 400 dpi by an electrical method. The X direction resolution (XR) and Y direction resolution (YR) can be specified independently. If IPC option is installed, Zooming function is available (see section 3.3.4). The output resolution with IPC option is shown in Table 2.4.

3.2.2   Main Window Clipping

(1)   Offset and Size

[A.4.7 SET WINDOW command / Upper left, Width, Length]

Offset is the length of ULX and ULY in Figure 3.1 and 3.2 with 1/1200 in unit.

It is important that the Origin point of the offset is deferent between Flatbed (FB) and ADF. When reading with ADF, user must specify the size of the document. Then the scanner set the origin point of that document size (X1) according to the size specified. (see Figure 3.2) If user specifies wrong document size, unintentional offset may be given.

When specifying the offset, you must count in the mechanical offset error of the scanner as shown in Table 3.3. You can adjust the offset with Setup mode of operator panel, scanner by scanner.

Table 3.3 Mechanical offset error of the scanner

Output resolution	X0 (dots) *1	Y0 (dots) *1
600 dpi	18 ± 18	24 ± 24
400 dpi	12 ± 12	16 ± 16
300 dpi	9 ± 9	12 ± 12
240 dpi	8 ± 8	10 ± 10
200 dpi	6 ± 6	8 ± 8
150 dpi	5 ± 5	6 ± 6
100 dpi	3 ± 3	4 ± 4

*1   When the document skewed, X0 and Y0 represents the minimum length of the offset along with the edge.

Origin point of ULX, ULY

Y0

X0

Actual origin point of the sheet
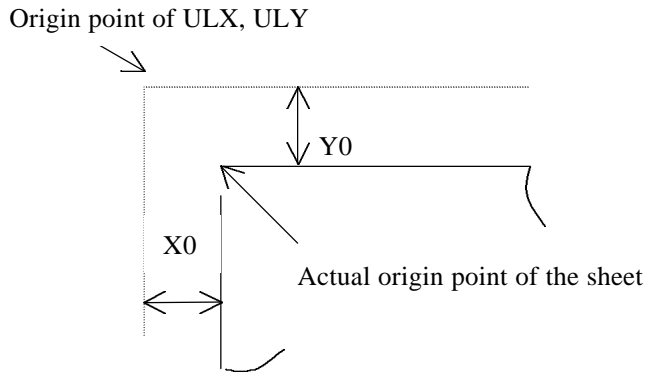
Size is the length of W and L in Figure 3.1 and 3.2 with 1/1200 in unit. The scanner rounds up the value to byte. The output pixels in main scanning direction and output lines in sub-scanning direction are obtained as follows.

a)   Output pixels in main scanning direction

Scanning width :   W (1/1200 in) = 10200

Output resolution: XR (dpi) = 400

$$\text{Output pixel} = \left\lceil \frac{[XR \times W/1200]}{8} \right\rceil = 425 \text{ (byte) *}$$

  * Values under 0 in [ ] are omitted

b)   Output lines in sub-scanning direction

Scanning length L (1/1200 in) = 13200

Output resolution YR (dpi) = 400

Output line = [YR x L/1200] = [400 x 13200/1200] = 4400 (line) *

* Values under 0 in [ ] are omitted

The physical limitations of the Main Window Clipping at Flatbed (FB) and ADF reading are illustrated in Figure 3.1 and 3.2 respectively.

NOTICE: This is not the guaranteed specification but the scanner may read the long document which fits the following condition.

i) $0 < ULY + L \leq 33072$ (@1/1200 in.)

ii) $L \div 1200 \times YR \leq 16383$ line

iii) The memory installed is enough for reading.
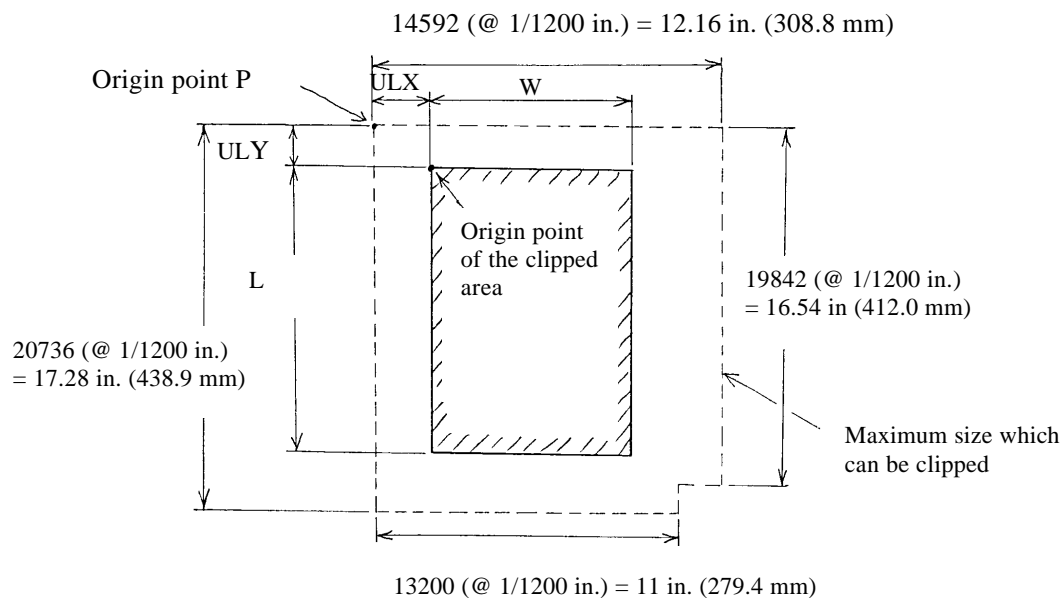
Figure 3.1 The window position and limitation of FB reading
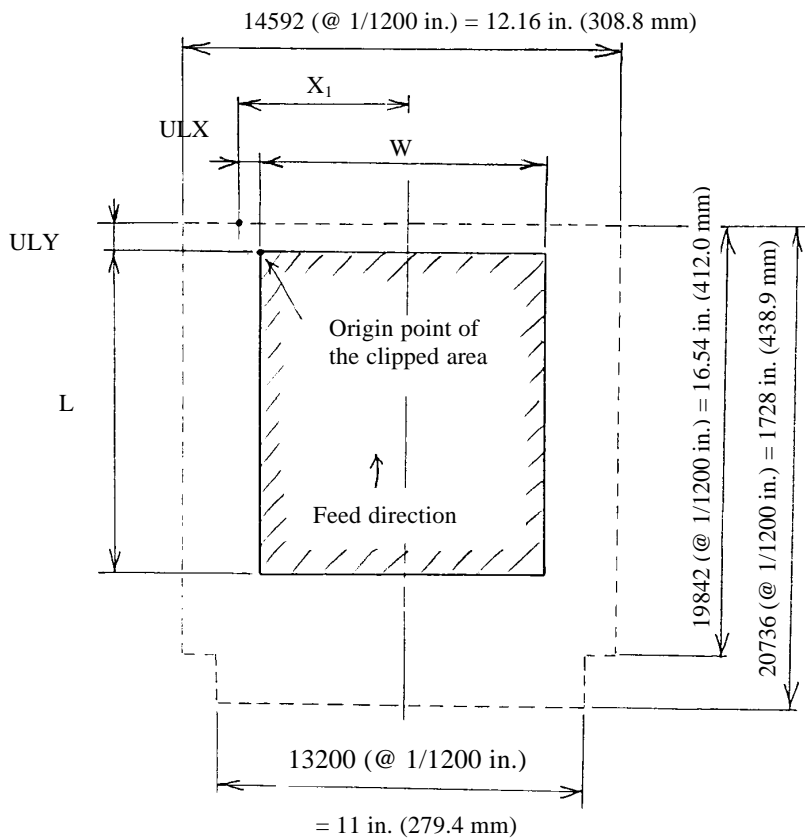
Figure 3.2 The window position and limitation of ADF reading

The Matrix size of the clipped Main Window is limited as shown in Figure 3.3. The unit of the number in Figure 3.3 is 1/1200 in.

W

9278 dots

7296 dots

L

Maximum
output size
without
Extended
Memory
option

10368 line

13824 line

Maximum output size with
Extended Memory option

Note: W must be greater than 9, and L must be
         greater than 1.
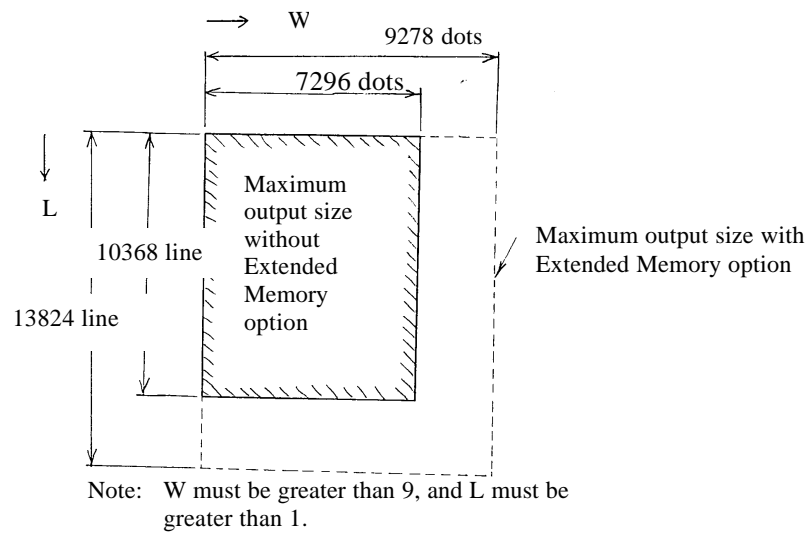
Figure 3.3 Matrix size limitation of the Window

(2)   Page End Detection
         [A.4.11 READ command / Detected paper length]

This function cuts the reading operation when page end is detected, even if all of the window length L (sub-scanning length) is not read yet. This function is useful to reduce the image data and increase the throughput. When Page End Detection is set ON, the image data which is out of the page end is deleted. (Example 2)

Example 1:

Image data transfer is completed at this line.
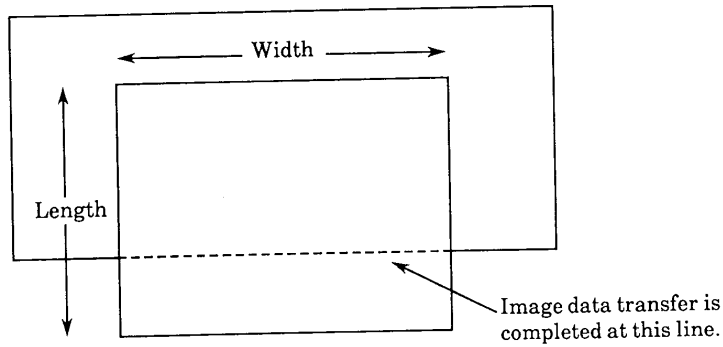
Example 2:
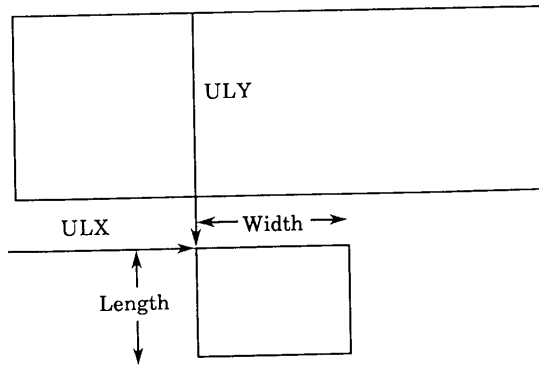
3.2.3   Binary reading

[A.4.7 SET WINDOW command / Image Composition = X'00']

Following three parameters are available when binarizing the image. The 256 levels of the density at each pixel is processed by Contrast and binarized by Threshold. When the White level following is se ON, the white level of the CCD output follows the background of the document. So this is useful for line art drawing but not for photograph.

Table 3.4 Parameter of Binarization

Parameter	value	Effect of parameter	Default
Threshold *1	X'01' to X'10' to X'FF'	Brightest Normal Darkest	X'80' (*1)
Contrast	X'01' to X'10' to X'FF'	Mostly soft contrast Normal Mostly sharp contrast	X'80'
Gamma pattern	X'01' X'02' X'03'	Normal Soft Sharp	X'01'
	X'80' to X'84'	Use download pattern	
White level following	ON	The threshold follows the background of the document. (*2)	ON
	OFF	The threshold do not follow the background of the document.	

*1   When the IPC-2D or IPC-3D is installed, the Threshold varies along with the control of DTC mode or IPC mode.

*2   3 mm from top of the document must be white or drop-out color (See section 2.6.5)

3.2.4 Halftone reading

[A.4.7 SET WINDOW command/Image Composition = X'01']

This scanner supports two types of halftone image, that is Dither and Error Diffusion.

(1) Dither

[A.4.7 SET WINDOW command / Halftone type = X'01']

This is a way of producing halftone images with white and black pixels. The scanned image is processed by the unit of group of pixels.

At first a reference table called "dither matrix" is specified. Each element in the matrix (8x8) has a threshold value of 256 levels. Allocation of threshold values in the dither matrix is called "dither pattern". Group of the scanned images are compared with the dither pattern, and each element is decided whether it is black or white. Number of black pixels corresponds to a level of scale, producing pseudo grayscale images.

Four built-in dither patterns are available.

(2) Error diffusion

[A.4.7 SET WINDOW command / Halftone type = X'02']

This is a way of producing halftone (Pseudo grayscale) images with white and black pixels. Optical density of pixels and its adjacent pixels are totaled and black pixels are repositioned in the order of density in accordance with relations between adjacent pixels.

This scheme aims to minimize errors between scanned density and printed density on the average. Density data of adjacent pixels are modified by diffusing errors on the objective pixel into several pixels to be binarized. This scheme is aimed to keep high levels of grayscale and high resolution, producing high quality halftone. Especially when dotted halftone images like photos on the newspaper are scanned, this scheme suppresses moire patterns.

Following parameters are available for this function

The parameters which affects the Halftone image are shown in Table 3.5.

Table 3.5 Parameters of Halftone

Parameter	value		Effect of parameter	Default
Brightness	X'01'		Brightest	
	to			
	X'80'		Normal	X'80'
	to			
	X'FF'		Darkest	
Contrast	X'01'		Mostly soft contrast	
	to			
	X'80'		Normal	X'80'
	to			
	X'FF'		Mostly sharp contrast	
Gamma pattern	X'01'		Normal	X'01'
	X'02'		Soft	
	X'03'		Sharp	
	X'80'		Use download pattern	
	to			
	X'84'			
Halftone scheme	Dither pattern	X'00'	For dark photo	Dither
		X'01'	For dark text and photo mix	
		X'02'	For light photo	
		X'03'	For light text and photo mix	
		X'80' to X'87'	downloaded pattern *1	
	Error Diffusion			

*1   IPC-2D or OPC-3D required. (See section 3.3.5)

NOTICE: The density of the halftone can not be adjusted by the Threshold in Table 3.4 but be adjusted by the Brightness in Table 3.5.

3.2.5 Grayscale reading

[A.4.7 SET WINDOW command / Image Composition = X'02']

Eight bit Grayscale reading is available. Following image processing functions can be specified for grayscale reading. (See Table 3.2)

- X,Y resolution (XR,YR)
- Main window offset (ULX, ULY)
- Main window size (W, L)
- Contrast
- Black and White reverse

NOTICE: The throughput of the grayscale reading may 1/2 slower than binary reading.

NOTICE: The output resolution is limited as shown in Table 2.3 and 2.4.

3.2.6 Compression

[A.4.7 SET WINDOW command/Compression type, argument]

Following parameters are selectable for Compression. When a compression is selected, memory option required.

Table 3.6 Parameter of Compression

Parameter	Value	Effect of parameter	Argument	Remarks
No	X'00'	No compression		
MH	X'01'	MH compression		
MR	X'02'	MR compression	K parameter	
MMR	X'03'	MMR compression		

3.3   Optional image function

Image functions in this section are available when IPC-2D or IPC3D option is installed.

The name of command and data in [ ] beneath the section title show the location for the reference in Appendix A.

3.3.1   DTC mode function (Auto I mode)

[A.4.7 SET WINDOW command / DTC selection = X'40']

This mode is designed to scan for better image quality to provide OCR (Optical Character Reader). Threshold algorithm was developed to capture important text features for recognition purpose. The image processing is deferent between IPC-2D and IPC-3D as follows.

IPC-2D : Note that the DTC image processing is composed by the following sub-functions.
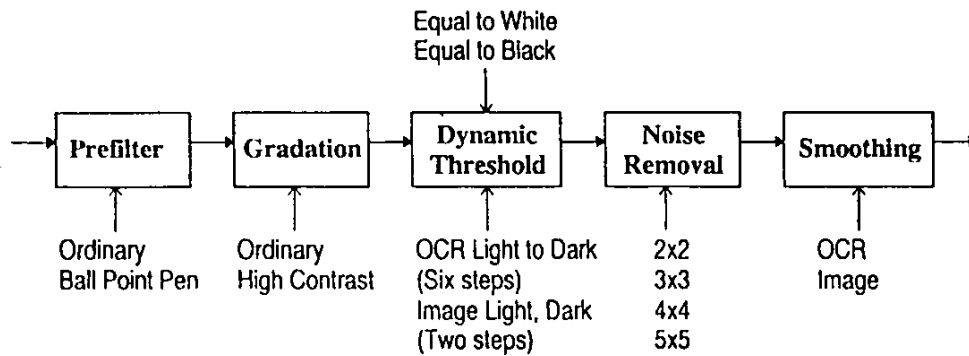
IPC-3D: Dynamic Threshold is identical to the Simplified Dynamic Threshold in IPC mode. (See section 3.3.2)

NOTICE 1:   Threshold, Brightness, and Contrast settings are ignored in DTC mode.

NOTICE 2:   Gamma correction is also ignored in DTC mode.

(1)   Pre-filter

[A.4.7 SET WINDOW command / DTC mode]

The pre-filter performs filtering before processing the Dynamic Threshold. Ordinary and Ball-point Pen are selectable in Pre-filter.

Table 3.7 Parameter of Pre-filter

Name of parameter	value	Effect with IPC-2D	Effect with IPC-3D	Default
Ordinary	X'00'	Linear gamma curve	Linear gamma curve	
High Contrast	X'10'	Makes low contrast Image clear (for dark background document)		X'00'

Use Ordinary basically. For the texts written by ball-point pens, use of Ball-point Pen may better for OCR. This is because, the texts written by ball-point pens actually have two thin lines per stroke. To human eye, this is not big problem, but OCR may not recognize the text. The Ball-point Pen filter detects lighter areas compared to the surroundings and increases the density of the lighter area. puts these two lines into one solid line. This can prevents cuts, void or too thin lines.

Effect Example

Ordinary Filter

Ball Point Pen Filter

(2)   Gradation

[A.4.7 SET WINDOW command / DTC mode]

Gradation specifies the gamma curve correction before processing Dynamic Threshold. When scanning news papers or old documents which background is dark, it is desirable that the gamma curve has coarse steps in the lighter side and fine steps in the darker side. This is called High Contrast gamma curve.

γ curve
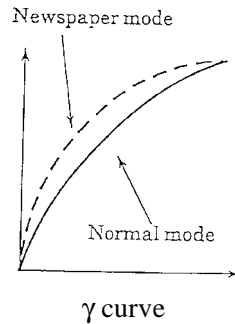
As the Dynamic Threshold with IPC-3D includes an automatic contrast adjustment, High Contrast setting is not required.

Table 3.8 Parameter of Gradation

Parameter	Value	Effect with IPC-2D	Effect with IPC-3D	Default
Ordinary	X'xxx00xxx'	Normal gamma curve (for general document)	Normal gamma curve	X'00'
High Contrast	X'xxx10xxx'	Makes low contrast Image clear	No effect	

*   for dark background document such as newspaper or old document
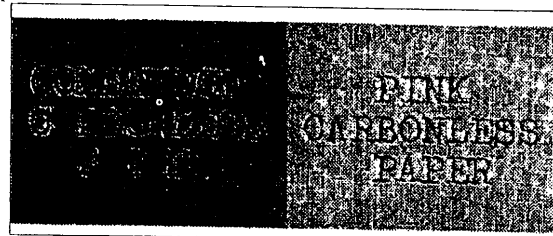
Ordinary Gradation
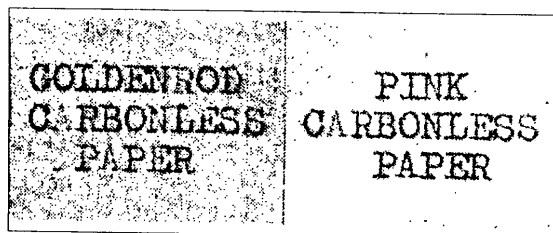
High Contrast Gradation

(3) Dynamic Threshold Curve

[A.4.7 SET WINDOW command/DTC mode]

For the Dynamic Threshold function, the threshold is changed with the average optical density of a small area (e.g. 5 x 5 pixel area).

Relation between the threshold and maximum density is formed as a curve when the threshold is expressed in the Y-axis and the maximum density in the X-axis. This curve is called "threshold curve".
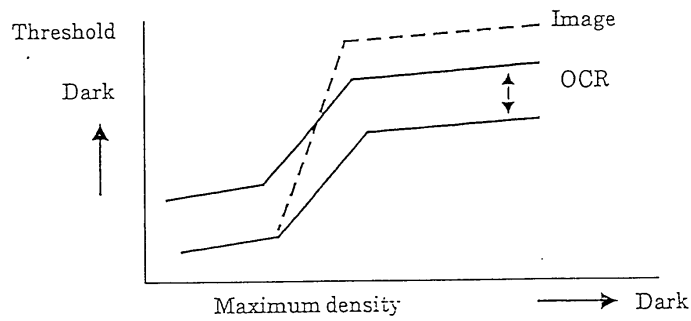
This function allows a customer to select a threshold curve. Several different curves are prepared, one is the OCR type and other is the image type. The characteristic of the curve is deferent between IPC-2D and IPC-3D.

IPC-2D: The image type curve has steeper inclination in the middle of the curve. For OCR type curve, the customer can select type (inclination) and density level.

PC-3D: 8 curves are available which adjusts the sensitivity of the image

The parameter of Dynamic Threshold are as follows.

Table 3.9 The deference of Dynamic Threshold Curve parameter

Option	Parameter	Value	Selectable parameter	Default
IPC-2D	0 for OCR to 5 for OCR	B'xxxxx000' to B'xxxxx101'	Brightest Darkest	6 for image
	6 for Image 7 for Image	B'xxxxx110' B'xxxxx111'	makes bright image to dark makes dark image to bright	
IPC-3D	0 to 4 to 7	B'xxxxx000' to B'xxxxx100' to B'xxxxx111'	Decrease the noise Normal makes image sharp but increases noise	4

See 3.2 (b) for IPC-3 effect example.

```
  ABCDEFGHIJKLMNOPQR
1 STUVWXYZ1234567890
2 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
3 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
4
5
```
Normal Threshld [128]

```
  ABCDEFGHIJKLMNOPQR
1 STUVWXYZ1234567890
2 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
3 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
4 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
5 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
```
Low Threshld [25]

```
  ABCDEFGHIJKLMNOPQR
1 STUVWXYZ1234567890
2 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
3 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
4 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
5 ABCDEFGHIJKLMNOPQR
  STUVWXYZ1234567890
```
Dynamic Threshld

(4)   Equal to White

[A.4.7 SET WINDOW command/DTC mode]

Equal to White specifies the result of binaizing when the value of a pixel equals the threshold. The default is Equal to White OFF.

The effect of this parameter is slight but, if the scanned image text is bold, set to Equal to White. If the scanned Image text is too narrow or lost, set to Equal to Black (Equal to White OFF).

Table 3.10 Parameter of Noise Removal

Parameter	Value	Effect	Default
Equal to White ON	B'xxxxxxx1'	Equal to White	Equal to White ON
Equal to White OFF	B'xxxxxxx0'	Equal to Black	

(5)   Noise Removal

[A.4.7 SET WINDOW command / DTC mode]

Noise Removal reduces the isolated spot noise after Dynamic Threshold. If the image is noisy. Turn on the Noise Removal and set the granularity to the size of noise to be removed. The parameter of Noise Removal is as follows.

Table 3.11 Parameter of Noise Removal

Parameter	Value	Effect	Default
OFF	B'001xxxxx'	Noise Removal is not done	
2x2	B'0000001x'	2x2 or smaller dot is removed	OFF
3x3	B'0000010x'	3x3 or smaller dot is removed	
4x4	B'0000100x'	4x4 or smaller dot is removed	
5x5	B'0001000x'	5x5 or smaller dot is removed	

NOTICE: In IPC-3D, Noise Removal is ignored when the OCR smoothing is ON.

Example:
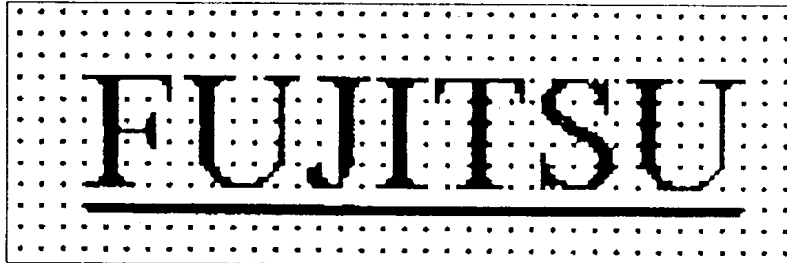
Noise Removal [OFF]
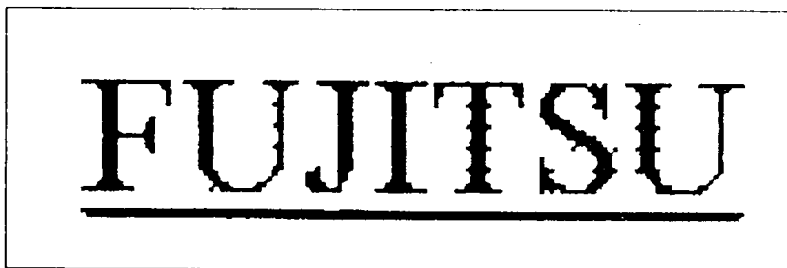
Noise Removal [ON, 2x2, 3x3, 4x4, 5x5]

(6)   Smoothing

[A.4.7 SET WINDOW command / DTC mode]

Smoothing in DTC mode is done after binarizing. This function smooths a slant line or curve by eliminating jagged edges on the line. An irregularly protruding portions are removed and an Irregularly cut portions are filled In. The parameters of smoothing are as follows. The Image Smoothing do no smoothing. If an image scanned in low resolution and the outline is jagged, specify the OCR smoothing. When OCR smoothing is specified with IPC-3D, Noise removal is not done.

Table 3.12 Parameter of Smoothing

Parameter	Value	Effect with IPC-2D	Effect with IPC-3D	Default
Image Smoothing	X'x00xxxxx'	No smoothing	No smoothing	X'00'
OCR Smoothing	X'x01xxxxx'	Smooth is done	Smooth is done *1	

*1   Noise removal is ignored.

NOTICE: In IPC-3D, Noise removal is ignored, when OCR smoothing is specified.

Example:
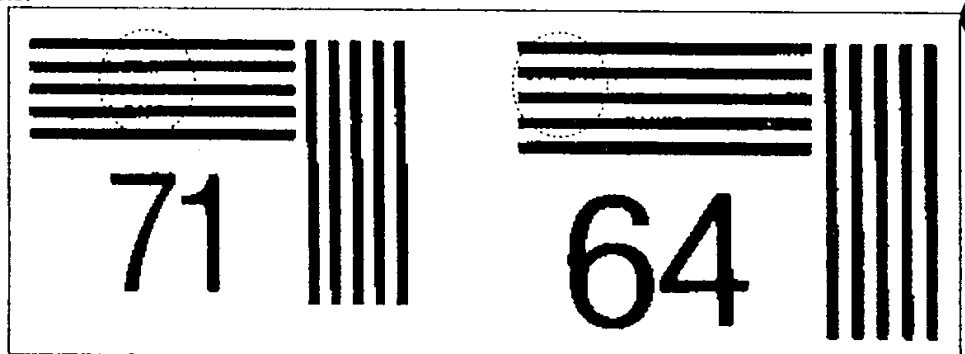
Image Smoothing
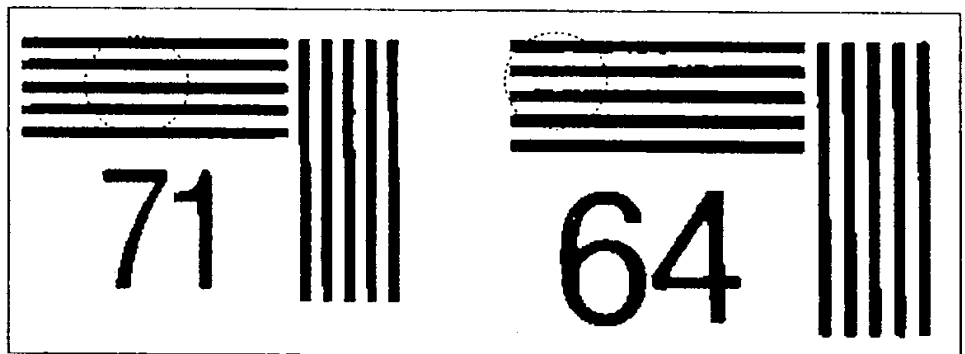
OCR Smoothing

3.3.2 IPC mode (Auto II mode)

[A.4.7 SET WINDOW command/DTC SELECTION = X'00' or X'80']

In this mode, the algorithm of dynamic threshold is deferent between IPC-2D and IPC-3D.
This mode is recommended for general electric filing purpose.

Option	Algorithm of the Dynamic Threshold	Condition
IPC-2D:	Simplified Dynamic Threshold	Anytime
IPC-3D:	Simplified Dynamic Threshold	When Image Emphasis is not specified
	IPC-2 like Simplified Dynamic Threshold	When Image Emphasis is specified

a) Simplified Dynamic Threshold

The Simplified Dynamic Threshold is effective to obtain sharp images or capture texts having colored backgrounds. This effect is similar to Image Emphasis. The difference is that the Simplified Dynamic Threshold does not emphasis the background. This is useful for forms, checks and most real world document.

In IPC mode, Simplified Dynamic Threshold was a simplified implementation of the Dynamic threshold. In IPC-2D, Simplified Dynamic Threshold is no simpler, but sometimes more effective than Dynamic Threshold for background texts. In IPC-3D, both Dynamic Threshold are the same and sophisticated.

Example IPC-3 Dynamic Threshold

Simplified Dynamic Threshold [OFF]

Simplified Dynamic Threshold [Sensitivty:6]
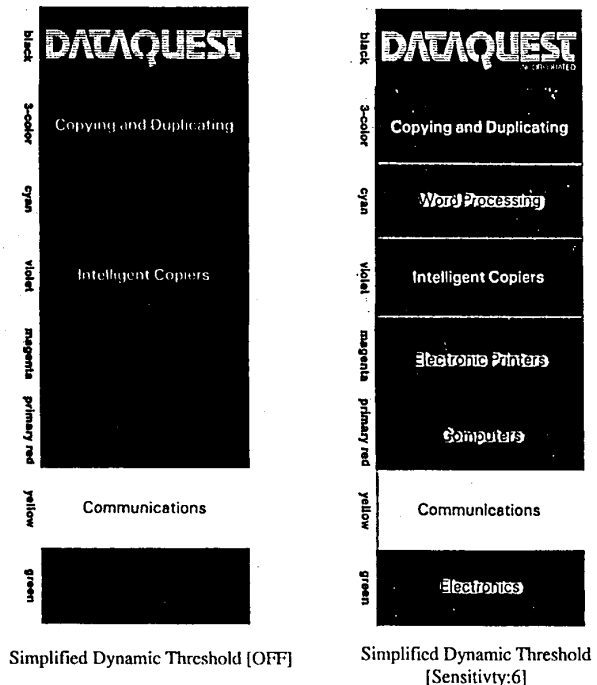
b) IPC2 like Simplified Dynamic Threshold

IPC-3D supports IPC-2 like Simplified Dynamic Threshold for compatibility purpose. When both Image Emphasis and Simplified Dynamic Threshold are set, it is regarded as IPD-2 like Simplified Dynamic Threshold. In this case, IPC-3D Sensitivity parameters in Simplified Dynamic Threshold are used as the Variance Rate, and Image Emphasis parameters are used for emphasis. The IPC-2 like Simplified Dynamic Threshold increases resolution.

Example:
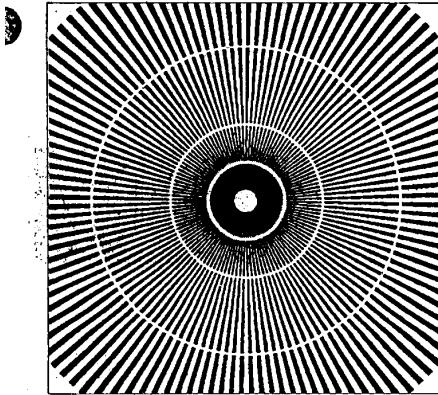
Simplified
Dynamic
Threshold
[OFF]
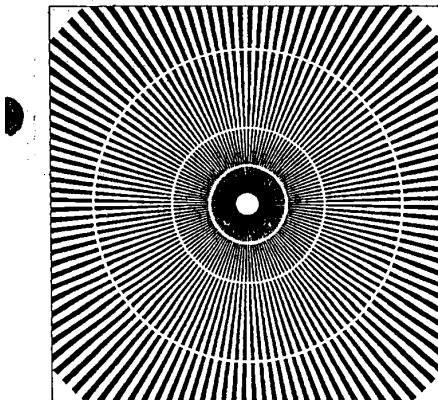
Simplified
Dynamic
Threshold
[Variance Rate:7,
Emphasis:High]

The conceptual image processing flow in the IPC mode is shown below.
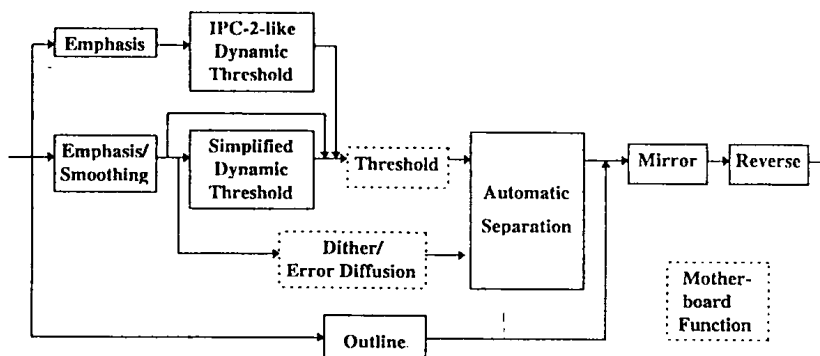
(1)   Image Emphasis

[A.4.7 SET WINDOW command / Image Emphasis]

Image Emphasis performs filtering to emphasize image edges or to smooth (IPC-2D) or remove background noise (IPC-3D). If text edges are not clear or faint, turn on the Image Emphasis. Three levels of Image Emphasis, High/Mid/Low, are available. As a side effect, Image Emphasis also emphasizes the noise. It is better to set Image Emphasis higher to obtain good image, until the noise is not perceptible.

In IPC-2D, Smooth is also available which works as negative emphasis so image edges becomes faint even if original is ordinary sharp.

In IPC-3D, Background Removal is available instead of Smooth. Background Removal is effective to remove background tones. For the case of the texts surrounded by halftone pattern such as dither, background should be removed to emphasize the text. Background is useful for such cases.

The algorithm of Smooth and Background Removal is deferent but the outputs are similar.

Table 3.13 Parameter of Image Emphasis

Option	Parameter	Value	Effect	Default
IPC-2D	OFF	X'00'	No emphasis and smoothing	OFF
	High	X'01' to X'2F'	High emphasis	
	Mid	X'30' to X'4F'	Medium emphasis	
	Low	X'50' to X'7F'	Low emphasis	
	Smooth	X'80' to X'FF'	Negative effect of emphasis	
IPC-3D	OFF	X'00'	No emphasis and background removal	Off
	High	X'01' to X'2F'	High emphasis	
	Mid	X'30' to X'4F'	Medium emphasis	
	Low	X'50' to X'7F'	Low emphasis	
	Background removal	X'80' to X'FF'	Removes noisy background	
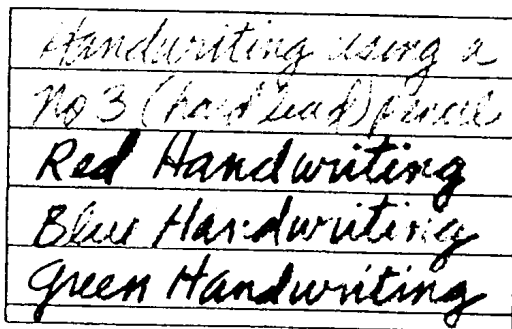
Image Emphasis [OFF]
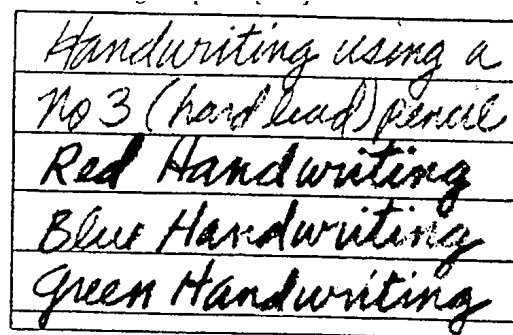
Image Emphasis [High]

Example 2 (Smoothing/Background Removal)
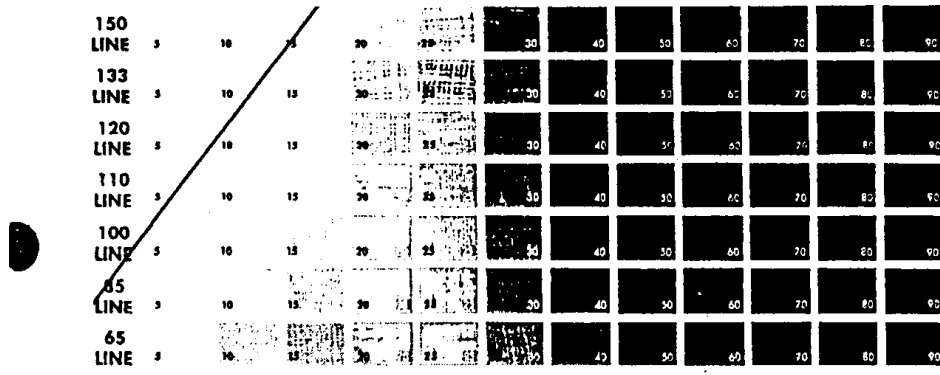
Background Removal [OFF]
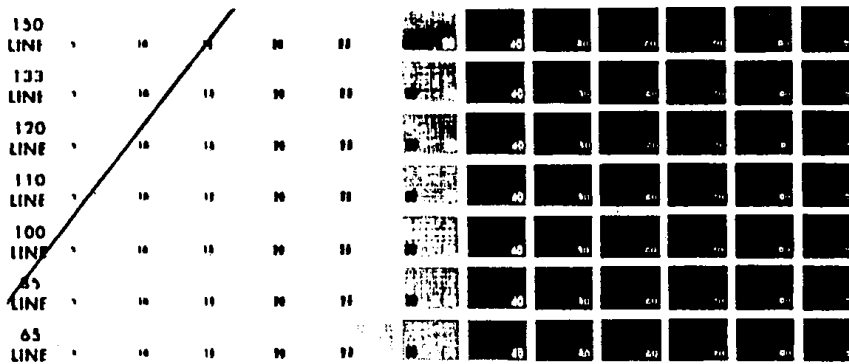
Background Removal [ON]

(2)   Outline Extraction

[A.4.7 SET WINDOW command / Outline extraction]

The Outline function extracts the edges from images. This function is rarely used. It may be used in DTP for image effects or image sensing.

Table 3.14 parameter of Outline Extraction

Parameter	Value	Effect	Default
OFF	X'00'	Outline Extraction is disabled.	OFF
ON	X'80'	Outline Extraction is enabled.	

Example:

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 12 pt

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 10 pt

Outline [OFF]

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 12 pt

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 10 pt

Outline [ON]

(3)   Automatic Separation

    [A.4.7 SET WINDOW command / Automatic Separation]

With this feature, the scanner automatically recognize the text areas and photo areas on the document. For the areas that are recognized as text areas, scanned data are processed as pure binary with no halftone algorithm (fixed threshold or automatic binarization). For areas that are recognized as photo areas, scanned data are processed with a halftone algorithm (Dither or Error Diffusion).

Table 3.15 Parameter of Automatic Separation

Parameter	Value	Effect	Default
OFF	X'00'	Automatic Separation OFF	OFF
ON	X'80'	Automatic Separation ON *1 *2	

*1   Simplified DTC and Image Emphasis are available for binary regions.

*2   In IPC-2D, other image processing as Simplified Dynamic Threshold and Image Emphasis are ignored.
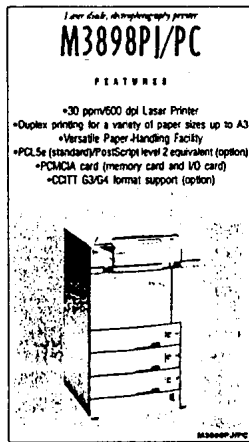
Digifized
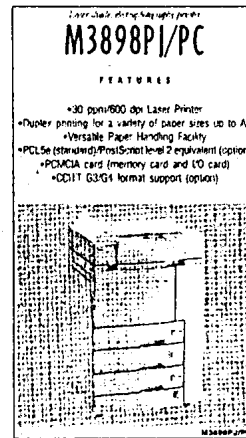
Dithering
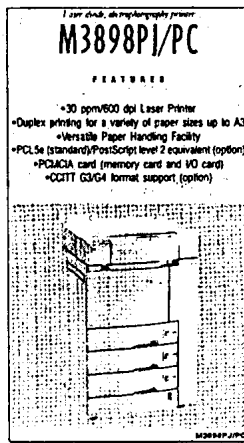
Automatic Separation [ON]

(4)   Mirror image

[A.4.7 SET WINDOW command / Mirror image]

A scanned image is turned over symmetrically in the main scan direction, generating a mirrored reflection of an image.

Table 3.16 Parameter of Mirror Image

Parameter	Value	Effect	Default
OFF	X'00'	Mirror Image OFF	
ON	X'80'	Mirror Image ON	OFF

Example:

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 12 pt

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890   Megaron Medium 10 pt

Mirror [OFF]

Mirror [ON]

(5)   Black and White reverse

[A.4.7 SET WINDOW command/RIF (reverse image format)]

Black and White Reverse turns the black part of the image white and white part of the image black. This effect is similar to the negative/positive image from camera.

Table 3.17 Parameter of Black and White Reverse

Parameter	Value	Effect	Default
OFF	X'00'	Black and White Reverse OFF	
ON	X'80'	Black and White Reverse ON	OFF

3.3.3   Sub-Window

[A.4.8 SET SUBWINDOW command]

In the Main Window specified in section 3.2.1, muximum four small portions on each front and back side of the document can be clipped as Sub-Window. In each Sub Window, the deferent scanning methods which is shown in Fig 3.2 can be specified.

NOTICE 1:   IF the area specified for any sub window does not fit in the area of the main window, the portion of the area outside the main window area is ignored. Only the portion where the main and sub window overlap (shown hatched) is processed.
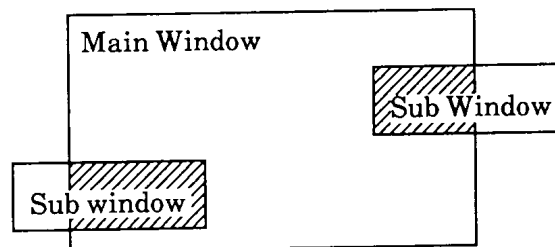
NOTICE 2:   If sub-windows in a main window overlap with each other as a result of the values ULX, ULY, W and L , the scanner returns the error.
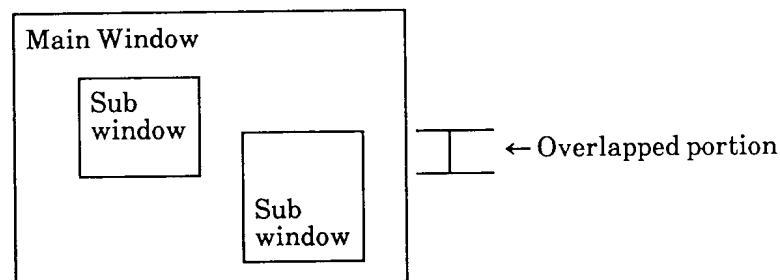
3.3.4   Zooming

[A.4.7 SET WINDOW command/X,Y resolution]

Zooming is the function to enlarge or reduce the image from 400 dpi. X and Y independent variable resolutions are supported. This zooming is processed in grayscale, so smooth and non-distorted images can be obtained even when halftone is applied.

NOTICE: Resolution is converted by an electrical method. Therefore , no matter how high resolution is specified, small texts or narrow lines will not be resolved more clearly than 400 dpi image does.

NOTICE: Zooming rate of back side reading must be same as front side.

No Zooming(400 dpi at 100%)

Zooming (800 dpi at 200%)
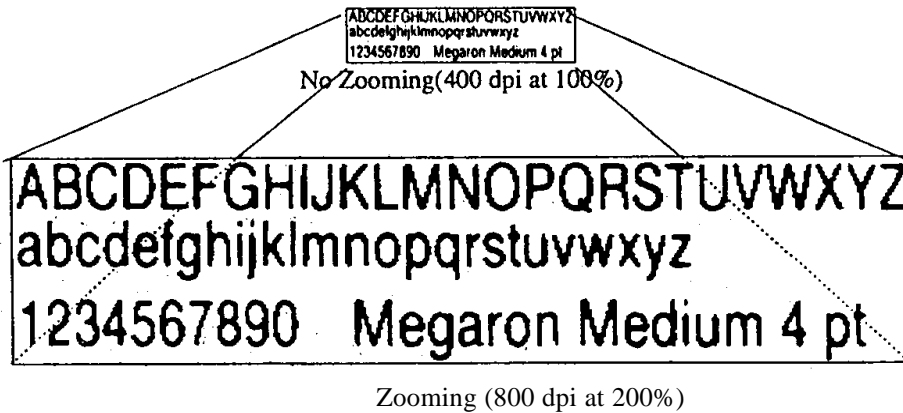
3.3.5   Dither download

[A.4.10 SEND command/SEND data]

User's own dither pattern is downloaded with this function. Four built-in dither patterns are available basically and 8 more dither patterns can be downloaded.

3.3.6   Gamma download

[A.4.10 SEND command/SEND data]

Gamma downloading is supported to scan with user's own gamma correction pattern. Two built-in gamma patterns, Ordinary and High contrast, are basically available. And five more gamma patterns can be downloaded.

NOTICE: When the downloaded gamma pattern is specified for grayscale reading, the last two bit of the pixel output data is always B'00'.

Chapter 4 Storage and Installation

4.1 Packaging box and storage condition

Physical specification of the packaging box are listed in Table 4.1

Table 4.1 Physical specifications of the packaging box

Item		Specification	Remarks
Size of the box	Width	670 mm	
	Depth	915 mm	
	Height	375 mm	
Weight of the box		29 kg	
Doggy door		Yes (size : 285 × 50 mm)	
Label for scanner identification		Attached on the side of the packaging box. Label contents; • Scanner type • Scanner Parts number • Serial number	See Figure 4.1
Condition of storage	Temperature	-20°C to 60°C	less than 15°C /hr
	Humidity	8 to 95%	with no condensation
	Stacking	less than 8 stories	
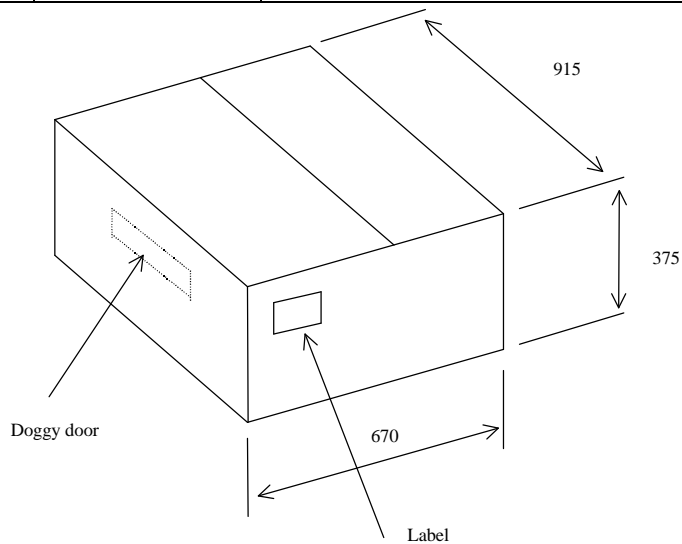
Figure 4.1 Packaging box

4.2 Components in the packaging box

Following components are included in the packaging box. Note that the power cable is deferent between the scanner for USA/North America and the scanner for Europe.

Table 4.2 The components in the box

Name of the component		Quantity per box		Description
		USA, North America version	Europe version	
Scanner		1	1	
Inspection report		1	1	
Operator's Guide		1	1	Manual
Cleaning and maintenance		1	1	Manual
Pad ASY		1	1	See Section 5.4
Power cable	for 100V	1	-	
	for 200V	-	1	
Stacker		1	1	
Terminator		1	1	

4.3 Installation procedure

4.3.1 Removing the carrier fixing bracket

<u>CAUTION</u>

Do not set the scanner upside down or on its side.
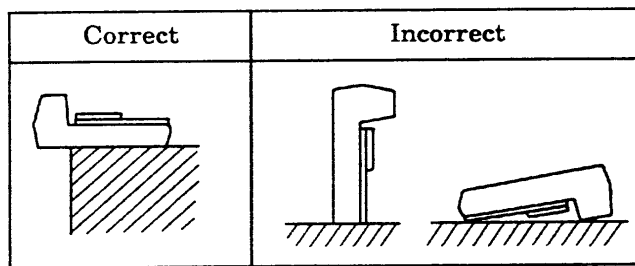
1) Set the scanner on the edge of the desk so that the ADF extends from the
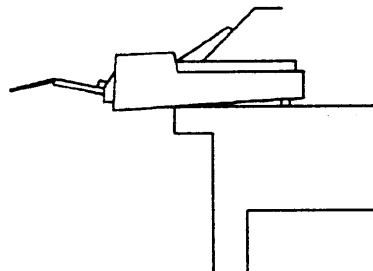
2)   Look at the bottom of the scanner to find the carrier fixing bracket.

3)   Remove the screw, and remove the carrier fixing bracket from position Ⓐ . Then install the
      carrier fixing bracket at position B .

Upper

Carrier bracket
(position during
operation)

Ⓑ

(Viewed from below)

ADF

Ⓐ

Carrier bracket
(position during
transportation)
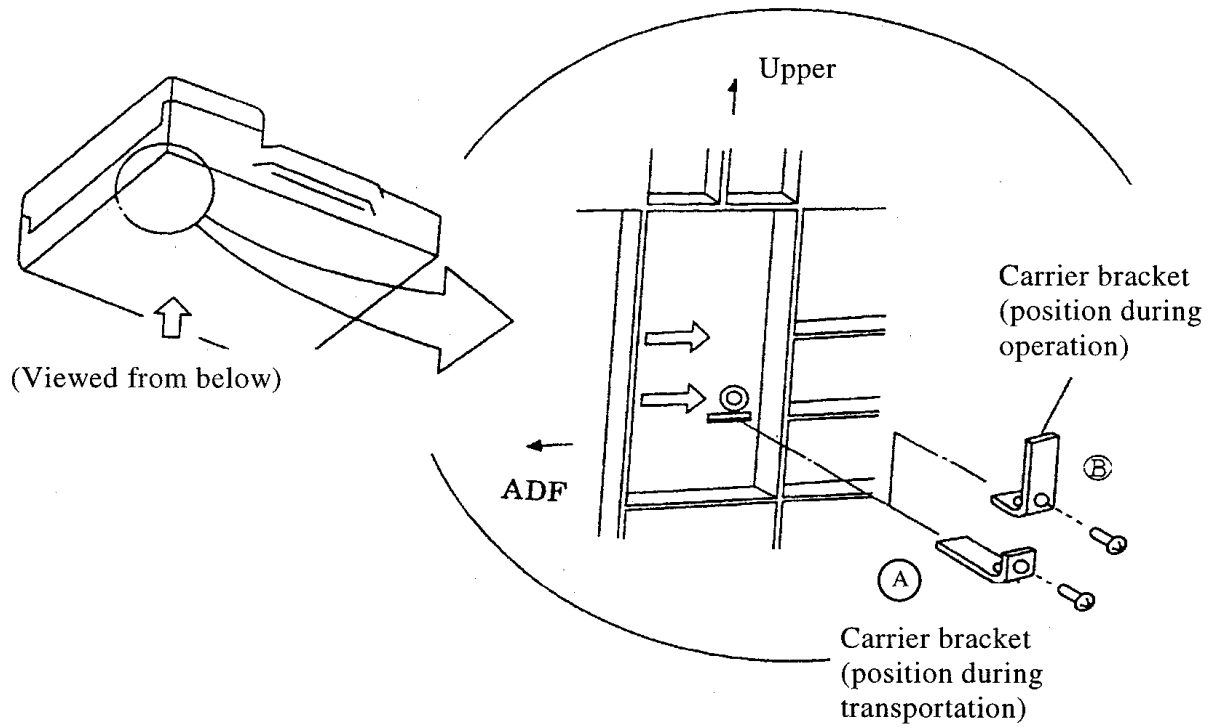
4.3.2 Connections

Connect the cables as follows;

(1)   Set the power switch OFF. (see Figure 1.1)

(2)   Connect the power cable.

Connect the power cable to the power inlet (see Figure 1.1) on the back of the image scanner.

Connect the other end of the power cable to a power outlet.

(3)   Connect the interface cables

Connect the interface cables to the interface connectors (see Figure 1.1) and fasten the cables with catches or screws. Connect the other end of each Interface cable to the host computer.

Back of the image

Interf

Terminator
If the image
scanner is at
the terminal
side, connect
the terminator
to the
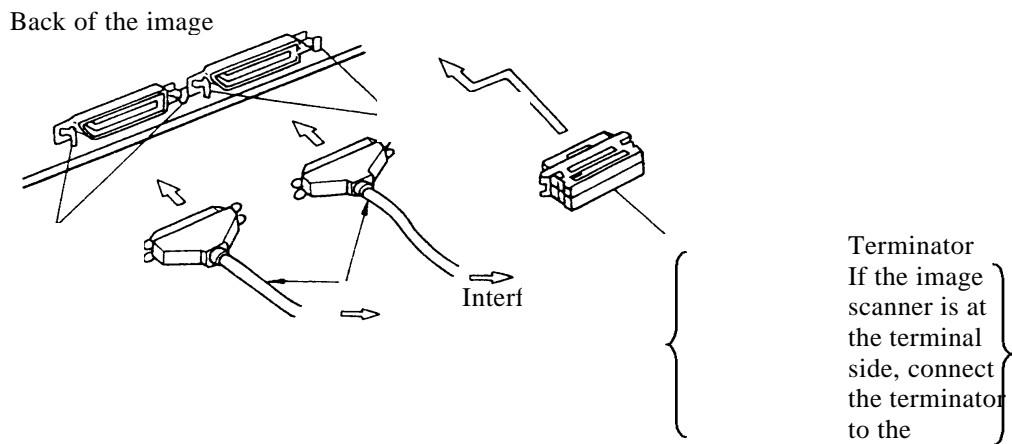
4.3.3 Mounting the stacker

Hook the pins on the stacker to the claws on the image scanner.

Stacker

Pin (inside)

Claw
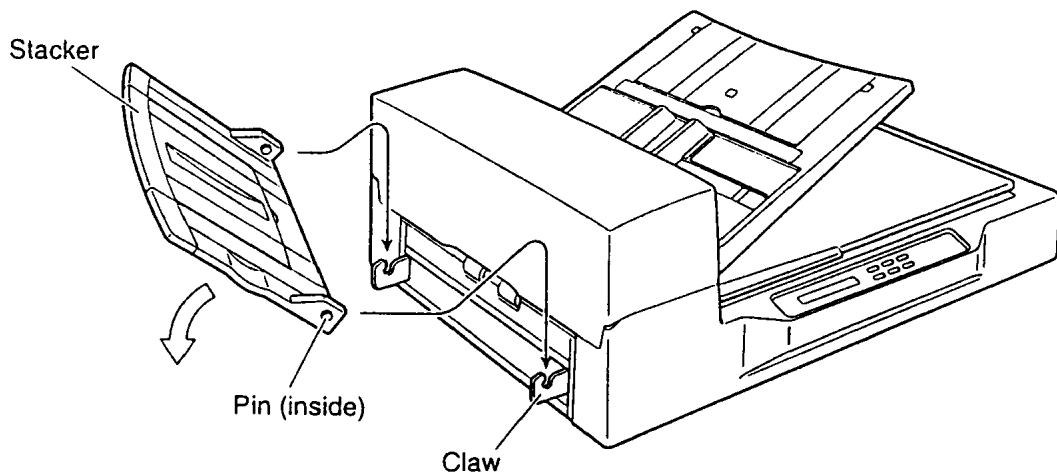
4.3.4   SCSI-ID setting
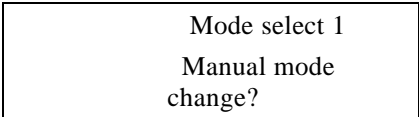
The default of SCSI-ID is 5. SCSI-ID is set by Setup mode of operator panel. The procedure to set SCSI ID is;

(1)   Turn the power ON by pressing "I" side of the power switch (see Figure 1.1). The scanner displays "Scanner Ready" on the lower line of LCD.
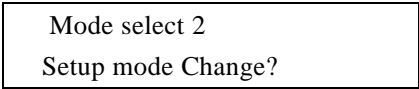
```
┌─────────────────────────────┐
│                             │
│   Scanner Ready      >      │
│                             │
└─────────────────────────────┘
```

(2)   Then press "Next" button. The scanner displays "Mode select 1".
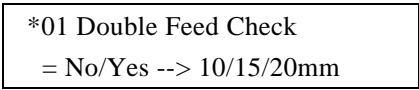
```
┌─────────────────────────────┐
│         Mode select 1       │
│         Manual mode         │
│         change?             │
└─────────────────────────────┘
```

(3)   Then press "Next" button. The scanner displays "Mode select 2" meaning that setup mode is ready. Then press "enter" button.
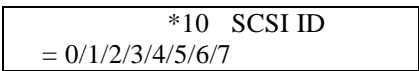
```
┌─────────────────────────────┐
│    Mode select 2            │
│    Setup mode Change?       │
└─────────────────────────────┘
```

(4)   Then press "enter" button. The scanner displays as follows.

```
┌─────────────────────────────┐
│  *01 Double Feed Check      │
│   = No/Yes --> 10/15/20mm   │
└─────────────────────────────┘
```

(5)   Press "Previous" once, then the scanner displays "SCSI ID" on the upper line of the LCD.

```
┌─────────────────────────────┐
│        *10   SCSI ID        │
│   = 0/1/2/3/4/5/6/7         │
└─────────────────────────────┘
```

(6)   Select SCSI ID by pressing " ➔ " or " ⬅ " button, and press "Enter". (SCSI ID is set.)

(7)   Press "Exit" to return to "Scanner Ready" screen.

Chapter 5 Operation and Maintenance

5.1 Operator panel operation

5.1.1 Operator panel function

Operator pane has one LCD, six buttons and three LEDs as follows. The functions of each button and LED are shown in Table 5.1.

Paper counter

```
                              ▲ 50
    Scanner Ready    100000
```

Abrasion counter

(↑)	(↓)	(STOP)	
Previous	Next	Exit	0 Power
		(START)	0 READ
←	→	Enter	0 Check
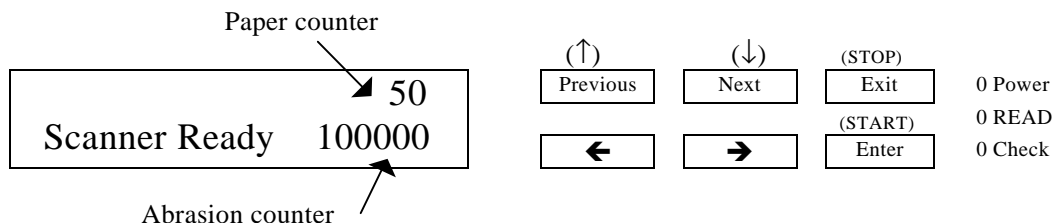
Table 5.1 Functions of buttons and LEDs

Name of the button and LED		Function
Button	Next	LCD displays the next screen on the screen flow chart of Figure 5.1 or 5.2. The settings you have made is effective.
	Previous	LCD displays the backward screen of the screen flow chart of Figure 5.1 or 5.2. The settings you have made is effective.
	←	Moves the cursor (the blinking part) to the left
	→	Moves the cursor (the blinking part) to the right
	Exit	When "Check" LED lights, pressing this button releases error status (turn off "Check" and returns to "Scanner Ready" screen).
		When you are setting on the operator, pressing this button returns to "Scanner Ready" screen immediately. Note that the setting you have select is effective after pressing this button.
	ENTER	Registers the parameter selected by cursor.
LED	Power	Indicates that the scanner is ON.
	READ	Indicates that the scanner is reading documents.
	Check	If it blinks at one second cycle, it means that some temporary error occurs. (See section 6.1)
		If it blinks at four seconds cycle, ADF cleaning is necessary.
		If it lights, it means that some alarm occurred. (See section 6.1)

Table 5.2 Functions of the counter

Counter	Function
Paper counter	Paper counter counts the scanned sheet from the start of reading to Hopper empty or an error detection.
Abrasion counter	Abrasion counter counts the accumulated number of the scanned sheet. This counter increments at every 10 sheets. Use this counter to check the cleaning cycle or parts replacement cycle.

5.1.2 Manual Feed mode

In this mode, the scanner waits for some predetermined time without issuing "Hopper empty" after all documents are read. This predetermined time (time-out limit) is specified by Setup mode. Therefore you can set next documents on ADF chute without interrupting reading operation. The procedures for setting manual feed mode are as follows.

(1)   Turn the power ON by pressing "I" side of the power switch (see Figure 1.1). The scanner displays "Scanner Ready".

> Scanner Ready

(2)   Press "Next" button. Then the scanner displays "Mode select 1"

> Mode select 1
> M Manual mode change?

(3)   Then press "Enter" button. Then the scanner displays following screen.

> M01 Manual feed
> = No/Yes

(4)   Select "Yes" by pressing "➔" button, and press "Enter". Now the Manual Feed mode is set.

(5)   Press "Exit" to return to "Scanner Ready " screen.
Note that "Manual Feed" is shown on the upper left of the LCD. This means that the scanner is in Manual Feed mode.

> Manual Feed
> Scanner Ready

M1

	Exit	M1 At Manual Feed mode

```
        xxx                    Manual Feed   xxx
  Scanner Ready  xxxx   ◄───   Scanner Ready  xxxx
```

M3   **Next** ↓ ↑ **Previous**

```
  Mode select 1          Enter
  M Manual mode Change?   ────►   To Manual Feed mode
```

M4   **Next** ↓ ↑ **Previous**

```
  Mode select 2          Enter
  ! Setup mode Change?    ────►   To Setup mode
```
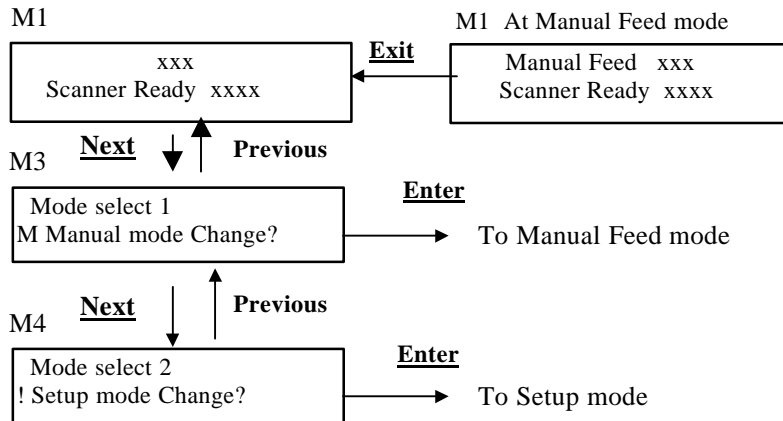
Figure 5.1 Mode change

5.1.3 Setup mode

Operator can set following items by Setup mode.

Table 5.3 Functions of Setup mode

No	Item	Description	Selectable parameters	Default
1	Double feed check	Double feed is detected by checking the document length one by one.	Tolerance: No/10/15/20 mm	No
2	IPC pre-setting	Scanner automatically sets the recommended reading parameters. Five sets of recommended parameters are available.	Document: No/1/2/3/4/5	No
3	Reset of Abrasion counter	Abrasion counter can be reset.	-	-
4	Pick start time setting	The time from the document insertion to the start of picking is specified. User can select most comfortable Pick start time for the job.	Time: 0.2 to 9.8 sec	1.0 sec
4	Time-out limit setting *	The time that the scanner waits for next document insertion after last document scanned can be specified.	Time: 27 values from 1 to 1999 sec	30 sec
5	ADF front offset setting *	Horizontal and vertical offset of the front side image by ADF is specified.	Offset: H: -2 to +3mm V: -2 to +3mm	Offset: H: 0 mm V: 0 mm
6	ADF back offset setting *	Horizontal and vertical offset of the back side image by ADF is specified.	Offset: H: -2 to +3mm V: -2 to +3mm	Offset: H: 0 mm V: 0 mm
7	FB offset setting*	Horizontal and vertical offset of the FB image is specified.	Offset: H: -2 to +3mm V: -2 to +3mm	Offset: H: 0 mm V: 0 mm
8	IPC/Memory status display	The type of IPC option (IPC-2D or IPC-3D) and total memory installed are displayed.		
9	SCSI ID setting	SCSI ID is selectable	SCSI ID: 1/2/3/4/5/6/7	5

* This offset means the deference from the value adjusted by automatic offset adjustment.

The procedures for setting Setup mode are as follows.

(1)   Turn the power ON by pressing "I" side of the power switch (see Figure 1.1). Then the scanner displays "Scanner Ready"

```
 Scanner Ready      >
```

(2)   Press "Next" button. Then the scanner displays "Mode select 1",

```
  Mode select 1
 M Manual mode change?
```

(3)   Press "Next" button again. Then the scanner displays "Mode select 2"

```
  Mode select 2
 ! Setup mode Change?
```

(4)   Press "Enter" button. Now the scanner is in Setup mode.

(5)   At first the screen is S41 in the screen flow chart next page. Select items by pressing "Next" or "Previous" buttons, and select parameters by pressing "←" or "→" buttons, and press "Enter" button to set the parameter. Finally close the Setup mode by pressing "Exit" button. The flow chart of the Setup mode is in Figure 5.2
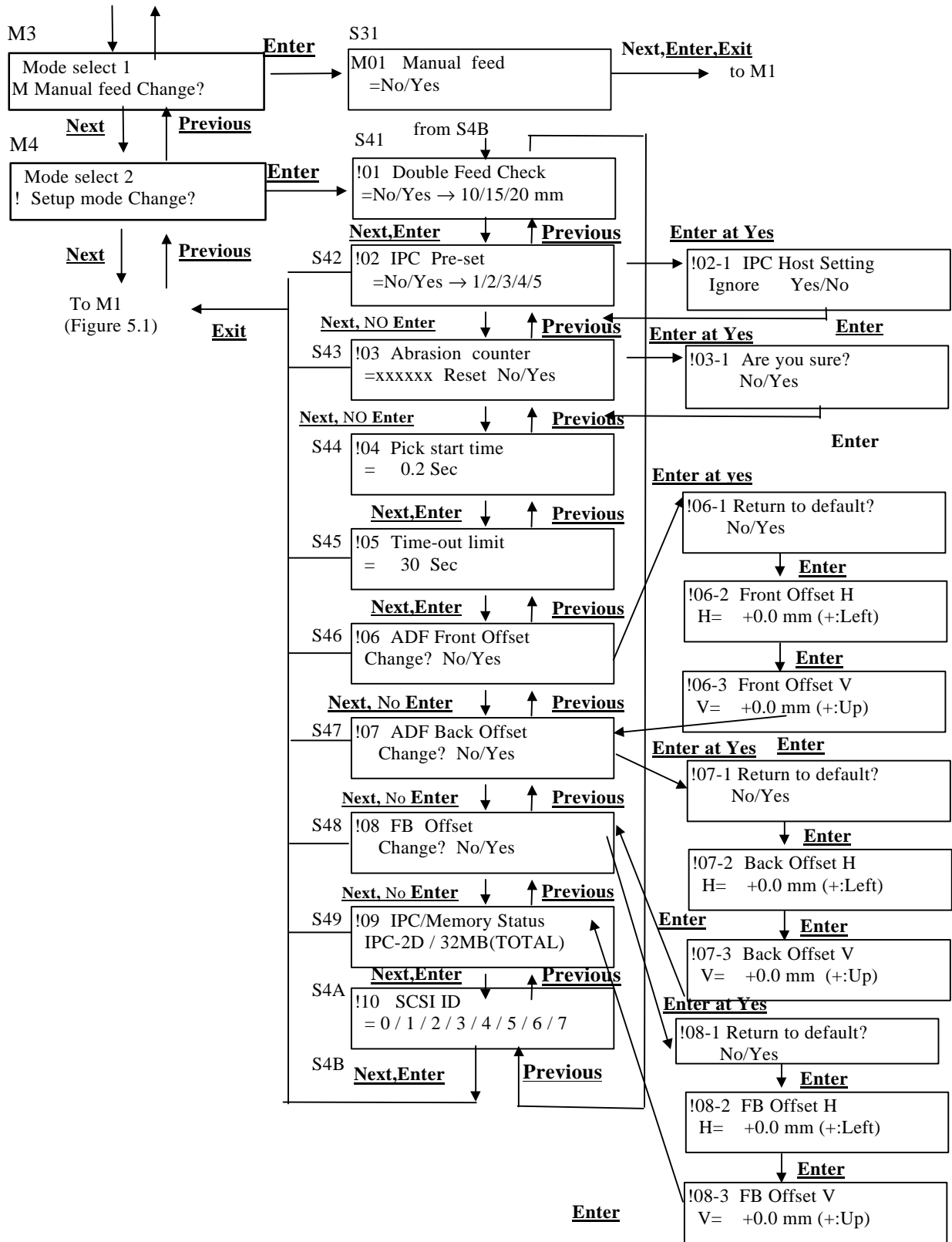
Figure 5.2 Flow chart of the Setup mode

5.1.4   Function of CE mode

CE mode is available only for maintenance person, so the details of the CE mode are shown in the maintenance manual of this scanner. In this section only the items of the CE mode is shown in table 5.4 as a reference.

Table 5.4 Function of CE mode

Items	Features
T01 Single Test feed	Scanner tests the FB or ADF single sheet reading. Scanner tests not only the feeding but also AGC control of carrier unit and Optical unit.
T02 Multi Test feed	Scanner continuously tests the feeding and AGC control unit "Exit" is pressed.
T03 Offset Adjsutment	Scanner automatically adjusts the offset of FB image, ADF front image and ADF back image.
T04 EEPROM Setting	This function supports the inquiry and over-writing of the EEPROM data.
T05 OP Panel Test	Scanner tests the function of the LCD, LEDs and switches on the operator panel.
T06 ADF Sensor Test	Scanner tests the switches on ADF indicating the ON/OFF real time status on LCD.
T07 PROM Version	Scanner displays the firmware version in PROM.
T08 Life Counter	Scanner displays the accumulated sheet number wich ADF has fed.
T09 Baud Rate	This function supports the baud rate setting of RS232C. Baud rate is selectable from 9600/4800/2400/1200 bps.
T10 Product ID	This function supports the setting of Product ID of SCSI interface. Product ID is selectable from M3099G/M3097DG/M3097G/M3093DG/M3093GX/M3096G/M3096GX.
T11 Memory Test	Scanner tests the image memory.

5.2   Document setting

5.2.1   Document setting on ADF paper chute

The procedures for setting the document on ADF are as follows.
NOTICE: Note that the documents follows section 2.6 "Document Specifications".

(1)   Pull up the ADF paper chute as follows:
Hold the document feeder with one hand and pull up the ADF paper chute with the other hand to set the shaft in position B.

ADF paper chute

Document cover

ADF paper chute

Rotation direction

Bar

Operating position
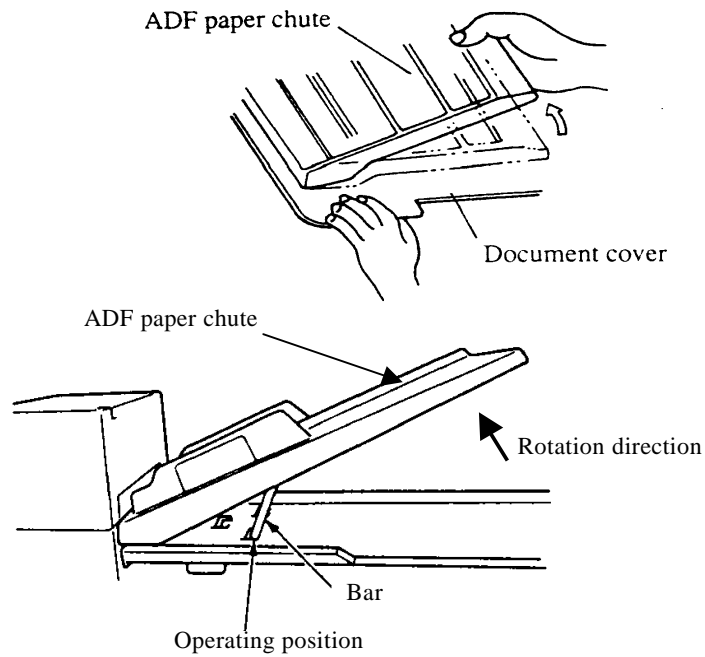
(2)   Fan the document
Fan the document to loose static electricity and prevent double feed or jam.

15 to 20 mm
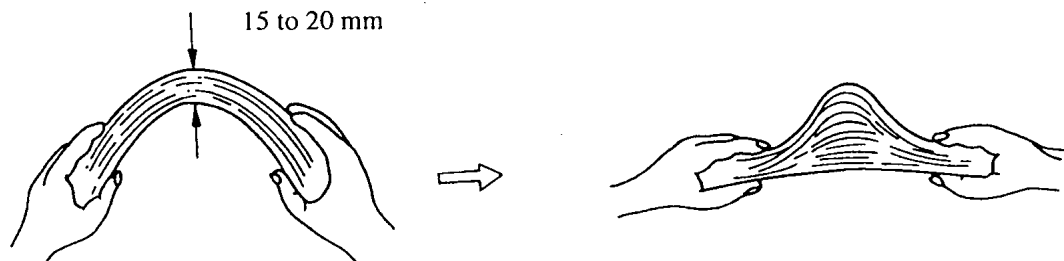
(3) Angle the document edges as follows to avoid double feed.
   a) Lift the documents holding the both ends with both hands.
   b) Hold the documents tightly with your left hand, and bend the documents as shown in B.
   c) Grip tightly with your right hand, loosen the grip of your left hand, and straighten the documents as shown in C.

A

Top

(For portrait mode)

B

D

20° or less

C
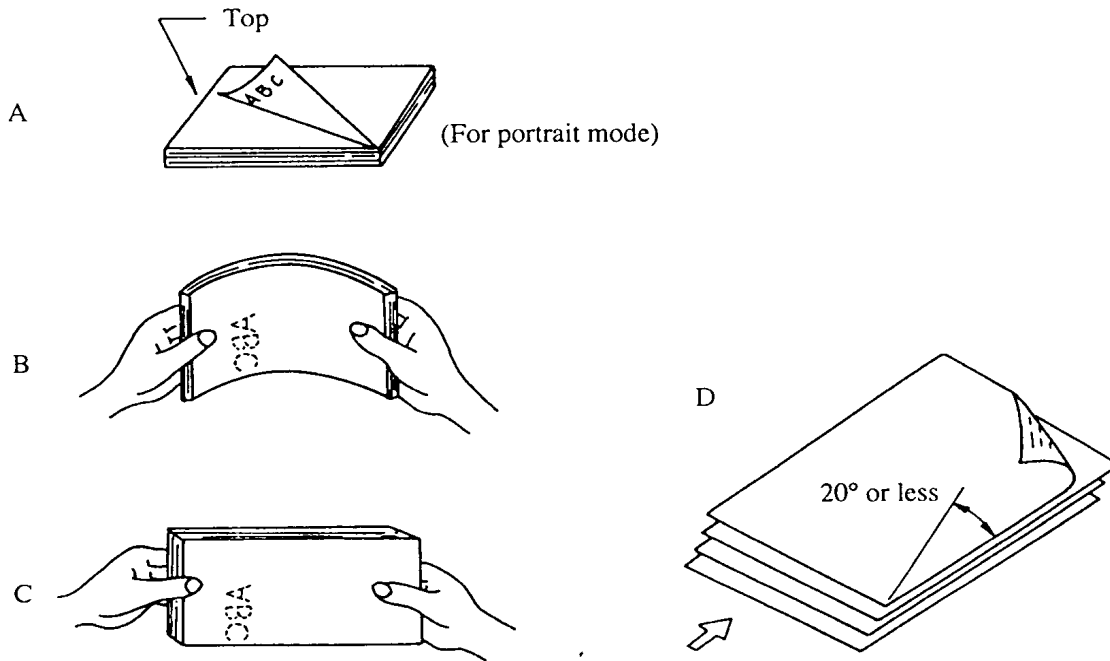
(4) Place the documents on ADF paper chute as follows
   a) Open the right and left guides of the ADF paper chute about 5 mm wider than the document width
   b) Place the documents with front side down onto ADF paper chute with the top edges facing the ADF.
   c) Adjusts the right and left guides to the document sides. Skewing may occur if there is a gap between the guides and documents.
   d) Slides the documents down until they touch the pick roller in the ADF. If the documents hit the pick roller in ADF hard, two or more sheets may be fed at once. Make sure that the upper end of documents are not turned.

Guide

Automatic document feeder

Documents

ADF paper chute

Guide lever

Guide
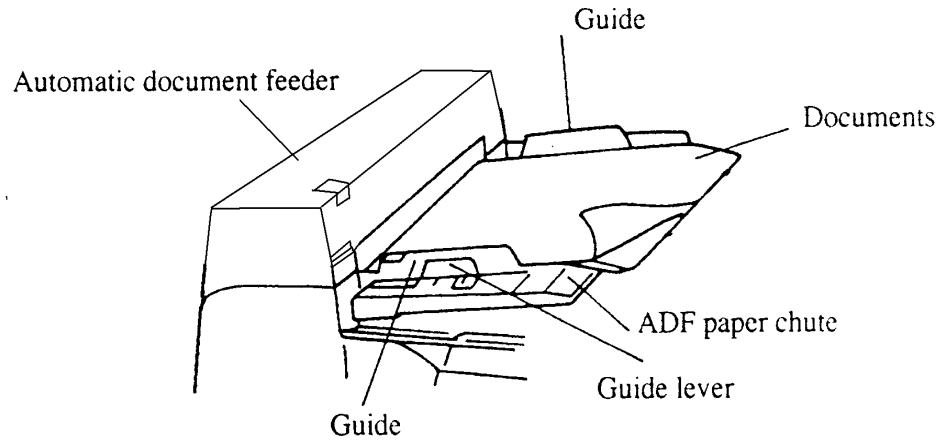
NOTICE: The number of the documents to be placed on ADF paper chute is limited as described in section 2.6.3.

(6)   Start read operation. After reading, remove the documents from the stacker.

NOTICE: If a wrong document size or mode is selected, the document may not be read correctly. For example;
- Portrait and landscape setting
- If 3mm of the leading edge of the document is not white or drop-out color, set
White level following OFF.

Portrait

Short side

Landscape

Automatic document feeder

ADF paper chute

Long side
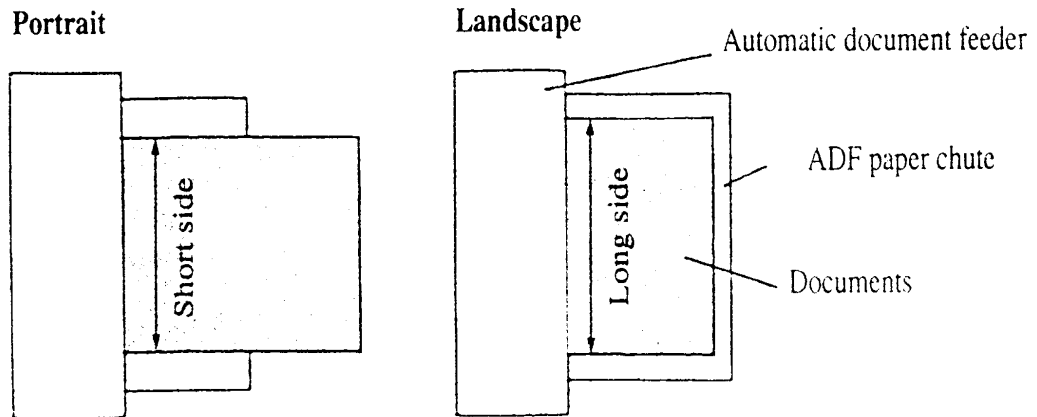
Documents

5.2.2 Document setting on flatbed

The procedures for setting the document on ADF are as follows.

(1) Open the document cover.
(2) Place the document with face down on the document bed. Correct any curled or folded parts of the document.
(3) Position the long side (in landscape mode) or the short side (in portrait mode) of the document to the left side of the document bed.
(4) Position the left top corner of the document to the reference mark. If the document is not placed correctly, scanned image position may be incorrect.
(5) Close the document cover slowly.
(6) Start the read operation. After reading, open the document cover and remove the document.

Document cover

Reference mark

Document

Indication panel

Document bed

Landscape mode

Long side ③

Portrait mode

Short side ③

Document bed

Document
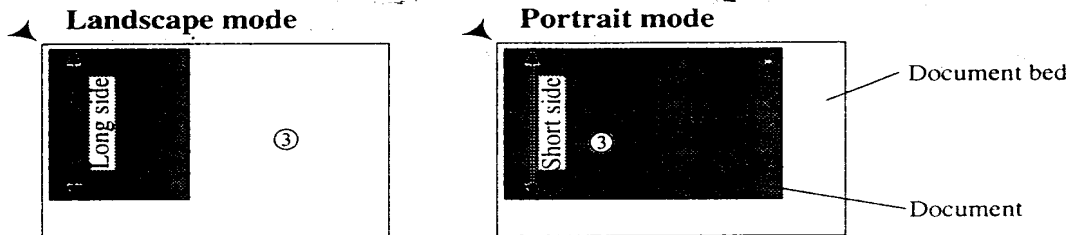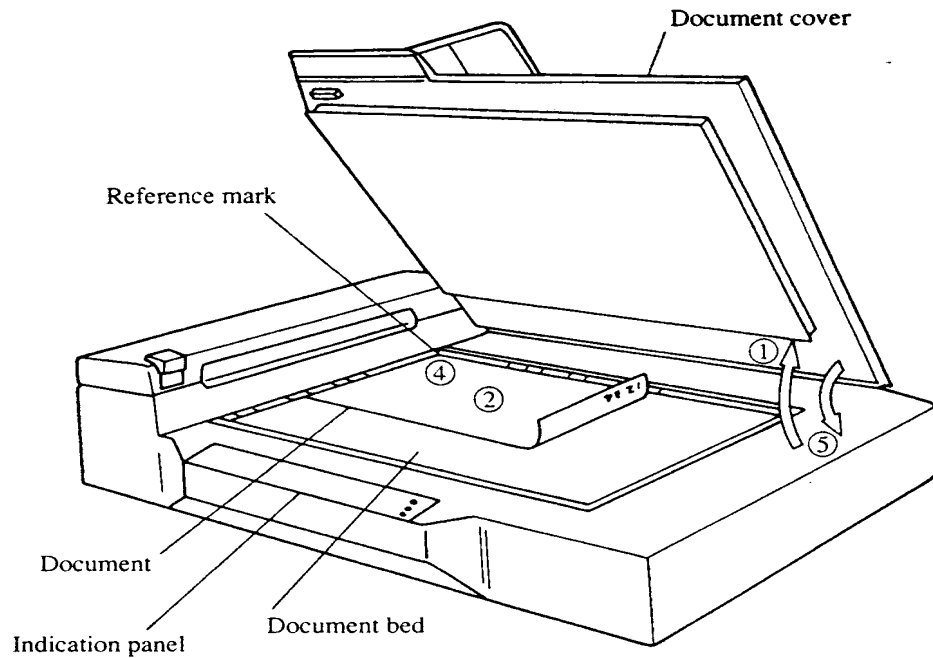
5.3 Cleaning

Cleaning is important to keep stable scanning. Cleaning section, tool and cycle are explained in Table 5.5.

Table 5.5 Cleaning of the scanner

No	Cleaning section		Tool	Cleaning cycle
1	ADF	Pad	Dry cloth and Isopropyle alcohol *1	
2		Rubber rollers (Pick roller, Feed roller, Ejection rollers)		5,000 sheets
3		Plastic rollers*2 (Coupled feed roller)	or	
4		White part of the guide	Cleaning paper *1	
5		Glass		
6		Sheet guide or other area		
7	FB	Document holding pad	Dry cloth and neutral cleanser *3 *4	
8		Document bed (glass)		

*1   Fujitsu recommends to use following cleaning tools, ask your dealer or Fujitsu sales representative if it is available.

Tool name	Part number	Description
Cleaner F1	CA91001-2316	Isopropyl alcohol 100ml
Cleaning paper	CA91001-2314	10 absorbent sheets

*2   Fujitsu recommends to use following cleaning tool when the plastic roller is heavily soiled.

Tool name	Part number	Description
Cleaner F2	CA91001-2317	Organic solvent 70ml

*3   Do not use organic solvents such as a thinner.
*4   Make sure no liquid enters the scanner from the edges of the document bed glass.

Labels in figure: Document cover, Document holding pad, Cloth, Document bed, Neutral cleanser, Thinner
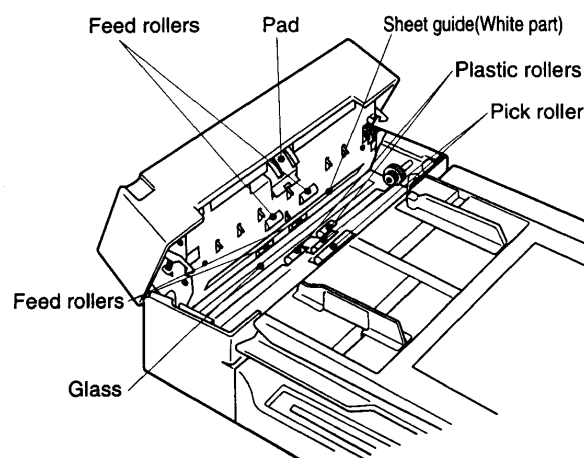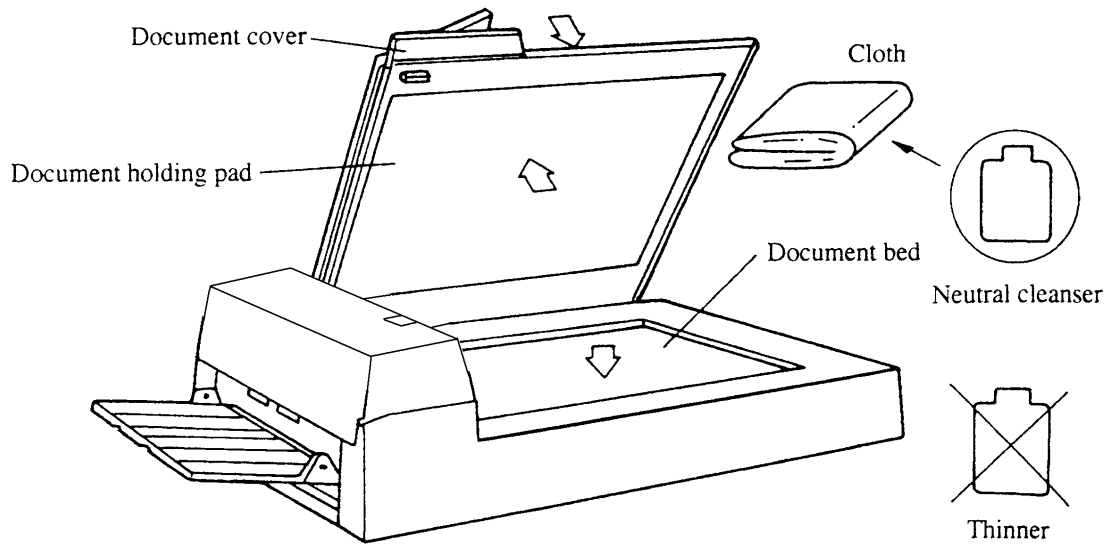
5.4　Consumable

Operator needs to replace following parts. It is recommended to use abrasion counter on the operator panel and schedule the replacement of parts. Parts to be replacement cycle are as follows.
The parts replacement procedures are described in the Operator's Guide.

Table 5.6　Parts replacement

No	Part name	Part number	Replacement cycle	Remarks
1	Pad ASY	PA03951-0021	Every 100,000 sheets or annually *1	One per scanner
2	Pick roller	PA03951-0025	Every 200,000 sheets or annually *1	One set per scanner (two rollers are in one set)

*1　These replacement cycle may be shortened depending on the paper scanned and bad scanner cleaning. When carbon-less paper is used, the replacement cycle becomes short so these parts must be prepared earlier than above.

Figure 5.3　Pad ASY

2 6 9

2 6 9
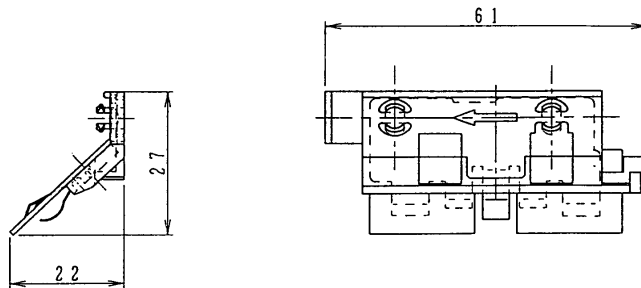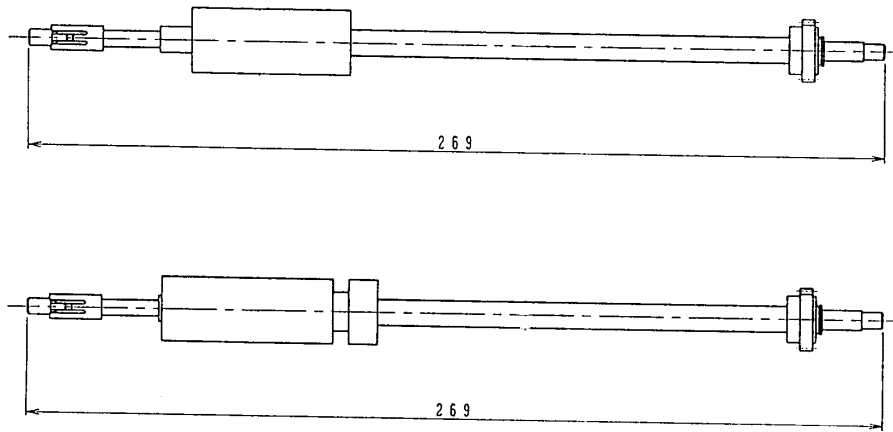
(Two rollers are included)

Figure 5.4 Pick roller

Chapter 6 Error display and Recovery

6.1　Error display

6.1.1　Temporary error

(1)　Hopper empty

Paper Empty

This message is displayed if there is no more paper on the ADF paper chute during a read operation in ADF mode. Fill the ADF paper chute with paper. To enable the read operation, press the stop button

(2)　Jam

Paper Jam

This message is displayed if a document is jammed in the ADF. See section 6.2 for removing jammed documents.

(3)　ADF cover open

ADF-Cover Open

This message is displayed if the ADF is not closed completely. Close the ADF completely, and enable the read operation.

(4)　Double feed error

Double Feed Error

This message is displayed when the ADF detects the Double feed error. Check the document and re-scan the document.

NOTICE:　The scanner stores the length of the first sheet. And scanner compares the length of scanned document with first sheet. Double feed is detected when the scanned document is longer than the first sheet. So each sheet length of the document must be same.

NOTICE:　The scanner can not detect the Double feed error when the documents completely overlap each other.

6.1.2　Alarm

One of the following message is displayed if an error occurs in the scanner. If one of the following error message is displayed, turn the power off and then on again. If the same message is displayed, contact your service representative.

(1)　Optical alarm front

Optical Alarm(F)

(2)　Optical alarm back

Optical Alarm(B)

(3)   FB mechanism alarm

    Mechanical Alarm

(4)   Motor fuse alarm

    Motorfuse Alarm

(5)   Lamp fuse alarm

    Lampfuse Alarm

(6)   Image transfer alarm

    Image Transfer Alarm

(7)   Memory alarm

    Memory Alarm

(8)   EEPROM alarm

    EEPROM Alarm

6.2   Jam clearance

If documents jam while being fed by the ADF, remove the jammed documents as follows.

(1)   Remove the documents from the ADF paper chute.
(2)   Pulling the ADF lever, open the ADF unit.
(3)   Remove the jammed documents.
(4)   Close the ADF until the ADF lever locks.

ADF lever

Automatic document feeder (ADF)
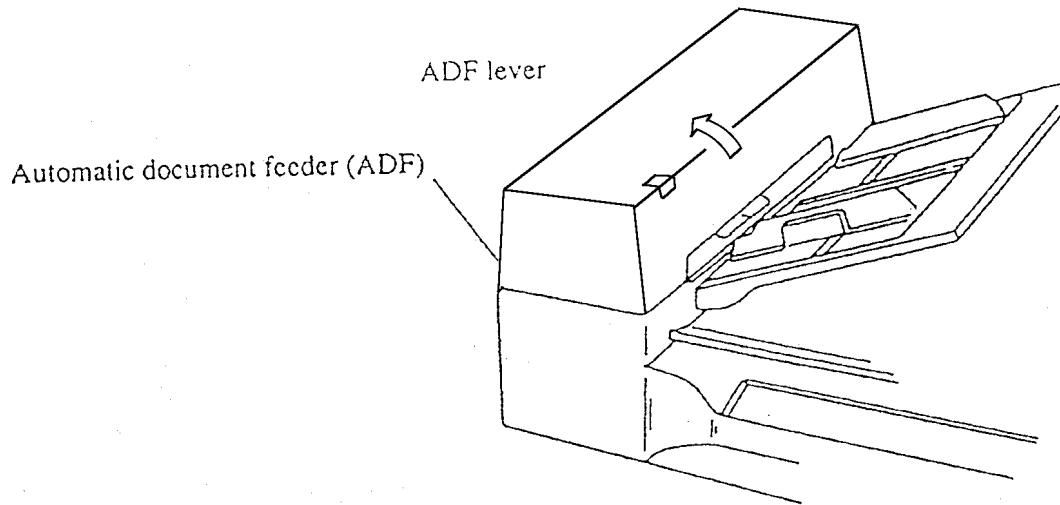
Figure 6.1 Jam clearance

Appendix A Scanner Interface

This image scanner and the host are connected via an 8-bit parallel interface. The interface follows the ANSI (American National Standards Institute) SCSI 2 (Small Computer System Interface 2) Revision 10c.

This chapter provides an overview of SCSI (minimum information necessary for understanding this scanner), as well as descriptions peculiar to the scanner. For details of SCSI, refer to the ANSI standard.

The following terms are needed to understand this section.

- SCSI device: A host adapter or a target controller that can be attached to the SCSI bus
- Initiator: An SCSI device (usually a host system) that requests an I/O process to be performed by another SCSI device (a target)
- Target: An SCSI device that performs an operation requested by an initiator
- Logical unit: A physical or virtual peripheral device that is addressable through a target

Range of support

(1)   System configuration

This scanner operates under the multi-initiator, multi-target environment. An initiator function is not provided. This scanner incorporates an integrated target and logical unit (image scanner).

SCSI ID: 0 to 7, variable by Digital switch: default is 5.

Logical unit number (LUN):   000, fixed

(2)   Bus phases

All phases are supported.

(3)   Commands

The following commands are supported by this scanner:

- INQUIRY
- OBJECT POSITION
- MODE SELECT (6)
- MODE SENSE (6)
- READ
- RELEASE UNIT
- REQUEST SENSE
- RESERVE UNIT
- SEND
- SEND DIAGNOSTIC
- SET SUBWINDOW
- SET WINDOW
- TEST UNIT READY
- SCAN

A control byte is not supported.   If the value other than X'00' is specified, an error is generated.

(4)   Statuses

     The following statuses are supported by this scanner:

- BUSY
- CHECK CONDITION
- GOOD
- RESERVATION CONFLICT

(5)   Messages

     The following messages are supported by this scanner:

- ABORT
- BUS DEVICE RESET
- COMMAND COMPLETE
- DISCONNECT
- IDENTIFY
- INITIATOR DETECTED ERROR
- MESSAGE PARITY ERROR
- MESSAGE REJECT
- NO OPERATION
- RESTORE POINTERS
- SAVE DATA POINTER
- SYNCHRONOUS DATA TRANSFER REQUEST

(6)   Others

     The bits and fields for which the word "Reserved" is described are checked. For a non-zero, an error is returned.

A.1 Physical Specifications

     The devices linked to this interface are daisy-chained with each other. A terminator is attached to the ends of the interface.   Interface specifications are shown below.

(1)   Connection

SCSI device	SCSI device	SCSI device

Terminator   Terminator
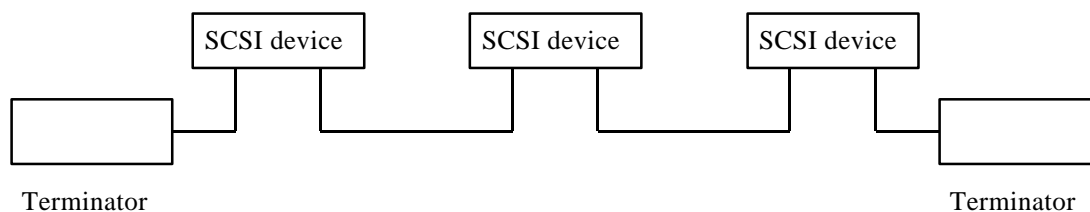
(2)   Physical specifications

Table A.1 SCSI physical specifications

Item		Specification
Driver/Receiver		Single-ended
Connector		50 Contact Shielded Low Density
Cable	Max. cable length	6 m
	Characteristic impedance	132 Ω
	Cable type	25 signal twisted pair
	Stub wire	≤ 0.1 mm (from main cable in scanner to internal wiring)
Signal level	Terminator	See the figure under (3).
	Driver/receiver	Open collector or three-state driver
	Output characteristics	Low level (true) = 0.0 to 0.5 VDC
		High level (false) = 2.5 to 5.25 VDC
		Output current = 48 mA (corresponding output voltage ≤ 0.5 V)
	Input characteristics	Low level (true) = 0.0 to 0.8 VDC
		High level (false) = 2.0 to 5.25 VDC
		Input load = -0.4 mA max. (at 0.4 V input voltage)
		Input hysteresis = 0.2 VDC min.
Connector pin assignments for signal lines		See (4).

(3)   Termination
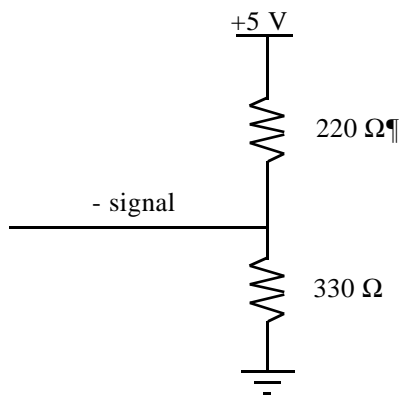
(4)   Pin assignments

Signal name	Pin number		Signal name
GND	1	26	-DB (0)
GND	2	27	-DB (1)
GND	3	28	-DB (2)
GND	4	29	-DB (3)
GND	5	30	-DB (4)
GND	6	31	-DB (5)
GND	7	32	-DB (6)
GND	8	33	-DB (7)
GND	9	34	-DB (P)
GND	10	35	GND
GND	11	36	GND
Reserved	12	37	Reserved
(Open)	13	38	TERMPWR
Reserved	14	39	Reserved
GND	15	40	GND
GND	16	41	-ATN
GND	17	42	GND
GND	18	43	-BSY
GND	19	44	-ACK
GND	20	45	-RST
GND	21	46	-MSG
GND	22	47	-SEL
GND	23	48	-C/ D
GND	24	49	-REQ
GND	25	50	-I/ O

Note:

Reserved pins are connected to GND.

Figure A.1 Pin assignment

A.2   SCSI Bus

A.2.1   System configuration

(1)   System configuration

The SCSI bus connects up to eight SCSI devices, each linked with a daisy chain. The both ends of the daisy chain require a terminator.

Each SCSI device operates as an initiator or a target, so that a series of operations are performed between a pair of initiator and target pair.

The system may be configured with any combination of initiators and targets as long as the number of the initiators and targets combined does not exceed eight.

(2)   Addresses of SCSI devices

Every SCSI device on the bus is assigned a unique address (SCSI ID) that corresponds to the data bus bit number. ID#7 through ID#0 correspond to DB7 through DB0. The SCSI ID provides identification for specifying particular SCSI device when an initiator selects a target or when a target reconnects an initiator.

SCSI ID also represents the priority for using the bus in the arbitration phase. (A description regarding the bus phase is given later.) Priorities are given in the descending order of data bus bit numbers (DBn), with the highest priority placed on ID#7 (DB7) and the lowest priority on ID#0 (DB0).

(3)   Peripheral equipment

With the basic specification, an initiator can designate up to eight peripheral devices (logical units) belonging to a single target, where the peripheral devices are used as the I/O units of the initiator. Logical units are identified and selected by specifying their LUNs (logical unit numbers) in the IDENTIFY message or command (CDB: command descriptor block).

This scanner is equipped with a target and a logical unit, and its LUN is 000.

A.2.2 Bus signals

Signal name		Type of signal	Initiator ⇨ ⇦ Target
Data	DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 (Data Bus n) DBP (Data Bus Parity)	Eight data-bit signals, plus a parity-bit signal that form a DATA BUS. DB(7) is the most significant bit and has the highest priority during the ARBITRATION phase. Bit number, significance, and priority decrease downward to DB(0). A data bit is defined as one when the signal value is true. A data bit is defined as zero when the signal value is false. Data parity DB(P) shall be odd. Parity is undefined during the ARBITRATION phase.	⇨ ⇦
Control signals	BSY (Busy)	An "ORtied" signal that indicates that the bus is being used	⇨ ⇦
	SEL (Select)	An "ORtied" signal used either by an initiator to select a target or by a target to reselect an initiator	⇨ ⇦
	RST (Reset)	An "ORtied" signal that indicates the RESET condition	⇨ ⇦
	C/ D (Control/Data) I/ O (Input/Output) MSG	The C/D, I/O, and MSG signals are used to distinguish between the different information transfer phases.	⇦
	REQ (Request)	During an information transfer phase, the target uses this signal to request the initiator to transfer data	⇦
	ACK (Acknowledge)	A signal driven by an initiator to indicate an acknowledgement for REQ/ACK data transfer handshake	⇨
	ATN (Attention)	A signal driven by an initiator to indicate the ATTENTION condition	⇨

A.2.3   Bus signal drive conditions

SCSI devices drive signals of the SCSI bus. The types of SCSI devices are summarized in the following table, showing the signals that they can drive for each operating phase of the interface.

There are two kinds of signal driving methods, OR tied and NON-OR tied, as shown in Table A.2. During an interface operating sequence, the BSY signal could be driven simultaneously by two or more SCSI units when the data bus is in the ARBITRATION or RESELECTION phase. This situation also occurs with the RST signal (Reset). These two signals must be ORtied. For the other signals, either of the two methods may be used; further more, different drive methods may coexist for a signal on the bus.

Table A.2 Bus phases vs. signal drive sources

Signal Bus phase	BSY	SEL	I/O	C/D MSG	REQ	ACK	DB7 to 0 DBP	ATN	RST
BUS FREE	N	N	N	N	N	N	N	N	A
ARBITRATION	A	W	N	N	N	N	ID	N	A
SELECTION	I&T	I	N	N	N	I	I	I	A
RESELECTION	I&T	T	T	T	T	I	T	I	A
COMMAND	T	N	T	T	T	I	I	I	A
DATA IN	T	N	T	T	T	I	T	I	A
DATA OUT	T	N	T	T	T	I	I	I	A
STATUS	T	N	T	T	T	I	T	I	A
MESSAGE IN	T	N	T	T	T	I	T	I	A
MESSAGE OUT	T	N	T	T	T	I	I	I	A

N: The signal shall be released, since it is not being driven by any SCSI device.

A: The signal shall be driven by all SCSI devices that are actively arbitrating.

I: If driven, this signal shall be driven only the active initiator.

T: If the signal is driven, it shall be driven only by the active target.

W: The signal shall be driven by the one SCSI device that wins arbitration.

ID: A unique data bit (the SCSI ID) shall be driven by each SCSI device that is actively arbitrating. The other seven data bits shall be released (shall not driven) by this SCSI device. The parity bit (DB (P)) may be released or driven to the true state, but shall never be driven to the false state during this phase.

I&T: The initiator and target drive the signal according to the interface operating sequence. The RESELECTION phase includes a sequence in which the initiator and target simultaneously drive the signal.

The signal shall be driven by the initiator, target, or both, as specified in the SELECTION phase and RESELECTION phase.

Table A.3 Method of driving the interface signal

	OR connection	NON-OR connection
False	No signal is driven by any SCSI device. Signal status is made false by the termination resistor circuits.	The signal is driven false by a certain SCSI device (initiator or target), or is not driven by any SCSI device.
True	A SCSI device drives the signal true.	

A.3 Bus Phases

The SCSI architecture includes the following eight distinct phases:

- BUS FREE phase
- ARBITRATION phase
- SELECTION phase
- RESELECTION phase
- COMMAND phase
- DATA phase
- STATUS phase   INFORMATION TRANSFER phase
- MESSAGE phase

The SCSI bus can never be in more than one phase at any given time.

The following diagram shows how each phase transits to another.
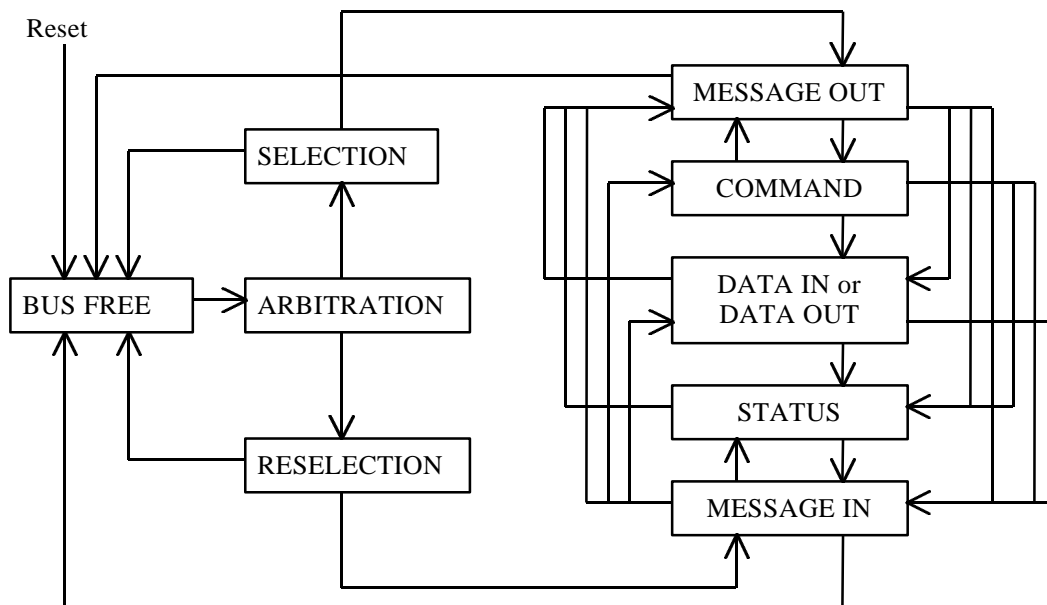
The signal delay times for each bus phase are defined as follows:

Figure 4.2 Phase sequence

Table A.4 Signal delay times definition   (1/2)

No.	Item	Time	Definition
1	Arbitration delay	2.4 μs	The minimum time an SCSI device shall wait from asserting BSY for arbitration until the DATA BUS can be examined to see if arbitration has been won. There is no maximum time.
2	Assertion period	90 ns	The minimum time that a target shall assert REQ (or REQB) while using synchronous data transfers. Also, the minimum time that an initiator shall assert ACK while using synchronous data transfers.
3	Bus Clear delay	800 ns	The maximum time for an SCSI device to stop driving all bus signals after: (1) The BUS FREE phase is detected (BSY and SEL both false for a bus settle delay) (2) SEL is received from another SCSI device during the ARBITRATION phase (3) The transition of RST to true. For the first condition listed, the maximum time for an SCSI device to clear the bus is 1200 nanoseconds from BSY and SEL first becoming both false. If an SCSI device requires more than a bus settle delay to detect BUS FREE phase, it shall clear the bus within a bus clear delay minus the excess time.
4	Bus free delay	800 ns	The minimum time that an SCSI device shall wait from its detection of the BUS FREE phase (BSY and SEL both false for a bus settle delay) until its assertion of BSY when going to the ARBITRATION phase.
5	Bus set delay	1.8 μs	The maximum time for an SCSI device to assert BSY and its SCSI ID bit on the DATA BUS after it detects BUS FREE phase (BSY and SEL both false for a bus settle delay) for the purpose of entering the ARBITRATION phase
6	Bus settle delay	400 ns	The minimum time to wait for the bus to settle after changing certain control signals as called out in the protocol definitions
7	Cable skew delay	10 ns	The maximum difference in propagation time allowed between any two SCSI bus signals measured between any two SCSI devices
8	Data release delay	400 ns	The maximum time for an initiator to release the DATA BUS signals following the transition of the I/O signal from false to true
9	Deskew delay	45 ns	The minimum time required for deskew of certain signals

Table A.4 Signal delay times definition   (2/2)

No.	Item	Time	Definition
10	Disconnection delay	200 μs	The minimum time that a target shall wait after releasing BSY before participating in an ARBITRATION phase when honoring a DISCONNECT message from the initiator
11	Hold time	45 ns	The minimum time added between the assertion of REQ (or REQB) or ACK (or ACKB) and the changing of the data lines to provide hold time in the initiator or target while using synchronous data transfers. REQB and ACKB timings only apply to optional wide data transfers.
12	Negation period	90 ns	The minimum time that a target shall negate REQ (or REQB) while using synchronous data transfers. Also, the minimum time that an initiator shall negate ACK (or ACKB) while using synchronous data transfers. REQB and ACKB timings only apply to optional wide data transfers.
13	Power-on to selection time	10 sec (recom-mended)	The recommended maximum time from power application until an SCSI target is able to respond with appropriate status and sense data to the TEST UNIT READY, INQUIRY, and REQUEST SENSE commands
14	Reset to selection time	250 ms (recom-mended)	The recommended maximum time after a hard RESET condition until an SCSI target is able to respond with appropriate status and sense data to the TEST UNIT READY, INQUIRY, and REQUEST SENSE commands
15	Reset hold time	25 μs	The minimum time over which RST must be kept asserted
16	Selection abort time	200 μs	The maximum time required from the moment when selection or deselection of an initiator or target is detected until BSY is asserted
17	Selection timeout delay	250 ms (recom-mended)	The minimum time required for an initiator or target in the selection or deselection phase to wait for a BSY response before it starts the timeout procedure
18	Transfer period	-	The minimum allowable period, during sync data transfer, between the start of consecutive REQ pulses and the start of consecutive ACK pulses

A.3.1   BUS FREE phase

The BUS FREE phase is used to indicate that no SCSI device is actively using the SCSI bus, and that it is available.

SCSI devices shall detect the BUS FREE phase after the SEL and BSY signals are both false for at least a bus settle delay.

SCSI devices shall release all SCSI bus signals within a bus clear delay after the BSY and SEL signals become continuously false for a bus settle delay.
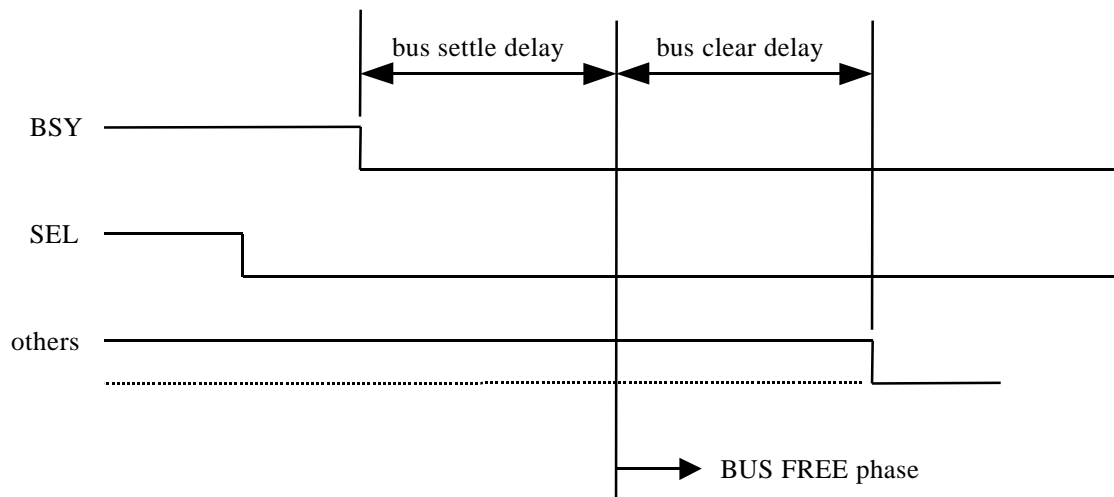
A.3.2   ARBITRATION phase

The ARBITRATION phase allows one SCSI device to gain control of the SCSI bus so that it can initiate or resume an I/O process. The procedure for an SCSI device to obtain control of the SCSI bus is as follows:

1)   The SCSI device shall first wait for the BUS FREE phase to occur.

2)   The SCSI device shall wait a minimum of a bus free delay after detection of the BUS FREE phase (i.e. after the BSY and SEL signals are both false for a bus settle delay) before driving any signal.

3)   Following the bus free delay in Step 2), the SCSI device may arbitrate for the SCSI bus by asserting both the BSY signal and its own SCSI ID, however, the SCSI device shall not arbitrate (i.e. assert the BSY signal and its SCSI ID) if more than a bus set delay has passed since the BUS FREE phase was last observed.

4)   After waiting at least an arbitration delay (measured from its assertion) the SCSI device shall examine the DATA BUS. If a higher priority SCSI ID bit is true on the DATA BUS (DB (7) is the highest), then the SCSI device has lost the arbitration and the SCSI device may release its signals and return to Step 1). If no higher priority SCSI ID bit is true on the DATA BUS, then the SCSI device has won the arbitration and it shall assert the SEL signal. Any SCSI device other than the winner has lost the arbitration and shall release the BSY signal and its SCSI ID bit within a bus clear delay after the SEL signal becomes true. An SCSI device that loses arbitration may return to Step 1).

5)   The SCSI device that wins arbitration shall wait at least a bus clear delay plus a bus settle delay after asserting the SEL signal before changing any signals.
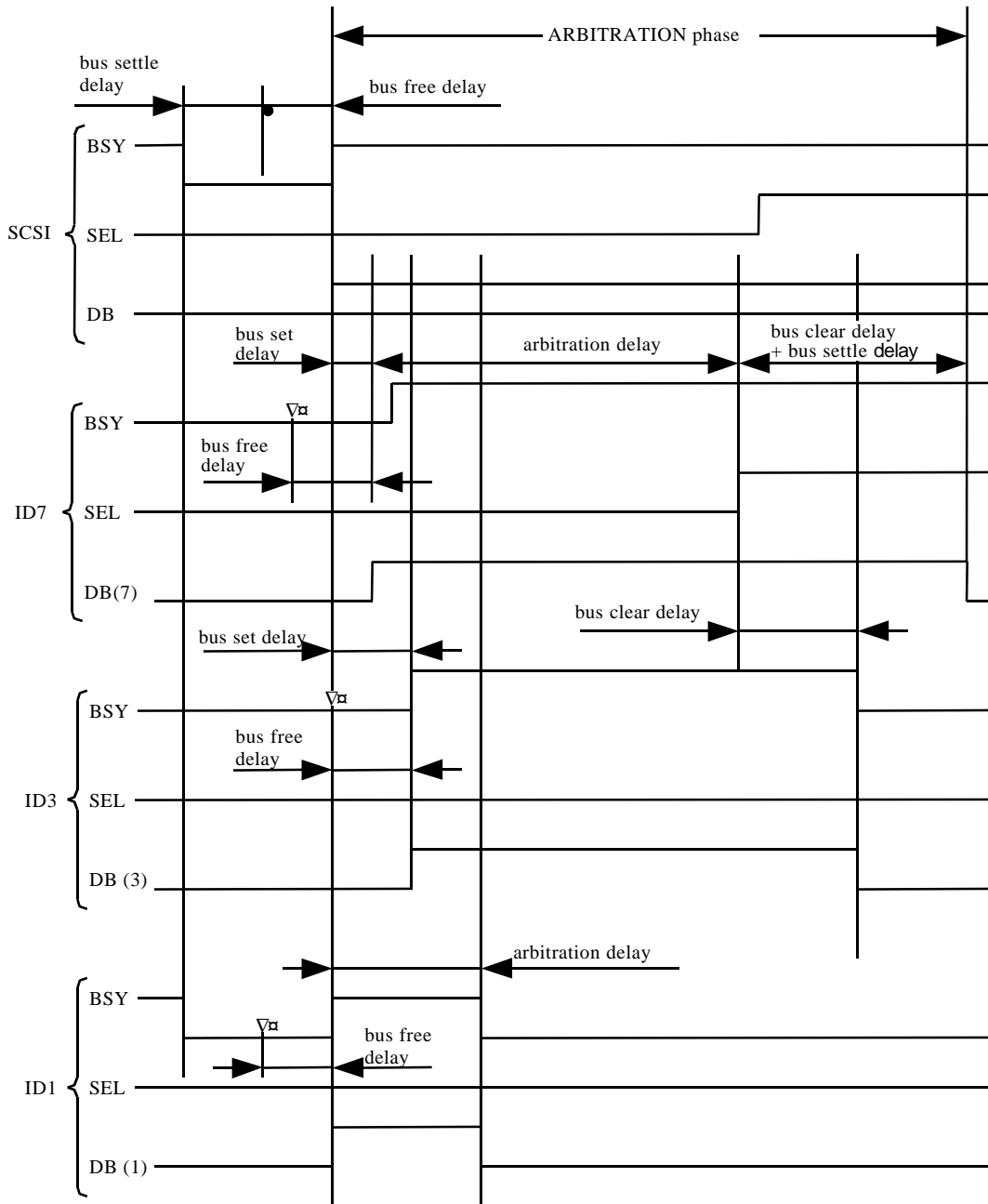
ID7:   Succeeds in ARBITRATION

ID3:   Detects the SEL signal of other SCSI unit

ID1:   Detects the SCSI ID with higher priority than itself

∇:   The point at which the BUS FREE phase is detected by each SCSI unit.

A.3.3   SELECTION phase

The SELECTION phase allows an initiator to select a target for the purpose of initiating some target function (e.g., READ or WRITE command). During the SELECTION phase the I/O signal is negated so that this phase can be distinguished from the RESELECTION phase.

1)   The SCSI device that won the arbitration has both the BSY and SEL signals asserted and has delayed at least a bus clear delay plus a bus settle delay before ending the ARBITRATION phase. The SCSI device that won the arbitration becomes an initiator by not asserting the I/O signal.

2)   The initiator shall set the DATA BUS to a value which is the OR of its SCSI ID bit and the target fs SCSI ID bit, and it shall assert the ATN signal.

3)   The initiator shall then wait at least two deskew delays and release the BSY signal.

4)   The initiator shall then wait at least a bus settle delay before looking for a response from the target.

5)   The target shall determine that it is selected when the SEL signal and its SCSI ID bit are true and the BSY and I/O signals are false for at least a bus settle delay. The selected target may examine the DATA BUS in order to determine the SCSI ID of the selecting initiator. The selected target shall then assert the BSY signal within a selection abort time of its most recent detection of being selected; this assertion is required for correct operation of the selection time-out procedure.

      The target shall not respond to a selection if bad parity is detected. Also, if more than two SCSI ID bits are on the DATA BUS, the target shall not respond to selection.

6)   No less than two deskew delays after the initiator detects the BSY signal is true, it shall release the SEL signal and may change the DATA BUS. The target shall wait until the SEL signal is false before asserting the REQ signal to enter an information transfer phase.
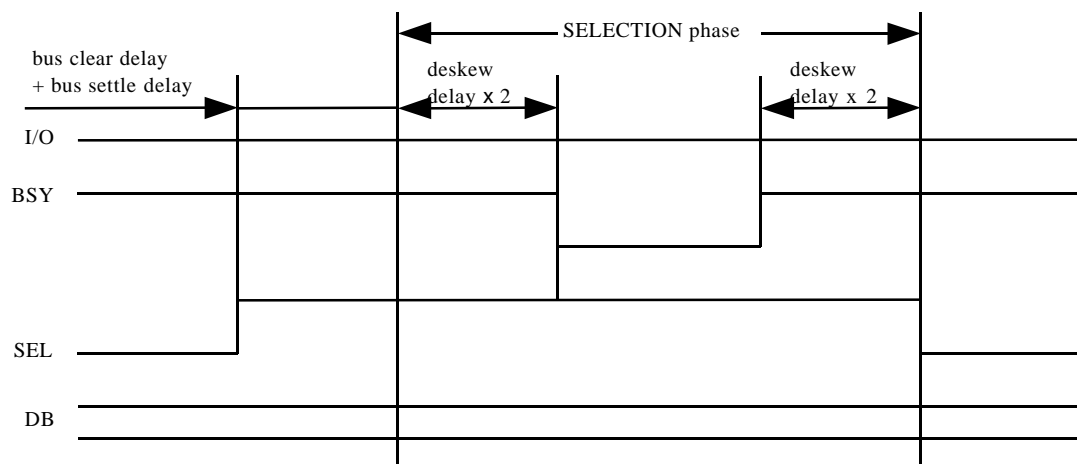
A.3.4　RESELECTION phase

RESELECTION is an optional phase that allows a target to reconnect to an initiator for the purpose of continuing some operation that was previously started by the initiator but was suspended by the target (i.e., the target disconnected by allowing a BUS FREE phase to occur before the operation was complete).

1)　Upon completing the ARBITRATION phase, the winning SCSI device has both the BSY and SEL signals asserted and has delayd at least a bus clear delay plus a bus settle delay. The winning SCSI device becomes a target by asserting the I/O signal.

2)　The winning SCSI device shall also set the DATA BUS to a value that is the logical OR of its SCSI ID bit and the initiator's SCSI ID bit.

3)　The target shall wait at least two deskew delays and release the BSY signal.

4)　The target shall then wait at least a bus settle delay before looking for a response from the initiator.

5)　The initiator shall determine that it is reselected when the SEL and I/O signals and its SCSI ID bit are true and the BSY signal is false for at least a bus settle delay. The reselected initiator may examine the DATA BUS in order to determine the SCSI ID of the reselecting target. The reselected initiator shall then assert the BSY signal within a selection abort time of its most recent detection of being reselected; this is required for correct operation of the time-out procedure. The initiator shall not respond to a RESELECTION phase if bad parity is detected. Also, the initiator shall not respond to a RESELECTION phase if other than two SCSI ID bits are on the DATA BUS.

6)　After the target detects the BSY signal is true, it shall also assert the BSY signal and wait at least two deskew delays and then release the SEL signal. The target may then change the I/O signal and the DATA BUS. After the reselected initiator detects the SEL signal is false, it shall release the BSY signal. The target shall continue asserting the BSY signal until it relinguishes the SCSI bus.
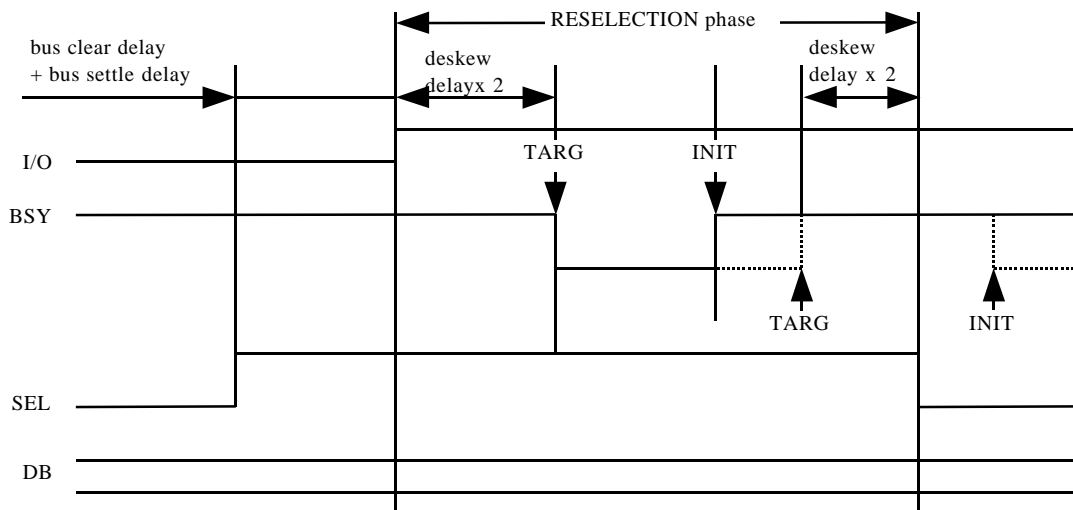
A.3.5   INFORMATION TRANSFER phases

Note:
   The COMMAND, DATA, STATUS, and MESSAGE phases are all grouped together as the information transfer phases because they are all used to transfer data or control information via the DATA BUS. The actual content of the information is beyond the scope of this section.

The C/D, I/O, and MSG signals are used to distinguish between the different information transfer phases (see Table A.5). The target drives these three signals and therefore controls all changes from one phase to another. The initiator can request a MESSAGE OUT phase by asserting the ATN signal, while the target can cause the BUS FREE phase by releasing the MSG, C/D, I/O, and BSY signals.

Table A.5 INFORMATION TRANSFER phase type

Phase	C/D	I/O	MSG	DB7 to 0, P	Transfer direction
DATA OUT	0	0	0	Data	INIT ⇒ TARG
DATA IN	0	1	0	Data	INIT ⇐ TARG
COMMAND	1	0	0	Command	INIT ⇐ TARG
STATUS	1	1	0	Status	INIT TARG
*	0	0	1	-	
*	0	1	1	-	
MESSAGE OUT	1	0	1	Message	INIT ⇒ TARG
MESSAGE IN	1	1	1	Message	INIT ⇐ TARG

* : Reserved for future standardization

0:	False
1	True
INIT:	Initiator
TARG:	Target
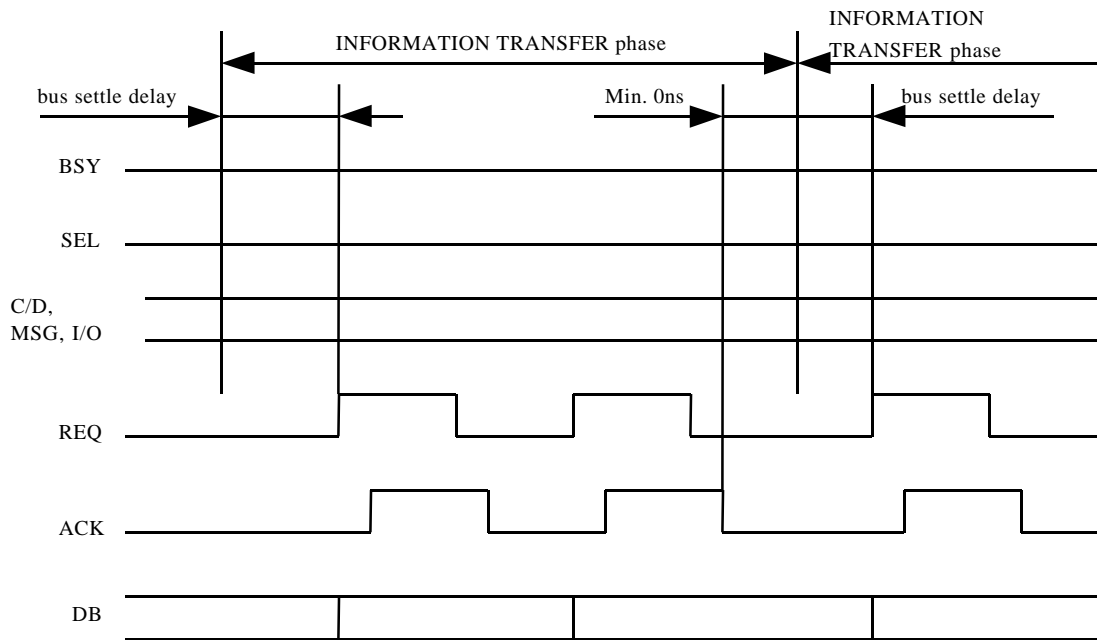
The INFORMATION TRANSFER phases use one or more REQ/ACK handshakes to control the information transfer. Each REQ/ACK handshake allows the transfer of one byte of information. During the INFORMATION TRANSFER phases the BSY signal shall remain true and the SEL signal shall remain false. Additionally, during the INFORMATION TRANSFER phases, the target shall continuously envelope the REQ/ACK handshake (s) with the C/D, I/O, and MSG signals in such a manner that these control signals are valid for a bus settle delay before the assertion of the REQ signal of the first handshake. These control signals remain valid until after the negation of the ACK signal at the end of the handshake of the last transfer of the phase.

(1)   Asynchronous information transfer

The target shall control the direction of information transfer by means of the I/O signal. When the I/O signal is true, information shall be transferred from the target to the initiator. When the I/O signal is false, information shall be transferred from the initiator to the target.

a.   Asynchronous transfer from target to initiator

If the I/O signal is true (transfer to the initiator), the target shall first drive the DB (7-0, P) signals to their desired values, delay at least one deskew delay plus a cable skew delay then assert the REQ signal. The DB (7-0, P) signals shall remain valid until the ACK signal is true at the target. The initiator shall read the DB (7-0, P) signals after the REQ signal is true then indicate its acceptance of the data by asserting the ACK signal. When the ACK signal becomes true at the target, the target may change or release the DB (7-0, P) signals and shall negate the REQ signal. After the REQ signal is false, the initiator shall then negate the ACK signal.

After the ACK signal is false, the target may continue the transfer by driving the DB (7-0, P) signals and asserting the REQ signal, as previously described.
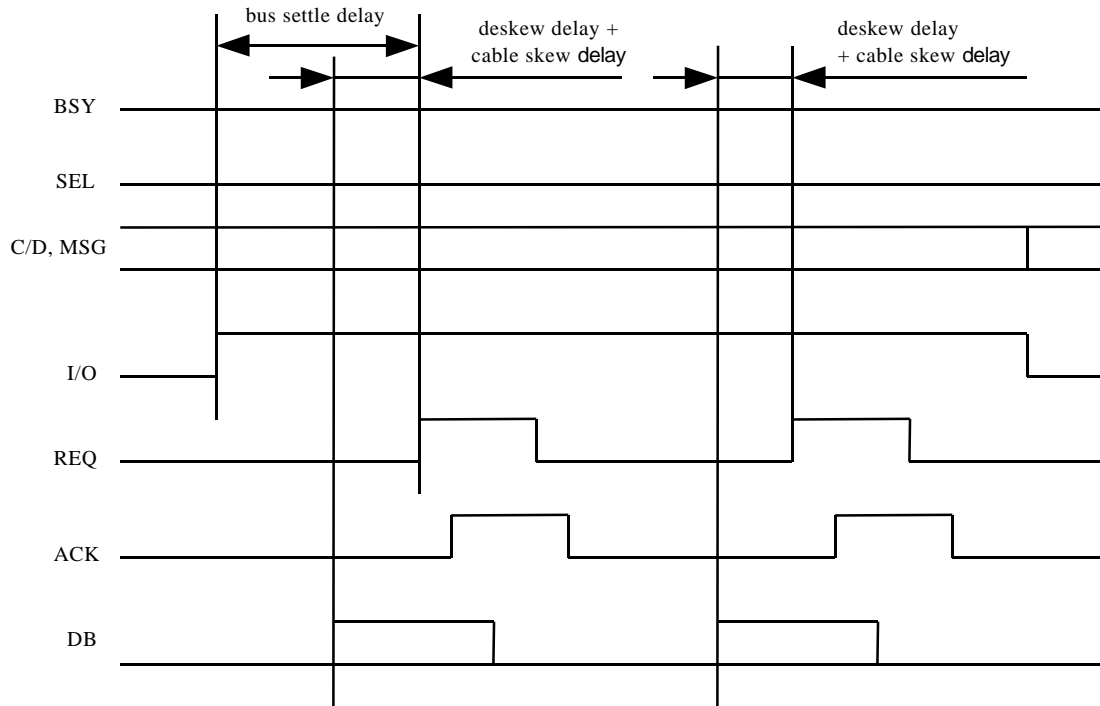
b.   Asynchronous transfer from initiator to target

If the I/O signal is false (transfer to the target), the target shall request information by asserting the REQ signal. The initiator shall drive the DB (7-0, P) signals to their desired values, delay at least one deskew delay plus a cable skew delay then assert the ACK signal. The initiator shall continue to drive the DB (7-0, P) signals until the REQ signal is false. When the ACK signal becomes true at the target, the target shall read the DB (7-0, P) signals then negate the REQ signal. When the REQ signal becomes false at the initiator, the initiator may change or release the DB (7-0, P) signals and shall negate the ACK signal. The target may continue the transfer by asserting the REQ signal, as previously described.

bus settle
delay

deskew delay +
cable skew delay

deskew delay
+ cable skew delay

BSY

SEL

C/D, MSG

I/O

REQ

ACK

DB
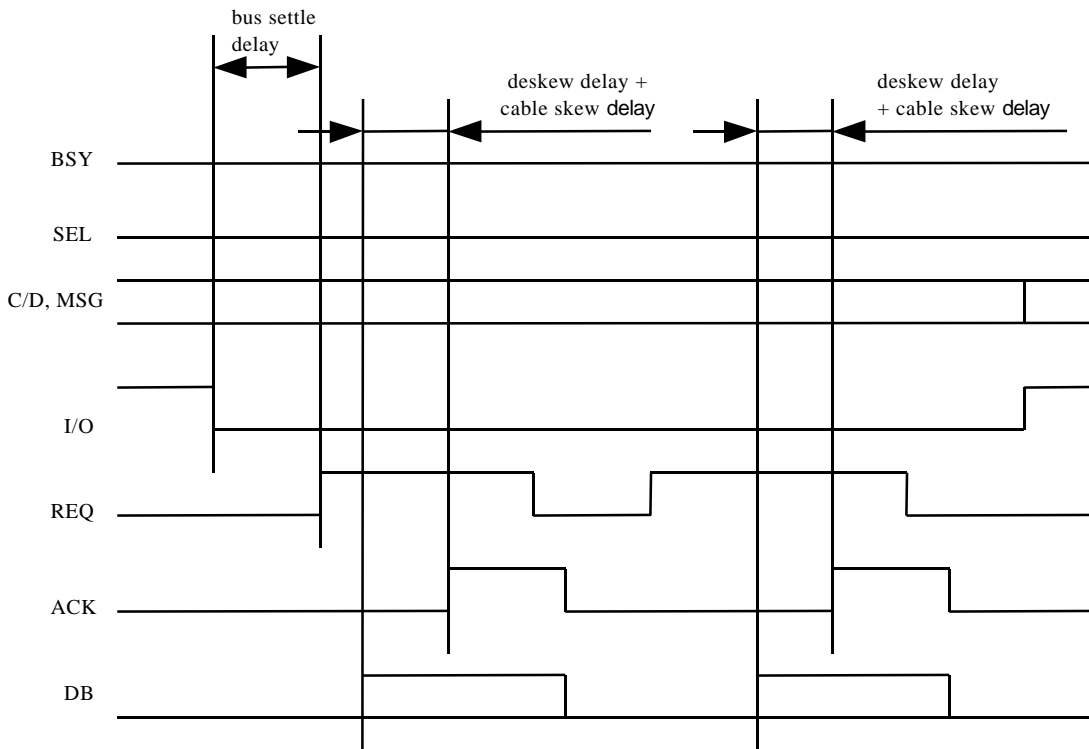
(2)   Synchronous information transfer

Synchronous data transfer is optional and is only used data phases. It shall be used in a data phase if a synchronous data transfer agreement has been established (see 4.6.2. (13)). The agreement specifies the REQ/ACK offset and the minimum transfer period.

The REQ/ACK offset specifies the maximum number of REQ pulses that can be sent by the target in advance of the number of ACK pulses received from initiator, establishing a pacing mechanism. If the number of REQ pulses exceeds the number of ACK pulses by the REQ/ACK offset, the target shall not assert the REQ signal until after the leading edge of the next ACK pulse is received. A requirement for successful completion of the data phase is that the number of ACK and REQ pulses be equal.

The target shall assert the REQ signal for a minimum of an assertion period. The target shall then wait at least the greater of a transfer period from the last transition of the REQ signal to true or a minimum of a negation period from the last transition of the ACK signal to false before asserting the ACK signal.

The initiator shall send one pulse on the ACK signal for each REQ pulse received. The ACK signal may be asserted as soon as the leading edge of the corresponding REQ pulse has been received. The Initiator shall assert the ACK signal for a minimum of an assertion period. The initiator shall wait at least the greater of transfer period from the last transition of the ACK signal to true or for a munimum of a negation period from the last transition of the ACK signal to false before asserting the ACK signal.

a. Synchronous transfer from target to initiator

If the I/O signal is true (transfer to the initiator), the target shall first drive the DB (7-0, P) signals to their desired values, wait at least one deskew delay plus one cable skew delay, then assert the REQ signals. The DB (7-0, P) signals shall be held valid for a minimum of one deskew delay plus one cable skew delay plus one hold time after the assertion of the REQ signal. The target shall assert the REQ signal for a minimum of an assertion period. The target may then negate the REQ signals within one hold time of the transition of the REQ signal to true. The initiator shall then respond with an ACK pulse.
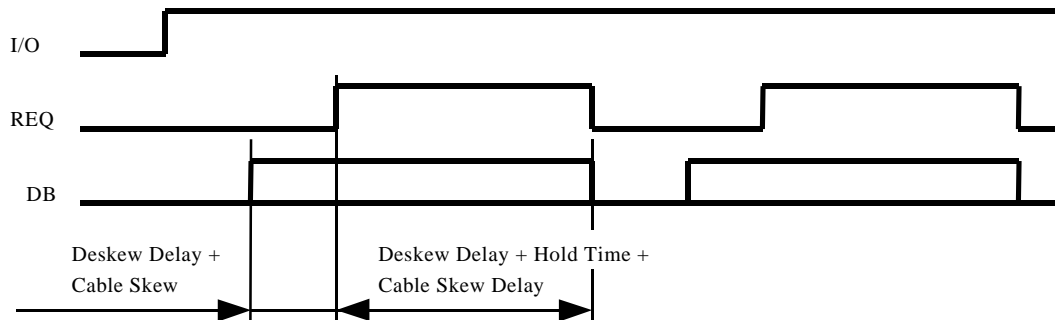
b. Synchronous transfer from initiator to target

If the I/O signal is false (transfer to the target), the initiator shall transfer one byte for each REQ pulse received. After receiving the leading edge of a REQ pulse, the initiator shall first drive the DB (7-0, P) signals to their desired values, delay at least one deskew delay plus one cable skew delay, then assert the ACK signal. The initiator shall hold the DB (7-0, P) signals valid for at least one deskew delay plus one cable skew delay plus one hold time after the assertion of the ACK signal. The initiator shall assert the ACK signal for a minimum of an assertion period. The initiator may then negate the ACK signal and may one hold time of the transition of the ACK signal to true.
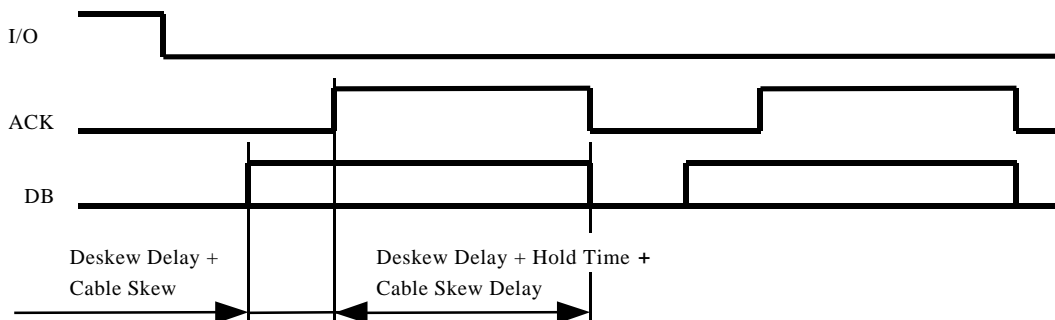
A.4 Commands

Commands are directions issued from an initiator to a target. This image scanner supports the following range of the commands specified by the SCSI standard.

(a)   The identification number of logical unit (LUN: logical unit number) is B'000'.

If this scanner receives a value other than 000, it returns error information as follows:

- Status key: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(b)   Relative addressing is not supported.

If this scanner receives a relative address (RelAdr) = 1, it returns error information as follows:

- Status key: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(c)   A control byte is not supported.

If this scanner receives a control byte $\neq$, X'00' , it returns error information as follows:

- Status key: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(d)   A bit and field described as "Reserved" are 0.

If this scanner receives a value other than 0, it returns error information as follows:

- Status key: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

The commands supported by this scanner

Table A.6 Commands

Command	Operation code (hex)	Description
RESERVE UNIT	16	Declares the exclusive use of a logical unit
RELEASE UNIT	17	Cancels the declaration of the execlusive use of a logical unit
INQUIRY	12	Examines the information regarding the target and logical unit
REQUEST SENSE	03	Requests a target for sense data
SEND DIAGNOSTIC	1D	Requests a target for self-check
TEST UNIT READY	00	Checks whether or not a logical unit is ready
SET WINDOW	24	Sets a window
SET SUBWINDOW	C0	Sets subwindows
SEND	2A	Sends Dither Matrix
OBJECT POSITION	31	Controls the automatic document feeder
READ	28	Requests transfer of image data
MODE SELECT	15	Selects operating mode of the device.
MODE SENSE	1A	Requests operating mode of the device.
SCAN	1B	Requests the target begin a scan operation

A.4.1 RESERVE UNIT command

The following table shows the normal sequence of the RESERVE UNIT command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies RESERVE UNIT (CDB)	→	
6	STATUS		←	Reports GOOD status
7	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
8	BUS FREE			

(1)   RESERVE UNIT command: COMMAND phase (initiator → target)

Where a logical unit can be accessed by two or more initiators, there could be interferences with command sequences, data, etc. This situation can be avoided by issuing the RESERVE UNIT command before initiating a series of operations.

Once a logical unit has properly accepted the RESERVE UNIT command, it will be occupied by the initiator that issued the RESERVE UNIT command.   If the 3rd party reservation option is supported, the logical unit might be occupied by another SCSI unit - one having an initiator function - which is specified TPID. In this condition, called "reserved,", the logical unit cannot be accessed from any other initiators. The reserved condition remains effective until one of the following events take place:

1)   The reservation is replaced by a new RESERVE COMMAND from the same initiator that has reserved the logical unit. (Issuing another RESERVE UNIT command with the reservation still effective does not results in an error. The previously established reservation is released as a result of 1), 2) or 3) described below.)

2)   The RELEASE UNIT command is issued from the same initiator that has reserved the logical unit.

3)   The BUS DEVICE RESET message is sent from any initiator.

4)   A hardware reset condition is detected.

The condition in effect after 3) or 4) is indicated by a sense key X'6' (UNIT ATTENTION), which is returned in response to a subsequent command.

When a logical unit is already reserved by another initiator, if a command other than RELEASE UNIT, INQUIRY, or REQUEST SENSE is issued, the target returns the following status:

- Status: B'01100' (RESERVATION CONFLICT)

The initiator having reserved a logical unit can change the reservation by issuing the RESERVE UNIT command to the same logical unit.

The command descriptor block (CDB) of this command is shown in the following illustration.
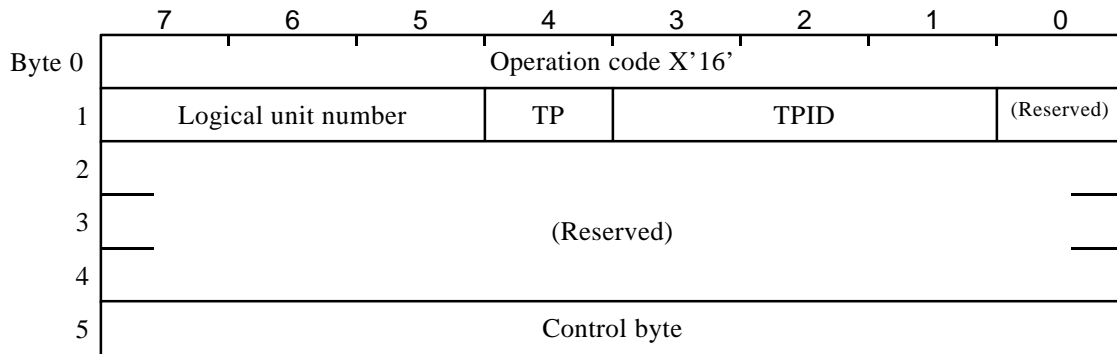
	7	6	5	4	3	2	1	0
Byte 0				Operation code X'16'				
1	Logical unit number			TP	TPID			(Reserved)
2								
3				(Reserved)				
4								
5				Control byte				

a.   TP (third party) : Byte 1

As this scanner does not support the 3rd party reservation option, setting this bit to 1 causes the target to return the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b.   TPID (third party device ID): Byte 1

This scanner ignores TPID.

A.4.2   RELEASE UNIT command

The following table shows the normal sequence of the RESERVE UNIT command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies RELEASE UNIT (CDB)	→	
6	STATUS		←	Reports GOOD status
7	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
8	BUS FREE			

(1)   RELEASE UNIT command: COMMAND phase (initiator → target)

The RELEASE UNIT command releases a reserved status. If this command comes from an initiator that has not declared reservation, the target ignores the command and responds with the GOOD status (the reserved status is not released).

The CDB of this command is shown in the following illustration.
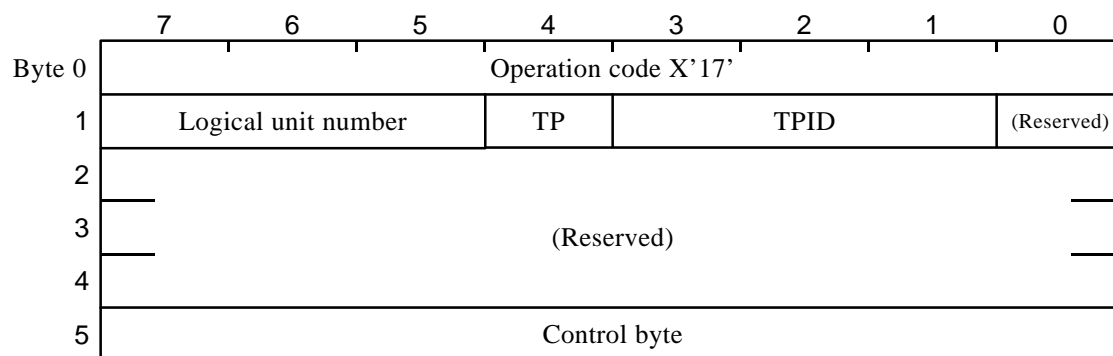
	7	6	5	4	3	2	1	0
Byte 0	Operation code X'17'							
1	Logical unit number			TP	TPID			(Reserved)
2								
3				(Reserved)				
4								
5	Control byte							

    a.   TP (third party): Byte 1

        As this scanner does not support the 3rd party reservation option, setting this bit to 1 causes the target to return the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

    b.   TPID (third party device ID):   Byte 1

        This scanner ignores TPID.

A.4.3   INQUIRY command

The following table shows the normal sequence of the INQUIRY command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies INQUIRY (CDB)	→	
6	DATA IN		←	Reports inquiry data
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
9	BUS FREE			

(1)   INQUIRY command: COMMAND phase (initiator → target)

        The INQUIRY command used to check information regarding a target and logical unit.

        The CDB of this command is shown in the following illustration.

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

a.   EVPD (enable vital product data) : Byte 1

The scanner returns the Standard inquiry data, if this bit is 0. If this bit is 1 and Page code is X'F0', M3093DG returns the Vital product data.

b.   Page code: Byte 2

The scanner supports page code for VPD page number specification. This is effective when EVPD is set to 1. If this bit is other than X'F0', the scanner returns the following error information.

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

c.   Allocation length: Byte 4

This field specifies the storage area in bytes that the initiator allocates for inquiry data. If a 0 is set here, inquiry data is not transferred, but this is not regarded as an error. The target terminates the DATA IN phase when it has transferred either the bytes of inquiry data specified in this field or all of effective inquiry data.

(2)   Standard inquiry data: DATA IN phase (target → initiator)

	7	6	5	4	3	2	1	0
Byte 0	Peripheral qualifier			Peripheral device type				
1	RMB	Device type qualifier						
2	ISO version		ECMA version			ANSI approved version		
3	AENC	(Reserved)			Response data format			
4	Additional length (n-4)							
5 6	(Reserved)							
7	RelAdr	Wbus32	Wbus16	SYNC	LINKED	CACHE	CMDQUE	SftRst
8 F	(MSB) Vendor identification (LSB)							
10 ∫ 1F	(MSB) Product identification (LSB)							
20 ∫ 23	(MSB) Product revision level (LSB)							
24 ∫ 5F	(Reserved)							

a.   Peripheral qualifier: Byte 0

Indicates the connection status of the devices under control of the target. This scanner returns B'000'.

b.   Peripheral device type: Byte 0

Indicates the type of the devices under control of the target. This scanner returns B'00110' (scanner).

c. Removable medium (RMB) : Byte 1

This scanner does not support RMB. This scanner returns B'0'.

d. Device type qualifier: Byte 1

This scanner does not support this field. This scanner always returns B'0000000'.

e. ISO version, ECMA version, ANSI approved version: Byte 2

Indicates the version number of the governing standard. This scanner returns X'02' (SCSI-2).

f. Asynchronous event notification capability (AENC) : Byte 3

This scanner does not support this field, so it returns B'0'.

g. Response data format: Byte 3

Indicates the standard, and its version number, that governs the format of inquiry data. This scanner returns B'0010' (SCSI-2).

h. Additional length (n-4) : Byte 4

Specifies the number of bytes, from byte 5 to the last byte. This value will not change with the allocation length value specified in CDB. This scanner returns X'5B' (the 91 bytes from byte 5 to byte 5F).

i. RelAdr, Wbus32, Wbus16: Byte 7

This scanner does not support RelAdr/ Wbus32/ Wbus16. This scanner returns B'000'.

j. SYNC (synchronous transfer) : Byte 7

This scanner returns B'1' ("gsynchronous transfer supported").

k. Linked, cache, CMDQUE: Byte 7

This scanner does not support linked/cache/CMDQUE. This scanner returns B'000'.

l. sftRst (Soft Reset) : Byte 7

This scanner performs Hardware Reset. This scanner returns B'0'.

m. Vendor identification: Bytes 8 to F

Indicates the vendor of the logical unit in ASCII code. The vendor name is left- justified, with the blank filled with spaces (X'20'). This scanner returns "FUJITSU".

n. Product identification: Bytes 10 to 1F

Indicates the product name in ASCII code. The name is left-justified, with the blank filled with spaces (X'20'). This scanner returns one of the following names:

Scanner type	M3097DG
Scanner without option	M3097DGdm
With IPC-2D option	M3097DGdim

o. Product revision level: Bytes 20 to 23

Indicates the version number of the product in ASCII code. This number is left- justified, with the blank filled with spaces (X'20').

(3)   Vital product data (JBMS compatible)

If the EVPD bit is 1 and the page code is X'F0' in the INQUIRY command, the command outputs the following vital product data:

	7	6	5	4	3	2	1	0
Byte 0				Peripheral device type				
1				Page number (F0)				
2				J Version				
3				Reserved				
4				Page length (m-5)				
5	(MSB)							
6				Basic X resolution				(LSB)
7	(MSB)							
8				Basic Y resolution				(LSB)
9		RES step X				RES step Y		
A	(MSB)							
B				Maximum X resolution				(LSB)
C	(MSB)							
D				Maximum Y resolution)				(LSB)
E	(MSB)							
F				Minimum X resolution				(LSB)
10	(MSB)							
11				Minimum Y resolution				(LSB)
12	(MSB)							
13				Standard resolution				(LSB)
14	(MSB)							
≷				Window width				
17								(LSB)
18	(MSB)							
≷				Window length				
1B								(LSB)
1C				Function				
1D				Reserved				
1E								
≷				Vender unique parameter byte				
n								

- Peripheral device type: Byte 0

  Indicates the type of device under control of the target. This scanner returns X'06' (scanner).
- Page number: Byte 1

  This scanner returns X'F0'.
- J version: Byte 2

  Indicates the JBMS or JIS version. This scanner returns X'02' (version 0.2).
- Page length: Byte 4

  Indicates the size of the page data. When the total byte length is m, the page length is m - 5. The scanner returns X'5F'.
- Basic X resolution: Bytes 5 and 6

  Indicates the resolution in the horizontal scanning direction. The scanner returns X'0190' (400 dpi).
- Basic Y resolution: Bytes 7 and 8

  Indicates the resolution in the vertical scanning direction. The scanner returns X'0190' (400 dpi).
- RES step X and RES step Y: Byte 9

  If the resolution can be changed with a fixed unit, this parameter indicates the fixed pixels-per-inch unit for both horizontal and vertical scanning resolutions. If the image processing option is not installed, the scanner returns X'00'. If the image processing option is installed, the scanner returns X'11'.
- Maximum X resolution: Bytes A and B

  Indicates the maximum resolution in the horizontal scanning direction.
  The scanner returns following value.

Without IPC option	With IPC option
X'0258' (600 dpi)	X'0320' (800 dpi)

- Maximum Y resolution: Bytes C and D

  Indicates the maximum resolution in the vertical scanning direction.
  The scanner returns following value.

Without IPC option	With IPC option
X'0258' (600 dpi)	X'0320' (800 dpi)

- Minimum X resolution: Bytes E and F

  Indicates the minimum resolution in the horizontal scanning direction.
  The scanner returns following value.

Without IPC option	With IPC option
X'0064' (100 dpi)	X'0032' (50 dpi)

- Minimum Y resolution: Bytes 10 and 11

  Indicates the minimum resolution in the vertical scanning direction.
  The scanner returns following value.

Without IPC option	With IPC option
X'0064' (100 dpi)	X'0032' (50 dpi)

- Standard resolution: Bytes 12 and 13

  As shown in the table below, this parameter specifies the bits that correspond to the
  resolutions that can be specified.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 12	60	75	100	120	150	160	180	200
Byte 13	240	300	320	400	480	600	800	1200

  The scanner returns following value.

Without IPC option	With IPC option
X'29D4'	X'FFFE'

- Window width: Bytes 14 to 17

  Indicates the width of the data that can be read by the scanner in basic X resolution dots.
  This scanner returns X'00001300'.

- Window length: Bytes 18 to 1B

  Indicates the length of the data that can be read by the scanner in basic Y resolution dots.
  This scanner returns X'00001B00'.

- Function: Byte 1C

  Selects functions from the table below. This scanner returns X'0E' or X'0F'.

Byte	Bit	Description
1C	Bit 0	Data overflow
		This bit is set to 1 for an image scanner in which an overflow can occur. The bit is set to 0 for an image scanner in which an overflow does not occur.
	Bit 1	Monochrome function (black and white)
		This bit is set to 1 if the image scanner has the monochrome (black and white) function. The bit is set to 0 if the image scanner does not have this function.
	Bit 2	Dither and half-tones
		This bit is set to 1 if the image scanner has the dithering and halftones functions. The bit is set to 0 if the image scanner does not have these functions.
	Bit 3	Multilevel (gray scale)
		This bit is set to 1 if the image scanner has the multilevel (gray scale) function. The bit is set to 0 if the image scanner does not have this function.
	Bit 4	Reserved (Bits 4 to 7 are reserved for JBMS)
	Bit 5	Monochrome (RGB color)
		This bit is set to 1 if the image scanner has the monochrome (black and white) function. The bit is set to 0 if the image scanner does not have this function.
	Bit 6	Dithering and halftones (RGB color)
		This bit is set to 1 if the image scanner has the dithering and halftones functions. The bit is set to 0 if the image scanner does not have these functions.
	Bit 7	Multilevel (RGB color)
		This bit is set to 1 if the image scanner has the multilevel (RGB color) function. The bit is set to 0 if the image scanner does not have this function.

Vendor unique parameter bytes (standard VPD page extended format)

	7	6	5	4	3	2	1	0
Byte 1E				Reserved				
1F				Reserved				
20 ... 21				Physical function				
22 ... 25				Buffering capability				
26 ... 29				Implemented standard command				
2A ... 31				Implemented vender specific command				
32 ... 51				Implemented vender unique parameter				
52 ... 57				Image control function				
58 ... 59	(MSB)			Image processing function				(LSB)
5A ... 5B	(MSB)			Compressing function				(LSB)
5C ... 5D	(MSB)			Endorser function				(LSB)
5E ... 61	(MSB)			Barcode function				(LSB)
62 ... 63				Reserved				

- Physical function: Bytes 20 and 21

```
        7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 20│   │   │   │   │   │   │   │ 0 │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```

→ Operator panel

→ Barcode

→ Endorser (stamp)

→ Duplex

→ Trancepareny

→ Flatbed

→ Automatic document feeder

1: The function is installed.
0: The function is not installed.
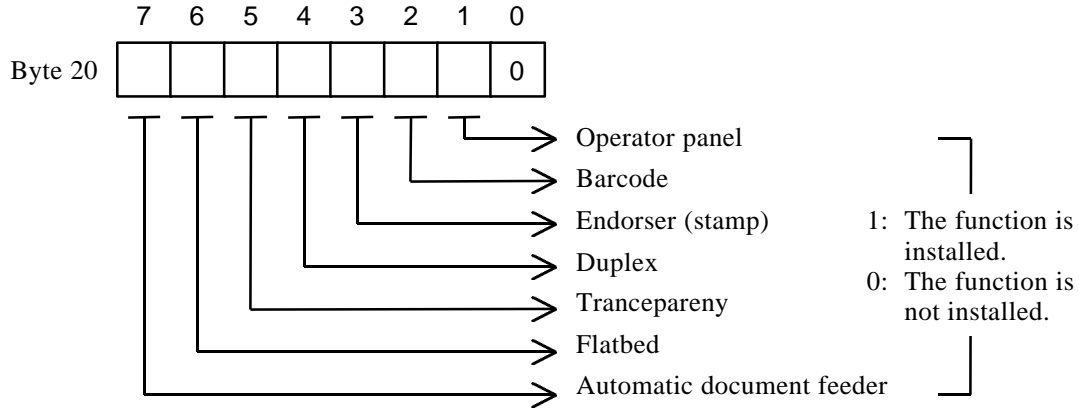
The scanner returns B'11010000'.

```
        7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 21│ 0 │ 0 │ 0 │ 0 │   │   │   │   │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```

→ Bit count for A-D converter
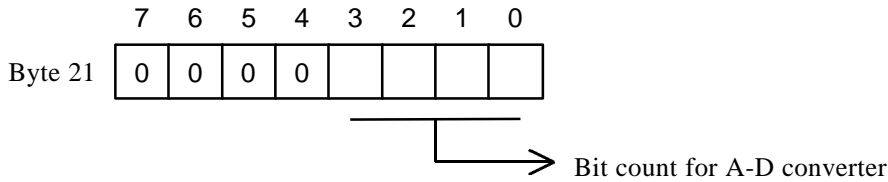
The scanner returns B'00001000'.

- Buffering capability: Bytes 22 to 25

Indicates the capacity of the image memory installed in the scanner.

The scanner returns X'01000000' (16M) if the memory option is not installed. The scanner returns a value appropriate for the memory capacity if the memory option is installed.

- Implemented standard command: Byte 26 to 29

Indicates the commands supported by the scanner. The bit is set to 1 if a command is supported. The bit is set to 0 if a command is not supported.

```
         7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 26│ 0 │ 0 │ 0 │ 0 │ 0 │ 0 │   │   │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```
Mode select (10)
Mode sense (10)

```
         7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 27│   │   │   │   │   │   │   │   │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```
Get data buffer status
Compare
Copy and verify
Write buffer
Read buffer
Change definition
Log select
Log sense

```
         7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 28│   │   │   │   │   │   │   │   │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```
Scan
Receive diagnostic results
Send diagnostic
Set widow
Get widow
Read
Send
Object position

```
         7   6   5   4   3   2   1   0
       ┌───┬───┬───┬───┬───┬───┬───┬───┐
Byte 29│   │   │   │   │   │   │   │   │
       └───┴───┴───┴───┴───┴───┴───┴───┘
```
Test unit ready
Request sense
Inquiry
Mode select (6)
Reserve unit
Release unit
Copy
Mode sense (6)

The scanner returns B'0000 0000 0000 0000 1110 1101 1011 1111' = X'0000EDBF'.

- Implemented vendor-specific command: Bytes 2A to 31

    A vendor-specific command consists of four field, each consisting of two byte. The bit location of each field indicates the lower four bits of a command code supported by the scanner.

Bytes	Field description
2A, 2B	Vendor specific command field – CXh
2C, 2D	Vendor specific command field – DXh
2E, 2F	Vendor specific command field – EXh
30, 31	Vendor specific command field – FXh

4 fields

Bit Byte	7	6	5	4		2	1	0
0	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
1	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

2-byte configuration

Field & bit	Command	Code
CXh 0	Set subwindow	C0h
DXh		
EXh		
FXh		

The scanner returns CXh = X'0001', DXh = X'0000', EXh = X'0000', and FXh = X'0000'.

- Implemented vendor unique parameter: Bytes 32 to 51

  Of the vendor unique parameters defined by the SET WINDOW command, this indicates only the supported parameter. The implemented vendor unique parameter consist of of 16 fields, each consisting of two bytes. The bit location of each field indicates the lower four bits of the vendor unique parameter code (vendor unique ID) supported by the scanner.

Bytes	Field description
32, 33	Vendor unique parameter – 0Xh
34, 35	Vendor unique parameter – 1Xh
36, 37	Vendor unique parameter – 2Xh
38, 39	Vendor unique parameter – 3Xh
3A, 3B	Vendor unique parameter – 4Xh
3C, 3D	Vendor unique parameter – 5Xh
3E, 3F	Vendor unique parameter – 6Xh
40, 41	Vendor unique parameter – 7Xh
42, 43	Vendor unique parameter – 8Xh
44, 45	Vendor unique parameter – 9Xh
46, 47	Vendor unique parameter – AXh
48, 49	Vendor unique parameter – BXh
4A, 4B	Vendor unique parameter – CXh
4C, 4D	Vendor unique parameter – DXh
4E, 4F	Vendor unique parameter – EXh
50, 51	Vendor unique parameter – FXh

  The scanner returns X'0001 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000'. (00 only)

- Image control function: Bytes 52 to 57

  - Indicates supplementary information for parameters defined in the SET WINDOW command.

  a) Brightness steps: Byte 52

      Indicates the brightness level. X'00' indicates that the brightness function is not supported. The scanner returns X'FF'.

  b) Threshold steps: Byte 53

      Indicates the threshold level. X'00' indicates that the threshold function is not supported. The scanner returns X'FF'.

  c) Contrast steps: Byte 54

      Indicates the contrast level. X'00' indicates that the contrast function is not supported. The scanner returns X'FF'.

  d) Reserved: Byte 55

e) Number of resident dither patterns and number of registrable dither patterns: Byte 56
   Indicates the number of internal dither patterns and the number of dither patterns that can be downloaded.
   B'nnnnXXXX': Number of internal dither patters (upper 4 bits)
   B'XXXXnnnn': Number of dither patterns that can be downloaded (lower 4 bits)
   The scanner returns X'48'.

f) Number of resident gamma patterns and number of registrable gamma patterns: Byte 57
   B'nnnnXXXX': Number of internal gamma patterns (upper 4 bits)
   B'XXXXnnnn': Number of gamma patterns that can be downloaded (lower 4 bits)
   The scanner returns X'38'.

g) Image processing function: Bytes 58 and 59
   Indicates the supported image processing functions.

Byte	Bit	Description
58	1XXXXXXX b	Black and white reversal
	X1XXXXXX b	Automatic I (automatic monochrome: DTC)
	XX1XXXXX b	Automatic II (simple automatic monochrome)
	XXX1XXXX b	Edge detection
	XXXX1XXX b	Edge highlighting
	XXXXX1XX b	Image area separation
	XXXXXX1X b	Mirror image
	XXXXXXX1 b	Unique white level
59	1XXXXXXX b	Subwindow
	X1XXXXXX b	Error distribution
	XX1XXXXX b	Reserved
	XXX1XXXX b	Reserved
	XXXX1XXX b	Reserved
	XXXXX1XX b	Reserved
	XXXXXX1X b	Reserved
	XXXXXXX1 b	Reserved

The scanner returns X'0140' if the image processing option is not installed. The scanner returns X'FFC0' if the image processing option is installed.

h) Compression function: Bytes 5A and 5B
Indicates the supported compression function.

Byte	Bit	Description
5A	1XXXXXXX b	MH
	X1XXXXXX b	MR
	XX1XXXXX b	MMR
	XXX1XXXX b	JBIG
	XXXX1XXX b	JPEC Base line system
	XXXXX1XX b	JPEG Extended system
	XXXXXX1X b	JPEG Independent function
	XXXXXXX1 b	Reserved
5B	00000000 b	Reserved

The scanner returns X'E000'.

i) Endorser function: Bytes 5C to 5D
Indicates the supported endorser function.

Byte	Bit	Description
5C	1XXXXXXX b	Mechanical endorser
	X1XXXXXX b	Stamper
	XX1XXXXX b	Electrical endorser
	XXX1XXXX b	Reserved
	XXXXnnnn b	Maximum endorser identifiers
5D	00000000 b	Reserved

The scanner does not support the endorser. The scanner returns X'0000'.

j) Bar code function: Bytes 5E, 5F, 60, and 61
    Indicates the supported bar code function.

Byte	Bit	Description
5E	0000XXXX b	Reserved
	XXXXnnnn b	Maximum barcode window
5F	1XXXXXXX b	WPC (EAN-13, EAN-8, UPC-A, UPC-E)
	X1XXXXXX b	EAN-13, EAN-8
	XX1XXXXX b	UPC-A, UPC-E
	XXX1XXXX b	UPC-D1
	XXXX1XXX b	UPC-D2
	XXXXX1XX b	UPC-D3
	XXXXXX1X b	UPC-D4
	XXXXXXX1 b	UPC-D5
60	1XXXXXXX b	2 OF 5 Interleaved
	X1XXXXXX b	2 OF 5 Standard
	XX1XXXXX b	Codabar (NW7)
	XXX1XXXX b	Code39
	XXXX1XXX b	Code93
	XXXXX1XX b	Code128
	XXXXXX1X b	Reserved
	XXXXXXX1 b	Reserved
61	00000000 b	Reserved

The scanner does not support bar code reading. The scanner returns X'00000000'.

A.4.4   REQUEST SENSE command

The following table shows the normal sequence of the REQUEST SENSE command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies REQUEST SENSE (CDB)	→	
6	DATA IN		←	Reports sense data
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
9	BUS FREE			

(1)   REQUEST SENSE command: COMMAND phase (initiator → target)

The REQUEST SENSE command requests the sense data that shows the status of a logical unit. On receiving this command, the target sets the unit•fs status in the sense data and returns it to the initiator.

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'03'							
1	Logical unit number			(Reserved)				
2	(Reserved)							
3								
4	Allocation length							
5	Control byte							
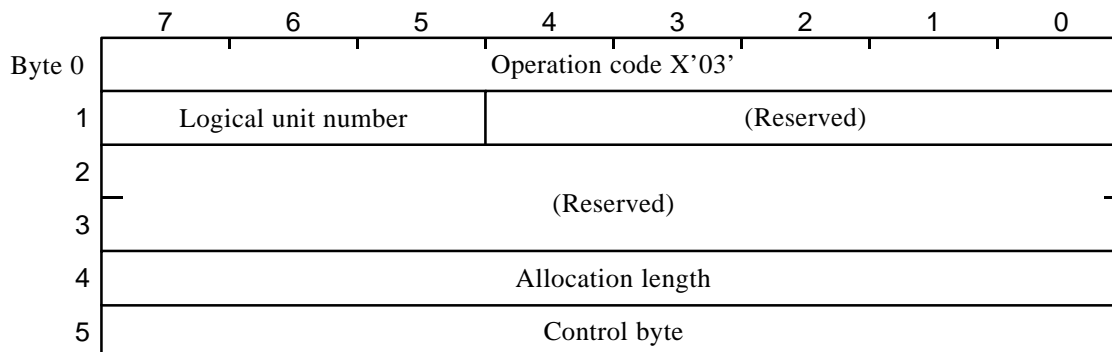
a.   Allocation length: Byte 4

Specifies the storage area in bytes that the initiator allocates for sense data. If a 0 is set here, sense data is not transferred, but this is not treated as an error. The target terminates the DATA IN phase when it has transferred either the bytes of sense data specified in this field or all of effective sense data.

(2)   Sense data: DATA IN phase (target → initiator)

The target creates sense data if its status is B'00001' (CHECK CONDITION) or if a BUS FREE error has occurred. This scanner creates sense data when any of the errors described later is encountered.

The sense data on this scanner is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Valid	Error code						
1	Segment number							
2	FM	EOM	ILI	(Reserved)	Sense key			
3	(MSB)							
⌇	Information bytes							(LSB)
6								
7	Additional sense length							
8	(MSB)							
	Command-specific information byte							(LSB)
B								
C	Additional sense code							
D	Additional sense code qualifier							
E	Field replaceable unit code							
F	SKSV							
10	Sense-key specific bytes							
11								
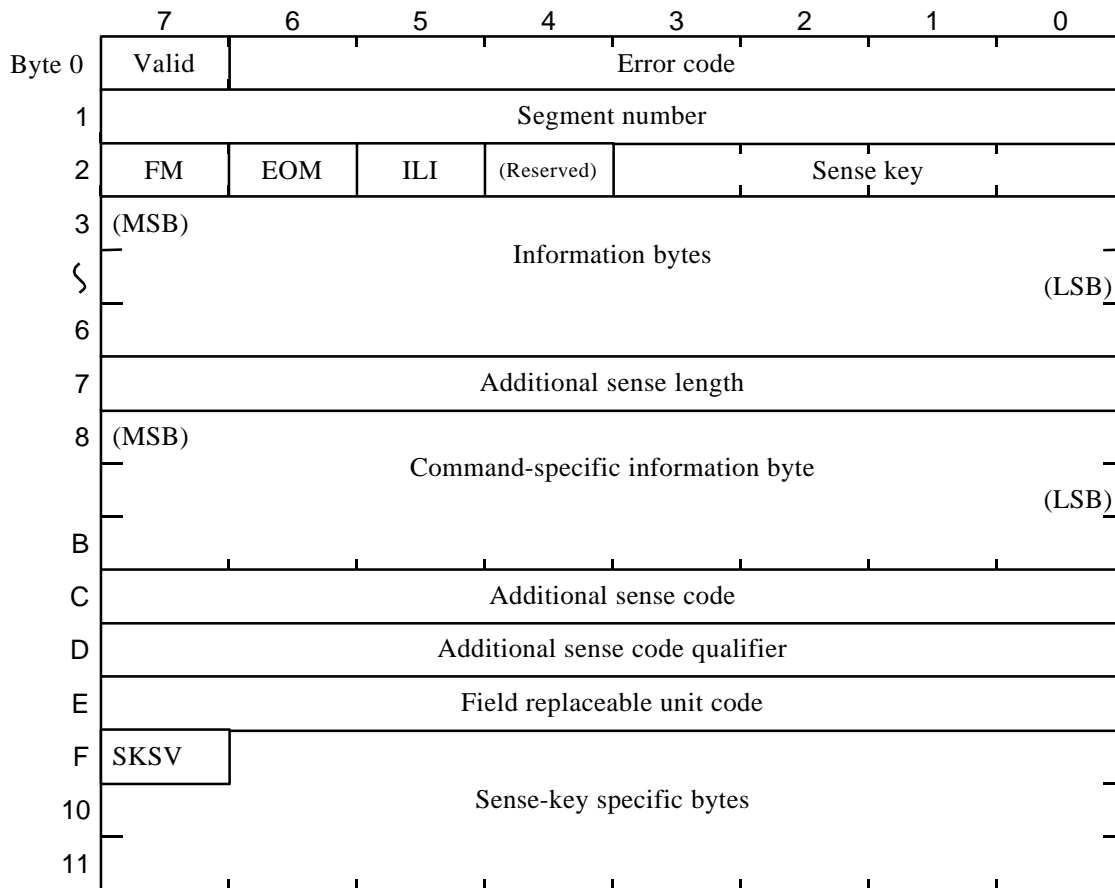
a.   Valid: Byte 0

Indicates whether or not the INFORMATION BYTES field is as specified by ANSI. This scanner returns B'1' ("specified by ANSI").

b.   Error code: Byte 0

Differentiates between current error or deferred error. This scanner returns X'70'
("CURRENT ERROR").

c.   Segment number: Byte 1

This scanner does not support SEGMENT NUMBER. This scanner returns X'00'.

d.   FM (file mark) :   Byte 2

This scanner does not support FM. This scanner returns B'0'.

e.   EOM (end of medium) :   Byte 2

Indicates the completion of window reading: 1 when completed, 0 when not completed

f.   ILI (incorrect length indicator) :   Byte 2

Indicates that an error in logical block length has been detected

g.   Sense key: Byte 2

Indicates the logical unit status using a sense key. This scanner supports the sense keys
shown in the following table:

Sense key	Status of logical unit
0	NO SENSE The logical unit has no information to be specifically described in a sense key. This status occurs because either a command has succeeded, or because a command has terminated in the CHECK CONDITION status since the ILI bit has been set to 1.
2	NOT READY The specified logical unit cannot be accessed.
3	MEIDUM ERROR A command has terminated because of a trouble with the medium. Typical causes of this error with this scanner are that the ADF paper chute is empty, paper is jammed in the ADF, or the ADF cover has been opened.
4	HARDWARE ERROR An unrecoverable error was detected.
5	ILLEGAL REQUEST An illegal parameter exists either in a command (CDB), or in a group of parameters sent in the DATA OUT phase following a command.
6	UNIT ATTENTION The target has been reset.
B	ABORTED COMMAND The target has aborted a command.

h. Information bytes: Bytes 3 to 6

The information in this field is effective if ILI is 1. This scanner returns the remainder (2's complement for any negative value) so the requested transfer amount subtracted by the actual transfer amount.

i. Additional sense length: Byte 7

Specifies the number of sense bytes that follows. Even if all additional sense bytes cannot be tranferred because the allocation length in CDB is small, the value in this field is not adjusted to indicate the remaining data. This scanner always assumes X'0A'.

j. Command-specific information bytes: Bytes 8 to B

On this scanner, this field is not supported and is fixed to X'00000000'.

k. Additional sense code, additional sense code qualifier: Bytes C and D

A combination of these fields specifies detailed information about the error reported in the sense key. This scanner reports the following information:

Sense key	Additional sense code	Additional sense code qualifier	Description
0	00	00	No-sense
2	00	00	Not ready
3	80	01	Jam
3	80	02	ADF cover open
3	80	03	Document chuter empty of paper
3	80	04	Detects job separation sheet (See Appendix A.5)
4	80	01	Blown fuse for FB motor
4	80	03	Blown lamp fuse
4	80	04	Blown fuse for ADF motor
4	80	05	Mechanical alarm
4	80	06	Optical alarm
4	44	00	Abnormal internal target
4	47	00	SCSI parity error
5	00	00	Page end is detected before reading (VGATE ON) when page end detection is enabled.
5	1A	00	Parameter length illegal
5	20	00	Invalid command
5	24	00	Invalid field in CDB
5	25	00	Unsupported logical unit
5	26	00	Invalid field in parameter list
5	2C	02	Wrong window combination
5	2C	00	Command sequence error
6	00	00	UNIT ATTENTION
B	43	00	Message error
B	45	00	SELECT/RESELECT FAILURE
B	47	00	SCSI parity error
B	80	01	Image transfer error

l.   Sense-key specific bytes: Bytes F to 11

This field is reserved on this scanner.

(X'00000000' must not be expected.)

A.4.5   SEND DIAGNOSTIC command

The following table shows the normal sequence of the SEND DIAGNOSTIC command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies SEND DIAGNOSTIC (CDB)	→	Performs self-test
6	STATUS		←	Reports GOOD status
7	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
8	BUS FREE			

(1)   SEND DIAGNOSTIC command: COMMAND phase (initiator → target)

The SEND DIAGNOSTIC command is used by an initiator to request a target or logical unit for self-test. Two types of self-diagnostic are: (a) the self-test performed by the unit itself, and (b) the test conducted according to the instruction data from the initiator.

This scanner supports the self-test only.

The results of self-test are reported using the status and sense data.

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0				Operation code X'1D'				
1		Logical unit number		PF	(Reserved)	SLFTST	D0	U0
2				(Reserved)				
3	(MSB)							
4				Parameter list length				(LSB)
5				Control byte				
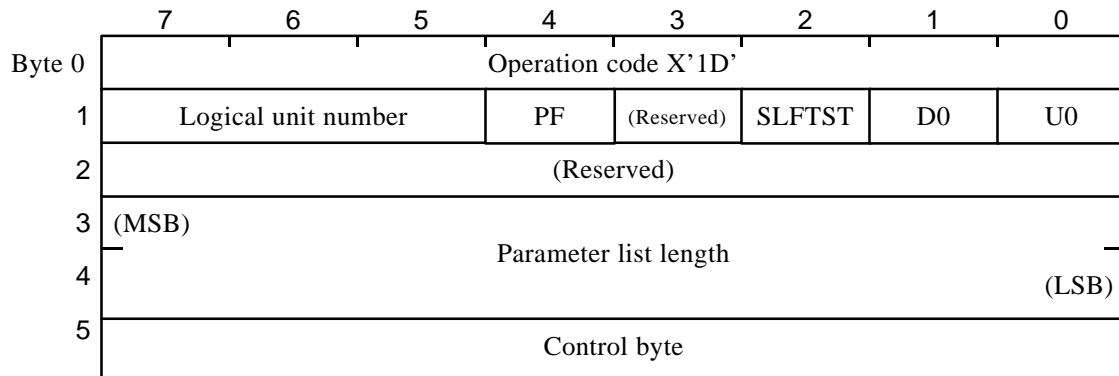
a.   PF (page format) : Byte 1

      This scanner ignores PF.

b.   SLFTST (self test) : Byte 1

      This value is 1 on this scanner.

c.   DO (device offline), UO (unit offline) : Byte 1

      This scanner ignores DO and UO.

d.   Parameter list length: Bytes 3 to 4

      This scanner does not support parameter list length.

(2)   Contents of self-test

The contents of self-test shall be an equivalent of NOP (Non Operation), provided that CHECK CONDITION is reported if error information is withheld in the unit.

(3)   Response

This scanner reports as follows:

a.   Normal

      The GOOD status is returned.

- Status: B'00000' (GOOD)
- Sense key: X'0' (NO SENSE)

b.   Abnormal

      If error information is being withheld, the following status is returned:

- Status: B'00001' (CHECK CONDITION)
- Sense key: Error information being withheld

A.4.6 TEST UNIT READY command

The following table shows the normal sequence of the TEST UNIT READY command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies TEST UNIT READY (CDB)	→	
6	STATUS		←	Reports GOOD status
7	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
8	BUS FREE			

(1)   TEST UNIT READY command: COMMAND phase (initiator → target)

The TEST UNIT READY command checks whether a logical unit is ready. This command does not request self-test. The acknowledgment of this command reported using the status and sense data.

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'00'							
1	Logical unit number			(Reserved)				
2	(Reserved)							
3								
4								
5	Control byte							
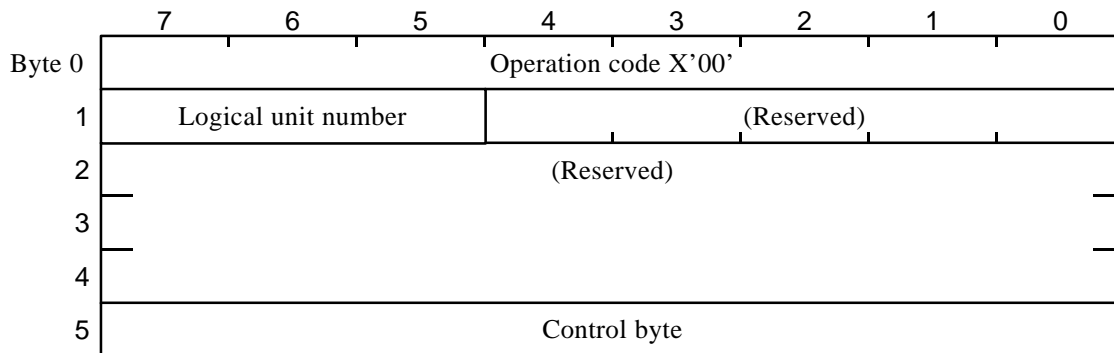
(2)   Response

This scanner reports as follows:

a.   Normal:

- Status: B'00000' (GOOD)
- Sense key: X'0' (NO SENSE)

b.   Abnormal:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'0', X'2', X'3', X'4', X'5', X'6', or X'B'

A.4.7   SET WINDOW command

The following table shows the normal sequence of the SET WINDOW command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	(MESSAGE OUT)	Selects logical unit	→	
5	COMMAND	Specifies SET WINDOW (CDB)	→	Sets window
6	DATA OUT	Specifies window data	→	
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
9	BUS FREE			

(1)　　SET WINDOW command: COMMAND phase (initiator → target)

　　　　The SET WINDOW command is used to set a window.

　　　　The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'24'							
1	Logical unit number			(Reserved)				
2 ⟨ 5	(Reserved)							
6 (MSB) 7 8	Transfer length (LSB)							
9	Control byte							
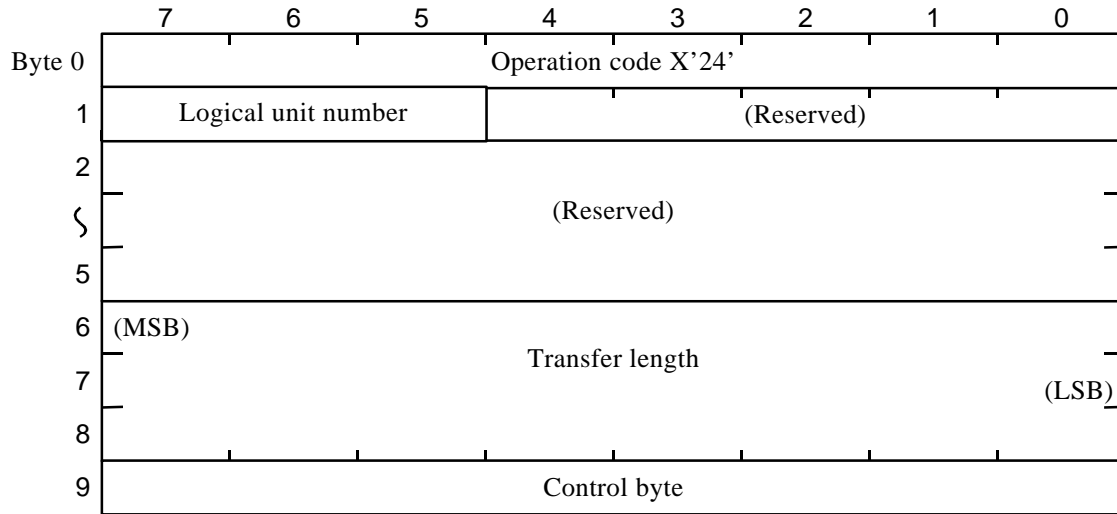
　　　a.　　TRANSFER LENGTH: Bytes 6 to 8

　　　　　Specifies the number of window data bytes sent in the DATA OUT phase.
　　　　　A zero (0) means that no data is to be transferred; this situation is not considered an error.

　　　　　If the number of bytes is not enough (less than 48) to set a window, the scanner returns the following error information:

　　　　　• 　Status:　　　B'00001' (CHECK CONDITION)
　　　　　• 　Sense key:　X'5' (ILLEGAL REQUEST)

(2)   Window data: DATA OUT phase (initiator → target)

Window data specifies the details of a window. Window data contains a head and one or more window descriptor block. Each window descriptor block specifies the attributes of a window (size, position, scan mode, etc.).

If a target receives the SET WINDOW command when it already has window data, the target discards all of the current window data and validates the newly received data.

a.   Header

Window data (header) is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0 ⌇ 5				(Reserved)				
6 (MSB) 7			Window descriptor block length					(LSB)
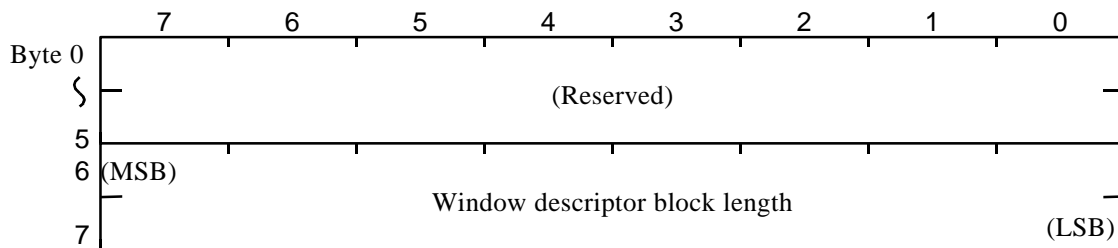
(a)   Window descriptor block length: Bytes 6 and 7

Specifies the length in bytes of a window descriptor block. Each block has the same length. The allowable range of length is between 40 and 248 bytes. For a length outside this range, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b.   Window descriptor block

Window parameter data (window descriptor block) is shown in the following illustration.

Note:

Front-side window data or back-side window data is specified by Window identifier. This scanner can use both front-side and back-side window data. If the scanner uses front-side and back-side window data at a time, those window data must be set by one SET WINDOW command.

	7	6	5	4	3	2	1	0
Byte 0				Window identifier				
1				(Reserved)				Auto
2	(MSB)			X resolution				
3								(LSB)
4	(MSB)			Y resolution				
5								(LSB)
6 ∫ 9	(MSB)			Upper left X				(LSB)
A ∫ D	(MSB)			Upper left Y				(LSB)
E ∫ 11	(MSB)			Width				(LSB)
12 ∫ 15	(MSB)			Length				(LSB)
16				Brightness				
17				Threshold				
18				Contrast				
19				Image composition				
1A				Bit per pixel				
1B	(MSB)			Halftone pattern				
1C								(LSB)
1D	RIF		(Reserved)			Padding type		
1E	(MSB)			Bit ordering				
1F								(LSB)
20				Compression type				
21				Compression argument				
22 ∫ 27				(Reserved)				
28 ∫ n				Vendor unique parameter				

(a)   Window identifier: Byte 0

Specifies a unique value that identifies a window. The value must be 0 (00h), if the window data is front-side. The value must be 128 (80h), if the window data is back-side. If two or more window identifiers are specified for a single set of window data, the most recently specified identifier is validated.

- •   Status: B'00001' (CHECK CONDITION)
- •   Sense key: X'5'(ILLEGAL REQUEST)

(b)   Auto: Byte 1

This scanner does not support Auto. If a value other than 0 is specified, this scanner returns the following error information:

- •   Status: B'00001' (CHECK CONDITION)
- •   Sense key: X'5' (ILLEGAL REQUEST)

(c)   X, Y resolution (XR, YR) : Bytes 2 to 3 and 4 to 5

Specified here are the resolutions in the horizontal (X) and vertical (Y) scanning directions, in pixels per inch. If 0 is specified, the default value (400 dpi) is assumed.

If the image processing option is not equipped, the acceptable resolution value is as follows.

Binary reading	0, 600, 400, 300, 240, 200, 150 or 100
Gray scale reading	0, 400, 300, 240, 200, 150 or 100

If the option is equipped the acceptable value is in the range as follows.

Binary reading	0 or 50 to 800 dpi with 1 dpi step
Gray scale reading	0 or 50 to 400 dpi with 1 dpi step

If the values are specified that does not comply with these conditions, the scanner returns the following error information.

- •   Status: B'00001' (CHECK CONDITION)
- •   Sense key: X'5' (ILLEGAL REQUEST)

The value of back-side reading must be 0 or the same value as front-side. Otherwise, the above error information may be returned.

(d)   Upper left X, Y (ULX, ULY) : Bytes 6 to 9, A to D

Specified here are the X and Y coordinates of the upper-left corner of the window. The coordinates are expressed in units of 1/1200 inches relative to the upper-left corner of the maximum scan area.

If the ULX or ULY value is outside the maximum scan area of this scanner, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(e)   Width, length (W, L) : Bytes E to 11, 12 to 15

Specifies here are the width and length of the window, in units of 1/1200 inches. If the W or L value is outside the maximum scan area of this scanner, the following error information is returned:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

The same error is also returned if this scanner is set to less than one raster line for vertical scanning or to less than two bytes for horizontal scanning.

Notes:

1.   ULX, ULY, W, L versus maximum scan area:

$0 < (ULX + W)$ ≤ 14592 (in 1/1200 inches)

$0 < (ULY + L)$ ≤ 20736 (in 1/1200 inches)

2.   Conditions for horizontal scanning:

$9 \leq [XR \times W/1200] \leq 7296$ (dot)

≤ 9728 (dot) (with memory and IPC option)

(Values under 0 in [ ] are omitted.)

3.   Conditions for vertical scanning:

$1 \leq [YR \times L/1200]$ ≤ 10368 (line)

≤ 13824 (line) (with memory and IPC option)

(Values under 0 in [ ] are omitted.)

4.   Conditions for horizontal and vertical scanning (in 1/1200 inches):

13200 (11") $< (ULX + W) \leq 14592$

When this condition is satisfied, following condition must also be satisfied.

$0 < (ULY + L) \leq 19842$ (A3 length)

Notes:

This is not the guaranteed specification but the scanner may read the long document which fits the following.

i) $0 < ULY + L \leq 33072$ (@1/1200 in.)

ii) $L \div 1200 \times YR \leq 16383$ line

iii) The memory installed is enough for reading.

For this scanner, the origin of the window is at the location shown below. The Y0-dot offset affects the vertical scanning direction, and the X0-dot offset affects the horizontal scanning direction. Take these offsets into account when specifying the X and Y coordinates of the top left corner of the window.

Origin (ULX, ULY) = (0, 0)

Y0

X0

Original document to be read
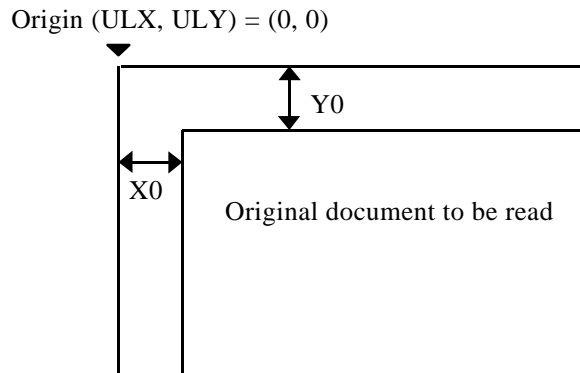
The offset values must be within the ranges listed below. The minimum X0 and Y0 values are within the range for ADF reading because of skewing.

Resolution (dpi)	X0 (dots)	Y0 (dots)
400	12 ±12	16 ±16
300	9 ±9	12 ±12
240	8 ±8	10 ±10
200	6 ±6	8 ±8

To set a value to zero, set ULX to 72 and ULY to 96. If this is done, however, part of the original document will be missing.

(f)   Brightness: Byte 16

Specifies the brightness for halftone (Byte 19=X'00') output.

Value (Hex)	Brightness
00	Default: same as value X'80'.
01	Brightest
80	Normal
FF	Darkest

(g)   Threshold: Byte 17

Specifies the threshold value for the line art (Byte 19='00'

Value (Hex)	Brightness
00	Default: • without IPC-2 or IPC-2D option - Same as value X'80'. • with IPC-2 or IPC-2D option - Dynamic threshold, or simplified dynamic threshold
01 ⇕ 80 ⇕ FF	Brightest Normal Darkest

(h)   Contrast: Byte 18

Specifies the contrast value for the line art or the halftone.

Value (Hex)	Brightness
00	Default: same as value X'80'.
01 ⇕ 80 ⇕ FF	Mostly soft Normal Mostly sharp

(i)   IMAGE COMPOSITION: Byte 19

Value (Hex)	Image output
00	Line art (Binary image)
01	Halftone (Binary image)
02	Gray scale
03 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:

- Status:　　B'00001' (CHECK CONDITION)
- Sense key:　X'5' (ILLEGAL REQUEST)

(j)　Bit per pixel:　Byte 1A

Specifies the number of bits per pixel.

Simplex reading supports X'01' and X'08', so X'00' and X'02' to X'FF' except for X'08' are reserved.

Duplex reading supports only X'01', X'00' to X'FF' except for X'01' are reserved.

If reserved value is specified, this scanner returns the following error information as follows:

- Status:　　B'00001' (CHECK CONDITION)
- Sense key:　X'5' (ILLEGAL REQUEST)

(k)　Halftone type:　Byte 1B

Value (Hex)	Halftone method
00	Default This scanner applies dither.
01	Dither
02	Error diffusion
03 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:

- Status:　　B'00001' (CHECK CONDITION)
- Sense key:　X'5' (ILLEGAL REQUEST)

(k)　Halftone Pattern:　Byte 1C

Value (Hex)	Halftone pattern
00	Dither pattern 0
01	Dither pattern 1
02	Dither pattern 2
03	Dither pattern 3
04 to 7F	(Reserved)
80 to 87	User down-load pattern
88 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(l) RIF (reverse image format) : Byte 1D, bit 7

This bit is used when the binary image data output is being reversed.

0: Output is not reversed
1: Output is reversed

If a 1 is specified for this scanner without the IPC-2 or IPC-2D option, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(m) Padding type: Byte 1D, bits 0 to 2

This scanner does not support Padding type. If a value other than B'000' is specified, this scanner returns following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(n) Bit ordering: Bytes 1E to 1F

This scanner does not support bit ordering. If a value other than X'0000' is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(o) Compression type, argument: Bytes 20 to 21

Specifies the compression method that is applied before the read data is sent to the initiator

TYPE (Byte 20)	Argument (Byte 21)
00 - Not compressed	Reserved
01 - MH	Reserved
02 - MR	K parameter
03 - MMR	Reserved

(p) Vender unique parameter (byte 28 and after)

Specifies, in byte 28 and after, a vender unique parameter, including items such as subwindow list, outline, emphasis, automatic separation, mirroring, and paper size, as required. This parameter is specified in the following format. This parameter does not need data until byte 3F. (It is unnecessary to transfer the unnecessary parameter, but the intermediate parameter cannot be omitted.)

	7	6	5	4	3	2	1	0
28				Vender unique identification code				
29				γ pattern				
2A				Outline extraction				
2B				Image emphasis				
2C				Automatic separation				
2D				Mirror image				
2E				Variance rate				
2F / 30	(MSB)			DTC mode				
31				Not supported				
32				White level follower mode				
33 / 34	(MSB)			Subwindow list				(LSB)
35				Paper size (for front-side) Reserved (for back-side)				
36 / ˙G / 39	(MSB)			Paper width X (for front-side) Reserved (for back-side)				(LSB)
3A / ˙G / 3D	(MSB)			Paper length Y (for front-side) Reserved (for back-side)				
3E				DTC selection				
3F				Reserved				
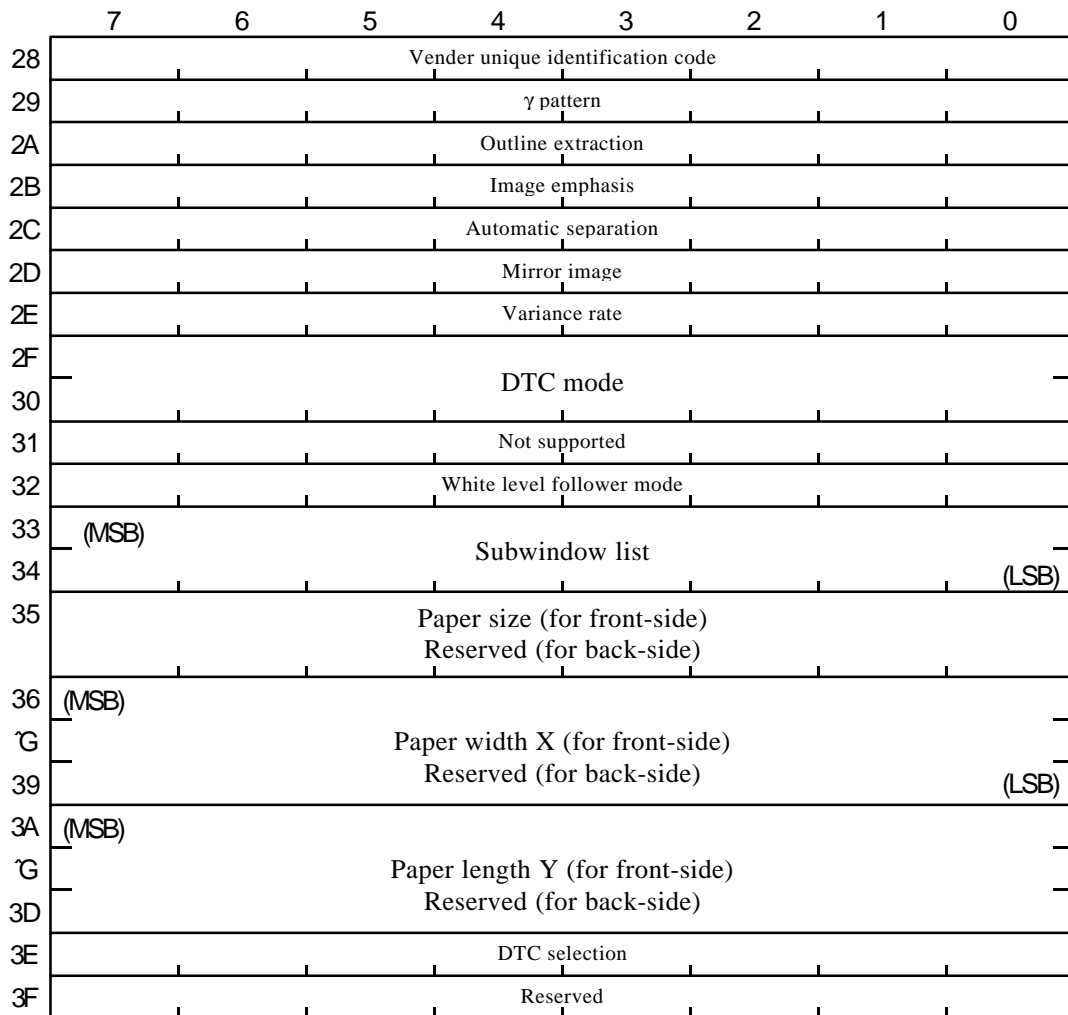
- Vender unique identification code: byte 28

  Specifies a vender unique identification code. For this scanner, X'00' must be specified.

  If other value is specified, this scanner returns the following error information:

  - Status: B'00001' (CHECK CONDITION)
 - Sense key: X'5' (ILLEGAL REQUEST)

- γ pattern: Byte 29

  Specifies the γ pattern number for the line art or the halftone.

Value (Hex)	γ pattern
00	Default This scanner applies "Normal".
01	Normal
02	Soft
03	Sharp
04 to 7F	(Reserved)
80 to 84	User down-load γ pattern
85 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

- Outline extraction: Byte 2A

Value (Hex)	Meaning
00	Default This scanner not applies outline extraction.
01 to 7F	(Reserved)
80	Enable outline extraction. See note 1.
81 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

Note 1:

   If IPC-2 or IPC-2D option is not provided, this scanner will report as error.

- Image emphasis: Byte 2B

  This scanner is limited to three levels of emphasis and one level of smoothing. These levels are specified as follows:

Value (Hex)	Meaning
00	Without emphasis and smoothing
01 to 2F	Low emphasis
30 to 4F	Medium emphasis
50 to 7F	High emphasis
80 to FF	Smoothing

  When the IPC-2D or IPC-3D option is not provided, and this parameter is specified, this scanner returns the following error information:

  - Status: B'00001' (CHECK CONDITION)
  - Sense key: X'5' (ILLEGAL REQUEST)

- Automatic separation: byte 2C

  Specifies the automatic separation for the window. When the automatic separation is performed, X'80' is specified. When the automatic separation is not performed, X'00' is specified. When the IPC-2D or IPC-3D option is not provided, and X'80' is specified, this scanner returns the following error information:

  - Status: B'00001' (CHECK CONDITION)
  - Sense key: X'5' (ILLEGAL REQUEST)

- Mirror image: byte 2D

  Specifies the mirroring for the window. When the mirroring is performed, X'80' is specified. When the IPC-2D or IPC-3D is not provided and this parameter is specified, following error information is responded:

  - Status: B'00001' (CHECK CONDITION)
  - Sense key: X'5' (ILLEGAL REQUEST)

- Variance rate: byte 2E

  Specifies variance rate for simplified dynamic threshold.

Value (Hex)	Variance rate
00	Default
01 to 1F	Small
20 to 3F	Small
40 to 5F	↑
60 to 7F	↓
80 to 9F	Normal
A0 to BF	↑
C0 to DF	↓
E0 to FF	Large

• DTC mode: byte 2F

X'A6' is set when the power is turned on.

This byte is valid when IPC-2D or IPC-3D option is installed, and byte 3E is X'40'.

MSB   LSB

7	6	5	4	3	2	1	0

DTC
Threshold curve
    000   Light ┐
    001   For OCR
    010   (Darken more and more)
    011
    100
    101   Dark ┘
    110   Dark ┐
    111   Light ┘ For Image scanner

Gradation
00 Ordinary image
10 High contrast image (Ex. Newspaper)

Smoothing mode
    00   For OCR
    01   For Image scanner
    10 ┐
    11 ┘ Not defined

Filtering
    0 :   Ball-point pen mode
    1 :   Ordinary mode
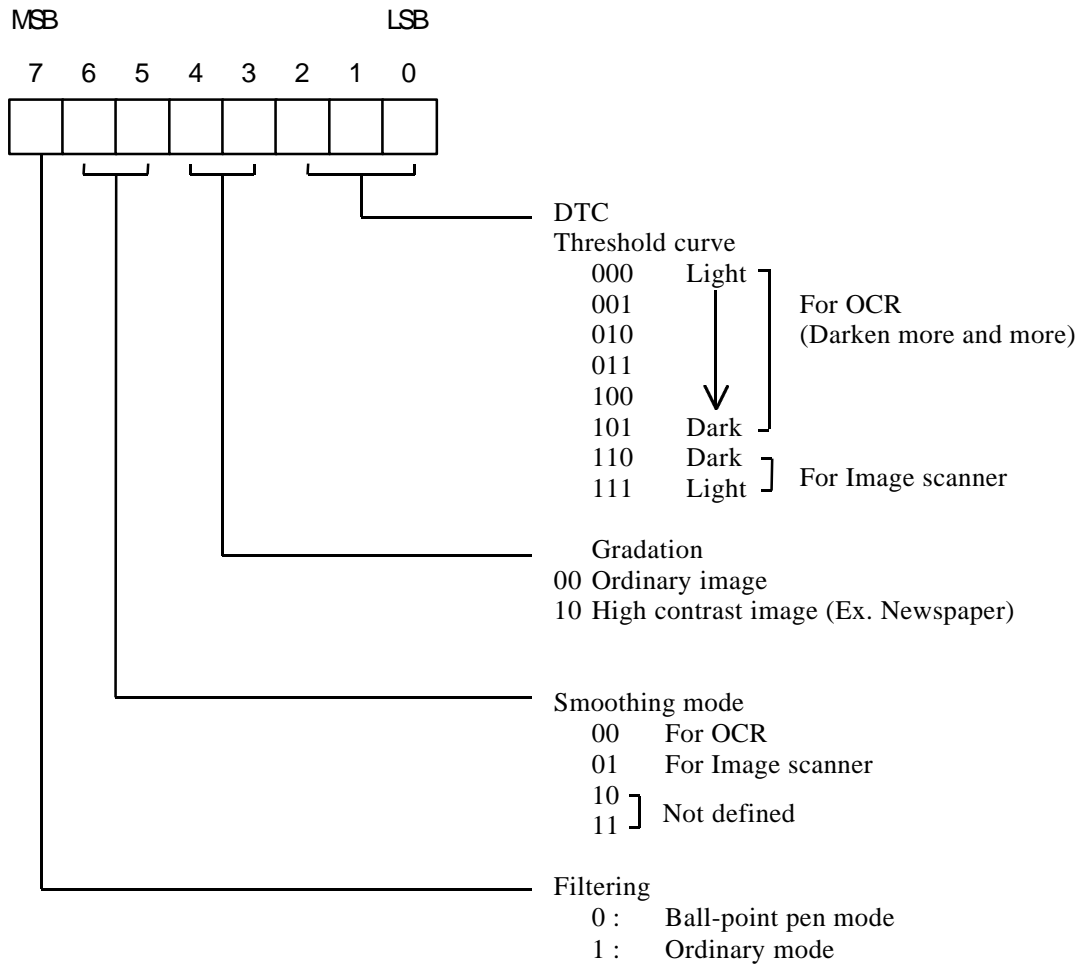
- DTC mode: byte 30

  X'20' is set when the power is turned on.

  This byte is valid when the IPC-2D or IPC-3D is installed, and byte 3E is X'40'.

MSB   LSB

7	6	5	4	3	2	1	0
0	0						

(Dynamic threshold mode setting)

Binary data when the threshold equals video data
to be binary-coded. (*1)
    0 :   Output binary data is "1" (Black)
1 : Output binary data is "0"(White)

Noise removing of 2 x 2 matrix
    0 :   OFF
    1 :   ON

Noise removing of 3 x 3 matrix
    0 :   OFF
    1 :   ON

Noise removing of 4 x 4 matrix
    0 :   OFF
    1 :   ON

Noise removing of 5 x 5 matrix
    0 :   OFF
    1 :   ON

Enables the noise removing bits (bits 1-4 when
this bit is active).
    0 :   ON
    1 :   OFF

*1   When this bit is "0", the output video data is black if the gradation of the video data is equal
      to or larger than threshold. When this bit is "1", the output video data is white if the
      gradation of the video data is equal to or larger than threshold.

- White level follower: byte 32

Value (Hex)	Meaning
00	Default. White level follower depends on the IMAGE COMPOSITION. 	IMAGE COMPOSITION	White level follower	 	Line art (X'00')	Enables white level follower	 	Halftone (X'01')	Disable	 	Gray scale	Disable	
01 to 7F	(Reserved)
80	Enables white level follower.
81 to BF	(Reserved)
C0	Disables white level follower.
C1 to FF	(Reserved)

If reserved value is specified, this scanner returns the following error information as follows:
- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

- Subwindow list: bytes 33 and 34

    Specifies the subwindow identifier for a subwindow included in the window according to the specification in bytes 33 and 34. (For example; X'00001' for subwindow 0, X'00002' for subwindow 1, X'00006' for subwindows 1 and 2.)

    The maximum number of subwindows which can be included in one window is shown in the table below.

Maximum number of subwindow	Value of byte 34
4	0 to 3

If other subwindows are specified, this scanner returns the following error information:
- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

• Paper size: bytes 35 (front-side window data only)

Specifies a paper size when the ADF is used. This parameter is valid when the ADF is used. When the flatbed being used, this parameter is ignored.

When X'00' is specified to this byte, the paper size setting is invalidated. Therefore, the scanner reads with the paper size detected by the paper width sensor.
If the window data is back-side, byte 35 must be X'00'

7	6	5	4	3	2	1	0
		0					

Standard document size
    0000   Undefined
    0001   Undefined
    0010   Undefined
    0011   A3
    0100   A4
    0101   A5
    0110   Double letter
    0111   Letter
    1000   Undefined
    1001   Undefined
    1010   Undefined
    1011   Undefined
    1100   B4
    1101   B5
    1110   Undefined
    1111   Legal

Orientation
    0: Portrait
    1: Landscape

Document selection
    00:    Undefined
    01:    Undefined
    10:    Standard document size (bits 4 to 0 effective)
    11:    Nonstandard document size (bytes 36 to 3D effective)

If undefined value is specified this scanner returns the following error information:
- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

- Paper width X, paper length Y: bytes 36 to 39, 3A to 3D (front-side window data only)

   These parameters are valid when the nonstandard size is specified in the paper size parameter (byte 35).

   The paper width and length is specified in 1/1200 inches unit.

   X must fit following condition

   $$X \leq 14034 \ (@ \ 1/1200 \ in.)$$

   If the window data is back-side, these bytes must be all X'00'.

Notes:

1. If the ADF is used and this parameter has not been specified, the paper is scanned on the default paper size (A3) of this scanner.

2. The paper size specified here concerns the sheets loaded in the ADF.
   The area specified by the WINDOW bytes 6 to 15 in the window data should be equal to or smaller than the specified paper size.

3. The ADF for this scanner positions paper relative to the center.
   Therefore, if paper size is not specified in the window data bytes 6 to 15, the window cannot be accurately positioned for the paper.

4. This parameter is only effective for reading with the ADF.

• DTC SELECTION: byte 3E
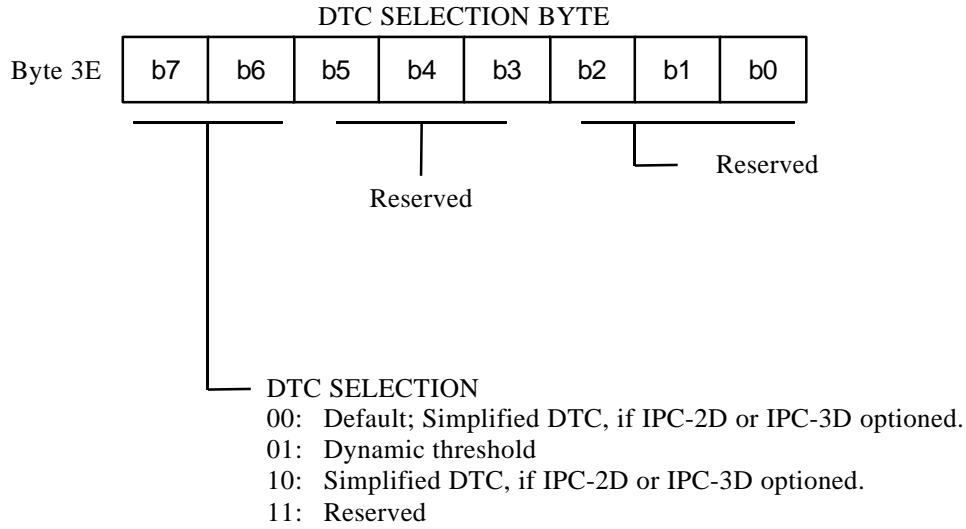
DTC SELECTION BYTE

Byte 3E | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

Reserved

Reserved

DTC SELECTION
00: Default; Simplified DTC, if IPC-2D or IPC-3D optioned.
01: Dynamic threshold
10: Simplified DTC, if IPC-2D or IPC-3D optioned.
11: Reserved

If reserved value is specified, this scanner returns the following error information as follows:

-   Status: B'00001' (CHECK CONDITION)
-   Sense key: X'5' (ILLEGAL REQUEST)

Note:

If simplified dynamic threshold is selected. (Byte 3E=X'00' or X'80'), variance rate (byte 2E) is valid.

If dynamic threshold is selected (byte 3E=X'40'), DTC mode (byte 2F and 30) are valid.

A.4.8   SET SUBWINDOW command

The following table shows the normal sequence of the SET SUBWINDOW command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies SET SUBWINDOW (CDB)	→	Sets subwindow
6	DATA OUT	Specifies subwindow data	→	
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
9	BUS FREE			

(1)   SET SUBWINDOW command: COMMAND phase (initiator → target)

The SET SUBWINDOW command is used to set subwindows. If this command is issued more than once, only the one issued directly before the READ command becomes effective.

The SET SUBWINDOW command only works if the IPC-2D or IPC-3D option is equipped. If this command is received by a scanner without the IPC-2D or IPC-3D option, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'C0'							
1	Logical unit number			(Reserved)				
2 ~ 5	(Reserved)							
6 (MSB)								
7	Transfer length							
8								(LSB)
9	Control byte							
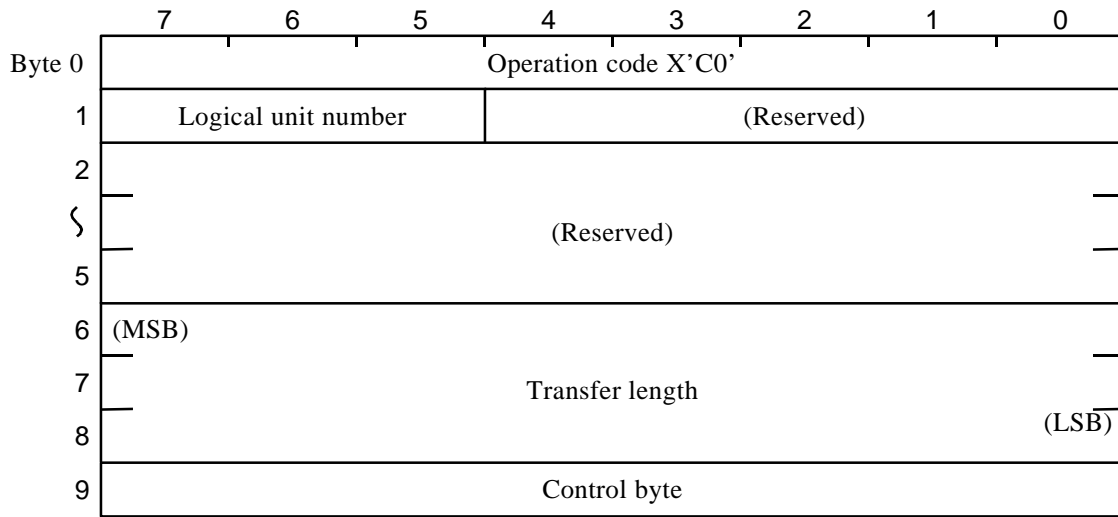
a.   Transfer length: Bytes 6 to 8

Specifies the number of subwindow data bytes sent in the Data Out phase. A 0 means no data is to be transferred; it is not considered an error.

If the number of bytes is not enough to set a single subwindow, an error occurs.

(2)   Subwindow data: DATA OUT phase (initiator → target)

Subwindow data specifies details of a subwindow.

Subwindow data contains one header and one or more subwindow descriptor blocks. Each subwindow descriptor block specifies the attributes of a subwindow (such as size, position, scan mode).

Note:
Front-side subwindow or back-side subwindow is specified by subwindow identifier.
This scanner can use both front-side and back-side subwindow data.
If the scanner uses front-side and back-side subwindow at a time, those subwindow data must be set by on SET SUBWINDOW command.

Up to four subwindows

| | #1 | #2 | | #4 |

Header

Subwindow descriptor block
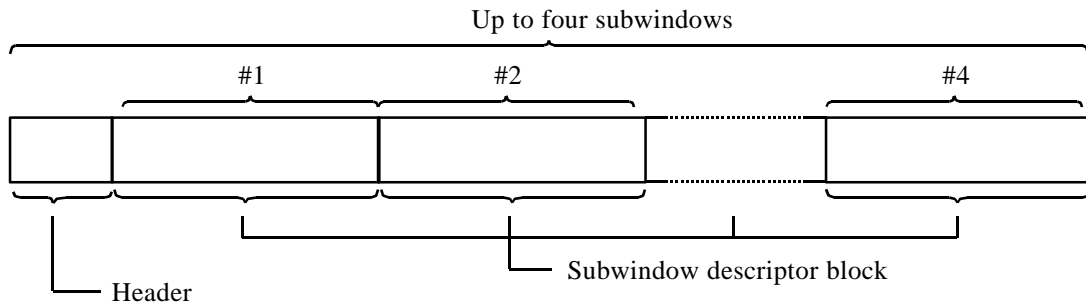
a. Header

Subwindow data (header) is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0 ⌇ 5				(Reserved)				
6 (MSB) 7			Window descriptor block length					(LSB)
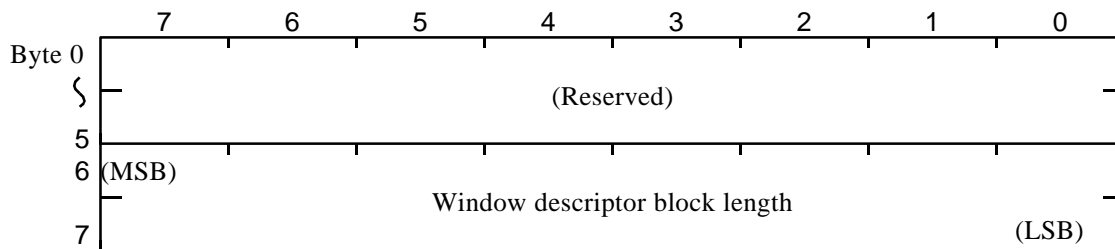
    (a)   Subwindow descriptor block length: Bytes 6 and 7

Specifies the length in bytes of a subwindow descriptor block. Each block has a same length. The allowable range of length is between 40 and 64 bytes. For a length outside this range, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b. Subwindow descriptor block

Subwindow data (window descriptor block) is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0				Subwindow identifier				
1 ⑀ 5				(Reserved)				
6 ⑀ 9	(MSB)			Upper left X				(LSB)
A ⑀ D	(MSB)			Upper left Y				(LSB)
E ⑀ 11	(MSB)			Width				(LSB)
12 ⑀ 15	(MSB)			Length				(LSB)
16				Brightness				
17				Threshold				
18				Contrast				
19				Image composition				
1A				Bit per pixel				
1B	(MSB)			Halftone pattern				
1C								(LSB)
1D	RIF		(Reserved)			Padding type		
1E ⑀ 27				(Reserved)				
28 ⑀ n				Vender unique parameter				
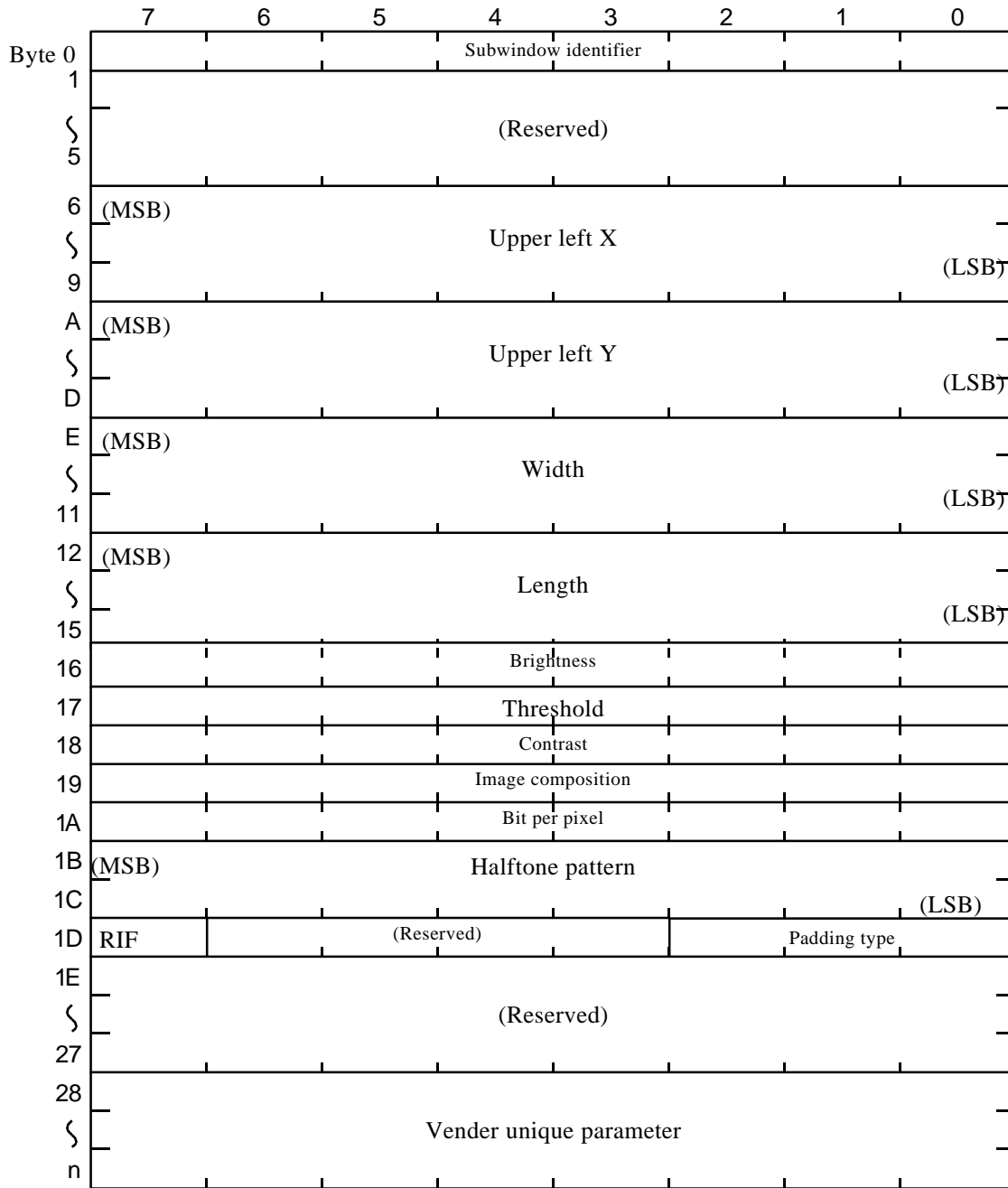
(a)   Subwindow identifier: Byte 0

Specifies a unique value that identifies a subwindow. If two or more subwindow identifiers are specified for a single set of subwindow data, the most recently specified identifier is validated.

If the subwindow is front-side of the document, the value must be;

    0 to 3

If the subwindow is back-side of the document, the value must be;

    0 to 3

When the value does not fit this condition, the scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(b)   Upper left X, Y (ULX, ULY) : Bytes 6 to 9, A to D

Specified here are the X and Y coordinates of the upper-left corner of the subwindow. The coordinates are expressed in units of 1/1200 inches relative to the upper-left corner of the maximum scan area.

(c)   Width, length (W, L) : Bytes E to 11, 12 to 15

Specified here are the width and length of the subwindow, in units of 1/1200 inches.

Notes:

1.   If the area specified for any subwindow does not fit in the area of the main window, the portion of the area outside the main window area is ignored. Only the portion where the main and subwindow overlap (shown hatched) is processed.
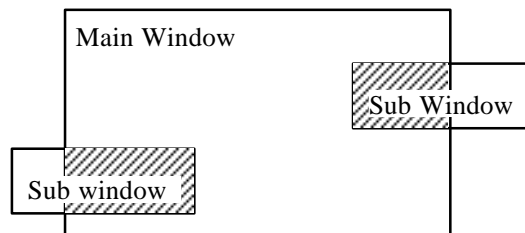
2.   If subwindows in a main window overlap with each other as a result of the values ULX, ULY, W and L specified here, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

Example:
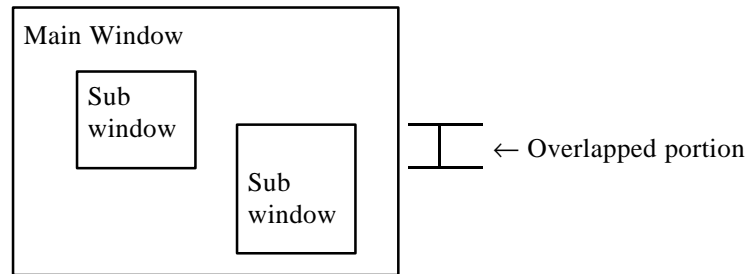
(d)   Brightness: Byte 16

Specifies the brightness for half tone. For details, see the SET WINDOW command.

(e)   Threshold: Byte 17

Specifies the threshold value for line art. For details, see the SET WINDOW command.

(f)   Contrast: Byte 18

Specifics the contrast value for half tone or line art. For details, see the SET WINDOW command.

(g)   Image composition: Byte 19

Specifies the type of image to be read. The following values are supported by this scanner:

X'00':   Line art

X'01':   Half tone

If a value X'02' or greater is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(h)   Bit per pixel: Byte 1A

Specifies the number of bits per pixel. On this scanner, X'01' (1 bit) is specified since only binary data is valid for subwindows. If any other value is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(i)   Half tone pattern: Byte 1B and 1C

Specify the halftone method and dithered pattern. For details, see the SET WINDOW command.

(j)   RIF (reverse image format): Byte 1D

This bit is used to reverse the binary image data output.

0:    Output is not reversed
1:    Output is reversed

(k)   Vender unique parameter: byte 28 and after

Specifies, in byte 28 and after, a vender unique identification parameter, including items such as outline, emphasis, and automatic separation, as required. This parameter is specified in the following format. This parameter does not need data until byte 3E. (It is unnecessary to transfer the unnecessary parameter but the intermediate parameter cannot be omitted.)

28	Vender unique identification code
29	γ Pattern number
2A	Outline extraction
2B	Image emphasis
2C	Automatic separation
2D	Reserved
2E	Variance rate
2F 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D	Reserved
3E	DTC selection

• Vender unique identification code: byte 28

Specifies a vender unique identification code. For this scanner, X'00' must be specified. If other value is specified, this scanner returns the following error information:

-    Status: 00001 (CHECK CONDITION)

-    Sense key: X'5' (ILLEGAL REQUEST)

• γ pattern: byte 29

Specifies γ pattern number for subwindow. For details, see the explanation of the SET WINDOW command.

- Outline extraction: byte 2A

  Specifies the outlining for the subwindow. For details, see the explanation of the SET WINDOW command.

- Image emphasis: byte 2B

  Specifies the emphasis for the subwindow. For details, see the explanation of the SET WINDOW command.

- Automatic separation: byte 2C

  Specifies the automatic separation for the subwindow. For details, see the explanation of the SET WINDOW command.

- Variance rate: byte 2E

  Specifies variance rate for simplified dynamic threshold. For details, see the explanation of the SET WINDOW command.

- DTC selection: byte 3E

Simplified DTC parameter

Byte 3E	b7	b6	b5	b4	b3	b2	b1	b0

Reserved

Reserved

DTC SELECTION
00:    Default; Simplified DTC, if IPC-2 or IPC-2D optioned.
01:    Reserved
10:    Reserved
11:    Reserved
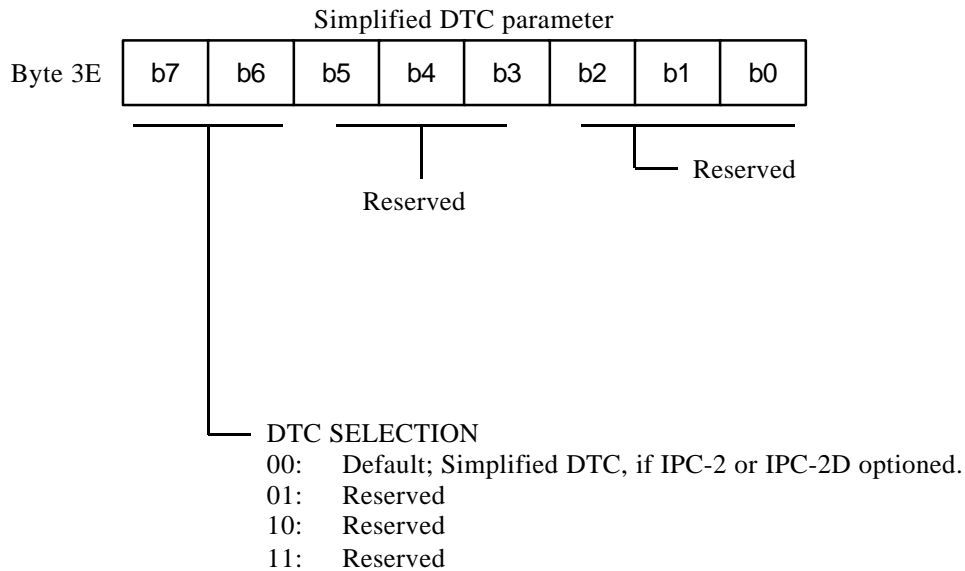
Note:
        Dynamic threshold cannot select for subwindow.

A.4.9   OBJECT POSITION command

The following table shows the normal sequence of the OBJECT POSITION command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies OBJECT POSITION (CDB)	→	Loads/unloads paper (ADF)
6	STATUS		←	Reports GOOD status
7	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
8	BUS FREE			

(1)   OBJECT POSITION command: COMMAND phase (initiator → target)

The OBJECT POSITION command controls the sheets in the ADF. When the ADF is used for reading, document sheets are loaded with this command before the READ command is issued.

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0				Operation code 'X31'				
1	Logical unit number			(Reserved)		Position type		
2	(MSB)							
3				(Count)				(LSB)
4								
5								
⟨				(Reserved)				
8								
9				Control byte				

a. Position type: byte 1

Specifies positioning functions

Bit 2	Bit 1	Bit 0	POSITION TYPE
0	0	0	Unload object
0	0	1	Load object

This scanner supports the unload object and load object functions only. If an other value is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(a) Unload object

This scanner unloads a document from the ADF. If the ADF chuter does not contain a document when this command is received, this scanner does not generate an error but returns the GOOD status.

The unload object function is not vital to the scanner. After completion of reading with the READ command, the scanner automatically unloads the document.

(b) Load object

This scanner loads the document from the ADF paper chute. If a document is already loaded in the ADF when this command is received, this scanner does not generate an error but returns the GOOD status.

b.   Count: bytes 2 to 4

This scanner does not support this field. If a value other than 0 is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(2)   Response

This scanner reports the OBJECT POSITION command as follows:

a.   Normal

The GOOD status is returned.

- Status: B'00001' (GOOD)
- Sense key: X'5' (NO SENSE)

b.   Abnormal

The CHECK CONDITION status is returned and sense data is created.

- Status: B'00001' (CHECK CONDITION)
- Send key: X'5' (MEDIUM ERROR)

  (The cause of the error is jammed paper, an opened ADF cover, or an empty paper supply.)

(3)   Command sequence to select the ADF or FB.

Read on ADF   Read on FB

| OBJECT POSITION command |

(Load object)

| READ command | | READ command |

| OBJECT POSITION command |

(Unload object)
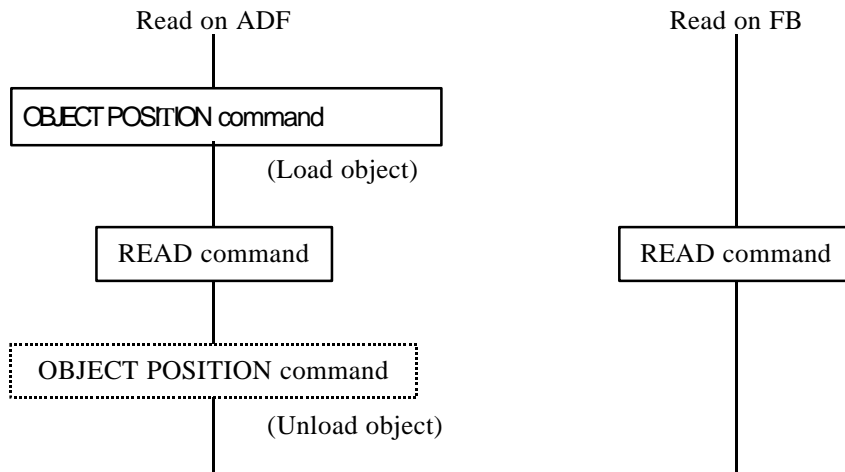
Note:
   If the document is shorter than the window area specified by the SET WINDOW command, the
   deficient portion is supplemented by white data.   The deficient portion is supplemented so that
   the data covers the entire specified window area and is tranferred.
   When the disconnecting is enabled by the IDENTIFY message, the disconnecting is performed
   during a loading or unloading operation and the reconnecting is performed after the operation is
   completed.

A.4.10 SEND command

The following table shows the normal sequence of the SEND command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies SEND (CDB)	→	
6	DATA OUT		→	Transfer data
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports Command Complete
				Releases BSY signal
9	BUS FREE			

(1)   SEND command: COMMAND phase (initiator → target)

The SEND command is used by an initiator to send data to a target. The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0				Operation code X'2A'				
1	Logical unit number			(Reserved)				RelAdr
2				Transfer data type				
3				(Reserved)				
4	(MSB)			Transfer identification				
5								(LSB)
6	(MSB)							
7				Transfer length				
8								(LSB)
9				Control byte				
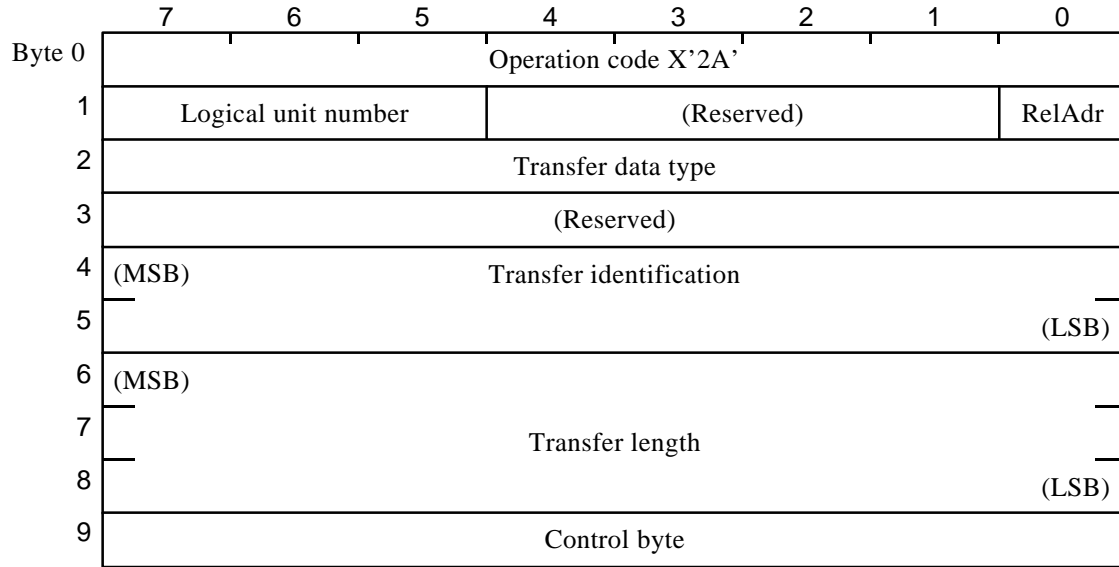
a.   Transfer data type: Byte 2

Specifies the type of data to be transferred between the initiator and target. This scanner supports X'02' (dither pattern) and X'03' (γ pattern). If any other value is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b.   Transfer identification: Byte 4 to 5

Identifies each data. On this scanner, this field is used to differentiate with a value from 0 to 4 downloadable dither patterns. If a value 5 or larger is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

c.   Transfer length (TL) : Bytes 6 to 8

Specifies the bytes of data to be transferred by the initiator.

If TL = 0, no data is transferred. This is not regarded as an error.

If TL ≠ 74 (except for a dither pattern of 8 x 8), this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

(2)   SEND data (dither pattern):   DATA OUT phase (initiator → target)

	7	6	5	4	3	2	1	0
Byte 0								
1				(Reserved)				
2								
3								
4	(MSB)							
5				X-direction dither matrix size				(LSB)
6	(MSB)							
7				Y-direction dither matrix size				(LSB)
8								
9				(Reserved)				
A								
B				Dither matrix data				
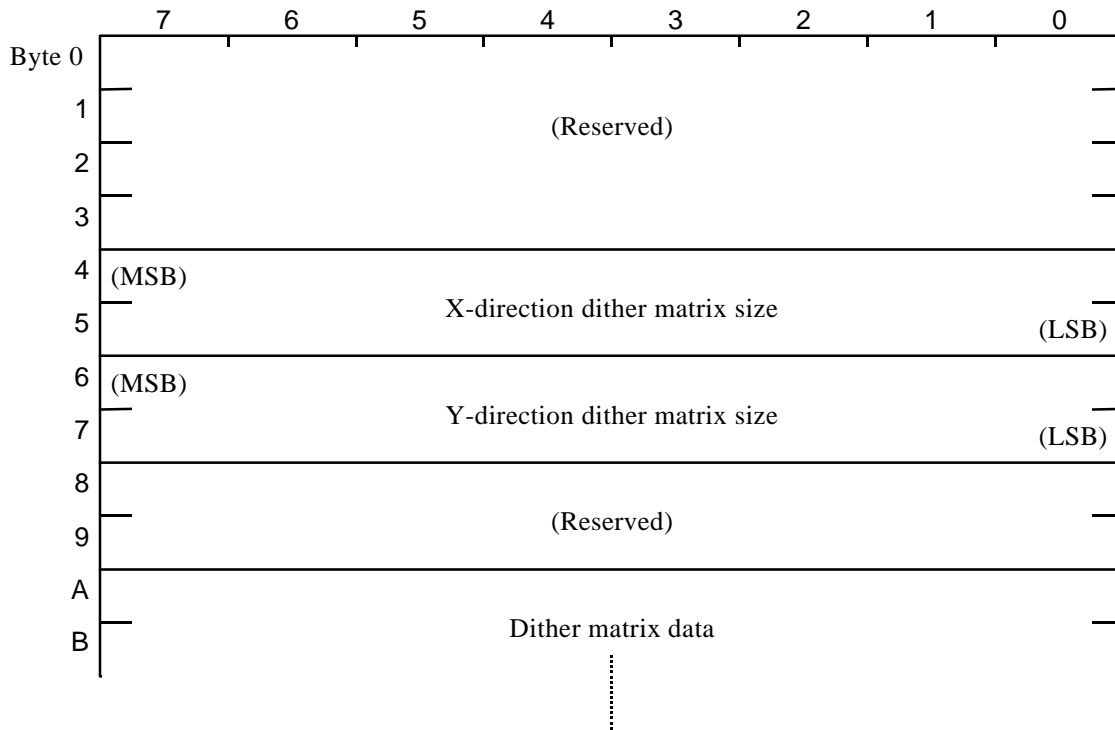
a.   Dither matrix size

Specifies the size of dither matrix to be downloaded. This scanner supports 8 x 8. If any other value is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b.   Dither matrix data

Specifies the values of dither matrix in the range of 0 to 255, starting from the upper- left corner. (Value 0 represents the darkest, with 255 the brightest.)

The number of data vlaues is the sum of the X- and Y-direction elements as specified in the matrix size fields. If the number of data values differs from that sum, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

Example:

d11	d12	d13	d14	d15	d16	d17	d18
d21	d22	d23	d24	d25	d26	d27	d28
d31	d32	d33	d34	d35	d36	d37	d38
d41	d42	d43	d44	d45	d46	d47	d48
d51	d52	d53	d54	d55	d56	d57	d58
d61	d62	d63	d64	d65	d66	d67	d68
d71	d72	d73	d74	d75	d76	d77	d78
d81	d82	d83	d84	d85	d86	d87	d88

⇩

DATA OUT phase

0	1	2	3	4	5	6	7	8	9
00	00	00	00	00	08	00	08	00	00

A	B	C	D	E	F	10	11
d11	d12	d13	d14	d15	d16	d17	d18

12	13	14	15	16	17	18	19
d21	d22	d23	d24	d25	d26	d27	d28

42	43	44	45	46	47	48	49
d81	d82	d83	d84	d85	d86	d87	d88

(3)   SEND data (γ pattern): DATA OUT phase (initiator → target)

Byte 0	
1	Reserved
2	
3	
4	X'0100'
5	
6	X'0100'
7	
8	Reserved
9	
A	γ pattern data
to	(256 byte)
n	
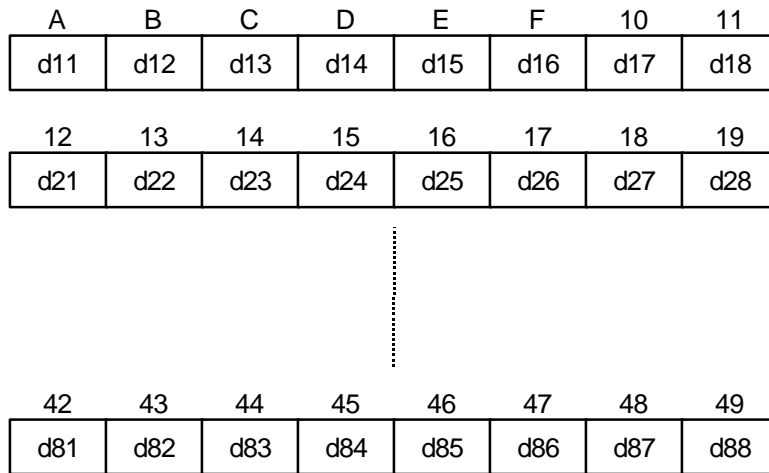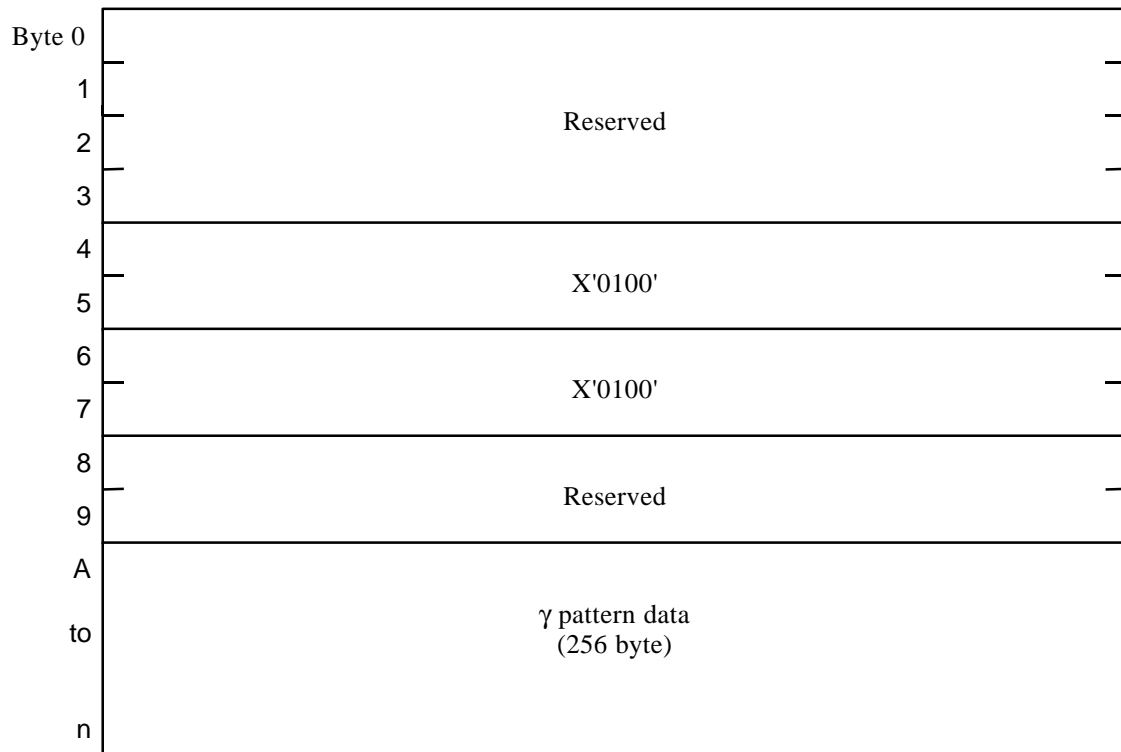
• γ pattern data

The γ pattern data must be transferred in the following order;

Transfer
order → 1   2   3   4   5   6   7   8   9   10 11 12   251 252 253 254 255 256

X → 00 01 02 03 04 05 06 07 08 09 0A 0B   FA FB FC FD FE FF

Y →

Conversion density corresponding to density X

← —————————————————— 256 bytes —————————————————— →

(Black) FF

Y

Conversion
density

00

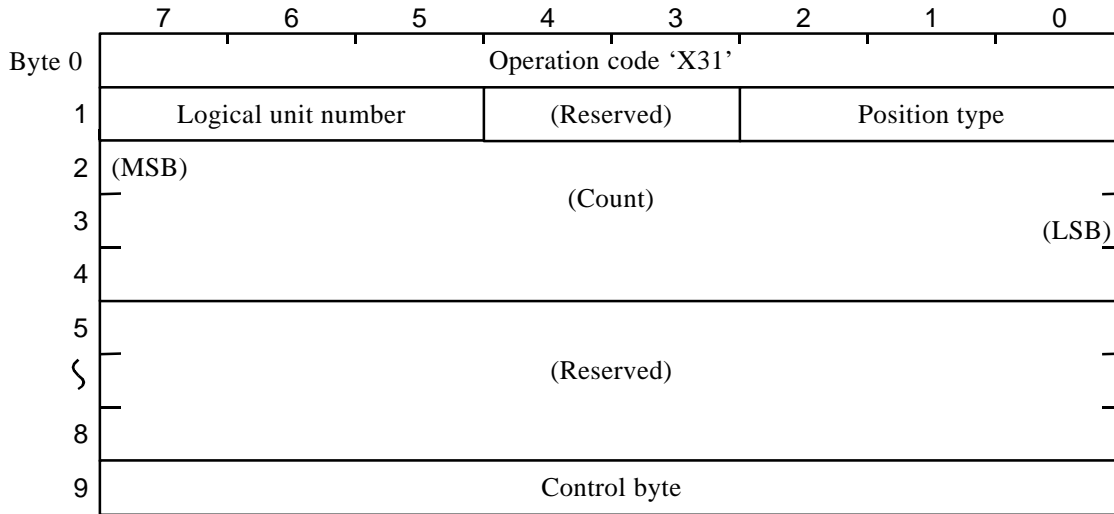00   Scanner read density   FF (Black)

X
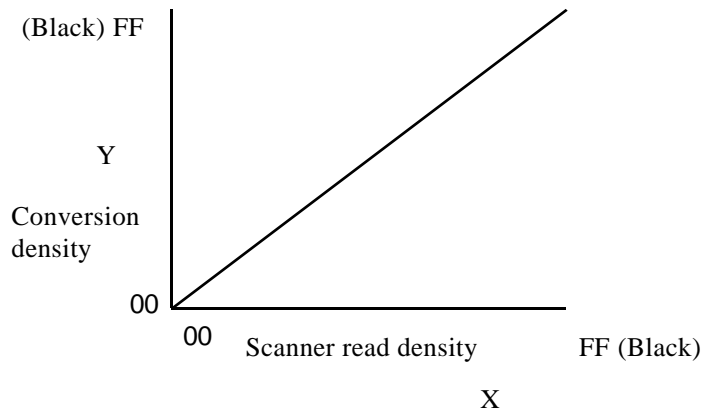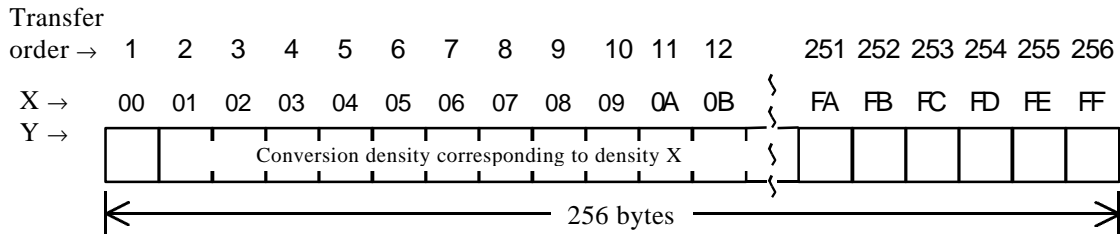
A.4.11 READ command

The following table shows the normal sequence of the READ command when used with this scanner.

Step	Bus phase	Initiator operation	← →	Target operation
1	BUS FREE	Verifies bus free		
2	ARBITRATION	Obtains bus-usage right		
3	SELECTION	Selects target	→	
				Drives BSY signal
4	MESSAGE OUT	Selects logical unit	→	
5	COMMAND	Specifies READ (CDB)	→	Reads document
6	DATA IN		←	Transfers image data
7	STATUS		←	Reports GOOD status
8	MESSAGE IN		←	Reports message (Command Complete)
				Releases BSY signal
9	BUS FREE			

(1)   READ command: COMMAND phase (initiator → target)

The READ command is used by an initiator to request a target for transfer of data. Upon receiving this command, the target returns scan data to the initiator.

The CDB of this command is shown in the following illustration.

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'28'							
1	Logical unit number			(Reserved)				RelAdr
2	Data type code							
3	(Reserved)							
4	(MSB) Data type qualifier							
5								(LSB)
6	(MSB)							
7	Transfer length							
8								(LSB)
9	Control byte							
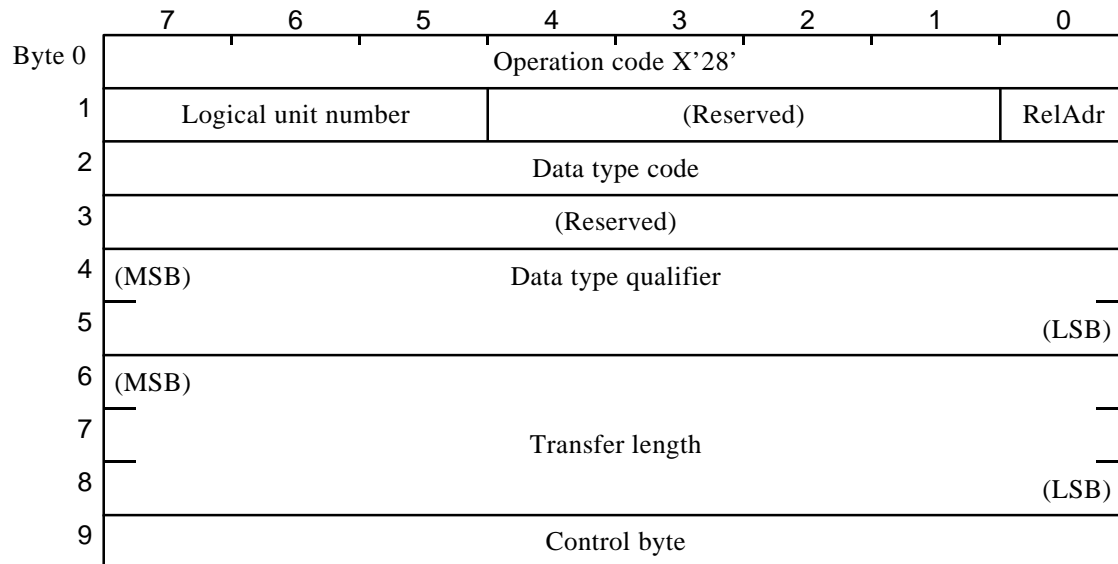
a. Data type code: Byte 2

Specifies the type of data to be transferred between the initiator and target. This scanner supports X'00' (image data), X'80' (pixel size), and X'81' (detected paper information) only. If any other value is specified, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

b. Data type qualifier: Bytes 4 to 5

This scanner requires specifying byte 4 = X'00' and byte 5 = window identifier. If the window identifier specified in byte 5 has not been declared by the SET WINDOW command, this scanner returns the following error information:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'5' (ILLEGAL REQUEST)

Note:
    When window identifier is 0, window is front-side of the document.
    When window identifier is 128, window is back-side of the document.
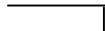
c. Transfer length (TL) : Bytes 6 to 8

Specifies the bytes of storage area that the initiator has allocated for the data to be transferred.

If TL = 0, no data is transferred. This is not assumed an error.

The target does not transfer more data than that which is indicated by TL.

If the actual transfer amount differs from the amount indicated by TL, the target creates the following status and sense data:

- Status: B'00001' (CHECK CONDITION)
- Sense key: X'0;' (NOSENSE)

  Sense data (VALID): ─────┐

  Sense data (LI): 1 ──────┴── (Difference in transfer amount)

- Sense data (INFORMATION) : TL indicated transfer amount subtracted by actual transfer amount

Note:
  For the read sequence, see Section 4.7.3.

(2) DATA IN phase (target → initiator)

a. Image data: (DATA TYPE CODE = X'00')
  (Not compressed)

Horizontal scan →

ULX					
Pixel 1	Pixel 2		i - 1	i	Raster line
i + 1	i + 2		2i - 1	2i	Raster line
2i + 1	2i + 2		3i - 1	3i	Raster line
i (j - |1) +	i (j - 1) +		ij - 1	Pixel ij	Raster line

ULY (top left)

Vertical scan direction ↓
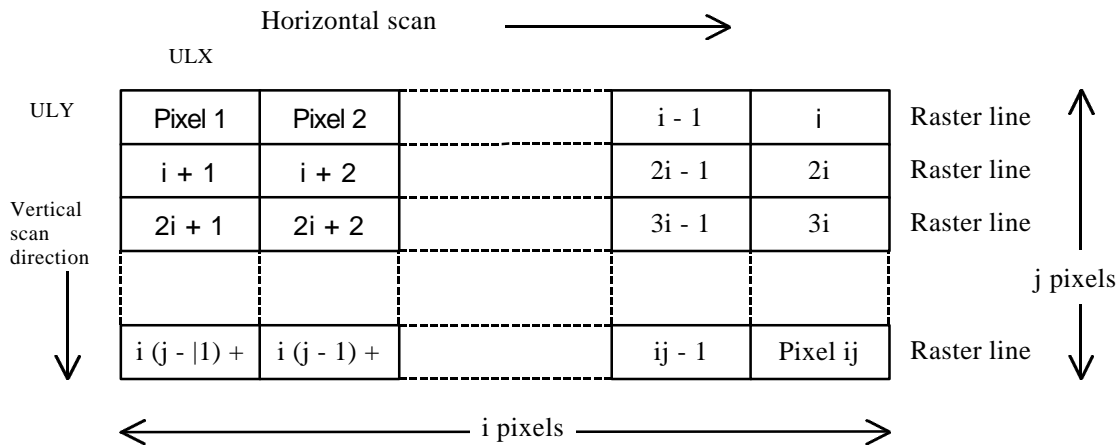
← i pixels →

j pixels ↕

The following format is the data format that this scanner uses when transferring the image data of a window comprising i x j pixels.

(a)   For binary data

   1 pixel: 1 bit

   8 pixels: 1 byte

Raster line 1	Raster line 2		Raster line j

Byte 0

Byte n

	7	6	5	4	3	2	1	0
Byte 0	Pixel 1	Pixel 2	Pixel 3	Pixel 4	Pixel 5	Pixel 6	Pixel 7	Pixel 8
ς								
Byte n	Pixel ij-7	Pixel ij-6	Pixel ij-5	Pixel ij-4	Pixel ij-3	Pixel ij-2	Pixel ij-1	Pixel ij

		7	6	5	4	3	2	1	0
	Byte 0	Pixel i	Pixel i-1	Pixel i-2	Pixel i-3	Pixel i-4	Pixel i-5	Pixel i-6	Pixel i-7
For mirror image	ς								
	Byte n	Pixel m+8	Pixel m+7	Pixel m+6	Pixel m+5	Pixel m+4	Pixel m+3	Pixel m+2	Pixel m+1

$$m = i\,(j - 1)$$

If the data amount per raster line is not a multiple of 8 bits, the window is rounded up to a multiple of 8 bits.

b.   Pixel size data: (DATA TYPE CODE = X'80')

The transfer format for this data is shown in the following illustration.

```
Byte 0 |(MSB)                                              _
       S        Number of X-direction pixels               
       3 |_                                        (LSB)⌐|
       4 |(MSB)                                           _
       S        Number of Y-direction pixels              
       7 |_                                        (LSB)⌐|
       8 |        Detected Paper Width                     _
       S              (Reserved)                           
       B |_                                               _|
       C |                                                _
       S         Detected Paper Length                    
       F |_                                               _|
```
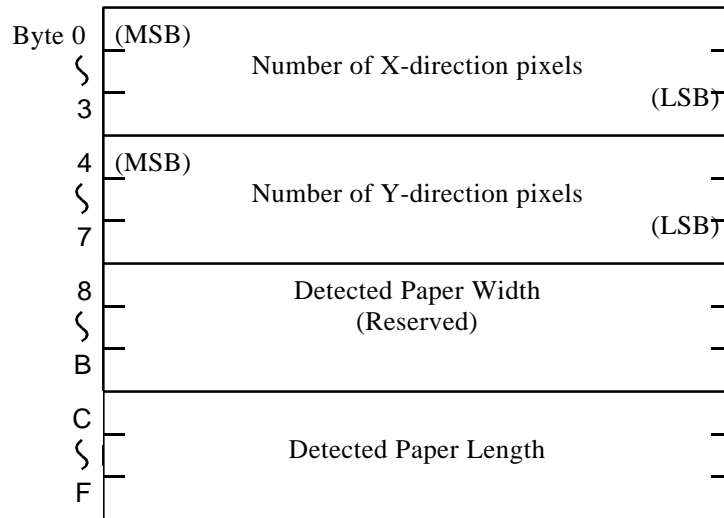
- Number of X-direction pixels: Byte 0 to 3

$$\text{Number of pixels} = \frac{\text{X Resolution x Width}}{1200}$$

- Number of Y-direction pixels: Byte 4 to 7

$$\text{Number of pixels} = \frac{\text{Y Resolution x Length}}{1200}$$

This scanner calculates the numbers of X-direction pixels and Y-direction pixels of the image data to be transferred to the initiator. The scanner performs this calculation by referencing the resolution and area set up with the SET WINDOW command. This data need not be issued if the numbers of pixels are known by the initiator.

- Detected Paper Length: Byte C to F

Detected Paper Length field returns detected line number (transferred line number), when ALD bit in Auto Size Detect page is set to 1 by MODE SELECT command. When ALD bit in Auto Size Detect page is set to 0, this field is reserved. Detected Paper Length field is valid from the completion of scanning to the next SET WINDOW/READ (image data) command.

Note:

If WINDOW ID = 0, pixel size data is calculated for front-side window. If WINDOW ID = 128, pixel size data is caluculated for both front-side and back-side windows.

Example:
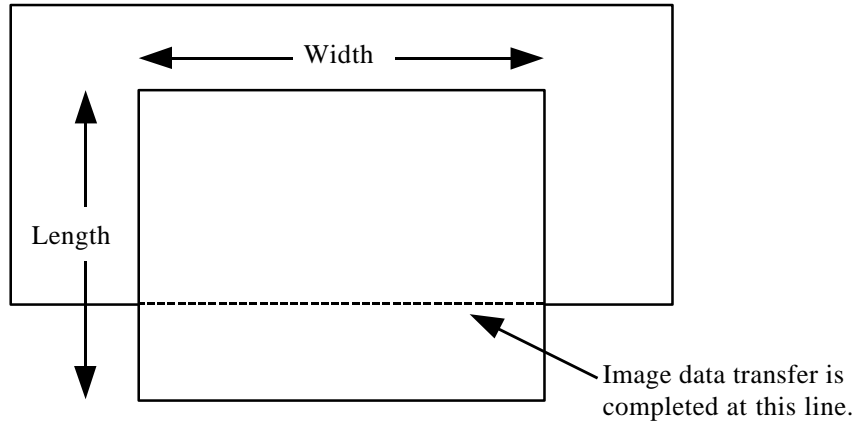
For the READ command, CHECK CONDITION is returned with ILI=0.

c.   Detected paper information (DATA TYPE CODE = X'81')

This scanner detects the paper size and the job separation sheet when OBJECT POSITION (load object) is received.

Read (DATA TYPE CODE = X'81') command is used to get detected paper information from this scanner.

Detected paper information shown below:

Byte 0	Reserved
1	
2	Job separation sheet (See section A.5)
3	Paper size
4	Reserved
5	
6	
7	

- Job separation sheet: Byte 2

     X'80': Job separation sheet detected.

     X'00': Job separation sheet not detected.

• Paper size: Byte 3

b7	B6	b5	b4	b3	b2	b1	b0

Following size detected (*2)

0000:	Undefined
0001:	Undefined
0010:	Undefined
0011:	A3 or DL (*1)
0100:	A4 or LT (*1)
0101:	A5
0110:	Undefined
0111:	Undefined
1000:	Undefined
1001:	Undefined
1010:	Undefined
1011:	Undefined
1100:	B4
1101:	B5
1110:	Undefined
1111:	Undefined

Reserved

0: Portrait   1: Landscape (*2)

0: Paper size detected, when the paper is fed from ADF.

1: Paper size not detected, when the paper is fed from ADF.

(*3)

0: The paper is loaded into ADF.

1: The paper is ejected from ADF.

Notes:

*1   This scanner cannot distinguish DL from A3 or LT from A4.

*2   When the paper is loaded into ADF by Object position (Load object), this scanner detects paper size assuming the orientation is portrait.
After the paper is ejected from ADF by Object position (Unload object), this scanner detects the orientation, and paper size.

*3   This bit (b6) only valid after Object position (Load/unload object) is completed.

*4   This byte is same regardless of front-side or back-side of the document.

A.4.12 MODE SELECT (6)

The normal sequence related to MODE SELECTE (6) of this scanner is listed below:

Step	Bus phase	Initiator operation	← →	Target operation
1	Bus Free	Checks Bus Free		
2	Arbitration	Acquires right to use the bus		
3	Selection	Selects the target	→	
				Outputs the BSY signal
4	Message out	Selects the logical device	→	
5	Command	Specifies MODE SELECT (6) (CDB)	→	Sets up mode data
6	Data In	Specifies MODE SELECT parameter data	→	
7	Status		←	Reports the GOOD status
8	Message In		←	Reports Command Complete
				Releases the BSY signal
9	Bus Free			

(1)   MODE SELECT (6) command: Command phase (Initiator to Target)

This command is used to set up miscellaneous parameters in peripheral devices.

CDB of this command is shown below:

	7	6	5	4	3	2	1	0
Byte 0	Operation code X'15'							
1	Logical unit number			PF	(Reserved)			SP
2	(Reserved)							
3								
4	Parameter list length							
5	Control byte							
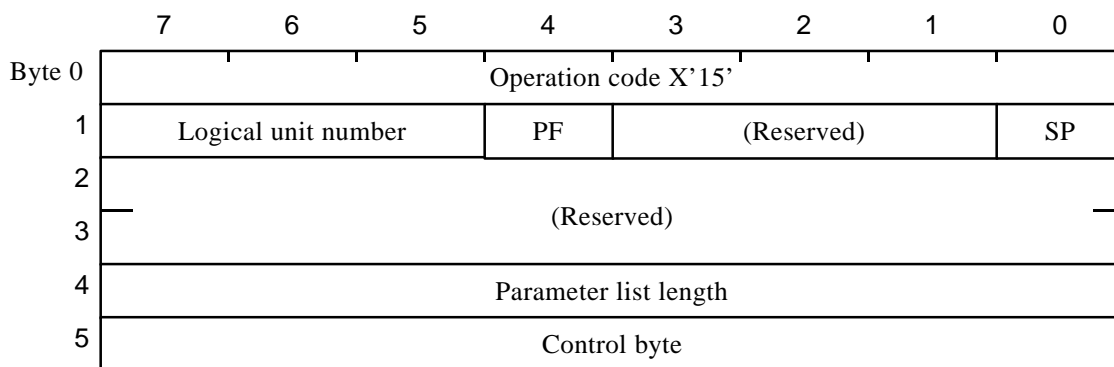
- PF (PAGE FORMAT): Byte 1

  When PF=1, it is indicated that the parameters of this command is fitted to the SCSI-2 specification.

  For this scanner, PF=1 only is supported.

  Otherwise, the following error is returned:

  - Status: B'00001' (CHECK CONDITION)
  - Sense key: X'5' (ILLEGAL REQUEST)

- SP (SAVE PAGES): Byte 1

  This scanner ignores SP.

- PARAMETER LIST LENGTH: Byte 4

  Specifies the number of bytes of the mode parameter list sent in the DATA OUT phase.

  0 means that there is no data to be transferred. This is not regarded as an error.

(2)   Mode parameter list data: DATA OUT phase (Initiator to Target)

The mode parameter list data consists of one header, 0 or more than one descriptor block, and 0 or more than one page as one unit.

In this scanner, the descriptor block and vendor-specific area are omitted, thus the mode parameter list data consists of one header and one page.

a.   Header

The mode parameter data (header) is shown below:

	7	6	5	4	3	2	1	0
Byte 0								
1				(Reserved)				
2								
3				Block descriptor length				
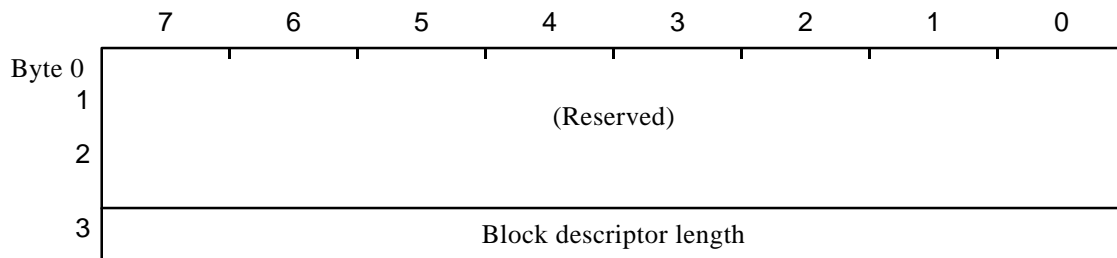
- BLOCK DESCRIPTOR LENGTH: Byte 3

  Specifies the length of the entire mode parameter descriptor block in units of byte. The page and vendor-specific parameter are not included.

  In this scanner, 0 is specified and the succeeding mode descriptor section shall be omitted.

b. Mode parameter descriptor block (Omitted in this scanner)

  The mode parameter data (mode descriptor block) is shown below:

	7	6	5	4	3	2	1	0
Byte 0				(Reserved)				
1	(MSB)							
2				Number of blocks				
3								(LSB)
4				Parameter list length				
5	(MSB)							
6				Block length				
7								(LSB)

- NUMBER OF BLOCKS: Byte 1 to 3

  Specifies the number of logical blocks fitted for the DENCITY CODE and BLOCK LENGTH.

- BLOCK LENGTH: Bytes 5 to 7

  Specifies the length of the logical blocks described in the BLOCK DESCRIPTOR in units of byte.

Note:
  In this scanner, this descriptor is omitted.

c. Mode page

The mode page format is indicated for each page code.

• Page code

The PAGE CODEs supported in this scanner are as follows:

Page code	Description
X'00'	Don't care (IGNORE)
X'01'	Reserved
X'02'	Not supported
X'03'	Not supported
X'04' to X'3B'	Reserved
X'3C'	Auto size detection
X'3D'	Lamp timer
X'3E'	Job separation sheet
X'3F'	Reserved

Each page is described below.

1) Auto size detection (PAGE CODE X'3C')

	7	6	5	4	3	2	1	0
Byte 0	(Reserved)		PAGE CODE (X'3C')					
1	Parameter length (X'06')							
2	AWD	(Reserved)						
3	ALD	(Reserved)						
4 to 7	(Reserved)							

• AWD (Automatic Width Detection): Byte 2

The AWD bit specifies detected paper width replaces width value which has specified in Width field in Set Window Parameter. When this bit is 0, automatic width detection is disabled. When this bit is 1, automatic width detection is enabled. After the scanning, detected width is set in Detected Paper Width field of Pixel Size Data.

The AWD bit is reserved now. If 1 is set to this bit, the scanner returns following error information.

Status: B'00001' (CHECK CONDITION)

Sense Key: X'5'(ILLEGAL REQUEST)

- ALD (Automatic Length Detection):   Byte 3

  The ALD bit specifies detected paper length replaces length value which has specified in Length field in Set Window Parameter. When this bit is 0, automatic length detection is disabled. When this bit is 1, automatic length detection is enabled. After the scanning, detected length (transferred line number) is set in Detected Paper Length field of Pixel Size Data.

Example 1:

Width

Length

Image data transfer is completed at this line.
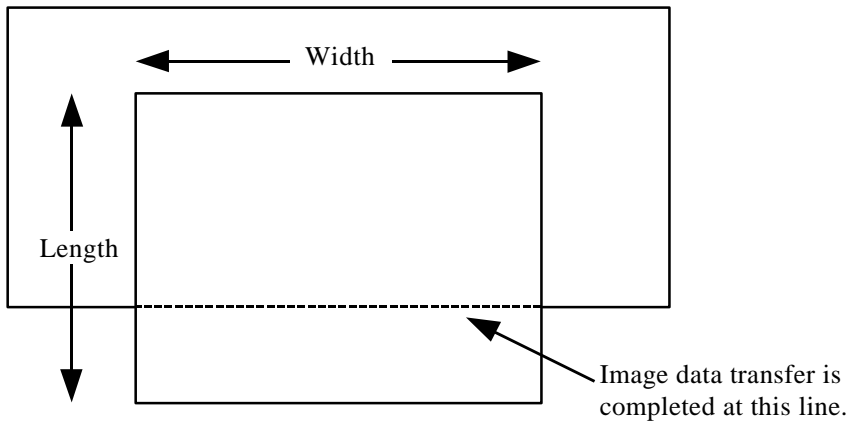
For the READ command, CHECK CONDITION is returned with ILI=0, if TL ≠ 0 like as image data shrink in compression.

Example 2:

ULY

ULX

Width

Length
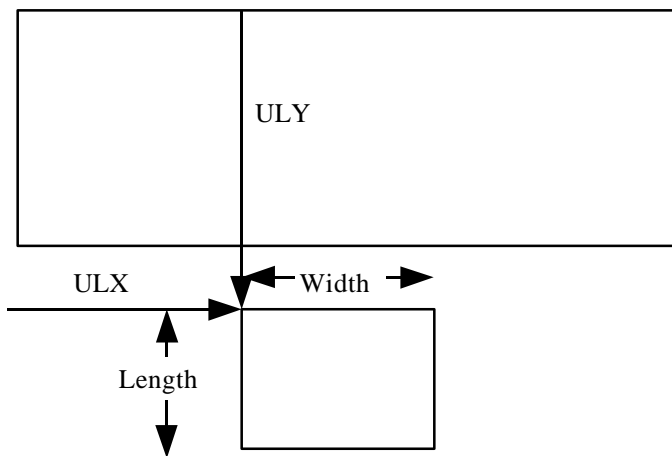
If Window region is started outside the paper, no image data is returned. For the READ command, CHECK CONDITION is returned and reading sequence terminates extraordinarily.

2)   Lamp timer PAGE (PAGE CODE X'3D')

	7	6	5	4	3	2	1	0
Byte 0	(Reserved)		Page code (X'3D')					
1	Parameter length (X'06')							
2	Lamp timer							
3 to 7	(Reserved)							

- •   LAMP TIMER: Byte 2
       The time during which the fluorescent lamp lights. 0: default (60 seconds). Up to 255 seconds can be set up in units of second.

3)   Job separation sheet (PAGE CODE X'3E')

	7	6	5	4	3	2	1	0
Byte 0	(Reserved)		Page code (X'3E')					
1	Parameter length (X'06')							
2	Parameter							
3 to 7	(Reserved)							

- -   PARAMETER: Byte 2
       X'80': Reports check condition status when detects job separation sheet.
       X'00': Does not report check condition status when detects job separation sheet.
             Spec. of job separation sheet shown in A.5.

A.4.13 MODE SENSE (6)

The normal MODE SENSE (6) sequence for the scanner is as follows:

Step	Bus phase	Initiator operation	← →	Target operation
1	Bus Free	Checks Bus Free		
2	(Arbitration)	Acquires the bus use right		
3	Selection	Selects the target	→	
				Drives the BSY signal
4	(Message Out)	Selects the logical device	→	
5	Command	Specifies MODE SENSE (6) (CDB)	→	
6	Data In	Specifies MODE SENSE parameter data	→	Reports mode data
7	Status		←	Reports the GOOD status
8	Message In		←	Reports message (Command complete)
				Releases the BSY signal
9	Bus Free			

(1)   MODE SENSE (6) command: Command phase (Initiator to Target)

The MODE SENSE (6) command is used for the target to report mode parameters to the initiator.

The command descriptor block (CDB) is as follows:

	7	6	5	4	3	2	1	0
Byte 0				Operation code X'1A'				
1	Logical unit number			Reserved	DBD		Reserved	
2	PC		Page code					
3	Reserved							
4	Allocation length							
5	Control byte							

- DBD (disable block descriptor): Byte 1

  When the DBD bit is 1, the target must not return the mode descriptor block in the Data In phase. When this bit is 0, the target may or may not return the block.

  This bit must be 0.

- PC (page control): Byte 2

  PC specifies the type of parameter returned, defined as follows:

PC	Parameter type
00	Current value
01	Changeable value
10	Default
11	Saved value

  Only 00 (current value) can be set. Other values cause the following error:

  Status: B'00001' (CHECK CONDITION)
  Sense key: X'5' (ILLEGAL REQUEAT)

  Page code: Byte 2

  The page code specifies the page to be reported. The following are supported:

Page code	Description
X'00'	Don't care (IGNORE)
X'01'	Reserved
X'02'	Not supported
X'03'	Not supported
X'04' to X'3D'	Reserved
X'3C'	Auto size detection
X'3D'	Lamp timer
X'3E'	Job separation sheet
X'3F'	Reserved

- Allocation length: Byte 4

  The allocation length specifies the storage area allocated by the initiator for the mode sense data in bytes.

  0 means no data is transferred. This is not an error.

  The target terminates the DATA IN phase when mode sense data for the number of bytes specified in this field is transferred or when the tarnsfer of all valid mode sense data is completed.

(2) Mode data: DATA IN phase (Target to Initiator)

Mode parameter list data consists of a header, 0 or more than one descriptor block, and 0 or more than one page.
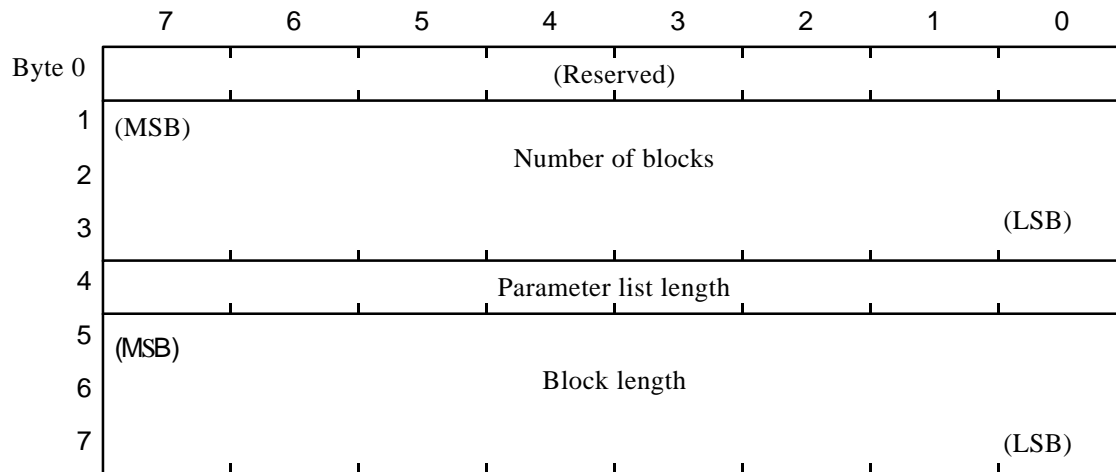
a. Header

Mode parameter data (header) is as follows:

	7	6	5	4	3	2	1	0
Byte 0				Mode data length				
1								
2				Reserved				
3				Block descriptor length				
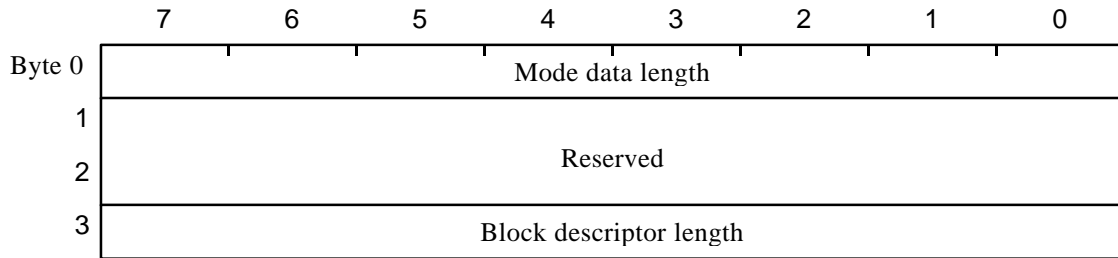
- Mode data length: Byte 0

  The length of available data to be successively transferred is specified in the mode data length in bytes. The mode data length itself is not included.

- Block descriptor length: Byte 3

  The block descriptor length specifies the length of the entire mode parameter descriptor block in bytes. The page and vendor-specific parameter are not included.

  0 is specified.

b. Mode parameter descriptor block (omitted in this scanner)

The mode parameter data (mode descriptor block) is as follows:

	7	6	5	4	3	2	1	0
Byte 0				Reserved				
1	(MSB)							
2				Number of blocks				
3								(LSB)
4				Reserved				
5	(MSB)							
6				Block length				(LSB)
7								
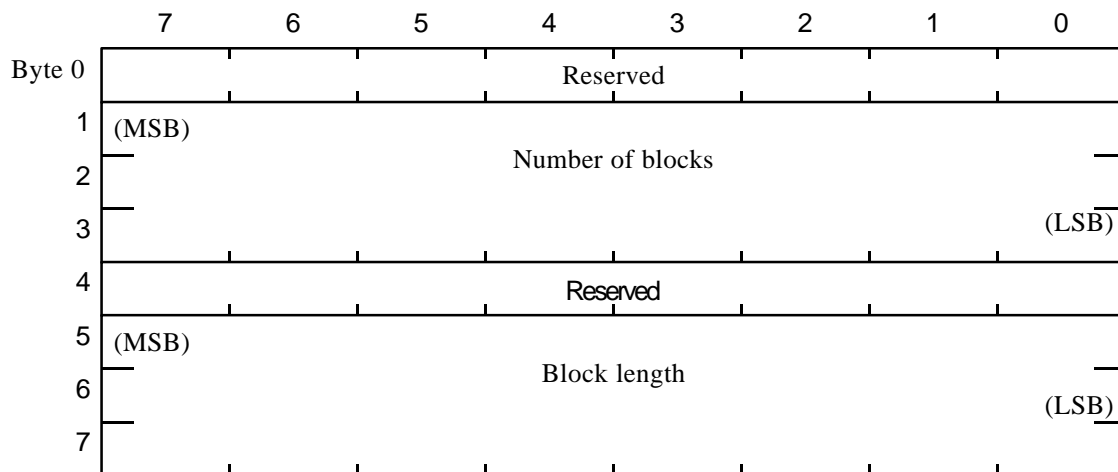
- Number of blocks: Bytes 1 to 3

  The number of logical blocks is specified fitted for the density code and block length.

- Block length: Bytes 5 to 7

  The block length specifies the length of the logical blocks in the block descriptor in bytes.

Note:

This descriptor is omitted.

c.   Mode page

The mode page format is as follows:

	7	6	5	4	3	2	1	0
Byte 0	Reserved		Page code					
1	Page length							
2 to n	Page specific parameter							
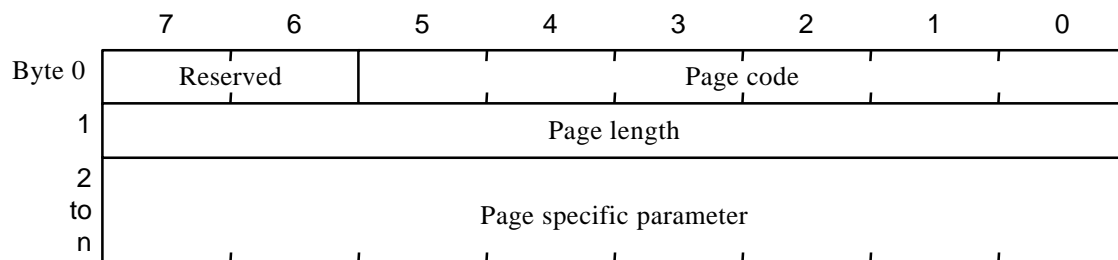
- Page code: Byte 0
- Page length: Byte 1
- Mode parameter: Byte 2

  For definitions, see Section 4.4.12, "Mode select (6)."

A.4.14 SCAN

The normal SCAN sequence for the scanner is as follows:

Step	Bus phase	Initiator operation	← →	Target operation
1	Bus Free	Checks Bus Free		
2	(Arbitration)	Acquires the right to use the bus		
3	Selection	Selects the target	→	
				Drives the BSY signal
4	(Message Out)	Selects the logical device	→	
5	Command	Specifies SCAN (CDB)	→	Specifies reading
6	Data Out	Specifies the window ID	→	
7	Status		←	Reports the GOOD status
8	Message In		←	Reports message (Command complete)
				Releases the BSY signal
9	Bus Free			

(1) SCAN command: Command phase (Initiator to Target)

The SCAN command defines reading method for the scanner.

The command descriptor block (CDB) is as follows:

	7	6	5	4	3	2	1	0
Byte 0				Operation code X'1B'				
1	Logical unit number			(Reserved)				
2				(Reserved)				
3								
4				Allocation length				
5				Control byte				
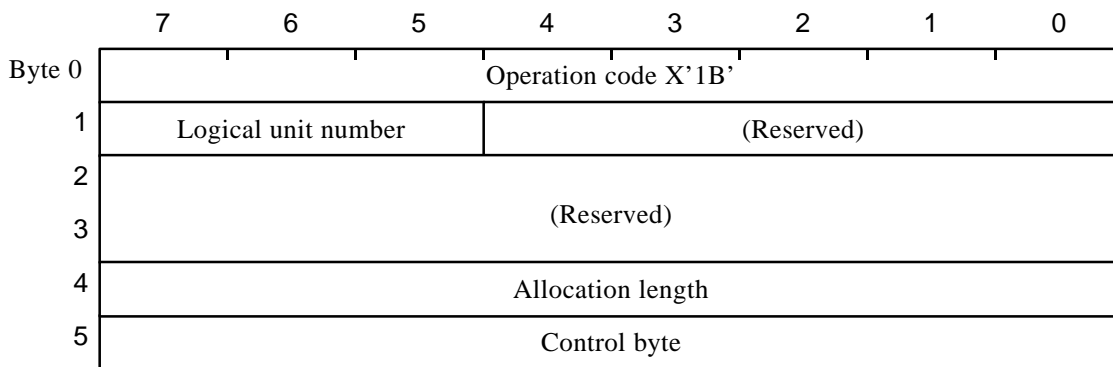
- Transfer length: Byte 4

    The transfer length specifies the number of bytes of window data sent during the DATA OUT phase. A 0 means that no data is transferred. This is not an error.

(2)   Window list data: DATA OUT phase (Initiator to Target)

The window list data parameter specifies the window ID for scanner reading. The scanner supports the following.

a.   Simplex reading specification

Transfer length = 1

Window list data

Byte 0	Window ID=0

b.   Duplex reading specification

Transfer length = 2

Window list data

Byte 0	Window ID=0
1	Window ID=128

If any other combinations are specified, the following errors are returned:

-    Status: B'00001' (Check condition)

-    Sense key: X'5' (Illegal request)

(3)   Operation

When the SCAN command is received, the reading method is defined for the scanner.

A.5 Status: STATUS phase (target → initiator)

Each time a command is terminated, the target moves into the STATUS phase and returns a status byte to the initiator to report the completion of the command.

Status byte

	7	6	5	4	3	2	1	0
Byte 0	(Reserved)			Status byte code				(Reserved)
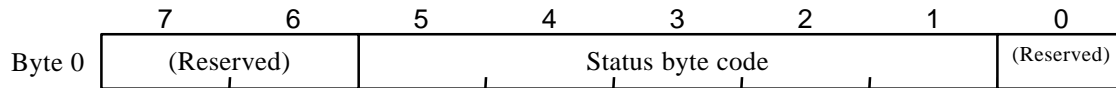
The status supported by this scanner are summarized in the following table.

Code	Status of unit
000000	GOOD • The command has successfully terminated.

000001	CHECK CONDITION
	
	a) The command has abnormally terminated.
	b) An abnormal condition was detected before a unit is selected.
	
	   • The target detected an error before start of command-controlled processing.
	   • A unit that switched from the NOT READY status to the READY status was selected for the first time.
	   • A unit that received a RESET CONDITION or a BUS DEVICE RESET message was selected for the first time.

00100	BUSY
	
	A target or logical unit cannot accept a new command.
	
	   • The logical unit is executing processing.
	   • The target is executing processing on a specified logical unit or other logical unit.
	   • The target intends to report to an other initiator the sense data of a specified logical unit.
	   • The target intends to report to an other initiator the sense data of a logical unit that was not specified.
	   • The target intends to report the status to any initiator.

01100	RESERVATION CONFLICT • The specified unit is already reserved by another initiator.

When a target is released from the BUSY status, it will not issue a notification of the release. Therefore, the initiator needs to check the status of units periodically and needs to issue the command again.

A.6 Messages

This section describes the detection of an ATN signal and explains the types of messages supported by this scanner.

A.6.1 ATN detection

The following table summarizes the timing at which this scanner detects an ATN signal.

Phase	ATN detection timing
SELECTION	Immediately before a phase change
COMMAND	Immediately before a phase change
DATA OUT	Immediately before a phase change
DATA IN	Immediately before a phase change (*1)
STATUS	Immediately before a phase change
MESSAGE OUT	Upon each reception of a message
MESSAGE IN	Upon each transmission of a message

*1   This scanner detects ATN signal for every Read command during an image data transmission. When an ATN signal is detected, scanning operation is interrupted.

A.6.2 Message types

Messages provide information consisting of one or more bytes that are transferred in the MESSAGE IN and MESSAGE OUT phases. These messages are used to control the bus phase sequence.

The initiator creates an ATTENTION condition for the target, indicating that it has a message to be reported to the target. Only then the target switches to the MESSAGE OUT phase to receive the message.

If the target has completed the SELECTION/RESELECTION phase, it can execute the MESSAGE IN phase at any time to send the message to the initiator.

The messages that can be communicated with this scanner are listed in the following table.

Code	Message
00	COMMAND COMPLETE
05	INITIATOR DETECTED ERROR
06	ABORT
07	MESSAGE REJECT
08	NO OPERATION
09	MESSAGE PARITY ERROR
0C	BUS DEVICE RESET
80 to FF	IDENTIFY
04	DISCONNECT
02	SAVE DATA POINTER
03	RESTORE POINTERS
***	SYNCHRONOUS DATA TRANSFER REQUEST

Note:

   *** is Extended Message

(1)   COMMAND COMPLETE (X'00') :   MESSAGE IN phase (target $\rightarrow$ initiator)

This message indicates that a command has been terminated and a valid status has been reported to the initiator.

The target always reports the COMMAND COMPLETE message after the STATUS phase at the completion of the input/output operation. (This requirement also applies if the COMMAND phase is not executed because of a command cannot be received.)

Uopn receiving the COMMAND COMPLETE message, the initiator knows that a command has terminated.

After sending the COMMAND COMPLETE message, the target switches into the BUS FREE phase.

If the COMMAND COMPLETE message is rejected with the MESSAGE REJECT message, this scanner switches into the BUS FREE phase.

(2)   INITIATOR DETECTED ERROR (X'05') : MESSAGE OUT phase (initiator $\rightarrow$ target)

This message indicates that the initiator detected a retriable error and intends to request the target for retry. The value of the current pointer is not guaranteed.

The initiator does not intend to issue another message by activating ATN before it deactivaes the ACK of the INITIATOR DETECTED ERROR message.

When this scanner receives the INITIATOR DETECTED ERROR message, this scanner enters the MESSAGE IN phase and sends the RESTORE POINTERS message to the initiator. Then this scanner returns to the original phase and makes a retry.

After issuing the RESTORE POINTERS message, this scanner takes action as shown in the following table.

ATN detection phase	Action
SELECTION	Moves to the BUS FREE phase
COMMAND	Discards the CDB already received and returns to the COMMAND phase
DATA OUT	Discards the data already received and returns to the DATA OUT phase
DATA IN	• When transferring image data, enters the DATA IN phase. If the memory option is provided, transfers image data again. If no memory option is provided, moves to the STATUS phase (Check Condition) $\rightarrow$ MESSAGE IN phase (Command Complete) $\rightarrow$ BUS FREE phase and keeps the sense key X'B' (Aborted Command). • When transferring inquiry data or sense data, returns to the DATA IN phase and transfers data again
STATUS	Returns to the STATUS phase and sends the status byte again
MESSAGE OUT	Ignores this message (does not issue the RESTORE POINTERS message)
MESSAGE IN	Returns to the MESSAGE IN phase and sends the message byte again

(3)   ABORT (X'06') :   MESSAGE OUT phase (initiator $\rightarrow$ target)

The initiator requests the target to clear the input/output operation of the specified I/O unit (i.e., the input/output operation ordered by the initiator that issued this message) and to move to the BUS FREE phase. Input/output operations ordered by other initiators are not affected.

If a logical unit is not identified before the ABORT message, the target merely moves to the BUS FREE phase.

If no operation to be cleared, an error does not occur.

The initiator does not intend to issue another message by activating ATN before it deactivates the ACK of the ABORT message.

This scanner does not have a function that clears input/output operation for certain initiators. The scanner must have been reserved when it is operated in multi-initiator environment.

(4)   MESSAGE REJECT (X'07') :   MESSAGE IN/OUT phase (initiator $\rightarrow$ target)

This message indicates that a transferred message was rejected by the receiver as invalid or unexecutable.

The initiator does not intend to issue another message by activating ATN before it deactivates the ACK of the MESSAGE REJECT message.

Upon receiving the MESSAGE REJECT message, this scanner takes action as shown in the following table.

Message rejected	Action
COMMAND COMPLETE	Moves to the BUS FREE phase. (It is not assumed as an error.)
MESSAGE REJECT	Responds the CHECK CONDITION status
DISCONNECT	The command execution is continued with connecting the SCSI bus (without disconnecting).
SAVE DATA POINTER	The command execution is continued with connecting the SCSI bus (without disconnecting).
IDENTIFY	When this message is issued for reconnection, the command is terminated with an error. In this case, the reconnection for the command is not performed
RESTORE POINTERS	The error recover is interrupted and the CHECK CONDITION status is responded.
SYNCHRONOUS DATA TRANSFER REQUEST	The command execution is continued in Asynchronous transfer mode.
No message issued	Moves to the BUS FREE phase

(5)   NO OPERATION (X'08') :   MESSAGE OUT phase (initiator → target)

This message is issued in response to a message request from the target and indicates that the initiator does not have a valid message.

The initiator does not intend to issue another message by activating ATN before it deactivates the ACK of the NO OPERATION message.

(6)   MESSAGE PARITY ERROR (X'09') :   MESSAGE OUT phase (initiator → target)

This message indicates that the initiator detected a parity error in the message received. The target resends only that message.

The initiator does not intend to issue another message by activating ATN before it deactivates the ACK of the MESSAGE PARITY ERROR message.

Upon receiving the MESSAGE PARITY ERROR message, this scanner takes action as shown in the following table.

Phase when ATN is detected	Action
MESSAGE IN	Moves to the MESSAGE IN phase and resends the message (*1)
Other	Moves to the BUS FREE phase

*1   This scanner retries three times with the message in the MESSAGE IN phase. If the third retry fails, this scanner immediately moves to the BUS FREE phase.

(7)   BUS DEVICE RESET (X'0C') :   MESSAGE OUT phase (initiator → target)

This message addresses any initiators that are operating, or waiting for operation, on the target. The message initializes those initiators by resetting their input/ output operations.

The BUS DEVICE RESET message is transferred in the asynchronous mode.

This scanner generates the UNIT ATTENTION condition to all initiators.

After being initialized, the initiators move to the BUS FREE phase.

The initiators do not intend to issue another message by activating ATN before they deactivate the ACK of the BUS DEVICE RESET message.

(8)   IDENTIFY (X'80' to X'FF') :   MESSAGE OUT phase (initiator → target)

This message specifies either a logical unit under control of the target, or a process incorporated in the target (maintenance, self-diagnostic, etc.).

Specifies a logical unit number (for bit 4 = 0)
Specifies a process incorporated in the target (for bit = 1)

(Reserved)

(Reserved)

1:    Processed by the target alone
0:    Processed by the target and logical unit

1:    The initiator does not permit disconnect
0:    The initiator permits disconnect

Bit for distinguishing from other messages
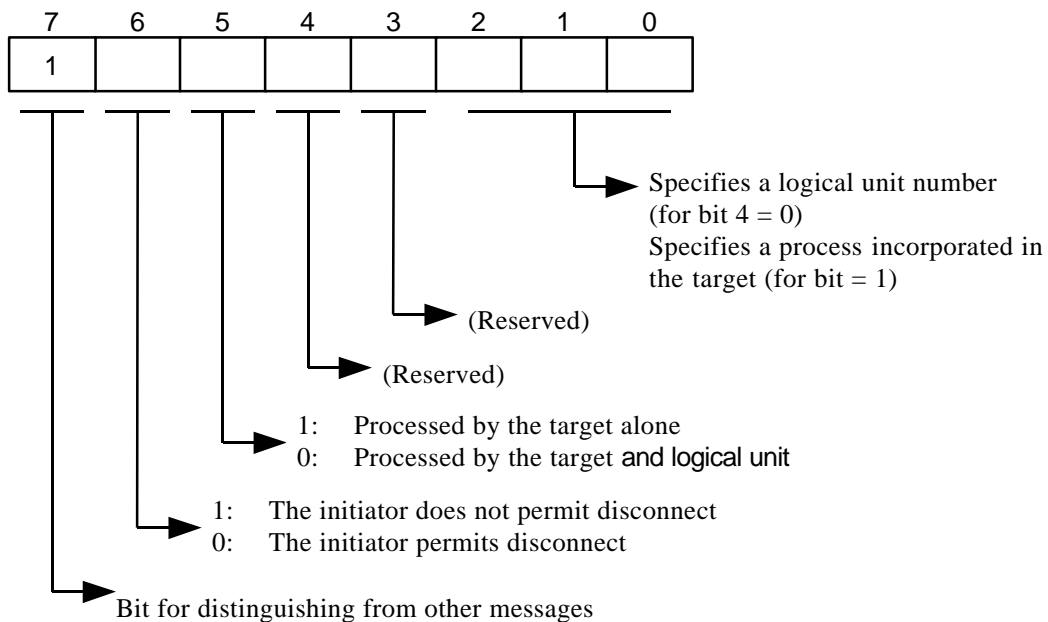
This scanner does not support the target-incorporated process function. Therefore, if a 1 is set in bit 5, the IDENTIFY message is rejected with the MESSAGE REJECT message.

(9)   DISCONNECT (X'04'):   MESSAGE IN phase (target → initiator)

Sent from the target to the initiator, this message indicates that the current link will be disconnected but it will later have to be reconnected to complete the current process.

After successfully sending the DISCONNECT message, the target releases the BSY signal to switch into the BUS FREE phase. The target assumes the message transfer to be successful if it detects that the ATN signal as well as the ACK signal from the DISCONNECT message are false.

This scanner issues the DISCONNECT message if bit 6 (DiscPriv) in the IDENTIFY message from the initiator is 1 and if a long time is expected for processing in the scanner (e.g., when the scanner receives the READ command and prepares data to be transferred to the initiator).

The link will not be disconnected if bit 6 in the IDENTIFY message is 0. Also, it will not be disconnected if the IDENTIFY message is not issued in a given command sequence. For disconnect to occur therefore, bit 6 in the IDENTIFY message must be set to 1.

When performing the disconnection during data transfer, this scanner sends the SAVE DATA POINTER message before sending the DISCONNECT message so that the data pointer is saved.

Example:

```
BUS FREE
   ↓
ARBITRATION
   ↓
SELECTION
   ↓
MESSAGE OUT  (IDENTIFY:   BIT6=1)
   ↓
COMMAND  (READ command)
   ↓
MESSAGE IN  (DISCONNECT message)
   ↓
BUS FREE
   .
   .    }  The data to be transferred to the initiator is prepared during this interval.
   .
   .
RESELECTION
   ↓
MESSAGE IN  (IDENTIFY message)
   ↓
DATA IN  (Transfer of image data)
   ↓
MESSAGE IN  (SAVE DATA POINTER message)
   ↓
MESSAGE IN  (DISCONNECT message)
   ↓
BUS FREE

   .
   .    }  The data to be transferred to the initiator is prepared during this interval.
   .

RESELECTION
   ↓
MESSAGE IN  (IDENTIFY message)
   ↓
DATA IN  (Transfer of image data)
   ↓
STATUS  (GOOD status)
   ↓
MESSAGE IN  (COMMAND COMPLETE message)
   ↓
BUS FREE
```

(10) SAVE DATA POINTER (X'02') :   MESSAGE IN phase (target → initiator)

This message is sent from the target to the initiator in order to save the current data pointer. The initiator saves the current data pointer value into the saved pointer for the logical unit currently connected.

When the disconnection is enabled by the IDENTIFY message and this scanner cannot prepare data to be transferred in the DATA IN phase, this scanner issues the DISCONNECT message after issuing the SAVE DATA POINTER message so that the SCSI bus is released.

Notes:

1. When no memory option is provided, this scanner does not issue the SAVE DATA POINTER message.

2. When the required data for the READ command is less than 64 KB, this scanner does not issue the SAVE DATA POINTER message.

(11) RESTORE POINTERS (X'03') :   MESSAGE IN phase (target → initiator)

The initiator restores the saved pointer by using this message. The initiator restores the command data status pointer value from the saved pointer for the logical unit connected when this message is received. The initiator stores the value into the current pointer.

Note:

This scanner issues the RESTORE POINTER message only during error recovery when the INITIATOR DETECTED ERROR message has been received.

(12) SYNCHRONOUS DATA TRANSFER REQUEST (Extended message) Message IN/OUT Phase (Init ↔ Targ)

The SYNCHRONOUS DATA TRANSFER REQUEST consists of 5bytes is only an extended message by this scanner.

SYNCHRONOUS DATA TRANSFER REQUEST

Bit Byte	7	6	5	4	3	2	1	0
0	Extended message (06h)							
1	Extended message length (03h)							
2	SYNCHRONOUS DATA TRANSFER REQUEST code (01h)							
3	Transfer Period Factor							
4	REQ/ACK Offset							

ASYNCHRONOUS DATA TRANSFER REQUEST (SDTR) message exchange shall be initiated by an SCSI device whenever a previously arranged data transfer agreement may have become invalid. The agreement becomes invalid after any condition which may leave the data transfer agreement in an indeterminate state such as:

a)   after a hard reset condition;

b)   after a BUS DEVICE RESET message and;

c)   after a power cycle.

In addition, an SCSI device may initiate an SDTR message exchange whenever it is appropriate to negotiate a new data transfer agreement (either synchronous or asynchronous). SCSI device that are capable of synchronous data transfers shall not respond to an SDTR message with a MESSAGE REJECT message.

The SDTR message exchange establishes the permissible transfer periods and the REQ/ACK offsets for all logical units on the two devices. This agreement only applies to data phases.

Transfer Period Factor: 62, 93, 125, 156 (4.0, 2.6, 2.0, 1.6 [MB/S])

The transfer period factor times four is the value of the transfer period. The transfer period is the minimum time allowed between leading edges of successive REQ pulses and of successive ACK pulses to meet the device requirements for successful reception of data.

REQ/ACK Offset: 0 (Async), 1 to 8

The REQ/ACK offset is the maximum number of REQ pulses allowed to be outstanding before the leading edge of its corresponding ACK pulse is received at the target. This value is chosen to prevent overflow conditions in the device's reception buffer and offset counter. A REQ/ACK offset value of zero shall indicate asynchronous data transfer mode; a value of FFh shall indicate unlimited REQ/ACK offset.

The originating device (the device that sends the first of the pair of SDTR message) sets its values according to the rules above to permit it to receive data successfully. If the responding device can also receive data successfully with those value (or smaller transfer periods or larger REQ/ACK offsets or both), it returns the same values in its SDTR message. If it requires a larger transfer period, a smaller REQ/ACK offset, or both in order to receive data successfully, it substitutes values in its SDTR message as required, returning unchanged any value not required to be changed. Each device when transmitting data shall respect the limits set by the other's SDTR message, but it is permitted to transfer data with larger transfer periods, smaller REQ/ACK offsets, or both than specified in the other's SDTR message. The successful completion of an exchange of SDTR message implies an agreement as follows:

Responding Device SDTR response	Implied Agreement
1) Non-zero REQ/ACK offset	Each device transmits data with a transfer period equal to or greater than and a REQ/ACK offset equal to or less than the values received in the other device's SDTR message.
2) REQ/ACK offset equal to zero	Asynchronous transfer
3) MESSAGE REJECT message	Asynchronous transfer

A.7   Command Sequence

This section describes the initial sequence and read sequence.

A.7.1   Initial sequence

Host side		Scanner side
		Power ON/reset/initialize Scanner does not respond for 3
Verify the logical	INQUIRY → ← INQUIRY	Prepare INQUIRY data Respond with INQUIRY data
Verify scanner READY	TEST UNIT READY → ← Status byte	Respond with GOOD status if READY Respond with CHECK CONDITION status if UNIT ATTENTION
Check status byte Receive GOOD status Receive CHECK CONDITION status Request sense data Receive UNIT ATTENTION sense data	REQUEST SENSE → ← Sense data	Prepare sense data Respond with sense data Clear sense data (Release UNIT ATTENTION)
Verify scanner READY	TEST UNIT READY → ← Status byte	Respond with GOOD status if READY Respond with CHECK CONDITION status if NOT READY
Check status byte Receive GOOD status Receive CHECK CONDITION status Request sense data Receive sense data NOT READY HARDWARE ERROR	REQUEST SENSE → ← Sense data	Prepare sense data Respond with sense data
End (Ready to read)		End (Ready to read)
Abnormal termination		

A.7.2   Command sequence to read

The following illustration is an example of the command sequence used with this scanner. All commands are assumed to be issued from a single initiator.

(1)   Normal sequence

Initiator	Target
RESERVE UNIT	Move to reserved status
SET WINDOW	- Set window parameters - Calculate the number of scan lines covering all windows set up, in terms of lines effective after magnification change

Example: Set up window 0 (front-side) and window 128 (back-side).
Declare subwindows 0 and 1 in both front-side and back-side subwindow list (M3093DE)

Document

Window 0 (front-side)

Document

Window 128 (back-side)

SET SUBWINDOW	Set subwindow parameters

Example: Set up subwindows 0 and 1 (If it is necessary to set subwindows) in window 0 and
            128. (M3093DE)

Document   Document

| Window 0 (front-side) | | Window 128 (back-side) |

Subwindow 0

Subwindow 1

Subwindow 1

Subwindow 0

Initiator   Target

| SEND | → | Dither pattern download |

(if necessary)

| OBJECT POSITION | → | Load document on ADF |

(Not required if ADF is not used)

| SCAN (M3093DE) | → | Set simplex or duplex reading |

| READ command sequence | → | Start scan/transfer |

See item 4.7.3 for the READ command sequence.

| (OBJECT POSITION) | → | Unload document from ADF |

(Not required if ADF is not used)

(Not required if ADF is used, because document is unloaded automatically.)

(2)   When document size detection function is used

RELEASE UNIT	→	Release reserved status

Initiator   Target

RESERVE UNIT	→	Move to reserved status

OBJECT POSITION	→	Load document from ADF

Read command (document size request)	→ ←	Report document size (Horizontal scanning direction is effective)

SET WINDOW	→	• Set window parameters • Calculate the number of scan lines covering all windows set up, in terms of lines effective after magnification change

SET SUBWINDOW	→	Set subwindow parameters

(If setting subwindows is required)

SEND	→	Dither pattern download

(Only if required)

SCAN (M3093DG only)	→	Set simplex or duplex reading

READ command sequence	→	Start scan and transfer

See Section (3) for Read command sequence.

(OBJECT POSITION)	→	Unload document from ADF

(Not required if ADF is not used)

(Not required if ADF is used, because document is unloaded automatically.)

RELEASE UNIT	→	Release reserved status

A.7.3   READ command sequence

A.7.3.1   Single read (disconnect disabled)

Request image data (TL). (one page)

READ command → Start scanning.

BUSY status

Issue command again.
Command completion.

Data volume < TL

or

Data volume ≥ TL
Send image data.

See Notes 1 and 2.

Data volume: Image data volume in the scanner at that time.

A.7.3.2   Single read (disconnect enabled)

```
                                          (M=0 before scanning)
Request image data (TL).    READ command  Start scanning.
(one page)
                            Disconnect     Data volume
                                           < Min(TL-M or 64 KB)

                                           Wait for following
                                           condition is satisfied.
        ................................................................
                            Reconnect      TL-M > Data volume          or
                                           ≥ 64 KB
                                           (only for disconnected case)

                 Image data
                 (64KB x N)
                                           Send image data.
                            Saved data pointer   M = M + 64 KB x N

                            Disconnect     Wait for following
                                           condition is satisfied.
                                           Data volume
                                           ≥ Min (TL-M or 64 KB)

        ................................................................
   or                       Reconnect                                  or
                                           Data volume ≥  TL-M
                                           (only for disconnected case)

                 Image data (TL-M)
Command completion                         Send image data.
```

See Notes 1 and 2.

Min (TL-M or 64 KB): Either TL-M or 64 KB which is smaller.

A.7.3.3 Multiple read (disconnect disabled)

Request image data (TL).

READ command → Start scanning.

Issue command again.

BUSY status ← Data volume < TL

or

Image data (TL) ← Data volume ≥ TL
Send image data.

Next data request

GOOD status ← Uncompleted reading (one page)

or

CHECK CONDITION status ← Completed reading (one page)

See Notes 1 and 2.

A.7.3.4 Multiple read (disconnect enabled)

Request image data (TL).

READ command

Disconnect

Reconnect

Image data
(64KB x N)

Saved data pointer

Disconnect

or

Reconnect

Image data (TL-M)

Command completion

Next data request

GOOD status

CHECK CONDITION
status

(M=0 before scanning)

Start scanning.

Data volume
< Min(TL-M or 64 KB)

(Wait for following
condition is satisfied.)

or

TL-M > Data volume
≥ 64 KB
(only for disconnected case)

Send image data.

M = M + 64 KB x N

(Wait for following
condition is satisfied)
Data volume
≥ Min(TL-M or 64 KB)

or

Data volume ≥ TL-M
(only for disconnected case)

Send image data
Completion

Uncompleted
reading (one page)

or

Completed
reading (one page)

See Notes 1 and 2.

Notes:

1.   If the requested transfer volume is not equal to the actual data volume, this scanner informs the initiator that the requested transfer amount is abnormal. This is done as the scanner returns the status 00001 (CHECK CONDITION) and creates the following sense data:

    - ILI = 1

    - INFORMATION = requested transfer amount (TL) - actual data amount

    This status is usually sent to the last READ command of the sequence.   (For commands other than the last READ, the GOOD status is reported.) If the data amount requested by the last READ command agrees with the last data amount left, the GOOD status is reported to the READ command, and the CHECK CONDITION status is reported to the next READ command.

2.   In addition to the means described above in Note 1, the initiator has another means for ascertaining the completion of transfer of image data for one window. Specifically, the initiator issues the REQUEST SENSE command after each completion of the READ command, and if the sense data received in response is NO SENSE, the initiator checks the EOM bit in the sense data:

    EOM bit = 0 . . . There is scan data yet to be transferred.

    EOM bit = 1 . . . All scan data has been transferred.

    However, issuing the REQUEST SENSE command after each completion of the READ command is not desirable in terms of processing efficiency.

3.   Once all scan data has been transferred, the CHECK CONDITION status is always reported to the READ command that follows. Before attempting another read, first issue the SET WINDOW command.

4.   Enable or disable of disconnection is decided by bit 6 of the IDENTIFY message issued by the initiator at the READ command. The initiator that requires disconnection must set bit 6 of the IDENTIFY message. When the CMP II option is not provided, the disconnection is not performed even if bit 6 of the IDENTIFY message is set.

A.8 Status Transition of Logical Unit

Power ON
Reset
BUS DEVICE RESET message

──────▶	GOOD status
┈┈┈┈┈▶	CHECK CONDITION status
═════▷	Status transition

Other command

UNIT ATTENTION status

INQUIRY command

REQUEST SENSE command
UNIT ATTENTION reported/cleared)

Range protected in reserved status

NOT READY status

Time to READY

Less than 60 seconds

NOT READY status

Other command

REQUEST SENSE
Command
(NOT READY

Normal status

READY status: Waiting

Other command

READ

Reading

Scan completed

C. A. status

- Hardware error
- Abnormal command
- Abnormal parameter
- Medium error

C. A status

REQUEST SENSE command
(Error detail reported/cleared)

Other command
(C. A. status released)

A.9   Error Table

The following table lists errors that may occur upon issue of each command.

	Sense key	0	2	3	4	5	6	B
	Content	NO SENSE	NOT READY	MEDIUM ERROR	HARD-WARE ERROR	UNIT ATTEN-TION	ILLEGAL REQUEST	ABORTED COMMAND
SET SUBWINDOW		o	o	-	o	o	o	-
SET WINDOW		o	o	-	o	o	o	-
INQUIRY		o	-	-	-	-	(*1)	-
OBJECT POSITION		o	o	o	o	o	o	-
READ		o	o	-	o	o	o	o
RELEASE UNIT		o	o	-	o	o	o	-
REQUEST SENSE		o	-	-	-	-	(*1)	-
RESERVE UNIT		o	o	-	o	o	o	-
SEND		o	o	-	o	o	o	-
SEND DIAGNOSTIC		o	o	-	o	o	o	-
TEST UNIT READY		o	o	(*2)	o	o	o	-
MODE SELECT		o	o	-	o	o	o	-
MODE SENSE		o	o	-	o	o	o	-
SCAN		o	o	-	o	o	o	-

*1   Error in command descriptor

*2   Jam of document being unloaded from ADF at power ON or reset time

Appendix B Interface deference between M3097DG and M3093DG

The interface difference between M3093DG and M3093DG is explained in this appendix. Unless otherwise specified here, the interface of M3097DG is same as that of M3093DG.

B.1 Product identification

M3097DG and M3093DG return the following product identifications when requested by INQUIRY command. The product identification is specified by the bytes 10 to 1F of standard inquiry data.

Table B.1.1 Product identification

Scanner type	M3097DG	M3093DG
Scanner without option	M3097DGdm	M3093DGdm
Scanner with IPC-2D or IPC-3D option	M3097DGdim	M3093DGdim

M3097DG and M3093DG can emulate following products by the following method.

Table B.1.2 Scanner which can be emulated

	M3097DG	M3093DG
Scanner which can be emulated *	M3099G M3099GH M3097D M3096GX M3093DG	M3099G M3096G M3093GX
Method of emulation	Selecting in the Setup mode of the operator panel	Switching the ADF sensor and power switch (see OEM manual)

* The suffix of the emulated product ID is same as M3093DG/M3097DG.

B.2 Window width and length

M3097DG and M3093DG return following window width and window length in vital product data (byte 14 to 1B). These data means the width and length that can be read by the scanner in basic resolution dots.

Table B.2.1 Window width and length

	M3097DG	M3093DG
Window width (Byte 14 to 17)	X'00001300'	X'00000D80'
Window length(Byte 18 to 1B)	X'00001B00'	X'000015E0

Ex. : X'00001300 = 4864 ,   X'00001B00 = 6912

B.3 Buffering capability

M3097DG and M3093DG return following buffering capability data at bytes 22 to 25 of the vendor unique parameter byte in vital product data. This data means the capacity of the image memory installed in the scanner.

Table B.3.1 Physical function

	M3097DG	M3093DG
Without option	X'01000000'	X'00400000'
With memory option	X'02000000'	X'00C00000'

Ex. : X'0100000' = 16 MB   X'00800000'= 8 MB

B.4 Window data limitation

Width and length of the window data have following limitations.

Table B.4.1 Window data limitation for M3097DG

	Without option	With IPC-2D/3D option	With memory option	With memory and IPC-2D/3D option
ULX + W	$0 < (ULX + W) \leq 14592$ (1/1200 in.)			
ULY + L	$0 < (ULY + L) \leq 20736$ (1/1200 in.)			
XR + W/1200	$9 \leq [XR \times W/1200] \leq 7296$ (dots)			$9 \leq [XR \times W / 1200] \leq 9728$ (dots)
YR + L/1200	$1 \leq [YR \times L/1200] \leq 10368$ (lines)			$1 \leq [YR \times L/1200] \leq 13824$ (lines)

(Values under 0 in [ ] are omitted)

Table B.4.2 Window data limitation for M3093DG

	Without option	With IPC-2D/3D option	With memory option	With memory and IPC-2D/3D option
ULX + W	$0 < (ULX + W) \leq 10368$ (1/1200 in.)			
ULY+ L	$0 < (ULY + L) \leq 16800$ (1/1200 in.)			
XR + W/1200	$9 \leq [XR \times W/1200] \leq 3456$ (dots)		$9 \leq [XR \times W/1200] \leq 5184$ (dots)	$9 \leq [XR \times W/1200] \leq 6912$ (dots)
YR + L/1200	$1 \leq [YR \times L/1200] \leq 5600$ (lines)		$1 \leq [YR \times L/1200] \leq 8400$ (lines)	$1 \leq [YR \times L/1200] \leq 11200$ (lines)

(Values under 0 in [ ] are omitted)

B.5 Paper size specification

Paper size data of ADF, byte 35 of vendor unique parameter, is deferent as follows. If this paper size is not specified, M3097DG reads as A3 size and M3093DG reads as A4 size.

Byte 35 of vendor unique parameter :

7	6	5	4	3	2	1	0
		0					
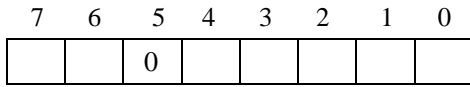
```
                        ----------+-----------

                +---------→ Paper size in vendor unique parameters
```

	M3097DG	M3093DG
0000	Undefined	
0001	Undefined	
0010	Undefined	
0011	A3	Undefined
0100	A4	
0101	A5	
0110	Double letter	Undefined
0111	Letter	
1000	Undefined	
1001	Undefined	
1010	Undefined	
1011	Undefined	
1100	B4	Undefined
1101	B5	
1110	Undefined	
1111	Legal	Undefined

B.6 Paper width X limitation of nonstandard size document

When nonstandard document is specified, the paper width data in byte 36 to 3D of vendor unique parameter must meet following limitations.

Table B.6.1 The limitation of paper width X

	M3097DG	M3093DG
Paper width X	$X \leq 14034$ (1/1200 in.)	$X \leq 10200$ (1/1200 in.)

B.7 The limitation of grayscale output

The lower two bit output of grayscale of M3093DG is limited when following setting specified.

Table B.7.1 The limitation of grayscale output of M3093DG

Setting		Grayscale output
γ pattern setting	contrast setting	
00 (Built-in, linear)	80	256 levels
00 (Built-in, linear)	Other than 80	Lower two bit is 00 fixed
Other than 00	XX	
Download pattern		

B.8 Paper size at DATA IN phase after Read command

Detected paper size (Byte 3 of detected paper information which can be requested by READ command) is deferent as follows.

Byte 3 of detected paper information :

7	6	5	4	3	2	1	0
		0					

-----------+---------
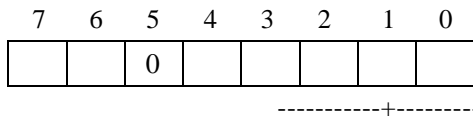
+---------→   The size detected

	M3097DG	M3093DG
0000	Undefined	
0001	Undefined	
0010	Undefined	
0011	A3 or Double letter	Undefined
0100	A4 or Letter	
0101	A5	
0110	Undefined	
0111	Undefined	
1000	Undefined	
1001	Undefined	
1010	Undefined	
1011	Undefined	
1100	B4	Undefined
1101	B5	
1110	Undefined	
1111	Undefined	

B.9 General Remarks

These are not the interface deference between M3097DG and M3093DG, but may be useful information for the driver engineers.

B.9.1   Command sequence

At Flatbed or ADF (simplex) or ADF (duplex) reading, the following command sequence is recommended.

FB reading   :   Set window (front) --> SCAN (front) --> READ (front) --> SCAN (front) --> READ (front) -> ...

ADF(simplex):   Set window (front) --> Object Position (Load) --> SCAN (front) --> READ (front) --> Object Position (Load) --> SCAN (front) --> READ (front) --> ....

ADF(duplex) :   Set window (duplex) --> Object Position (Load) --> SCAN (duplex) --> READ (front) --> READ (back) --> Object Position (Load) --> SCAN (duplex) --> READ (front) --> READ (back) --> ....

Notice: If the Object position (Load object) is issued without the SET command of duplex reading, the scanner returns the error below;

Status:	B'00001'(CHECK CONDITION)
Sense key:	B'5' (ILLEGAL REQUEST)
Additional sense code:	B'26'
Additional sense code qualifier:	B'00'

B.9.2   Additional sense code/ Additional sense code qualifier

Following sense code and sense code qualifier are missing in M3093DG OEM manual but the scanner can report.

Table B.9.1 Sense code and sense code qualifier not in OEM manual

Sense Key	Additional sense code	Additional sense code qualifier	Description
5	00	00	Page end is detected before reading (VGATE ON) when the page end detection is enabled.
5	1A	00	Parameter length illegal
B	45	00	SELECT/RESELECT FAILURE
B	47	00	SCSI parity error

Appendix C Throughput

Following is not a guaranteed data but a tested result in Fujitsu.

C.1 Offline test

Document size	Document direction	Offline test throughput (PPM) *, **			
		200 dpi	300 dpi	400 dpi	600 dpi
A3	Portrait	29.5	14.5	15.6	10.7
B4		32.9	23.1	17.7	12.2
A4		39.8	28.1	21.8	15.0
B5		37.9	26.9	21.3	14.8
A5		50.0	35.7	27.7	19.7
Double letter		28.6	20.0	15.2	10.4
Letter		40.1	28.1	21.5	15.0
Executive		41.7	29.4	21.1	16.1
A4	Landscape	50.0	35.7	27.7	19.7
B5		47.8	34.1	27.8	19.2
A5		TBD	TBD	TBD	TBD
LT		49.7	34.8	26.8	18.9
Executive		53.9	38.3	30.0	21.3

*   PPM: Paper Per Minute

**   The throughput at 150 dpi and 100 dpi is same as 200 dpi.

C.2 Online test

(1)   M3097DE
- Host computer: FMV-DESKPOWER (FMV41D4S3)
  DX4-100 MHz, 56 MByte
- KOFAX board: KF-9275
- Application: KOFAX Image Control Ver 2.1 (16 Bit)
- Driver: KOFAX for M3099EX/M3093DE
- Remarks: Image data was compressed by CCITT Group 4 and stored.

- Test result:

Document size/direction	Resolution	Simplex (PPM)	Duplex (IPM) *
A4, portrait	200	37.4	71.5
	300	26.8	46.6
	400	20.8	33.8
	600	14.5	20.3
Letter, portrait	200	39.3	75.4
	300	28.3	49.6
	400	22.1	35.7
	600	15.4	21.5
A3, portrait	200	28.5	44.1
	300	20.1	31.2
	400	15.5	22.1
	600	TBD	TBD

* IPM: Image Per Minute

(2) M3097DG

- Host computer: FMV5166TE5 Pentium 166 MHz, RAM72MByte
- SCSI board: AHA2940AU (Synchronous 10M)
- Application: Image View (Ver 2.0 10)
- Driver: ISIS (PIXDFLT 51.209, FUJIGINX Ver 1.140)
- Remarks: Product ID, M3093DG/M3099GX was selected.
- Test result:

Document size/direction	Resolution	Simplex (PPM)	Duplex (IPM) *
A4, portrait	200	37.4	67.3
	300	27.4	42.3
	400	20.7	34.3
	600	14.7	22.0
Letter, portrait	200	38.9	70.5
	300	28.7	44.9
	400	22.3	36.1
	600	15.5	23.2
A3, portrait	200	26.5	46.5
	300	20.4	28.1
	400	15.7	21.0

Appendix C-2