

M3097E
IMAGE SCANNER
OEM MANUAL

REVISION RECORD

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CHAPTER 1 GENERAL

1.1	General Description
1.2	Features

1.1 General Description

M3097E image scanners are compact, inexpensive, and ideal input devices for electronic filing systems, facsimiles, optical character readers (OCR), computer aided design (CAD) systems, and automatic publishing systems.

The M3097E can scan double-letter or A3 size paper. The M3097E has an automatic document feeder (ADF) that can accommodate up to 100 pages.

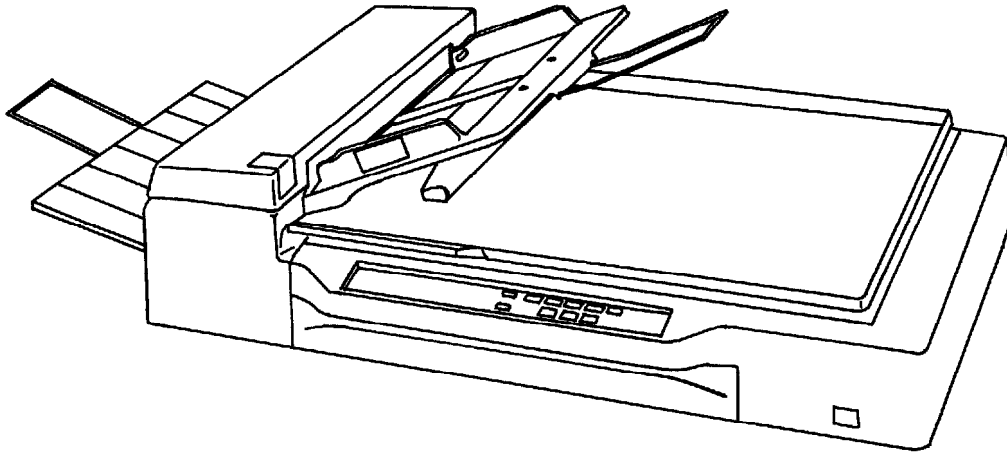


Figure 1.1 M3097E outer view

1.2 Features

(1) Fast reading

This scanner can read data about twice as fast as the M3096E+.
For flatbed reading: 1.3 seconds (A4, 200 dpi) (M3096E+: 2.3 seconds)
For ADF reading: 36 pages per minute (A4, 200 dpi) (M3096E+: 18 pages per minute)

(2) Large-capacity document feeder

Up to 100 pages (A4, 55-kg continuous forms) can be loaded into the document feeder. (M3096E+: Up to 50 pages)

(3) High-quality image

This scanner uses a compact optical system that provides sharper focus. Furthermore, the use of new LSI chips produces finer images.

(4) New image processing

The standard version of this scanner has error diffusion function. Dithering or error diffusion can be applied to those areas judged to be photographs by automatic separation (image processing II option).

(5) Compact

This scanner is small and light. (Its size is almost the same as that of the M3096E+)

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CHAPTER 2 SPECIFICATIONS

2.1	Function Specifications
2.2	Physical Specifications
2.3	Optional Circuit Feature
2.4	Connectors and Cables

2.1 Function Specifications

Table 2.1 Function specifications (1/2)

No.	Item	Specification	
1	Technology	CCD image sensor	
2	Operating method	Flatbed + ADF (automatic document feeder)	
3	Document size	Flatbed	MAX 297 × 432 mm
		ADF	MAX 297 × 432 mm MIN 105 × 148 mm
4	Light source	Green fluorescent lamp	
5	ADF capacity	MAX 100 (55 kg/continuous forms, A4 paper)	
6	Resolution	Horizontal scanning	400 dpi
		Vertical scanning	400, 300, 240, 200 dpi
7	Gray scale	256 steps	
8	Interface	RS232C (Control signal) + local (Video signal)	
9	Scanning speed	A4/200 dpi: 1.3 s	
		A3/400 dpi: 3.7 s	
10	Output density	Standard	400, 300, 240, 200 dpi (For horizontal scanning and vertical scanning)
		If the image processing II option is installed	50 dpi to 1600 dpi (Horizontal scanning and vertical scanning are independent.)

Table 2.1 Functional specifications (2/2)

No.	Item	Specification	
11	Binarization and halftone function	Standard	Fixed binarization Dither Error diffusion method
		If the image processing II option is installed	Separation, image emphasis, extraction, mirror image, inversion, outline simplified DTC.
			Dynamic threshold, smoothing, filtering, noise removing.

2.2 Physical Specifications

Table 2.2 Physical specifications

No.	Item		Specification
1	Dimensions (mm)	Height	173
		Width	696
		Depth	497
2	Weight (kg)		25
3	Power requirements	Voltage (VAC)	100 to 120, 220 to 240 VAC $\pm 10\%$
		Phase	Single
		Frequency	50/60 Hz +2% -4%
4	Power consumption (VA)		150 or less
5	Surge current (A)		30 or less
6	Momentary power failure		100% 0.5 Hz
7	Leakage current (mA)		1 or less
8	Dielectric strength		AC 1 KV or more for one minute or more (between FG and AG lines)
9	AC line noise		Voltage 1.2 KV pulse duration 5 μ s
10	Temperature (°C)	Operating	5 to 35
		Nonoperating	-20 to +60
11	Relative humidity (%)	Operating	20 to 80 (no condensation)
		Nonoperating	8 to 95 (no condensation)
12	Vibration (G)	Operating	0.2
		Nonoperating	0.4
13	Indication (%)	Operating	5
		Nonoperating	10
14	ESD (KV)		8 or more
15	Acoustic noise (dBA)	Operating	53 or less (ISO DIS 9296)
		Nonoperating	40 or less (ISO DIS 9296)

2.3 Optional Circuit Feature

The following option is provided for this scanner:

- Image processing circuit II (M3097E0191)

For the details, refer to Subsection 2.3.1.

2.3.1 Image processing circuit II (IPC II)

This option has the dynamic threshold function and image processing function.

2.3.1.1 Dynamic threshold function

The main purpose of this function is to read handwritten characters.

Handwritten character recognition preprocessing involves specifying required values for threshold curve setting, smoothing mode, and filtering mode.

Noise removal reduces noise often found in images after dynamic threshold processing.

The dynamic threshold circuit is selected when control register #1 bit 4 is set to 1 or DENSITY is set to AUTO 1 on the operator panel.

Threshold curve setting, smoothing mode, filtering mode, and noise removal are all dynamic threshold circuit (DTC) functions.

(1) Threshold curve setting

The contrast level of the dynamic threshold circuit can be changed with setting 3 bits (8 levels).

(2) Smoothing mode

The convex portion of the segment is removed and the concave portion is filled up to smooth the segment.

(3) Filtering mode

(a) Ball-point pen mode

This mode is used when this scanner is used as the input device of OCR system. When using writing materials caused inter-ommission, e.g. ball-point pen, the density of the omission portion is increased according to the density of surrounding portion to get the picture does not have inter-ommission.

(b) Normal mode

This mode is used when using writing materials other than above.

(4) Noise removal

Among black-dots in the binary picture code, the black-dot for the noise is changed to white-dot.

2.3.1.2 Image processing function

Table 2.3 Image processing function

No.	Function name	Details function
1	Separation (Line-drawing/Photo) automatic separation	Recognizes the photo area and Line-drawing area in one scanning automatically, and outputs data with applying dither processing or error diffusion for the photo and the binarizing for the line-drawing.
2	Outline extraction	Extracts the outline of the Line-drawing such as a thick character.
3	Image emphasis	Emphasizes the black-white contrast to raise the resolution.
4	Overlay	Overlays the pattern on the scanned data and make the overlaid black data to white data.
5	Inversion (White/black conversion)	Converts white into black and black into white of read data (binary data).
6	Mirror image	Turns over the both sides of read data.
7	Simplified Dynamic threshold	Changes the slice level of the binarizing according to the density of the document.
8	Zooming	Magnifies or reduces the document in the range between 25% and 400% with 1% step. Also reads the document with different magnification in horizontal and vertical scanning.
9	Subwindow	4 Subwindow can be specified on Main window.

The functions above are all image processing circuit (IPC) functions.

Table 2.4 Combination of IPC II features

Generic name of function	Name of function	When disable Halftone procese		When enable Halftone procese			
				Ditherd		Error diffusion	
		Main window	Sub window	Main window	Sub window	Main window	Sub window
DTC (*1)	Threshold curve smoothing mode filtering mode noise removing	S	NS	S (*2)	NS	S (*2)	NS
IPC	Image emphasis	S	S	S	S	S	S
	Outline extraction	S (*3)	S (*3)	NV	NV	NV	NV
	Automatic Separation	S (*4)	S (*4)	S (*4)	S (*4)	S (*4)	S (*4)
	Overlay	S (*5)	S (*5)	NV	NV	NV	NV
	Simplified dynamic shreshold	S (*6)	S (*6)	NV	NV	NV	NV
	Inversion	S	S	S	S	S	S
	Mirror image	S	NS	S	NS	S	NS
	Zooming	S	NS	S	NS	S	NS

S : Selectable

NS : Not Selectable

NV: Selectable but does nothing (Invalid)

*1 : When the DTC operates, the IPC functions can be specified by the image control and sub-window control registers, but IPC functions are disabled.

*2 : A satisfactory image can not be obtained.

*3 : When image emphasis is specified, outline extraction is disabled.

*4 : When outline extraction is specified, automatic separation is disabled.

*5 : When outline extraction or automatic separation is specified, overlay is disabled.

*6 : When outline extraction or overlay is specified, simplified dynamic threshold is disabled.

2.4 Connectors and Cables

2.4.1 Connectors/pin assignment for standard type

(1) Connectors for control interface (RS232C) cable

Scanner side connector: D-SUB 25-Pin connector

Cable side connector: FCN-770A53 (FUJITSU), GM-25LMK(HONDA), or equivalent

Pin assignment: See Figure 2.1.

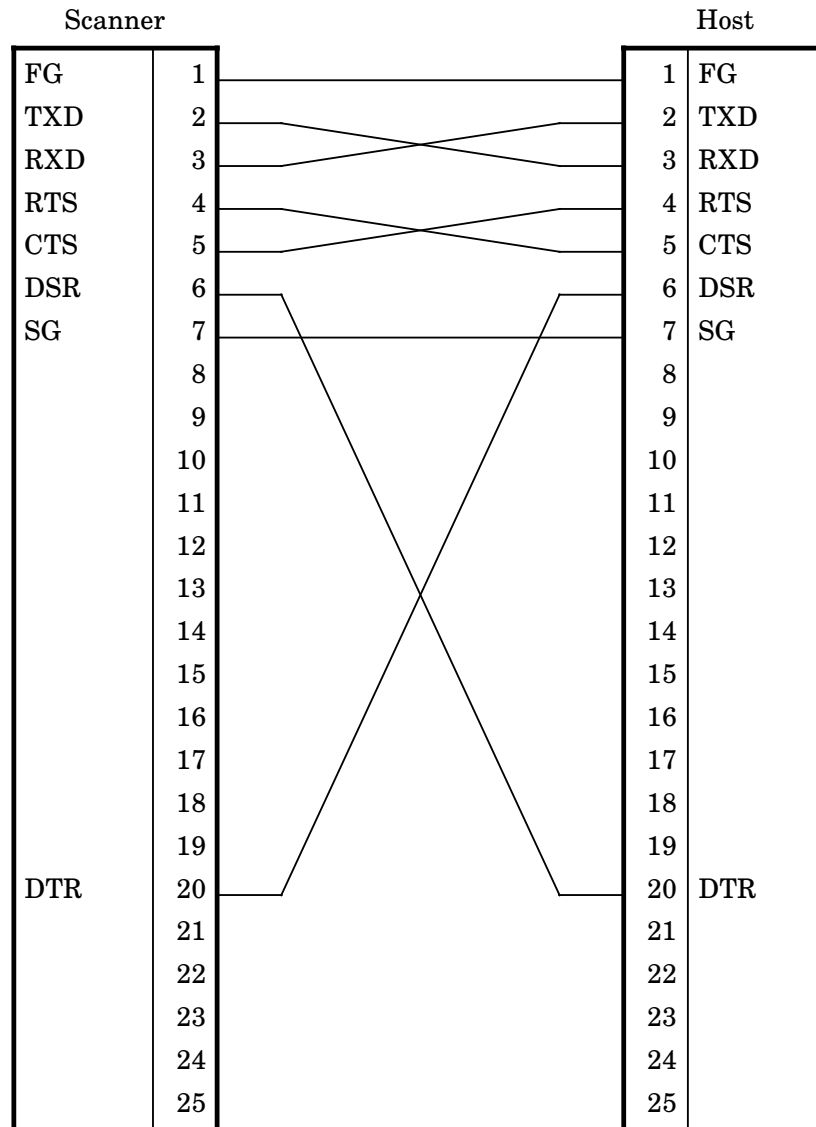


Figure 2.1 Control interface cable connector pin assignment

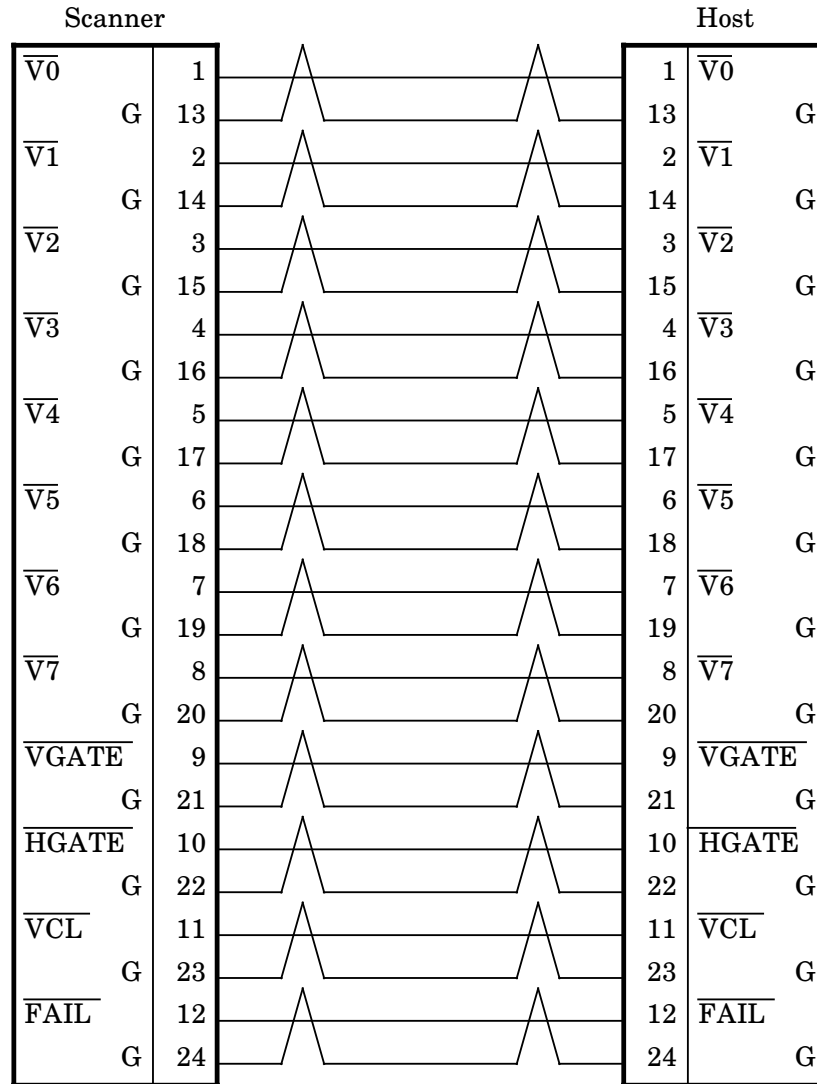
The above connection is an example.

(2) Connectors for video interface cable

Scanner side connector:

Cable side connector: 57FE-30240-20N-DDK (D8)

Pin assignment: See Figure 2.2.



G: Ground

Figure 2.2 Video interface cable connector pin assignment

(3) Cables

a. Control interface cable

Impedance $Z_0 = 100 \Omega$

b. Video interface cable

Impedance $Z_0 = 100 \Omega$

c. Cable length

Max: 5 m (FCC RFI test is performed with 3 m cable.)

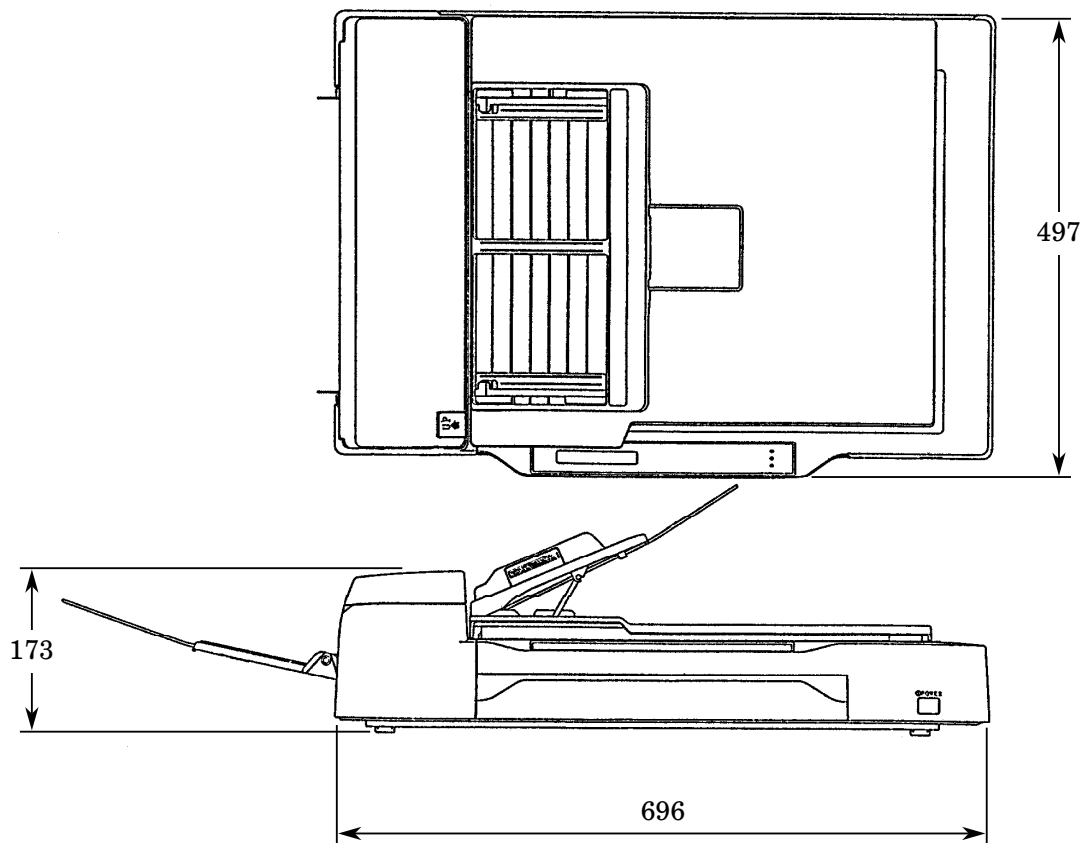
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CHAPTER 3 CONFIGURATION

- | | |
|------------|-------------------------------|
| 3.1 | Outer Dimensions |
| 3.2 | Circuit Configuration |
| 3.3 | Carrier Bracket Fixing |
| 3.4 | Power ON/OFF |
| 3.5 | Operator Panel |

3.1 Outer Dimensions

Figure 3.1 shows the outer dimensions of M3097E.



Unit: mm

Figure 3.1 Outer dimensions of M3097E

3.2 Circuit Configuration

This scanner uses CCD image sensor scanning system. This scanner consists of following sections;

- Optical system (including fluorescent lamp, and lenses)
- Video circuit (including CCD sensor, amplifier, and A/D converter)
- Scanner driver (including stepping motor and motor driver circuit)
- Control circuit (MPU circuit)
- Power section

Figure 3.2 is the function block diagram of this scanner.

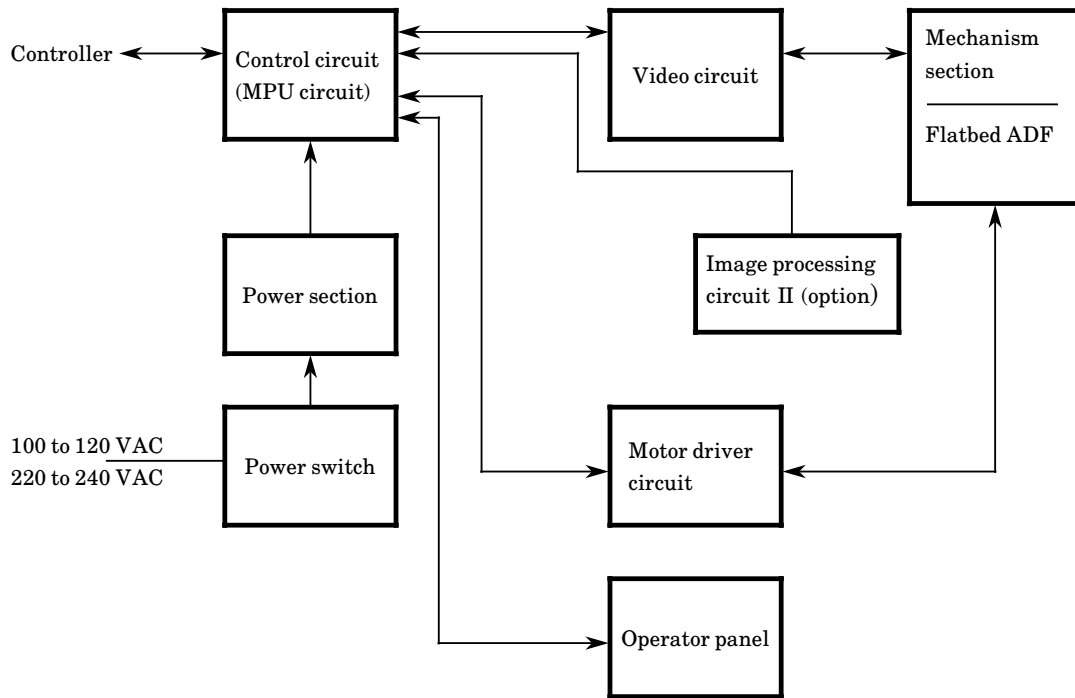


Figure 3.2 Function block diagram

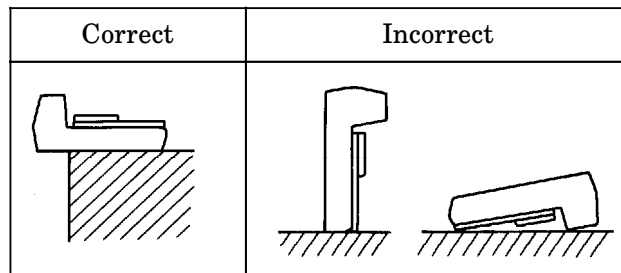
3.3 Carrier Fixing Bracket Removal

First, remove the carrier fixing bracket from the base of the scanner. This bracket fixes the carrier unit during the transportation.

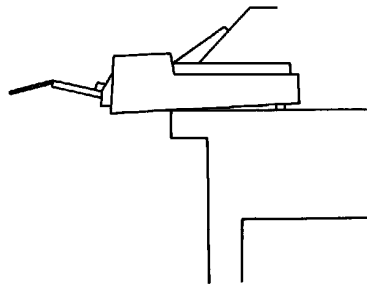
If the power is turned on while fixing bracket is still in place, the alarm lamp lights. Turn the power off, disconnect the power cable, and remove the bracket.

CAUTION

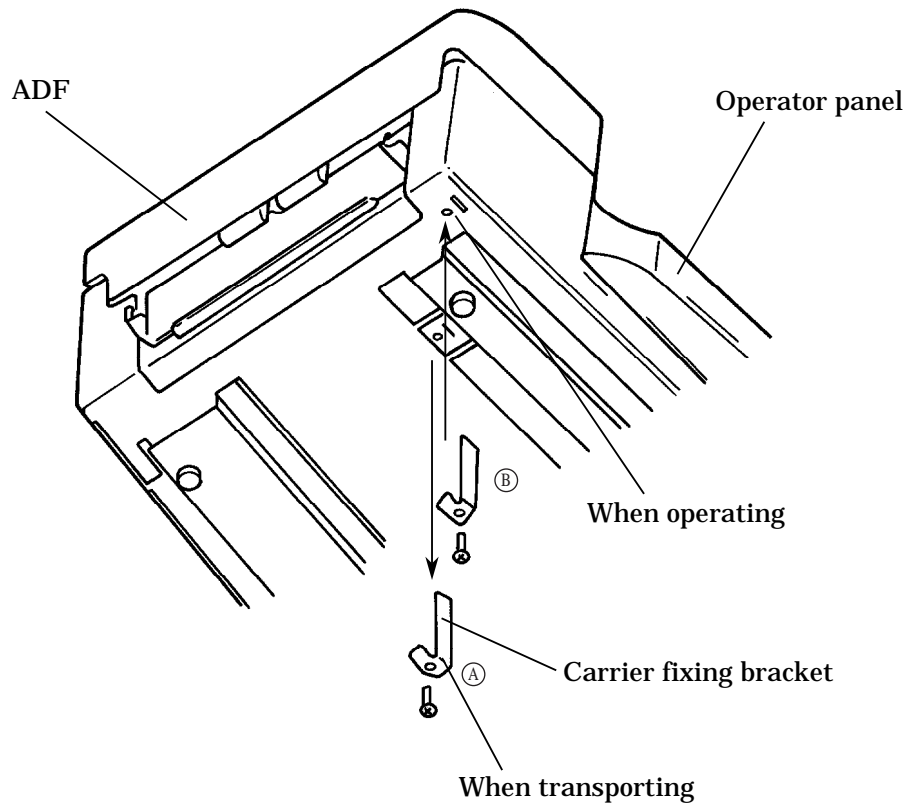
Do not set the scanner upside down or on its side.



- ① Set the scanner on the edge of the desk so that the ADF extends from the desk.



- 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Ⓑ.



CAUTION

*The scanner is transported.
Be sure the carrier fixing bracket is in positionⒶ.*

3.4 Power Switch

This switch is a pushbutton used to turn the power on and off.

Figure 4.1 shows the location of the power switch.

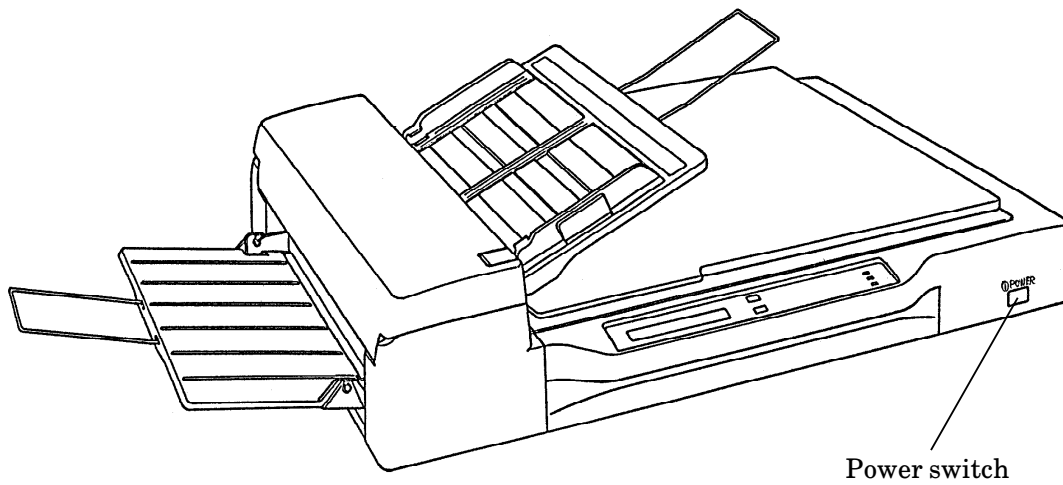


Figure 3.3 Power switch

3.5 Operator Panel

Figure 3.4 shows the operator panel and Tables 3.1 and 3.2 list the button and lamp names and functions.

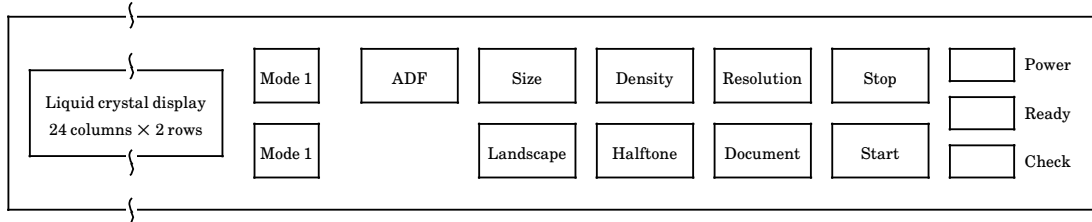


Figure 3.4 M3097E operator panel

Table 3.1 Button names and functions

Switch name	Function
Start	Press this button to start the read operation. In manual mode, when the ready lamp is lit.
Stop	If this button is pressed during a read operation, the following results occur: For a flatbed: Interrupts the read operation immediately, and returns the carrier to the home position. For an automatic feeder: Interrupts a read operation immediately, and ejects the paper being fed. Paper that has already been picked, but from which data has not been read yet, is ejected without being read. Press this button after removing jammed paper to release the jam state and enables read operation.
Resolution	Specifies the read resolution. The read resolution is displayed on the LCD.
Document	Specifies the documents from which data is read.
Halftone	Specifies whether to perform halftone processing (dithering or error diffusion). Also, specifies the automatic separation (dithering or error diffusion) if an image processing II option is present.
Density	Specifies the read density.
Size	Specifies the paper size.
ADF	Specifies whether to read data from documents by using the automatic document feeder or the flatbed.
Landscape	Specifies whether to read data from documents in portrait or landscape mode (read direction).
Mode 1	Will be described later.
Mode 2	Will be described later.

Table 3.2 Lamp names and functions

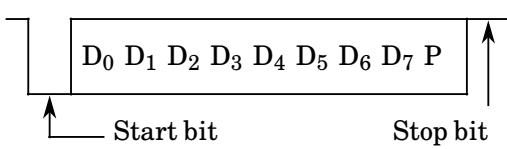
Name	Color	Functions
Power	Green	Indicates the power-on state of the device.
Ready	Green	In manual mode, this lamp indicates that the read operation is in progress.
Check	Yellow	Lights when there is a fault in the device.

CHAPTER 4 CONTROL INTERFACE

4.1	Connection Specifications
4.2	Control Interface Signals
4.3	Driver/Receiver
4.4	Timing

This chapter describes the control interface between the host computer and the scanner. For details of the interface, refer to the EIA RS-232C standard.

4.1 Connection Specifications

	Specification	Remarks
Transmission system	Half-duplex	
Synchronization system	Start-stop	
Data length	8 bits	
Stop bit	1 bit	
Data check	Odd parity check 	
Data transfer rate	1200, 2400, 4800, 9600 bps	Set by EEPROM on Interface PCA Default: 4800 bps.
Maximum connection	5 m (16 ft.)	
Standard	EIA RS-232C	

4.2 Control Interface Signals

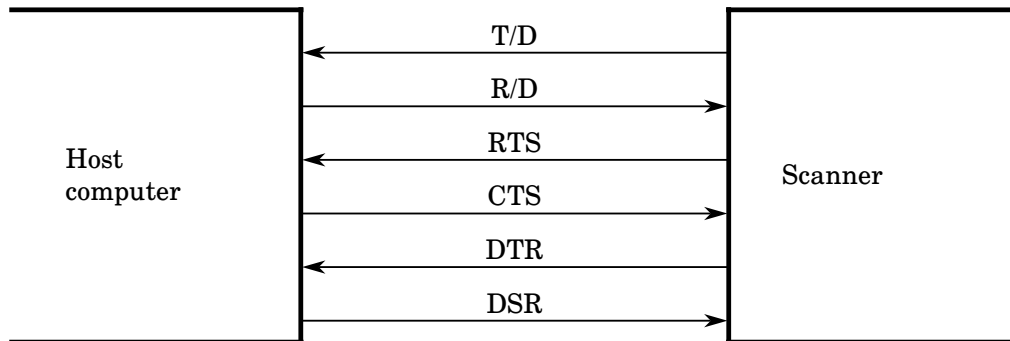


Figure 4.1 Control interface signal lines

(1) Send data (T/D)

This signal is the response and acknowledge for the command sent on the R/D line.

(2) Received data (R/D)

This line sends the command and acknowledge for a response.

(3) Send request (RTS)

This line sends a request to send a response and acknowledge for the command.

(4) Transmission enabled (CTS)

This line sends an acceptance of RTS signal.

(5) Terminal ready (DTR)

This signal indicates that the scanner is ready for transmission and reception. This signal is set to off when the scanner is turned off, when the scanner is initially checked after power-on, or when a fault is detected.

(6) Controller ready (DSR)

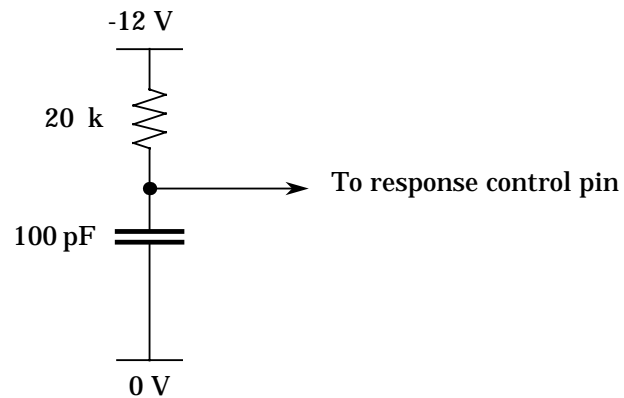
This signal indicates that the host computer is ready for transmission and reception.

4.3 Driver/Receiver

Driver: SN75188 or equivalent

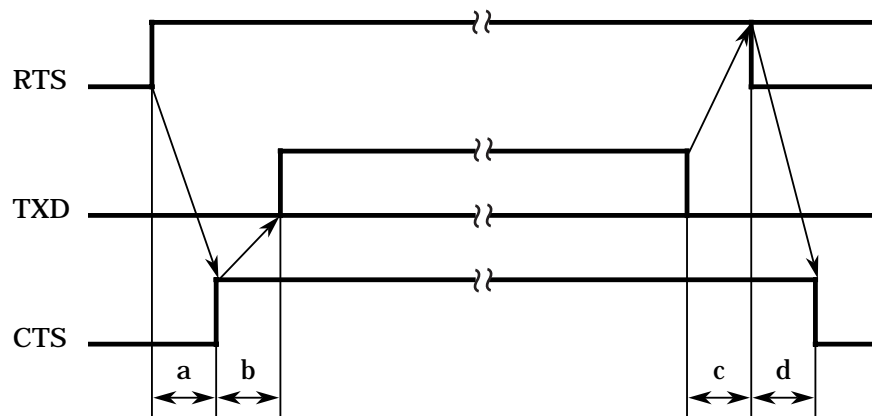
Receiver: SN75189 or equivalent

To determine the threshold level of the signal at the receiver, the following circuit must be connected to the response control pins.



4.4 Timing

Scanner → Host computer (At transmission)



- a: +0 ms
- b: +0 to 5 ms
- c: +0 to 10 ms (more than 1 word length)
- d: +0 ms

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CHAPTER 5 VIDEO INTERFACE

- | | |
|-----|-------------------------|
| 5.1 | Video Interface Signals |
| 5.2 | Driver/Receiver |
| 5.3 | Data Transfer |
| 5.4 | Timing |

This chapter describes the video interface, which transfers the scanning data from the scanner to the host computer.

5.1 Video Interface Signals

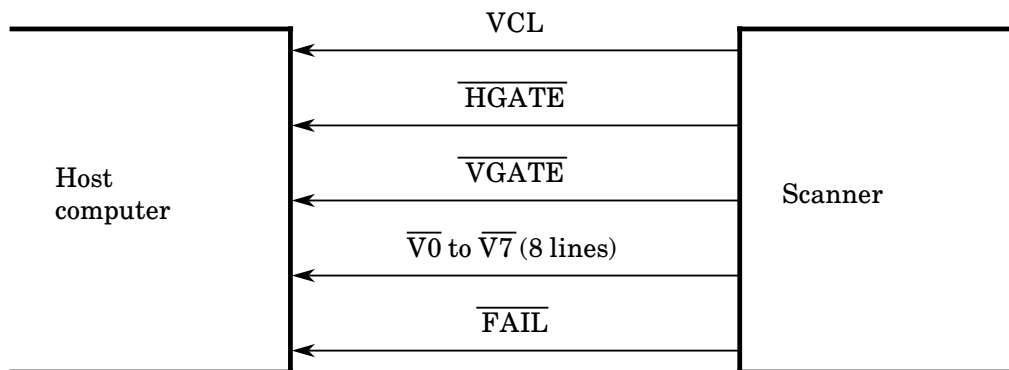


Figure 5.1 Video interface signal lines

- (1) VCL

This signal is a sampling clock for the video data $\overline{\text{V0}}$ to $\overline{\text{V7}}$.

- (2) $\overline{\text{HGATE}}$

This signal indicates that the main-scanning video data is valid.

- (3) $\overline{\text{VGATE}}$

This signal indicates that the subscanning video data is valid.

(4) $\overline{V0}$ to $\overline{V7}$

These signal lines carry the scanning video data. Logical “0” indicates a black dot.

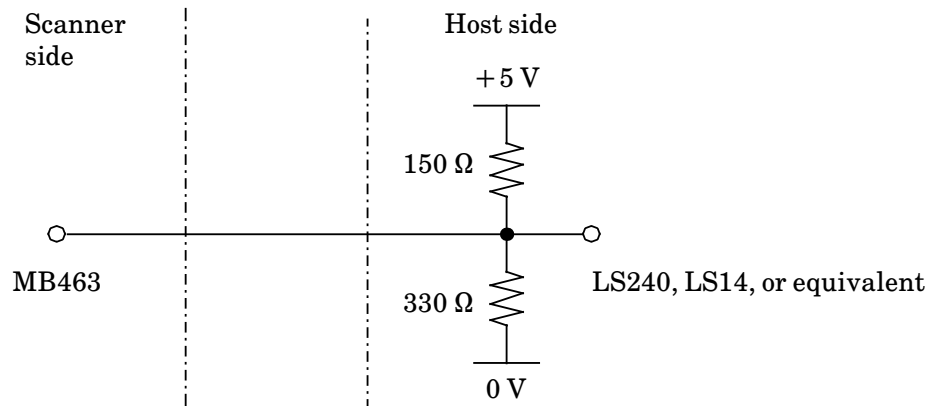
(5) \overline{FAIL}

This signal indicates that a device error (MPU ROM/RAM error) has occurred in the scanner.

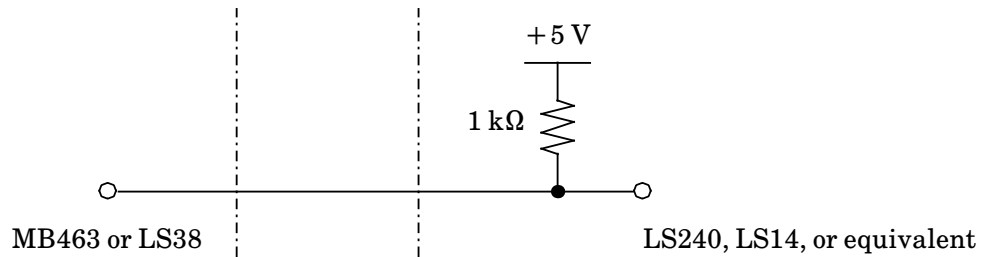
5.2 Driver/Receiver

5.2.1 Driver/receiver for standard connector and M3096A21 connector

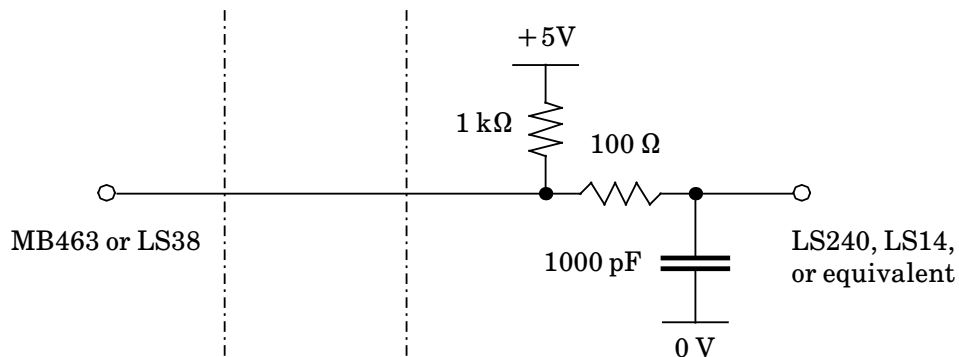
(1) VCL



(2) $\overline{V0}$ to $\overline{V7}$



(3) \overline{HGATE} , \overline{VGATE} , and \overline{FAIL}



5.3 Data Transfer

Scanning video data is transferred to the host computer through video data signal lines $\overline{V0}$ to $\overline{V7}$ in parallel synchronized with VCL.

5.3.1 Transfer sequence

Scanning is performed as shown in Figure 5.2, and the scanning data is assigned to the video data signal as shown in Figure 5.3. The scanning data is sent to the host computer in order of scanning.

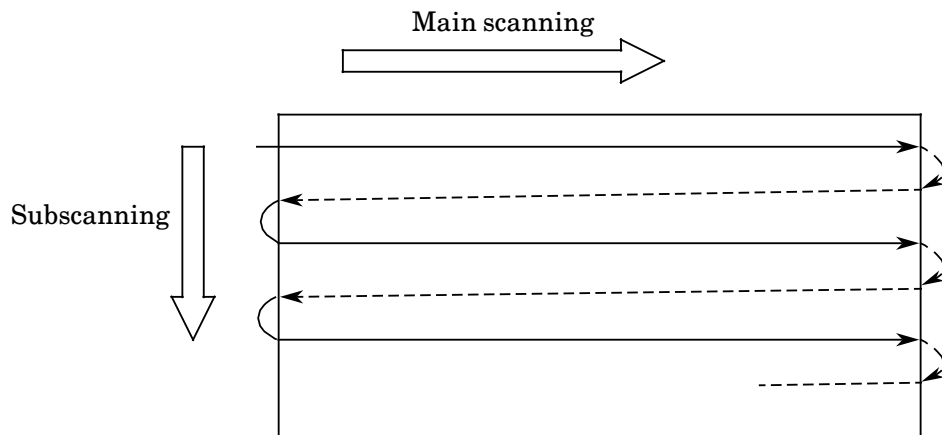
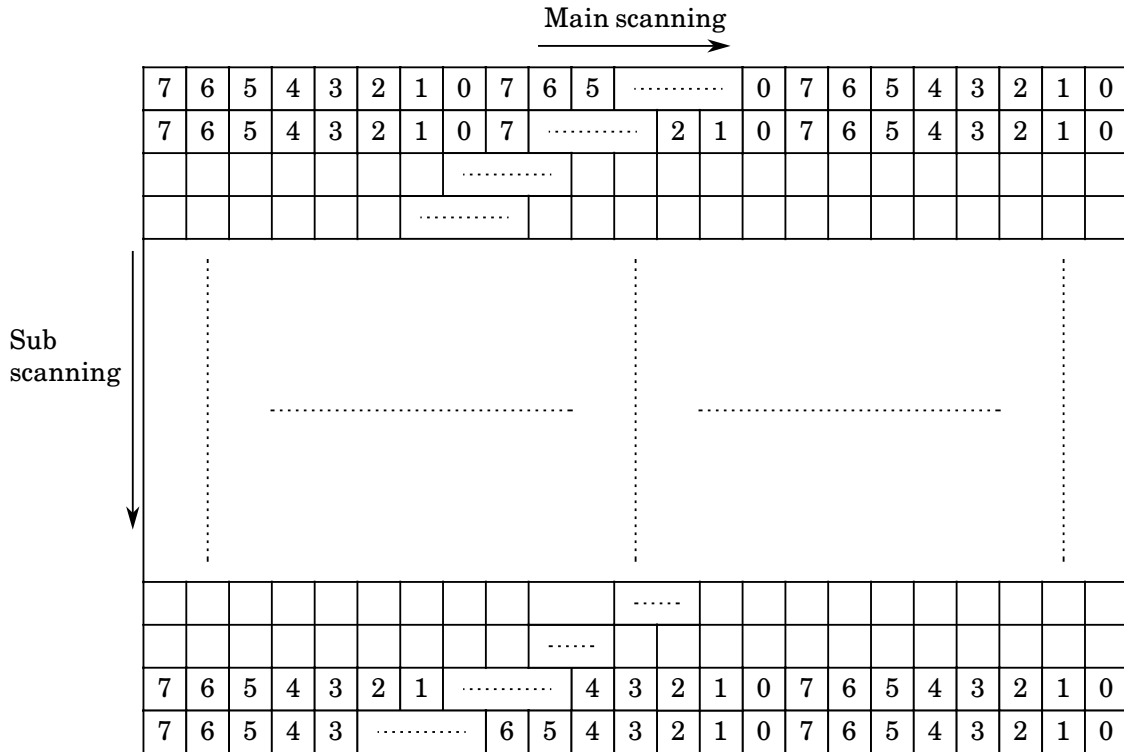


Figure 5.2 Scanning direction

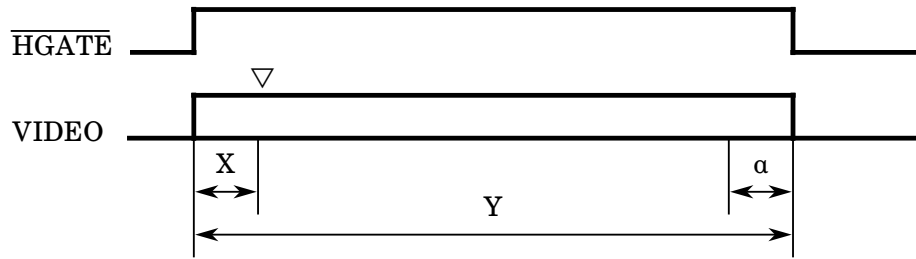


Notes:

1. "0" to "7" correspond to the video data signal $\overline{V0}$ to $\overline{V7}$ respectively.
2. The most significant bit (MSB) of each video data signal is read first.

Figure 5.3 Scanning data assignment

5.3.2 Effect in main scanning



- X : Offset dots
- Y : Transferred data
- α : Dummy dots
- ∇ : Reference point of main-scanning

(1) Flatbed

The values of X, Y, and α are shown in Table 5.1 and 5.2.

Table 5.1 Transferred data length in main scanning (portrait mode)

Paper size		A3	B4	A4	B5	A5	Legal	Letter	Double Letter
400 dpi	Offset dots	12±12	12±12	12±12	12±12	12±12	12±12	12±12	12±12
	Transferred data	4864	4096	3456	3456	2304	3456	3456	4400
	Dummy dots	-	-	-	-	-	-	-	-
300 dpi	Offset dots	9±9	9±9	9±9	9±9	9±9	9±9	9±9	9±9
	Transferred data	3648	3072	2592	2592	1728	2592	2592	3304
	Dummy dots	-	-	-	-	-	-	-	-
240 dpi	Offset dots	8±8	8±8	8±8	8±8	8±8	8±8	8±8	8±8
	Transferred data	2920	2464	2080	2080	1384	2080	2080	2640
	Dummy dots	-	-	-	-	-	-	-	-
200 dpi	Offset dots	6±6	6±6	6±6	6±6	6±6	6±6	6±6	6±6
	Transferred data	2432	2048	1728	1728	1152	1728	1728	2200
	Dummy dots	-	-	-	-	-	-	-	-

(Unit : dots)

Note :

Data of dummy dots are sent as white.

Table 5.2 Transferred data length in main scanning (landscape mode)

Paper size		A3	B4	A4	B5	A5	Legal	Letter	Double Letter
400 dpi	Offset dots	–	–	12±12	12±12	12±12	–	12±12	–
	Transferred data	–	–	4680	4048	3312	–	4400	–
	Dummy dots	–	–	–	–	–	–	–	–
300 dpi	Offset dots	–	–	9±9	9±9	9±9	–	9±9	–
	Transferred data	–	–	3512	3040	2480	–	3304	–
	Dummy dots	–	–	–	–	–	–	–	–
240 dpi	Offset dots	–	–	8±8	8±8	8±8	–	8±8	–
	Transferred data	–	–	2808	2432	1984	–	2640	–
	Dummy dots	–	–	–	–	–	–	–	–
200 dpi	Offset dots	–	–	6±6	6±6	6±6	–	6±6	–
	Transferred data	–	–	2344	2024	1656	–	2200	–
	Dummy dots	–	–	–	–	–	–	–	–

(Unit : lines)

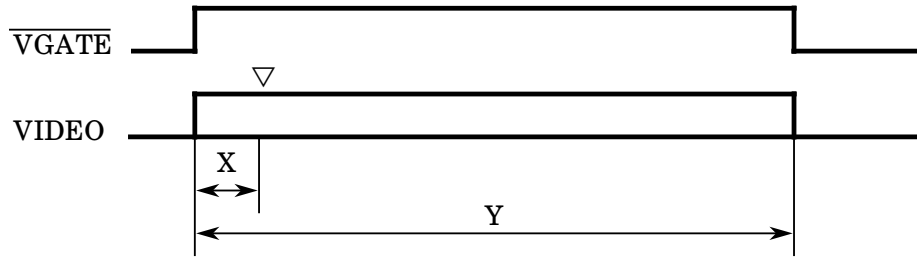
Note :

Data of dummy dots are sent as white.

(2) ADF

The values of X, Y, and α are same as the values used in Flatbed.

5.3.3 Effect in subscanning



X : Offset lines (Max.)
 Y : Transferred lines
 ▽ : Reference point of subscanning

(1) Flatbed

The values of X and Y and are shown in Tables 5.3 and 5.4.

Table 5.3 Transferred data line in subscanning (portrait mode)

Paper size		A3	B4	A4	B5	A5	Legal	Letter	Double Letter
400 dpi	Offset dots	32	32	32	32	32	32	32	32
	Transferred data	6614	5732	4677	4048	3307	5600	4400	6912
300 dpi	Offset dots	24	24	24	24	24	24	24	24
	Transferred data	4961	4300	3508	3036	2480	4200	3300	5184
240 dpi	Offset dots	20	20	20	20	20	20	20	20
	Transferred data	3969	3440	2806	2429	1984	3360	2640	4160
200 dpi	Offset dots	16	16	16	16	16	16	16	16
	Transferred data	3307	2886	2339	2024	1654	2800	2200	3456

(Unit : lines)

Table 5.4 Transferred data line in subscanning (landscape mode)

Paper size		A3	B4	A4	B5	A5	Legal	Letter	Double Letter
400 dpi	Offset dots	–	–	32	32	32	–	32	–
	Transferred data	–	–	3456	3456	2304	–	3456	–
300 dpi	Offset dots	–	–	24	24	24	–	24	–
	Transferred data	–	–	2592	2592	1728	–	2592	–
240 dpi	Offset dots	–	–	20	20	20	–	20	–
	Transferred data	–	–	2080	2080	1384	–	2080	–
200 dpi	Offset dots	–	–	16	16	16	–	16	–
	Transferred data	–	–	1728	1728	1152	–	1728	–

(Unit : lines)

Note:

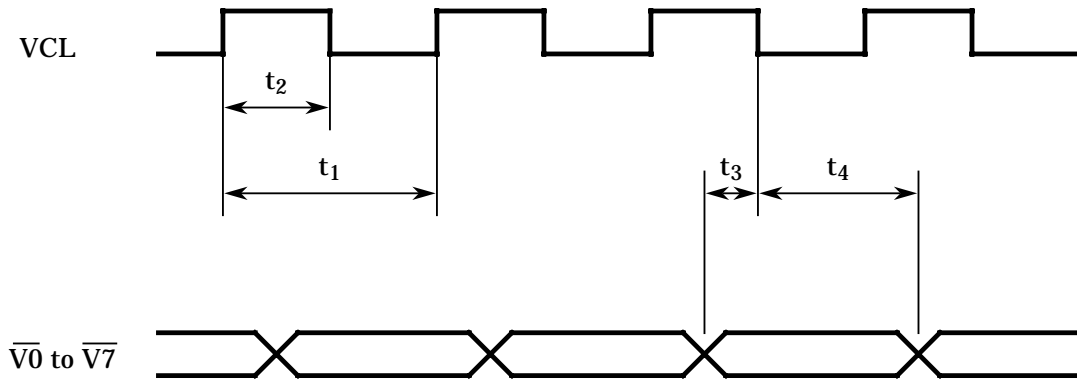
If ADF is used, transferred lines are determined by real size of the document. (Causes $\overline{\text{VGATE}}$ to take '0' when the document end passes through the reading position.)

(2) ADF

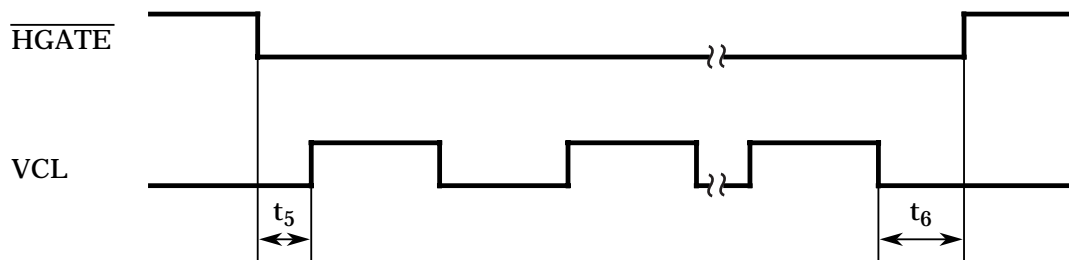
The document size ($\overline{\text{VGATE}}$) is set to off when the edge of the document passes the read position.

5.4 Timing

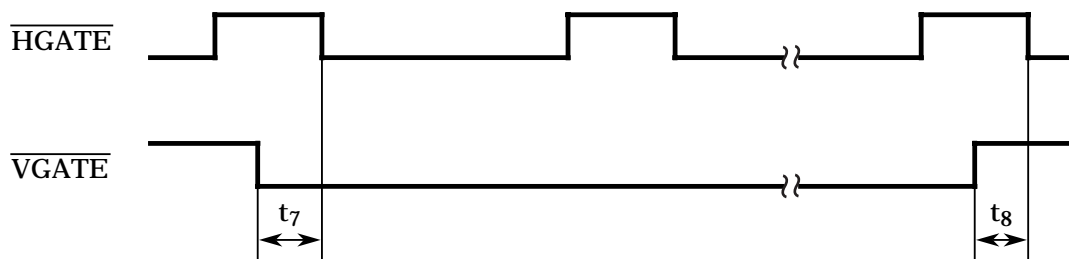
(1) VCL and $\overline{V0}$ to $\overline{V7}$



(2) VCL and \overline{HGATE}



(3) \overline{HGATE} and \overline{VGATE}



The values of t_1 to t_8 are shown in Tables 5.5 and 5.6.

Table 5.5 Timing specification at binary output

	400 dpi			300 dpi			240 dpi			200 dpi		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
t ₁	700	800	900	900	1000 or 1100	1200	1200	1300 or 1400	1500	1500	1600	1700
t ₂	500	600	700	500	600	700	500	600	700	500	600	700
t ₃	400	600	700	400	600	700	400	600	700	400	600	700
t ₄	100	200	300	300	400 or 500	600	600	700 or 800	900	900	1000	1100
t ₅	100	200	300	100	200	300	100	200	300	100	200	300
t ₆	100	200	1300	100	200	1300	100	200	1300	100	200	1300
t ₇	100	200	300	100	200	300	100	200	300	100	200	300
t ₈	2000	*		2000	*		2000	*		2000	*	

(Unit : ns)

Notes:

1. Signal timing follows above table of 400 dpi for each scanning resolution, if image processing II option is present.
2. Timing marked with * varies according to the scanning area.

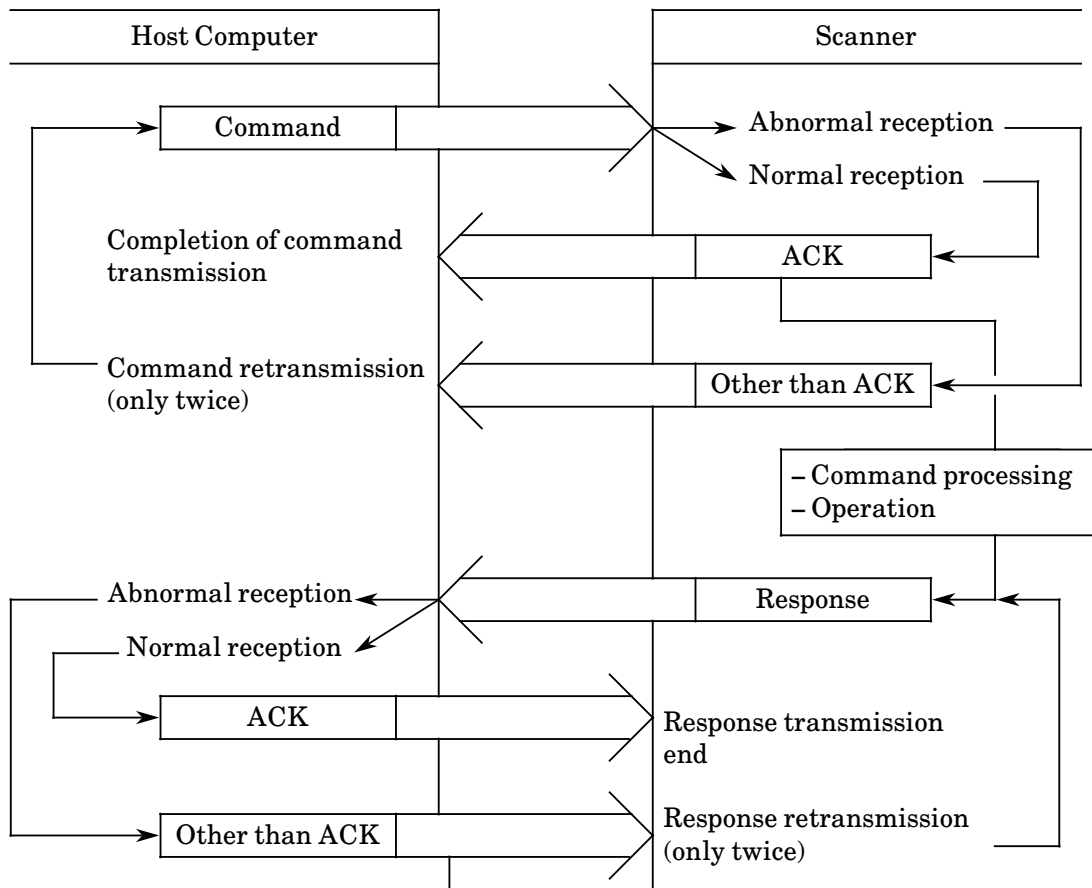
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CHAPTER 6 COMMANDS AND RESPONSES

- | | |
|------------|--|
| 6.1 | Basic Command/Response Sequence |
| 6.2 | Command/Response Format |
| 6.3 | Command |
| 6.4 | Response |
| 6.5 | Details Sequence |
| 6.6 | Command/Response Correspondence |
| 6.7 | Command/Response Timing Chart |

6.1 Basic Command/Response Sequence

Data is transmitted between the host computer and the image scanner in the form of commands and responses. Figure 6.1 shows the basic command/response sequence. In Figure 6.1, “Other than ACK” means a parity, framing, overrun, or count error.



Notes:

1. Abnormal reception means that a parity error, framing error, overrun error, or count error has occurred.
2. Command or response transmission is retried only twice.
3. Upon reception, a command or response is checked for transmission errors. When the check result has no problem, ACK is returned immediately to the originating source. When the check result has problem, data other than ACK is returned after all data has been received.
4. The originating source of the command/response monitors the response from the receiving side. ACK indicates that command/response transmission is completed. Data other than ACK causes the command/response to be transmitted again. The transmission is retried only twice. After that, the scanner waits for a new command.
5. Response data such as ACK must be returned to the originating source within 0.5 second.
6. The interval between words in the data stream must be no more than 10 ms.

Figure 6.1 Basic command/response sequence

Table 6.1 shows the meaning of the response data and its code (indicated in hexadecimal).

Table 6.1 Response data

Response data		Meaning	Code (Hex)
ACK (Acknowledge)		A command or response has been received normally.	'FF'
Reception error	Parity error	A parity error has been detected in received data.	'80'
	Flaming error Overrun error	A flaming error or an overrun error has been detected in received data.	'81'
	Count error	The byte count for the command or response does not match the number of bytes transferred.	'82'

6.2 Command/Response Format

The command/response format is as follows.

CNT	CMD/RPS	TEXT	Additional field
-----	---------	------	------------------

(1) CNT (count) field

The total number of bytes in the command/response to be transmitted is represented.

(2) CMD/RPS field

A command or response code is indicated.

(3) TEXT field

Additional information for a command or response, called control or device information, is indicated.

(4) Additional field

In some commands, additional field exists next to TEXT field.

6.3 Command

Commands sent from the host machine to the scanner are as listed in Table 6.2.

Table 6.2 Commands

Command name	Command code	Details
CLEAR	44	This command initializes the scanner. This command can be issued at any time.
CONTROL	58	This command sets the operation mode of the scanner and the operation mode in the main window.
IMAGE CONTROL	5A	This command sets the image processing mode of the scanner.
SUB WINDOW CONTROL	5C	This command sets the subwindow attribute of the scanner.
START	53	This command reports the size of a document to be read.
READ	54	This command starts reading. The scanner starts reading according to the operation mode set previously.
SENSE	41	This command requests a scanner status report.
RETURN SENSE	42	This command requests a status report on the return of the flatbed scan.
IMAGE MODE SENSE	43	This command requests a status report of the image processing mode of each main window and the number of pixels (in units of a byte) per line in the X-direction.
SEND DITHER	46	This command transfers the dither and overlay patterns.
SEND DITHER2	47	This command transfers the dither, y curve, or overlay patterns.

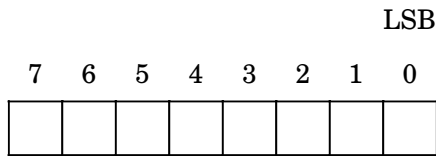
Command name	1	2	3	4 or later
CLEAR	X'03'	X'44'	CLEAR command details	-
CONTROL	X'0X'	X'58'	Control register start number.	Control register
IMAGE CONTROL	X'0X'	X'5A'	Image control register start number.	Image control register
SUB WINDOW CONTROL	X'0X'	X'5C'	Subwindow control register start number.	Subwindow control register
START	X'02'	X'53'	-	-
READ	X'02'	X'54'	-	-
SENSE	X'02'	X'41'	-	-
RETURN SENSE	X'02'	X'42'	-	-
IMAGE MODE SENSE	X'03'	X'43'	X'00'	-
SEND DITHER	X'43'	X'46'	Dither or overlay pattern number.	Dither or overlay pattern, 64 bytes or more
SEND DITHER2	X'05'	X'47'	X'00'	Byte 4 and 5: CNT Byte 6: Pattern ID Byte 7 or later: dither, overlay or y curve data

6.3.1 CLEAR command

This command initializes the scanner and can be issued at any time.

Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT
X'03'	X'44'	Details on CLEAR command

CLEAR command details



00: Power-on clear

This command resets the system to the power-on status.

01: Control register clear

This command initializes the operation mode, image processing mode, and subwindow mode. (*1)

10: Reading stop

This command stops operation during reading (VGATE OFF, return).

Note:

“Ready” is the response when this command ends normally.

*1 If the CONTROL REGISTER CLEAR command is issued after the READ command is sent to the scanner but before the Read Complete is received from the scanner, a command sequence error occur.

6.3.2 CONTROL command

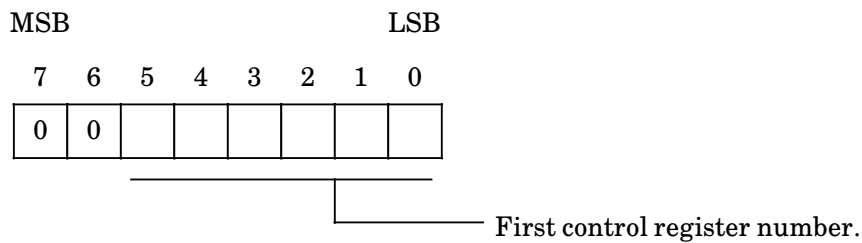
This command sets the scanner to the operation mode.

Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT	Byte 4 or later
X'0x' *	X'58'	Control register start number.	Control register

*: x = 04 or more (relating with number of control registers)

Control register start number.

Byte 3 (control register start number.) specifies the starting control register.



Control register

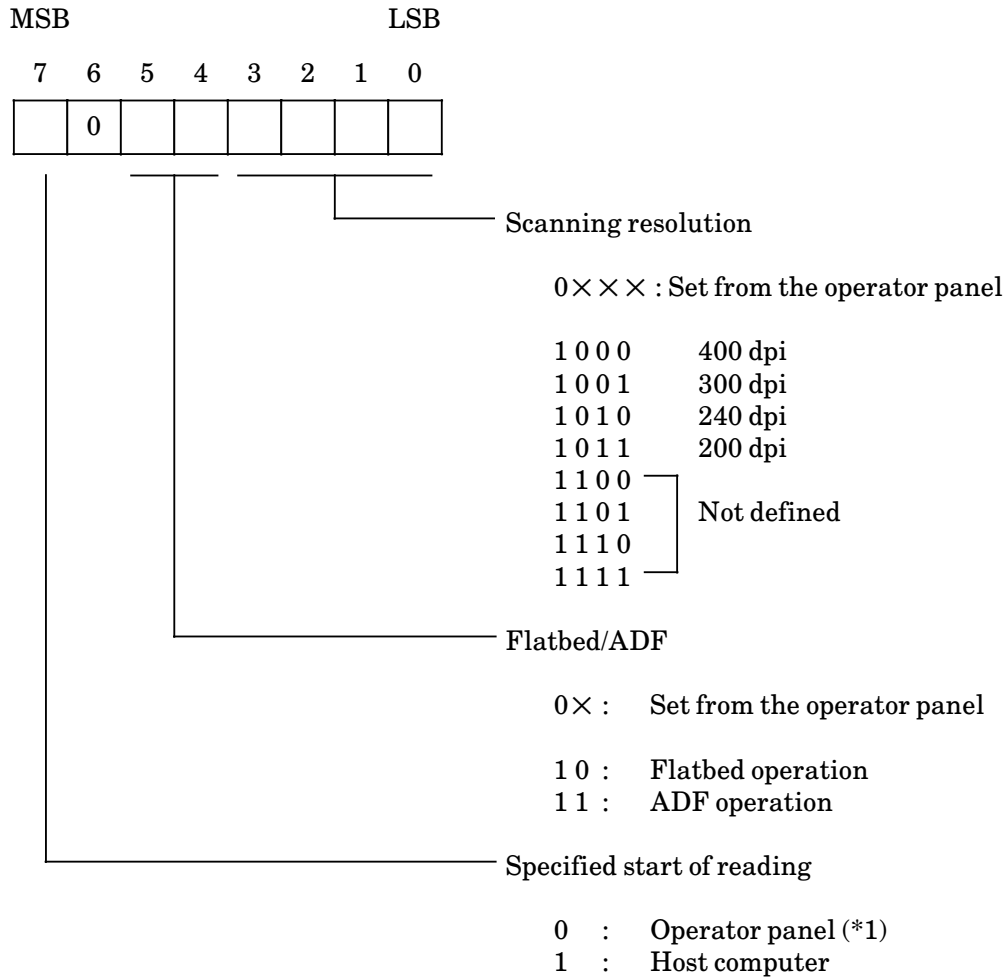
The control register specifies the scanner operation mode. Byte 4 and more specifies the control registers used in this command.

Note:

Control registers #6 to #9 are not defined.

(a) Control register #0

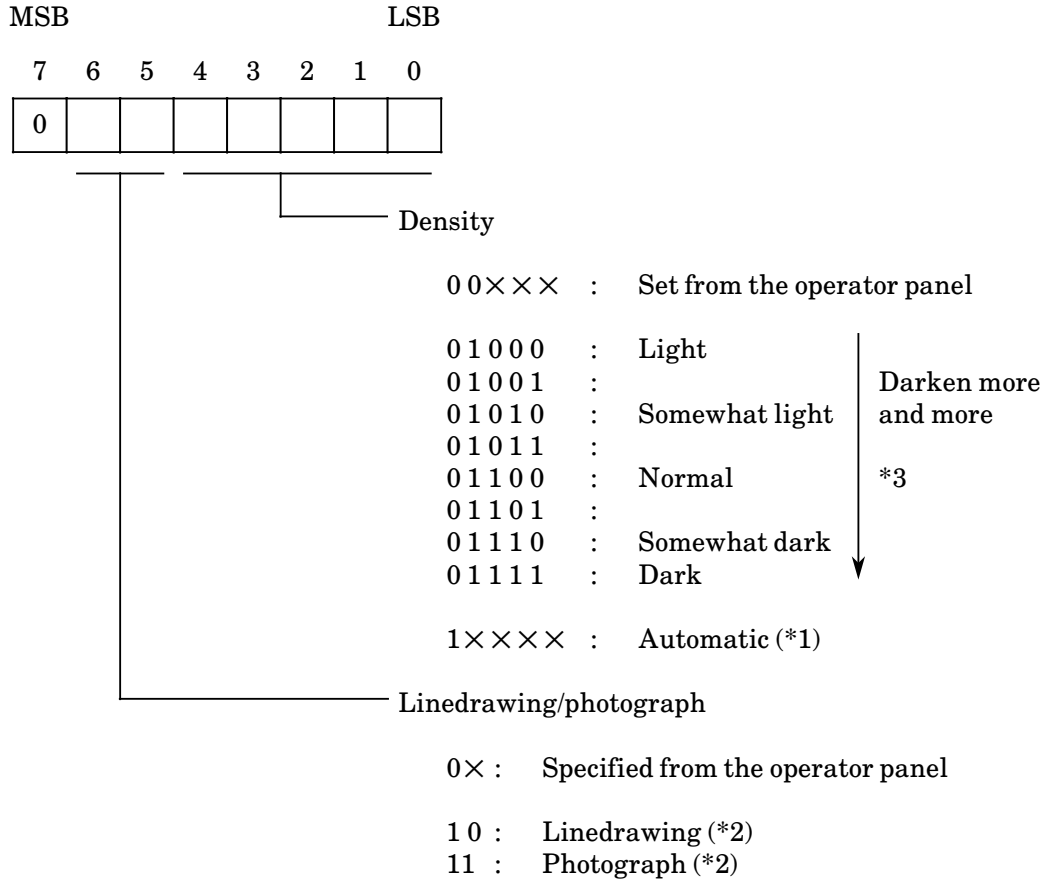
X'00' is set when the power is turned on or when a CLEAR command is issued for initialization.



*1 When the start of reading is specified from the operator panel, the Ready lamp lights at reception of a START command.

(b) Control register #1

X'00' is set when the power is turned on or when a CLEAR command is issued for initialization.



*1 This function is valid for image processing circuit (IPC II) option.

When the IPC II option is installed and these bits indicate 1xxxx, the scanner applies the DTC function, and the function of the image control register and subwindow control register are not operated.

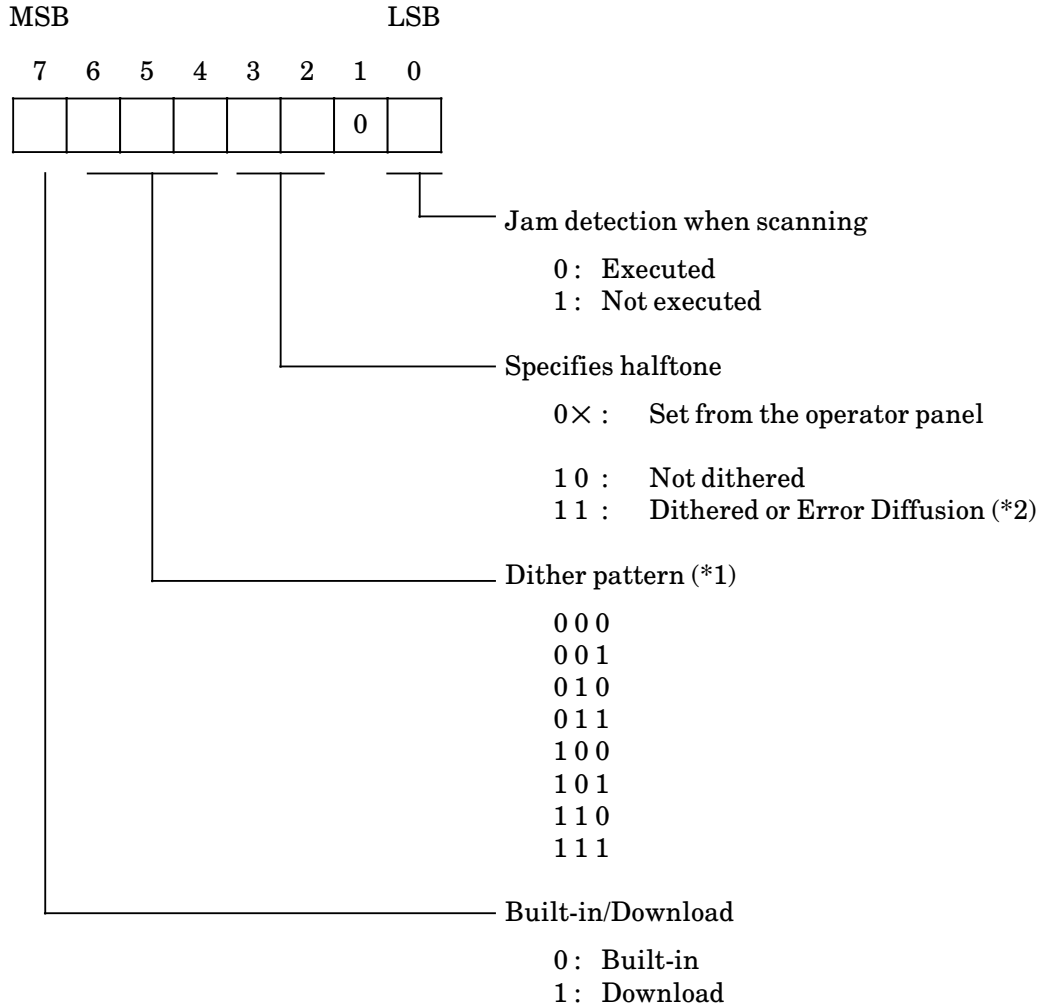
*2 The scanning speed of ADF (sheets/min) in Linedrawing mode is different from that of Photograph mode. See Appendix B for more information.

*3 When the control register #19, bit 0 is '0', 8 types density are selectable by the control register #1, bit 3 to 0.

And when the control register #19, bit 0 is '1', 256 types density are selectable by the control register #20.

(c) Control register #2

X'00' is set when the power is turned on or when a CLEAR command is issued for initialization.

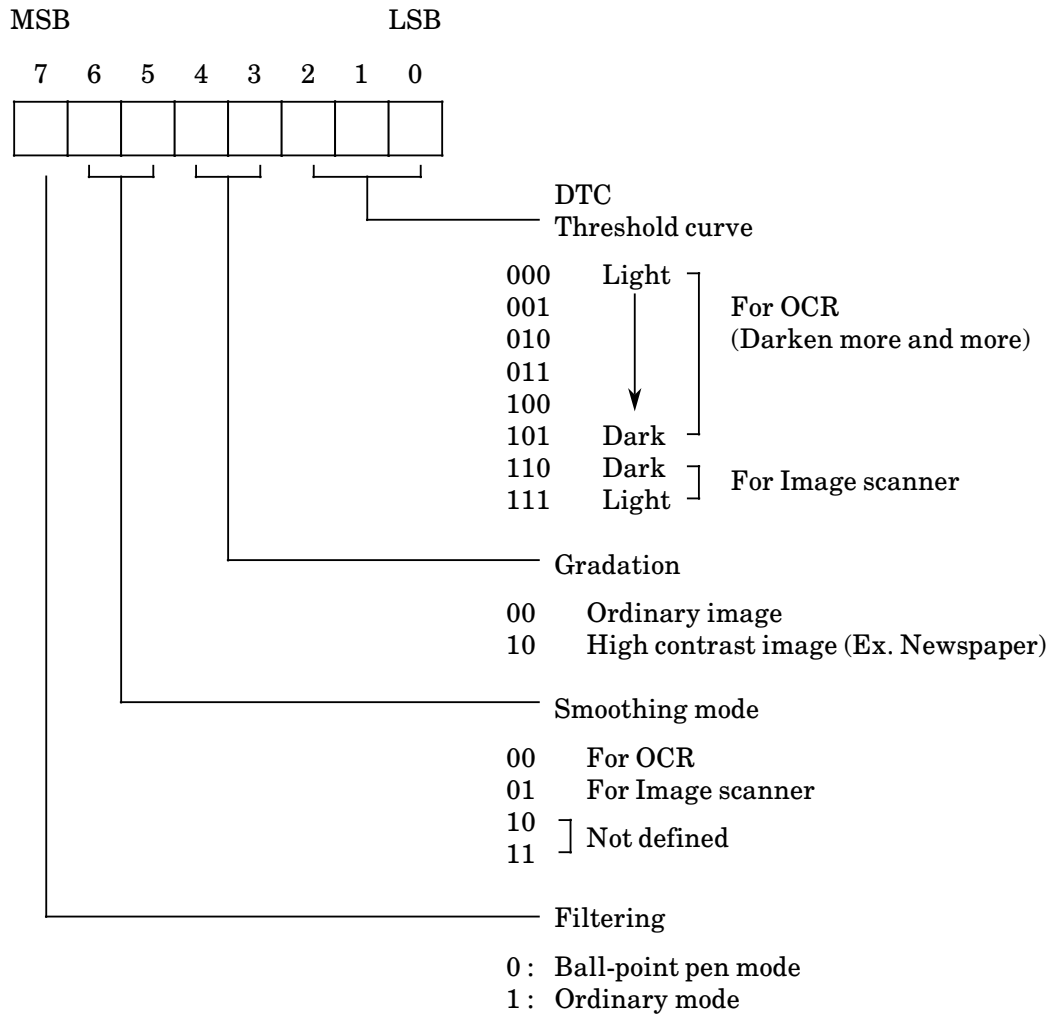


- *1 ● When the built-in pattern is used, the density information shown in the control register #1 is valid.
 - 4 patterns (000 to 011) are valid when the built-in pattern is selected.
 - When the download pattern is used, the density information shown in Control register #1 is invalid.
 - 8 patterns (000 to 111) is valid when the download pattern is selected.
- *2 Dithered or Error diffusion are selected by control register #19.

(d) Control register #3

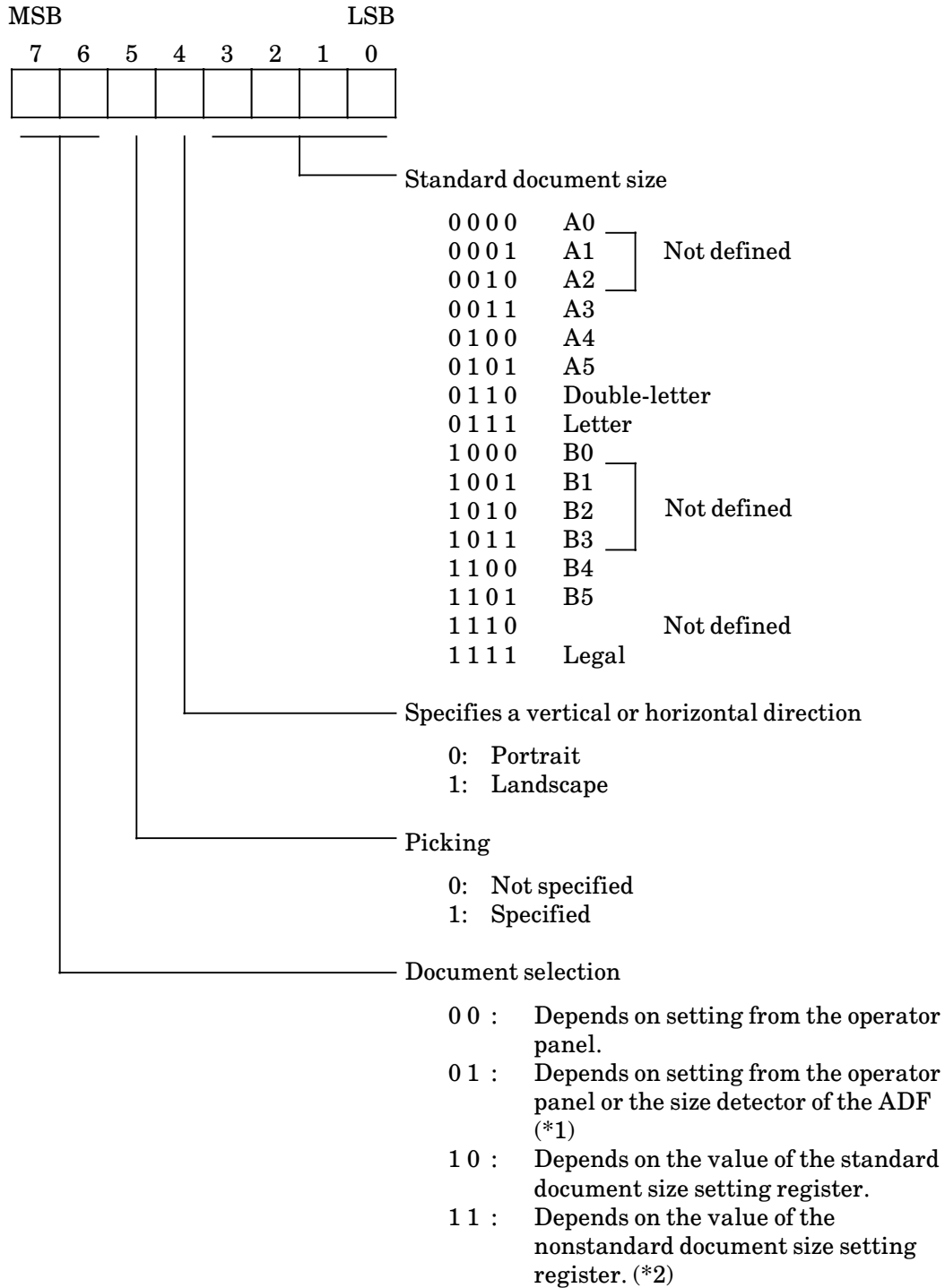
X'A6' is set when the power is turned on or when a CLEAR command is issued for initialization.

This register is valid when IPC II option is installed.



(f) Control register #5

X'0X' is set when the power is turned on or when a CLEAR command is issued for initialization. Default document size depends on the EEPROM setting. (Refer to Section C.2.)

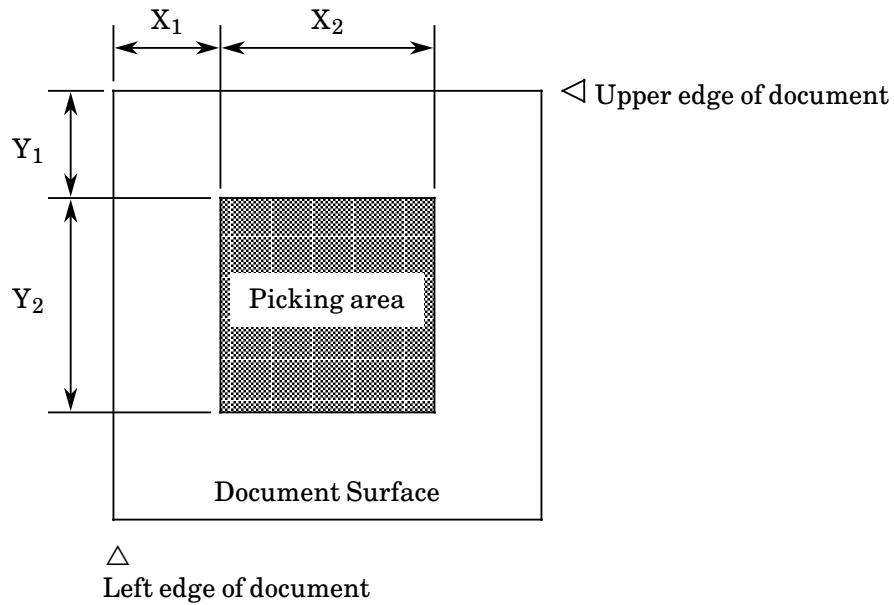
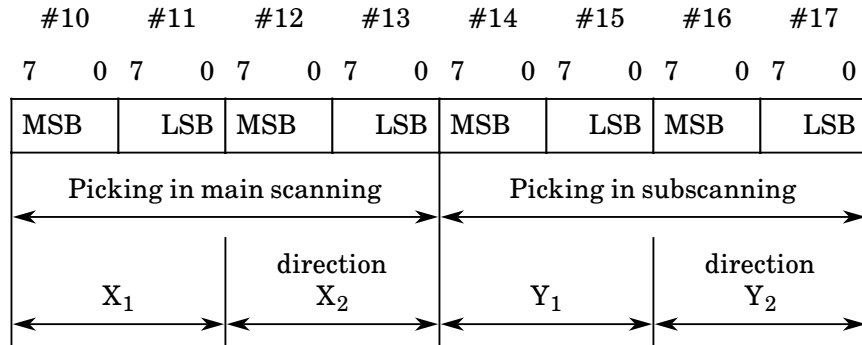


*1 For the flatbed, this setting depends on what is set by the operator panel. For the ADF, this setting depends on the size detector of the ADF.

*2 Not specified for this scanner.

(g) Control registers #10 to #17

Picking area setting register



Operation error occurs when the values of $X_1 + X_2$ [(#10, #11) + (#12, #13)] and $Y_1 + Y_2$ [(#14, #15) + (#16, #17)] are more than the values shown below.

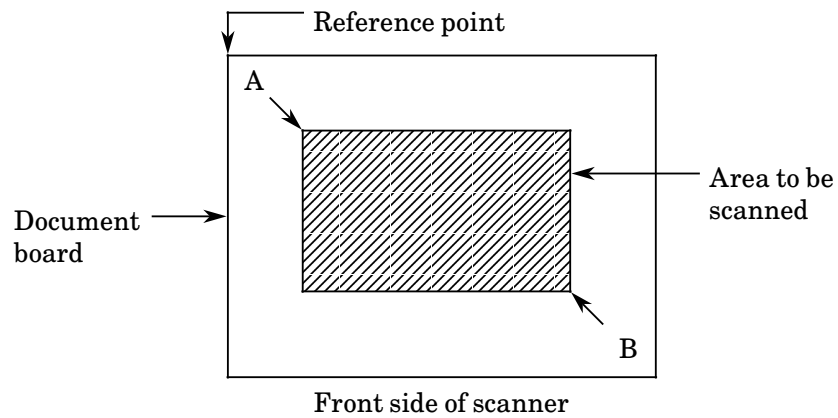
$X_1 + X_2$	$Y_1 + Y_2$
4864	6912

These values must be specified in binary in units of 1/400 inch.

Notes:

1. When the picking is specified, only a specified area of the document is read. However, when the ADF is used, and the document length is shorter than the specified area, read operation is stopped at the edge of document.
2. When the specified area is larger than the double letter size, read area specification error occurs.
3. When the jam detection bit (control register #2) is "1", a setting of Y2 is ignored.

Picking is specified when the scanner is required to read a special area as shown below.



Picking is applied when bit 5 of the control register #5 is “1” and the address of points A and B is specified in the control registers #10 to #17.

Note:

When these registers are specified, four consecutive registers (#10 to #13 or #14 to #17) must be specified.

Ex.

CNT	CND	REG.No.	#10	#11	#12	#13
			(#14)	(#15)	(#16)	(#17)

Or.

CNT	CND	REG.No.	#10	#11	#12	#13	#14	#15	#16	#17
-----	-----	---------	-----	-----	-----	-----	-----	-----	-----	-----

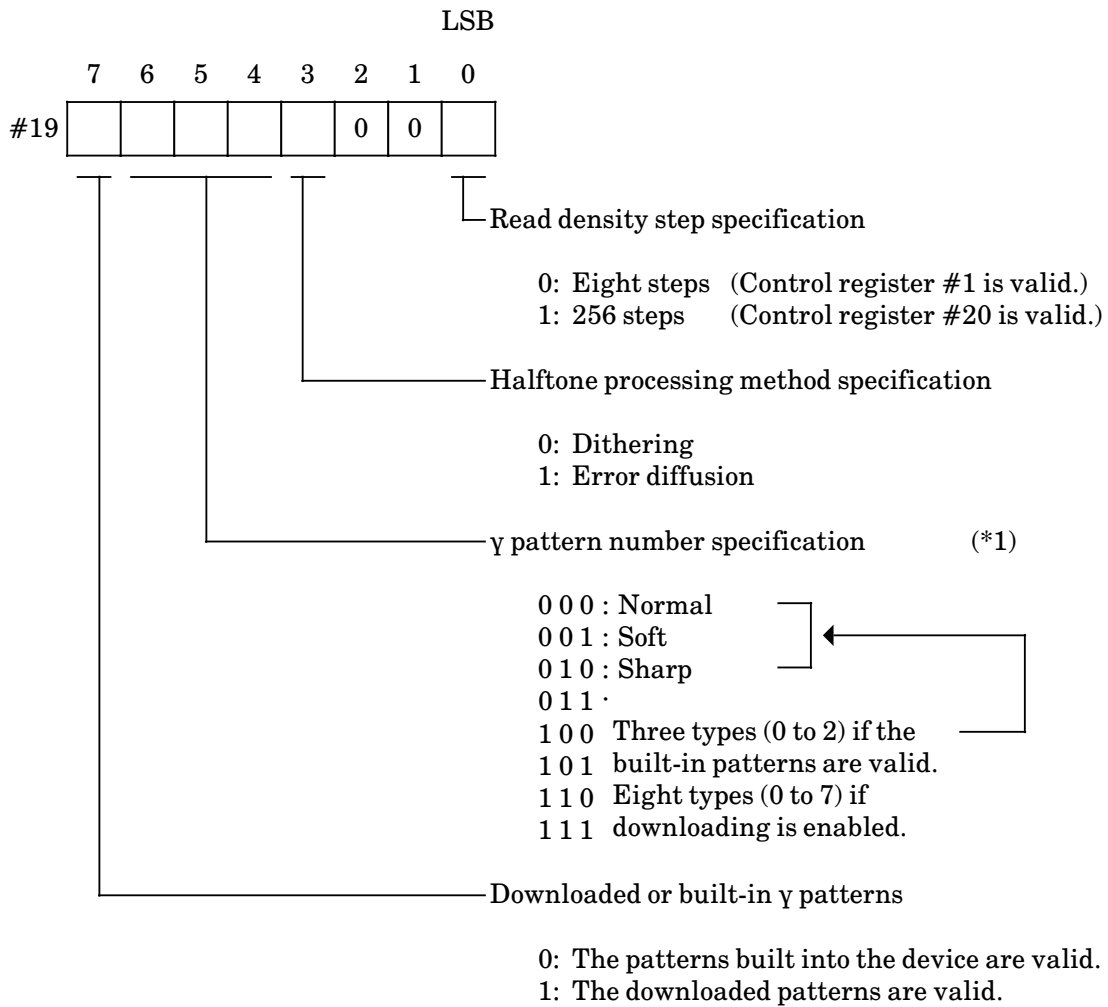
(h) Control register #18

							LSB	
	7	6	5	4	3	2	1	0
#18	0	0	0	0	0	0	0	0

This register reserved for future.

X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

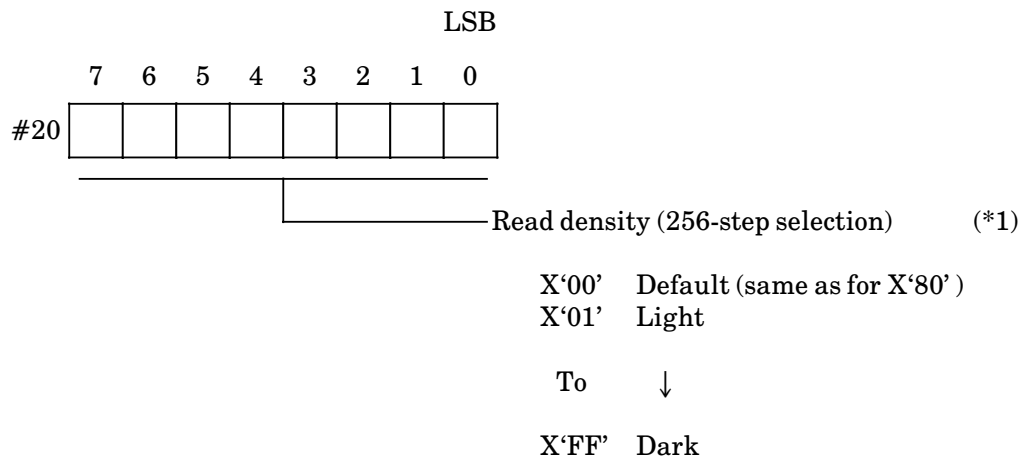
(i) Control register #19



*1 If the built-in patterns are valid, 0 to 2 ('000' to '010') can be selected.

X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

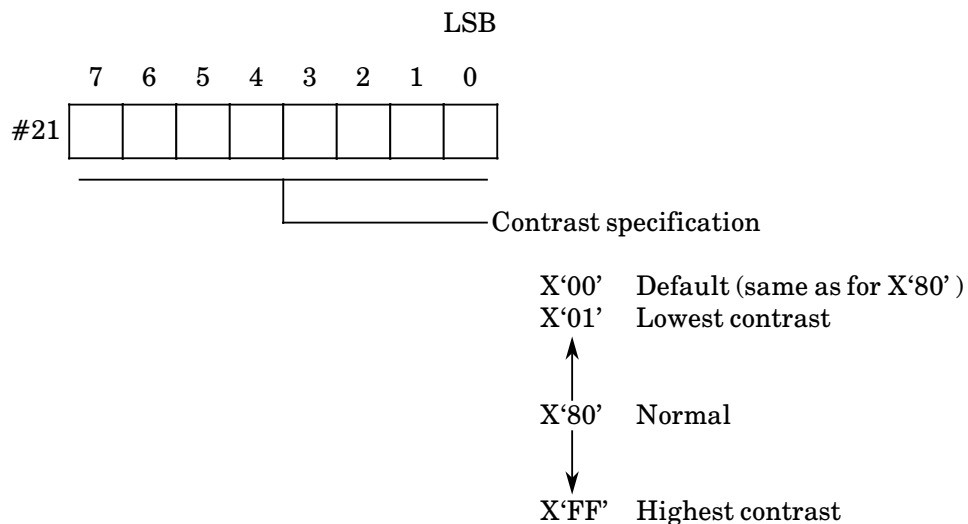
(j) Control register #20



*1 This register is valid if bit 0 of control register #19 is 1.

X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

(k) Control register #21

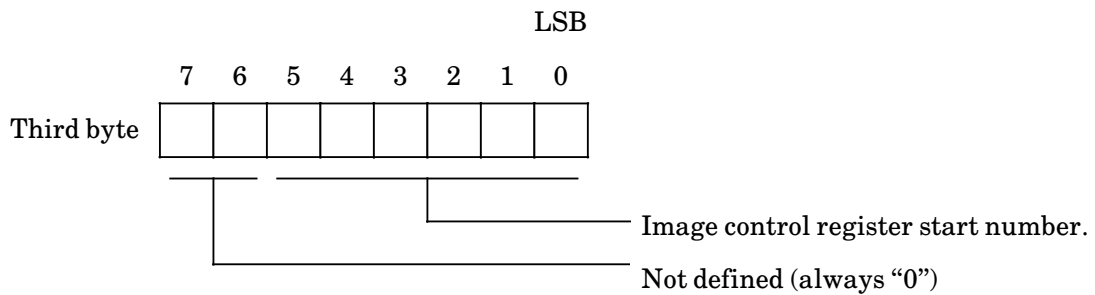


X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

6.3.3 IMAGE CONTROL command

This command sets the scanner to the operation mode of the image processing circuit.

Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT	Byte 4 or later
X'0x'	X'5A'	Image control register start number.	Image control register



Note:

If this command is sent to the scanner without image processing option (IPC II), the scanner sends "Operation error" as response.

Image control register

When the image processing option (IPC II) is connected, the following image processing can be executed. This register sets the image processing mode.

- Image area automatic separation function (simultaneous reading of characters and photographs)
- Inversion function (black/white conversion)
- Mirror image output function (right/left conversion)
- Image emphasis, outline extraction function
- Overlay function
- Symplified dynamic threshold
- Zooming function ranging from 25% to 400% in 1% increments.
- Function to change the reading mode of a section in the main window (subwindow function) (*3)

The method of image processing can be separately specified for the main window and subwindow.

*3: This function is executed by the subwindow control command described later.

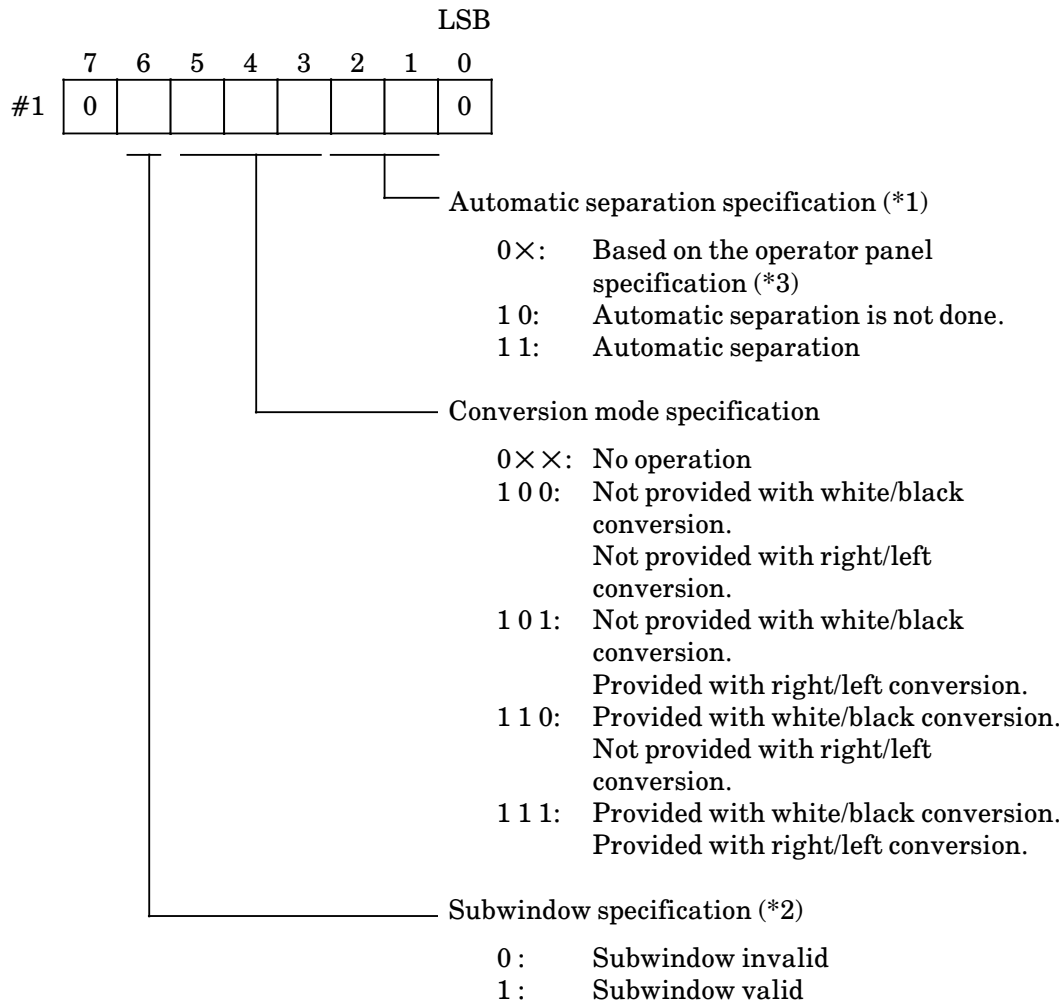
(a) Image control register #0

								LSB
	7	6	5	4	3	2	1	0
#0	0	0	0	0	0	0	0	0

X'00' is set when the power is turned on or the initial state is specified by the CLEAR command.

This register must be sent before setting the image control registers #1 to #8.

(b) Image control register #1



Note:

Image control registers #1 to #3 must be sent in one sequence. One of automatic separation, image emphasis, outline extract, overlay can be specified.

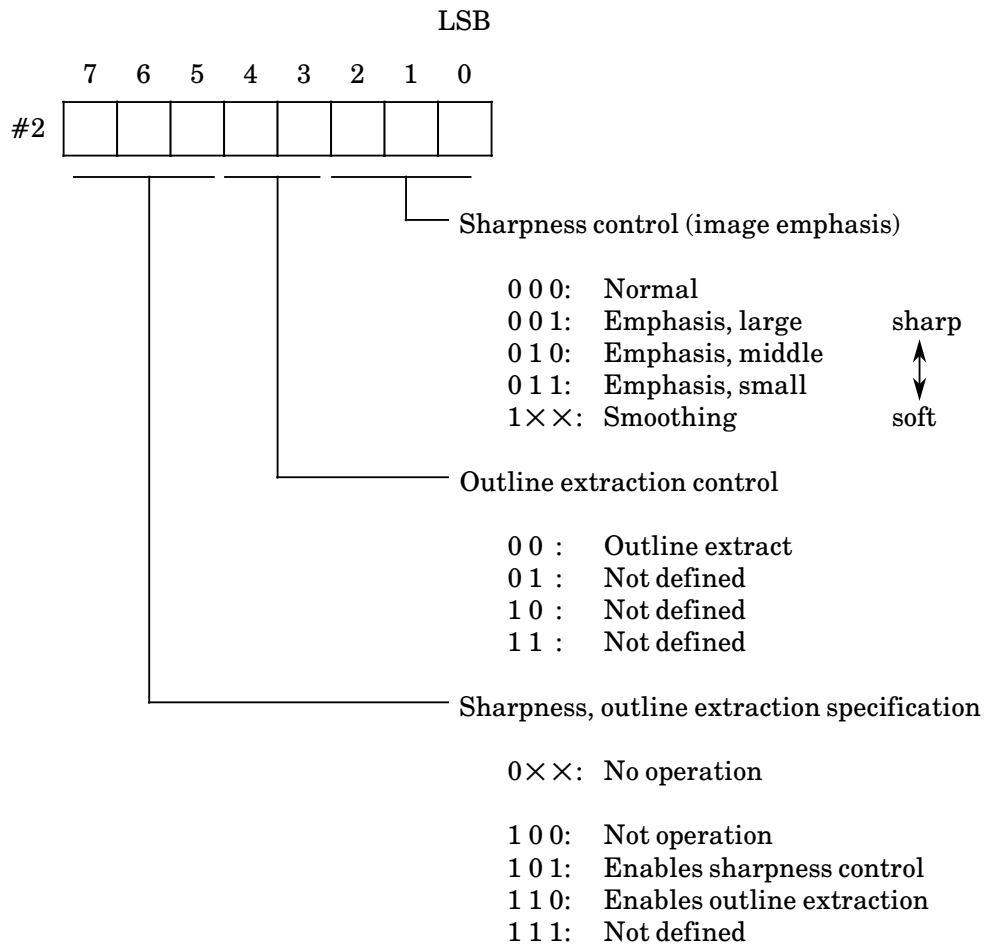
*1 Halftone specification (control register #2) is invalid in the automatic separation mode. However halftone processing (dither or error diffusion) for photo area follows control register #19, and the dither pattern follows control register #2.

*2 The subwindow control register is valid when the subwindow is valid.

*3 When automatic separation specification is based on operator panel, the bit 7 of image control register #2 and the bit 3 of image control register #3 must be set to '0'.

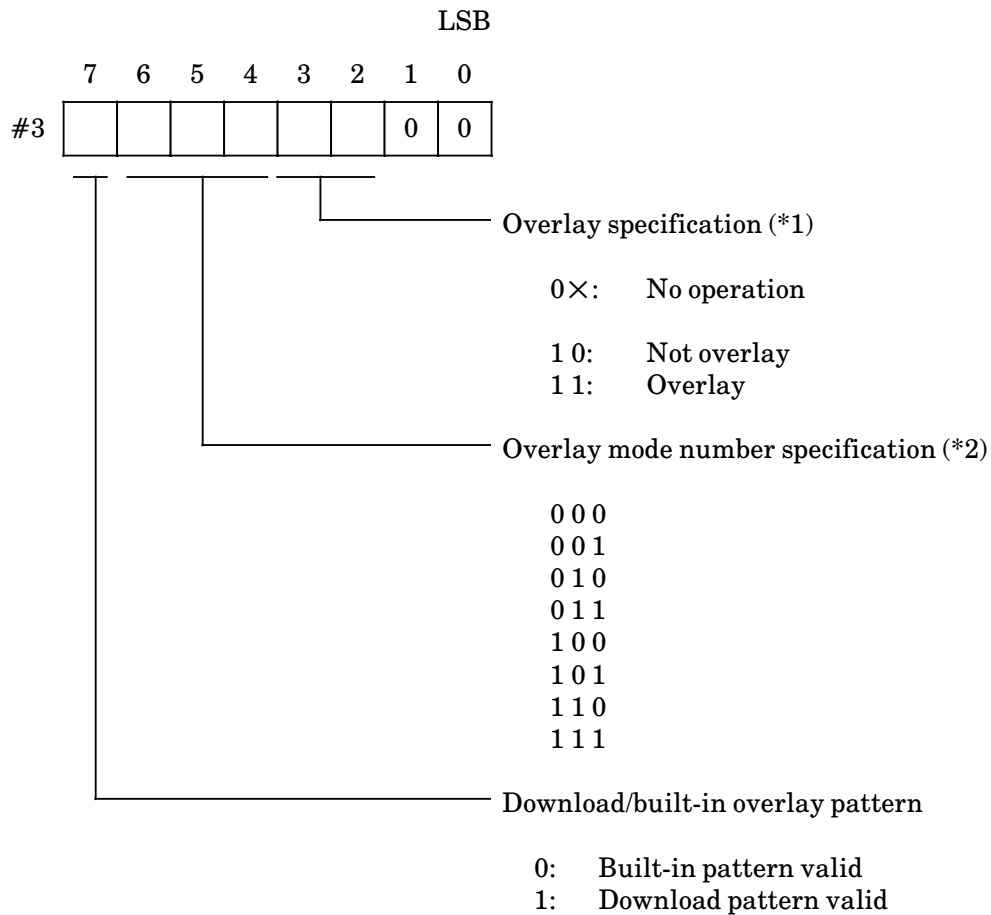
X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

(c) Image control register #2



X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

(d) Image control register #3



*1 When dither or Error Diffusion processing is valid by the control register #2 or operator panel, overlay is not performed even if it is valid by this register.

*2 This scanner has 6 patterns as built-in overlay pattern. (“000” to “101”)
8 patterns can be registered as down load pattern. (“000” to “111”)
The bits 4 to 7 is valid when the overlay specification is valid.

X‘00’ is set when the power is turned on or when the initial state is specified by the CLEAR command.

Built-in overlay pattern

No. 0
Horizontal lines

00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF

No. 1
Vertical lines

00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF

No. 2
Angled pattern

FF	FF	FF	00	00	00	00	FF
FF	FF	FF	FF	00	00	00	00
00	FF	FF	FF	FF	00	00	00
00	00	FF	FF	FF	FF	00	00
00	00	00	FF	FF	FF	FF	00
00	00	00	00	FF	FF	FF	FF
FF	00	00	00	00	FF	FF	FF
FF	FF	00	00	00	00	FF	FF

No. 3
Dots pattern

FF	FF	FF	FF	00	00	00	00
FF	FF	FF	FF	00	00	00	00
FF	FF	FF	FF	00	00	00	00
FF	FF	FF	FF	00	00	00	00
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF

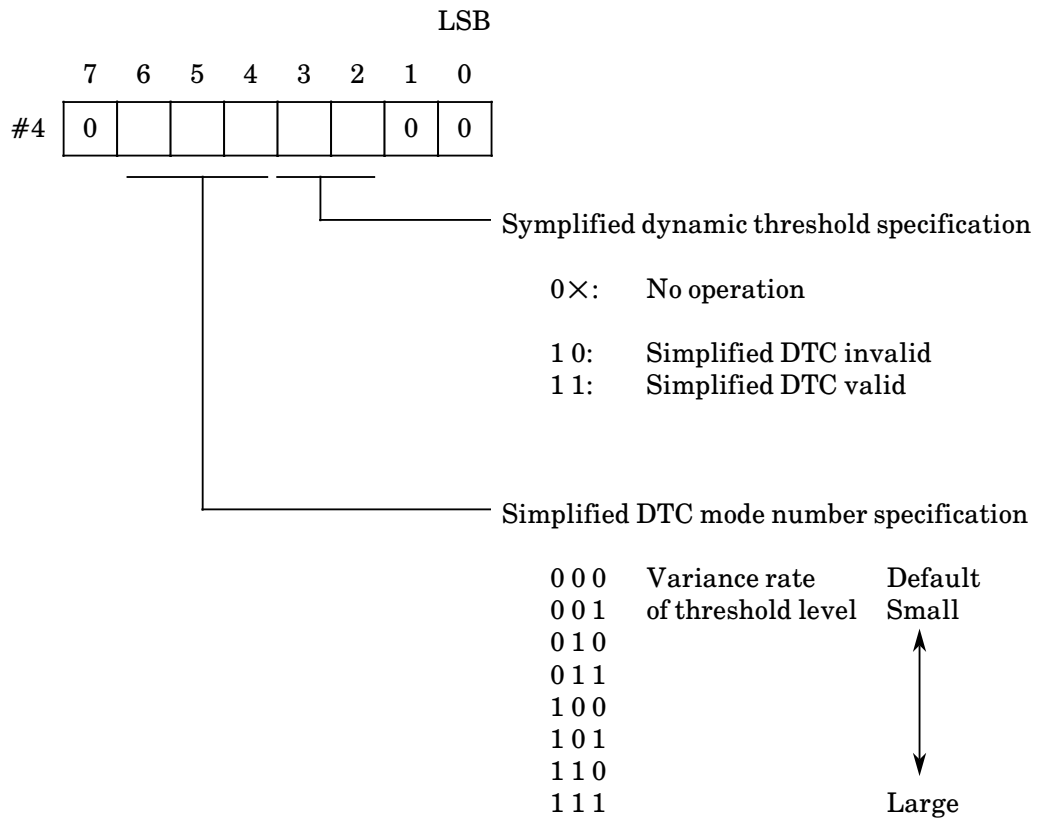
No. 4
Triangle pattern

FF	FF	FF	FF	FF	FF	FF	FF
00	FF	FF	FF	FF	FF	FF	FF
00	00	FF	FF	FF	FF	FF	FF
00	00	00	FF	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	00	FF	FF	FF
00	00	00	00	00	00	FF	FF
00	00	00	00	00	00	00	FF

No. 5
Lattice pattern

00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00
00	00	FF	FF	FF	FF	00	00
00	00	FF	FF	FF	FF	00	00
00	00	FF	FF	FF	FF	00	00
00	00	FF	FF	FF	FF	00	00
00	00	00	00	00	00	00	00
00	00	00	00	00	00	00	00

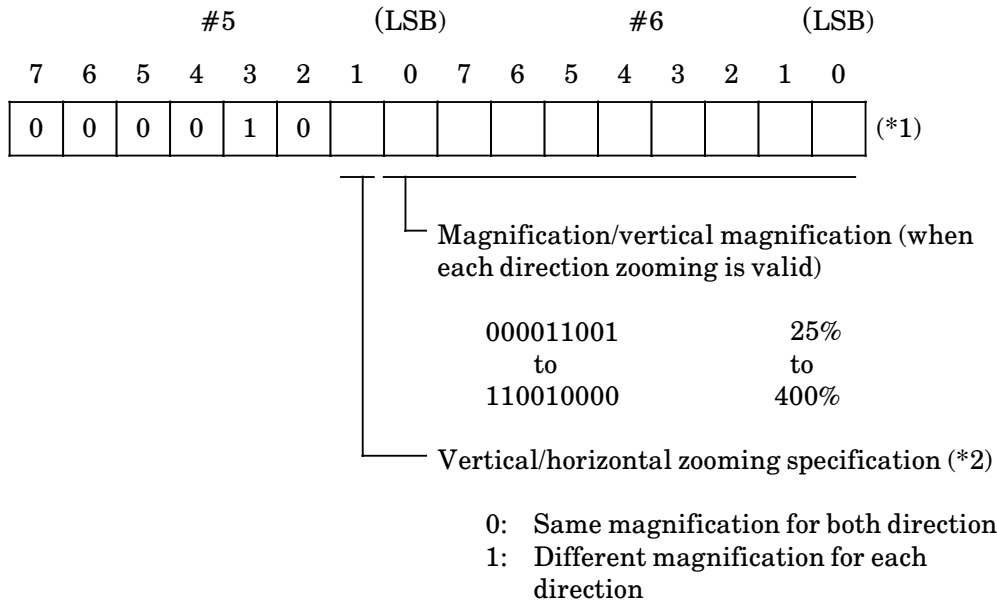
(e) Image control register #4



8 parameter (000 to 111) can be specified as variance rate.

X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

(f) Image control registers #5 and #6



*1 Registers #5 and #6 must be sent consecutively. Registers #5, #6, #7, and #8 must be sent consecutively for different vertical/horizontal magnification.

*2 When the vertical/horizontal zooming specification is set to “0”, the horizontal and vertical magnification is indicated. When this specification is set to “1”, vertical magnification is specified at bit 0 of the register #5 and at all bits of the register #6.

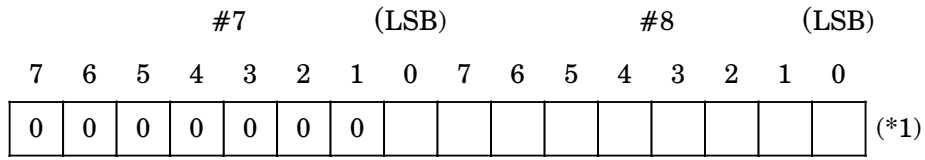
X'0864' is set when the power is turned on or when the initial status is specified.

Example

How to calculate the output resolution :

- Control register #1 is X'0B' (200 dpi)
 - Image control register #5 and #6 are X'0819' (25%)
- Output resolution = 200 dpi × 0.25 = 50 dpi

(g) Image control registers #7 and #8



(*1)

└───┬───┘
Horizontal magnification (when each direction zooming is valid.)

000011001 25%
 to to
110010000 400% (*2)

*1 Magnification is valid only when the horizontal/vertical zooming specification (bit 1 of the register #5) is set to "1".

*2 Document magnification has the following limitations:

Maximum main scanning data : 608 bytes/line

$$\frac{A \times (B/400) \times (C/100)}{8} \leq 608 \text{ (bytes)}$$

- A: Main scan width (unit: Number of pixels when scanned at 400 dpi)
- B: Basic resolution (set from operator panel or control register #0 : 200, 240, 300, 400 dpi)
- C: Horizontal magnification (25 to 400%)

This expression is rounded up to the integer:

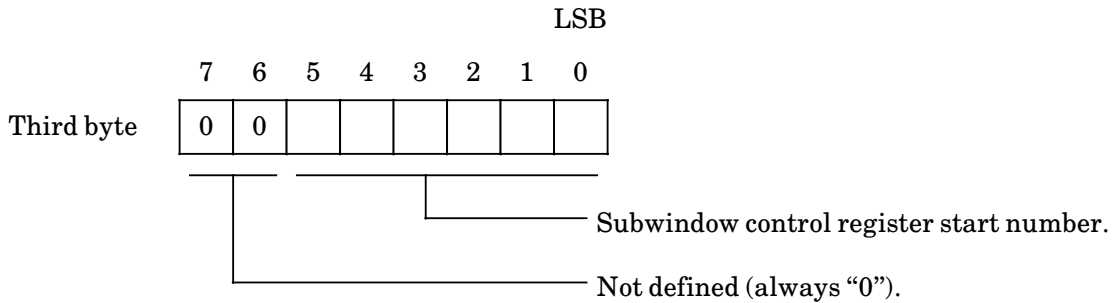
X'0000' is set when the power is turned on or when the initial state is specified.

6.3.4 SUBWINDOW CONTROL command

This command sets the scanner to the operation mode of subwindow.

Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT	Byte 4 or later
X'0x'	X'5C'	Subwindow control register start number	Subwindow control register

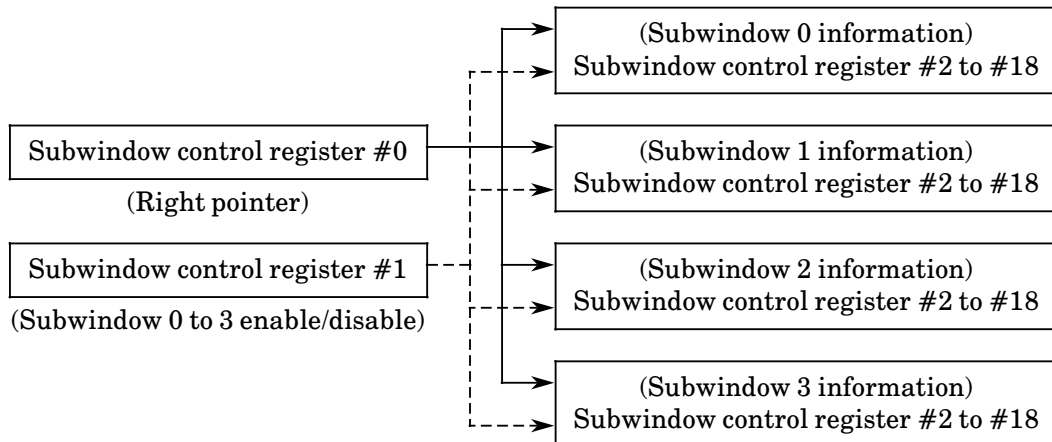
This command specifies the subwindow attribute information. The third byte specifies the subwindow control register start number. These registers are valid when bit 6 of the image control register #1 is set to "1" (subwindow is valid).



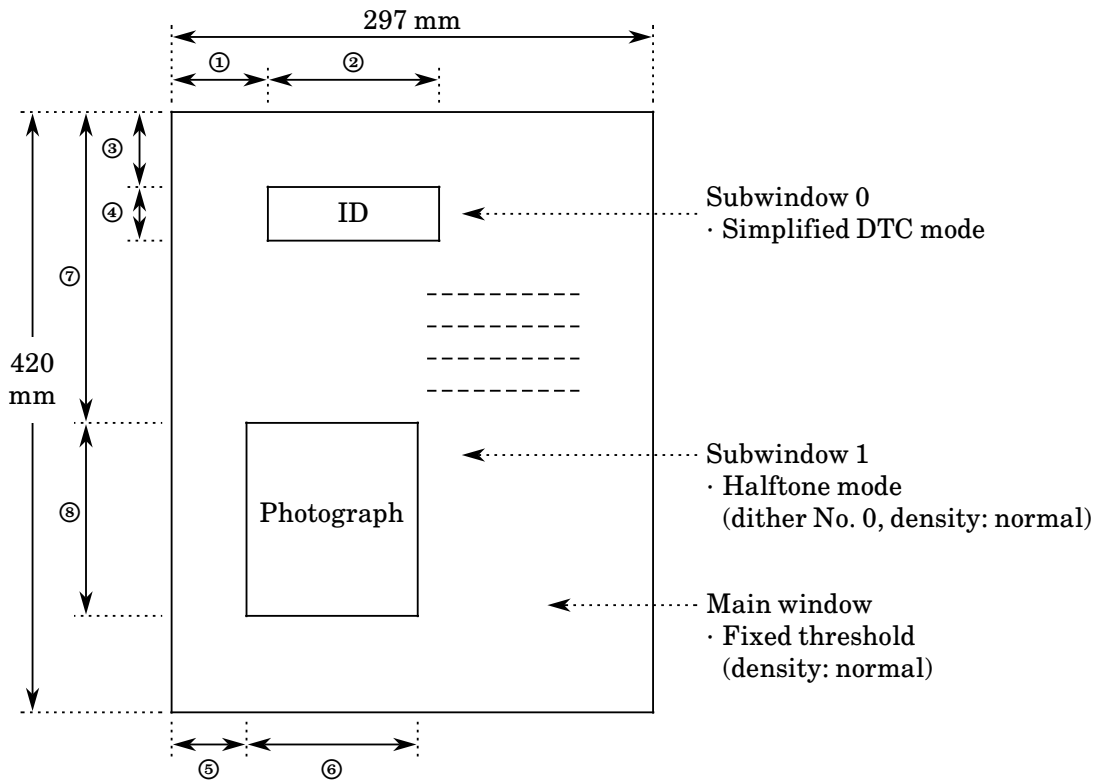
X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Relationship between subwindow control registers #0, #1 and #2 through #18

The subwindow control register #0 used to select the subwindow number (0 to 3). The subwindow control register #1 specifies which subwindow (0 to 3) is enabled at reading.



Example of subwindow setting



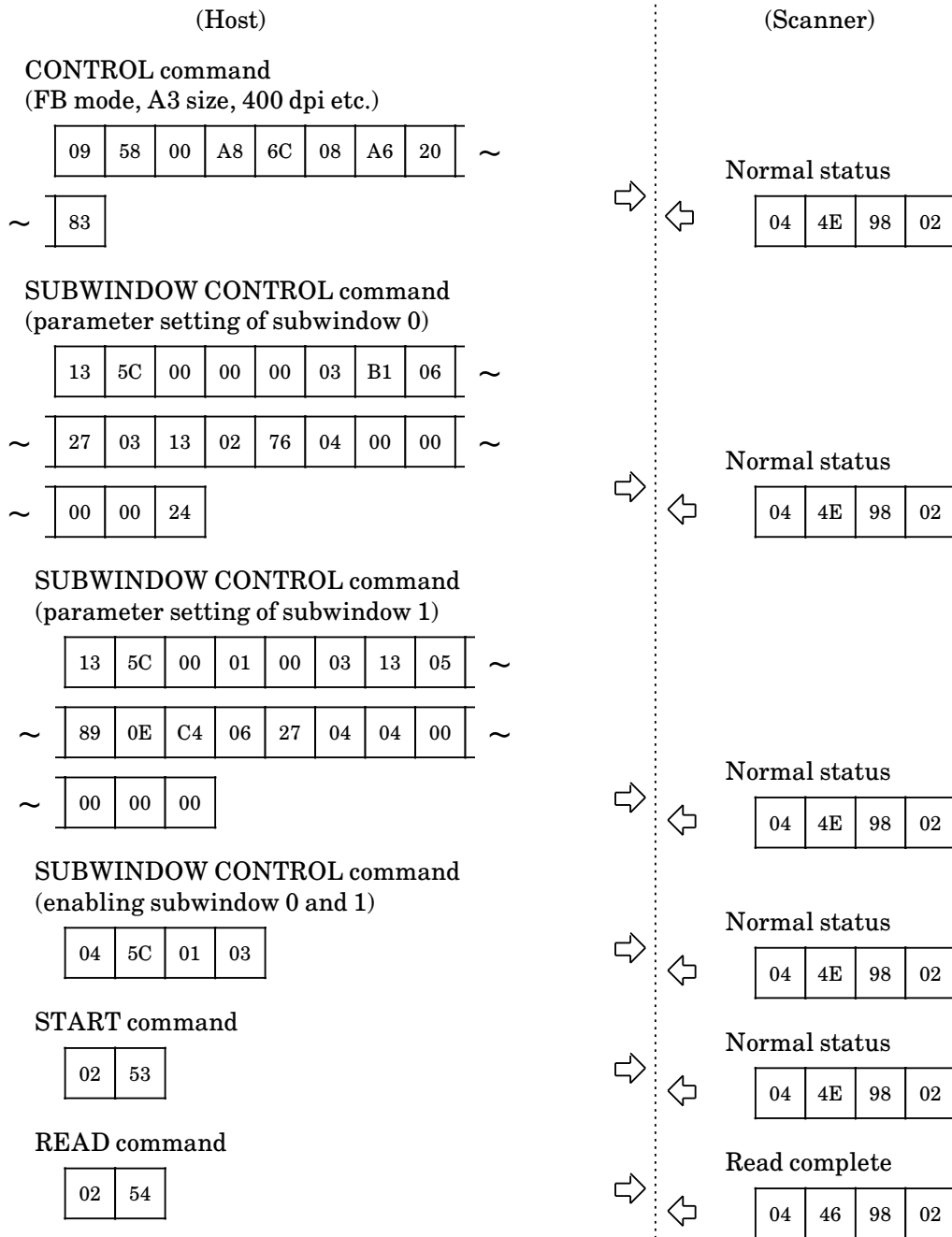
Subwindow 0

- ① 60 mm (X'03B1')
- ② 100 mm (X'0627')
- ③ 50 mm (X'0313')
- ④ 40 mm (X'0276')

Value in parentheses indicates hexadecimal indication of pixels at 400 dpi reading.

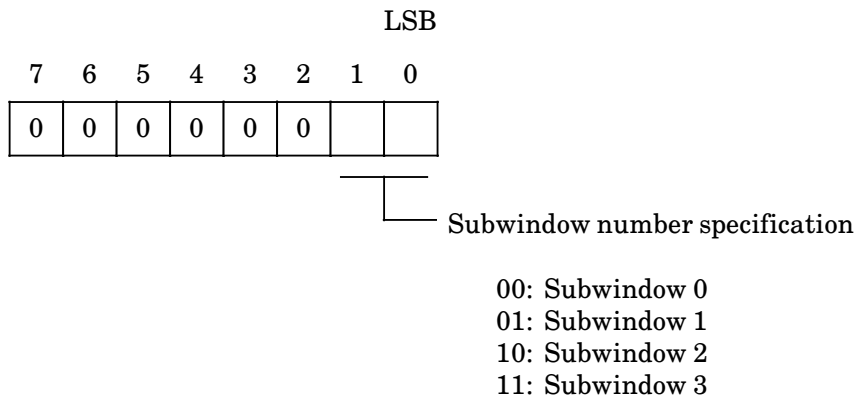
Subwindow 1

- ① 50 mm (X'0313')
- ② 90 mm (X'0589')
- ③ 240 mm (X'0EC4')
- ④ 100 mm (X'0627')



The IMAGE MODE SENSE or RETURN SENSE command can be issued at any timing in this sequence.

Subwindow control register #0

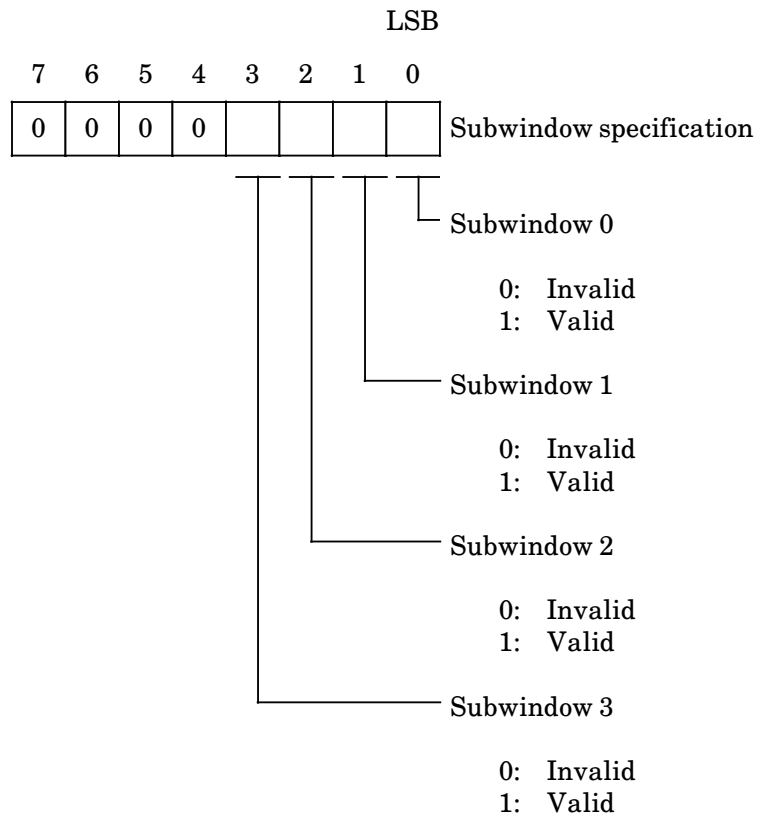


Note:

This register must be set before setting the subwindow control registers #2 to #18.

X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

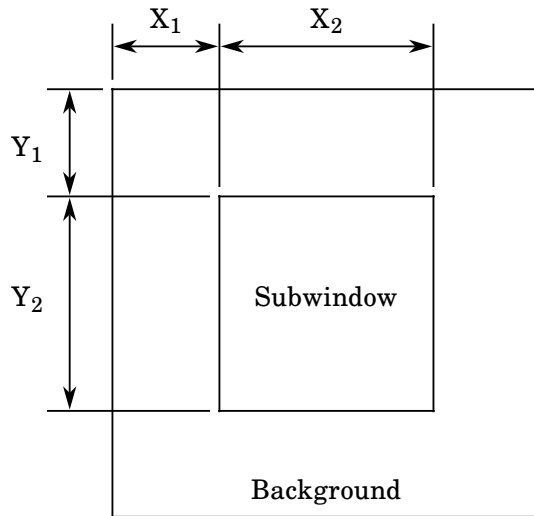
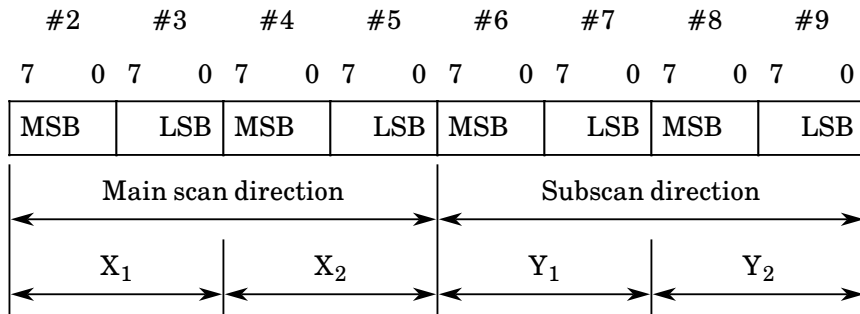
Subwindow control register #1



X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control registers #2 to #9

Subwindow area specification register



Value is specified in binary in units of 1/400 inch.

Note:

When specifying this register, send four consecutive bytes, #2, #3, #4, #5, or #6, #7, #8, and #9.

Example:

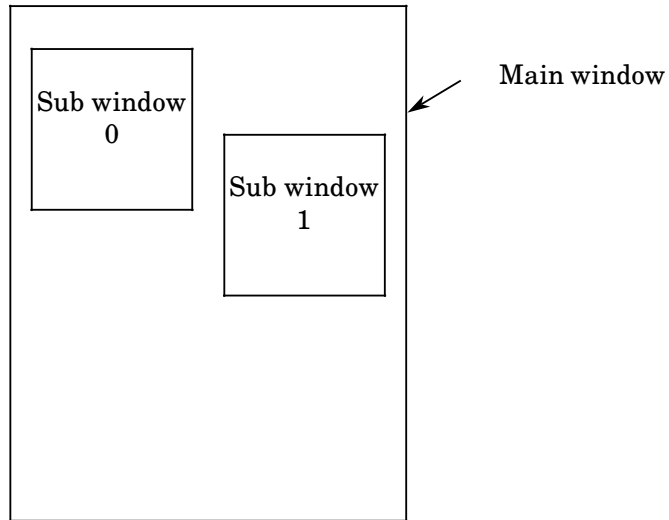
CNT	CMD	REG.No.	#2	#3	#4	#5
			(#6)	(#7)	(#8)	(#9)

Otherwise

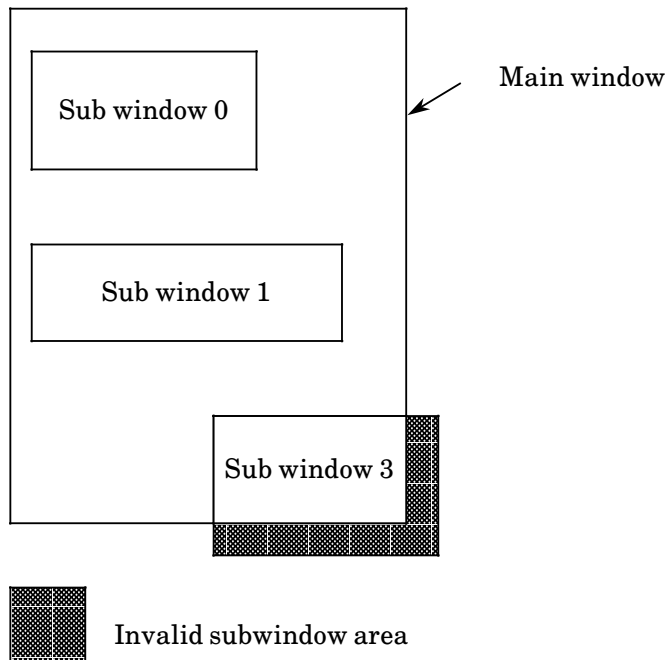
CNT	CMD	REG.No.	#2	#3	#4	#5	#6	#7	#8	#9
-----	-----	---------	----	----	----	----	----	----	----	----

Notes:

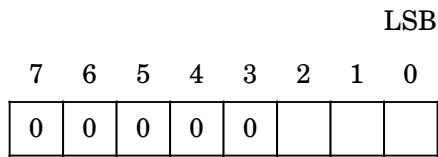
1. Each subwindow must not exist in same line (main scanning direction).



2. If the area of the subwindow exceeds the main window area, only the subwindow area included in the main window is valid.



Subwindow control register #10



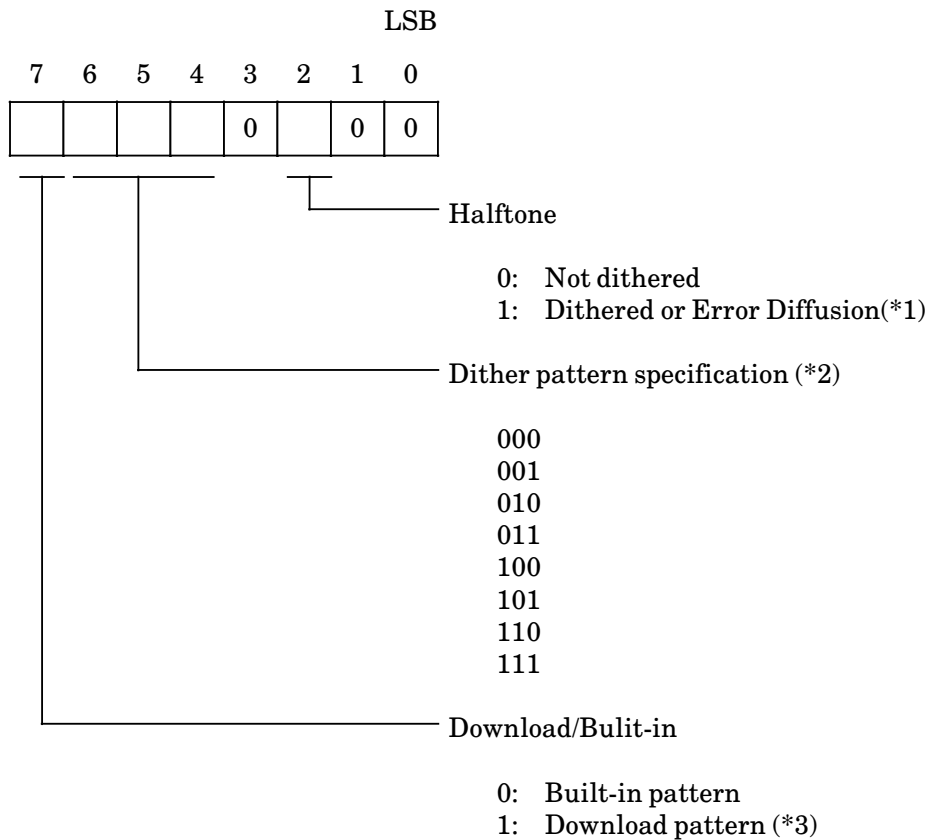
Density (*1)

000:	Light	↓ Darken more and more
001:		
010:	Somewhat light	
011:		
100:	Normal	
101:		
110:	Somewhat dark	
111:	Dark	

*1 Valid if bit 0 of subwindow control register #16 is 0 (eight-step selection). Otherwise, the density specification in subwindow control register #17 is valid (256-step selection).

X'04' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control register #11



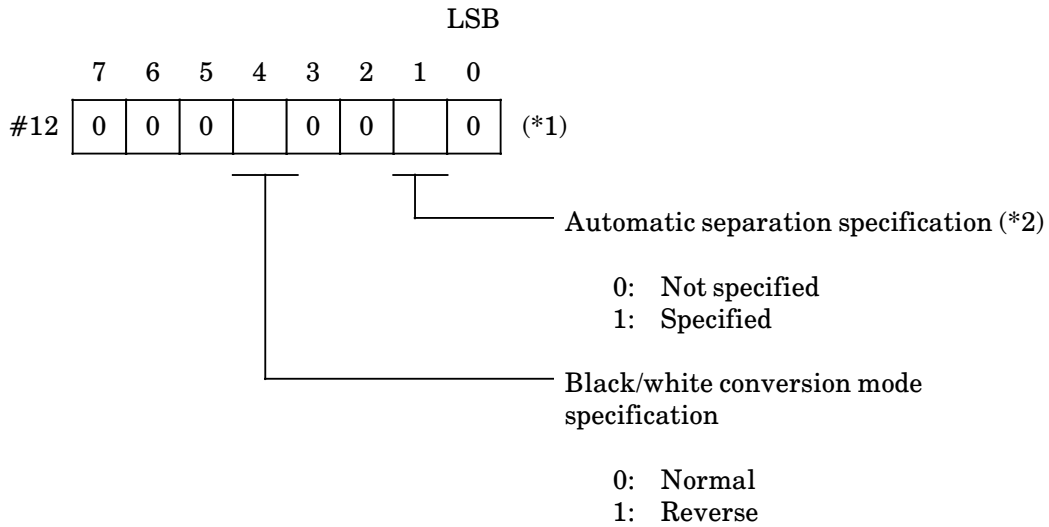
*1. Select dithering or error diffusion as the halftone processing type using subwindow control register #16. If dithering is selected, bits 4 to 7 are valid.

*2. Four pattern can be specified when built-in pattern is selected. Eight pattern is available for download pattern.

*3. When download pattern is specified, the density information (Subwindow control register #10 or #17) is ignored.

X'00' is set when the power is turned on or the initial state is specified by the CLEAR command.

Subwindow control register #12

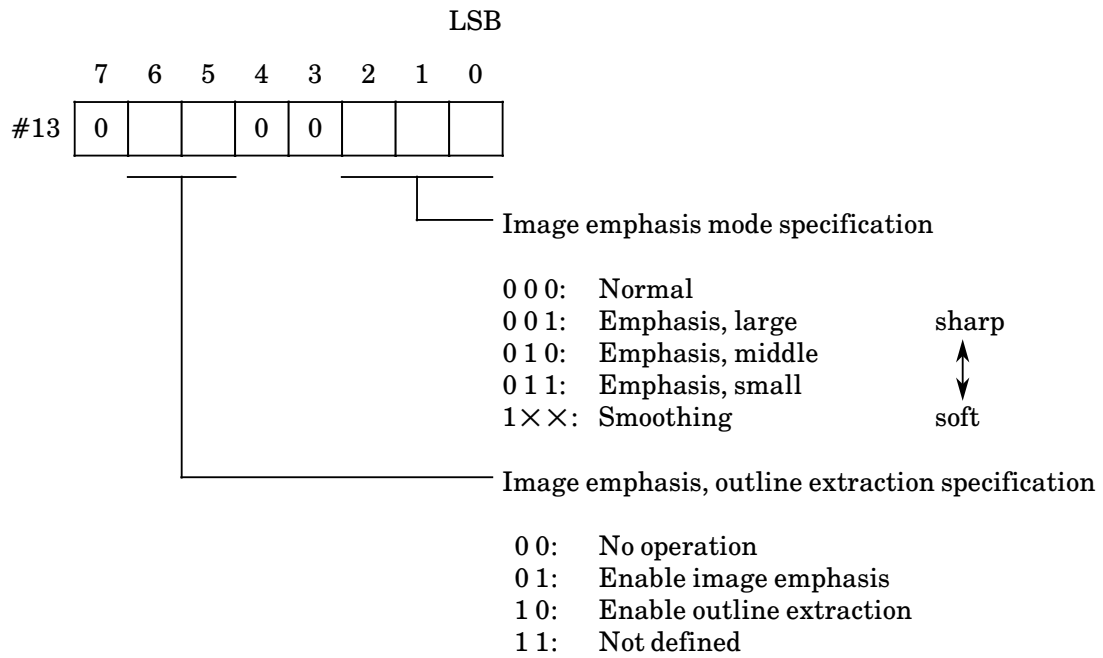


*1 Subwindow control registers #12 to #14 must be sent in one sequence. One of automatic separation, image emphasis, outline extract, overlay can be specified.

*2 When image area separation is specified, the density level for line drawing area follows the subwindow control register #10 or #17, and the dither pattern for photo area follows the subwindow control register #11, and halftone processing for photo area follows subwindow control register #16.

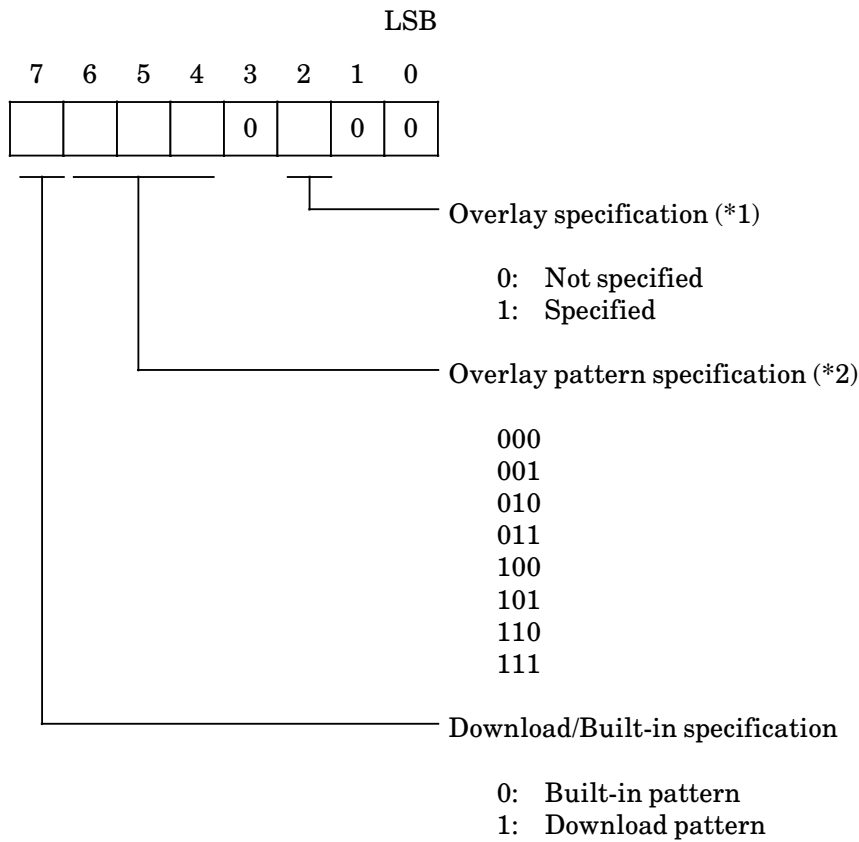
X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control register #13



X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control register #14

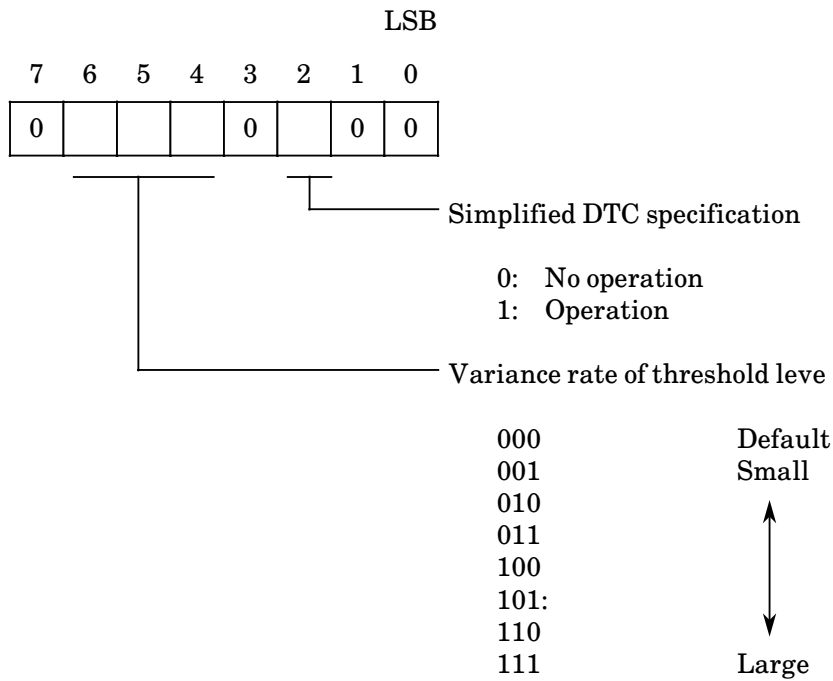


*1 When halftone is specified by subwindow control register #11, overlay never performed even if it is specified in this register.

*2 When built-in pattern is specified, six pattern (“000” to “101”) can be usable. When download pattern is specified, eight pattern can be usable.

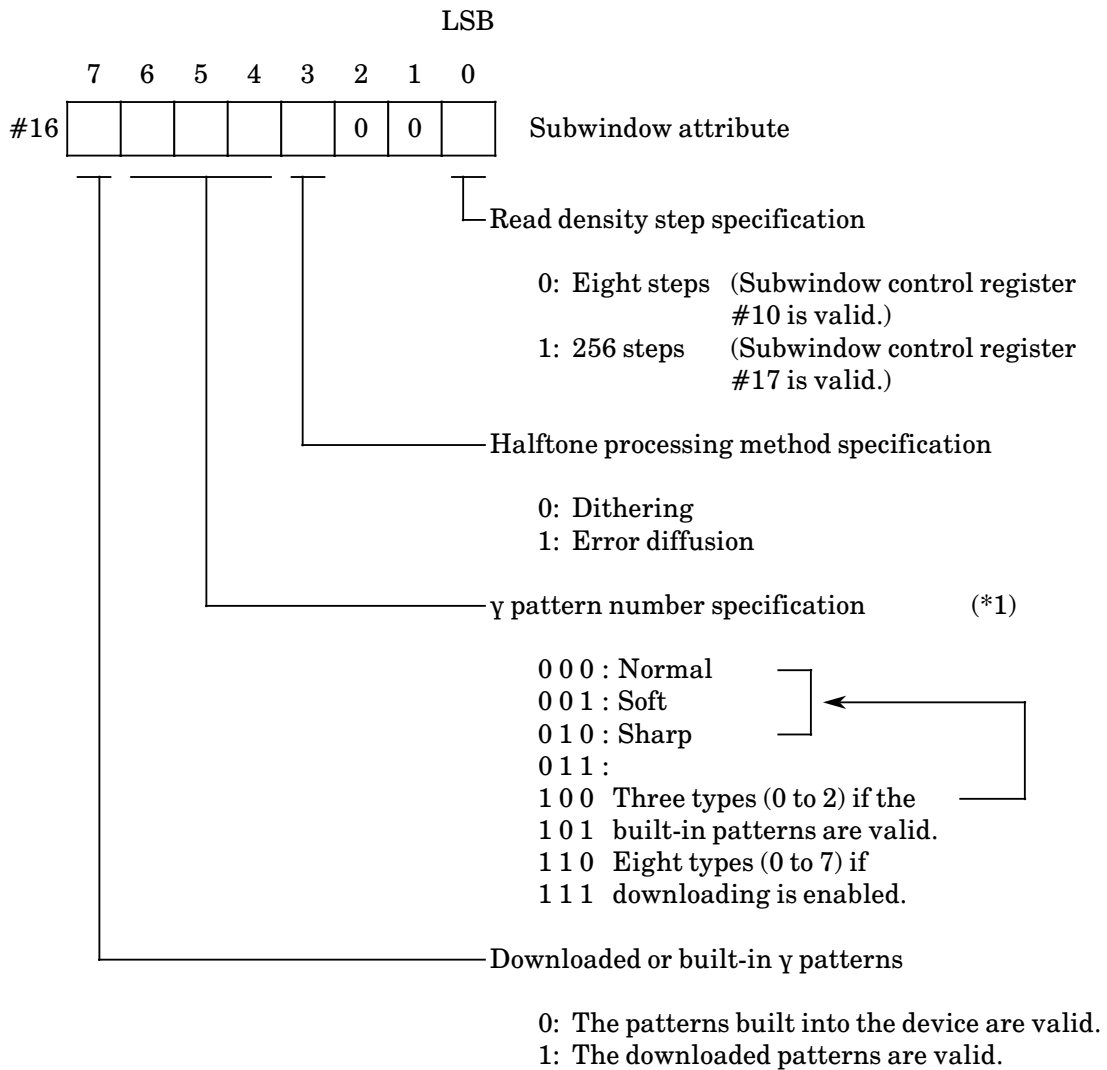
X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control register #15



X'00' is set when the power is turned on or when the initial state is specified by the CLEAR command.

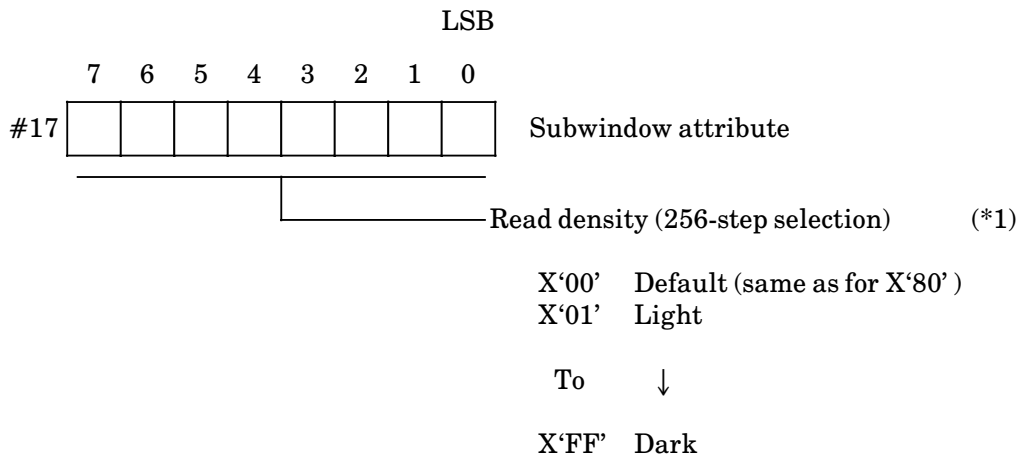
Subwindow control register #16



*1 If the built-in patterns are valid, number 0 to 2 (three types) can be selected.

X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

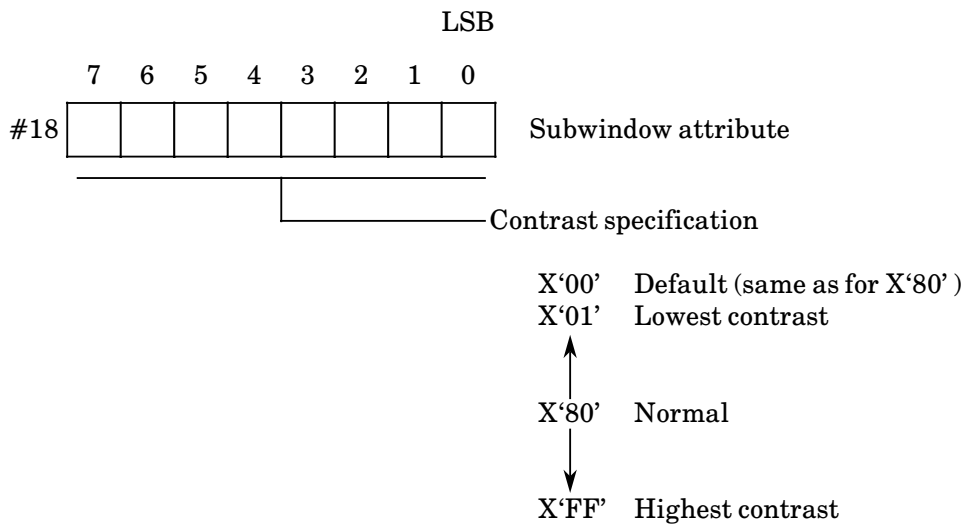
Subwindow control register #17



*1 This register is valid if bit 0 of subwindow control register #16 is 1.

X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

Subwindow control register #18



X'00' is set whenever the power is turned on or when the initial state is specified by the CLEAR command.

6.3.5 START command

When the scanner receives this command, the scanner reports the size of document being read.

Byte 1 CNT	Byte 2 CMD	Byte 3 and later
X'02'	X'53'	-

6.3.6 READ command

When the scanner receives this command, the scanner starts reading based on the previously set operation mode.

Issuing the response other than Read Complete during read operation causes error.

Byte 1 CNT	Byte 2 CMD	Byte 3 and later
X'02'	X'54'	-

6.3.7 SENSE command

When the scanner receives this command, the scanner reports the scanner status.

The Sense command can be issued at any time if another command does not require the response from the scanner.

Byte 1 CNT	Byte 2 CMD	Byte 3 and later
X'02'	X'41'	-

6.3.8 RETURN SENSE command

By this command, the scanner reports that the carrier unit has come back to the home position.

Byte 1 CNT	Byte 2 CMD	Byte 3 and later
X'02'	X'42'	-

6.3.9 IMAGE MODE SENSE command

This command is valid for the scanner with the image processing circuit. When the scanner receives this command, the scanner reports the image processing mode of the main window and the number of pixels (Unit: Byte) per line in the X-direction.

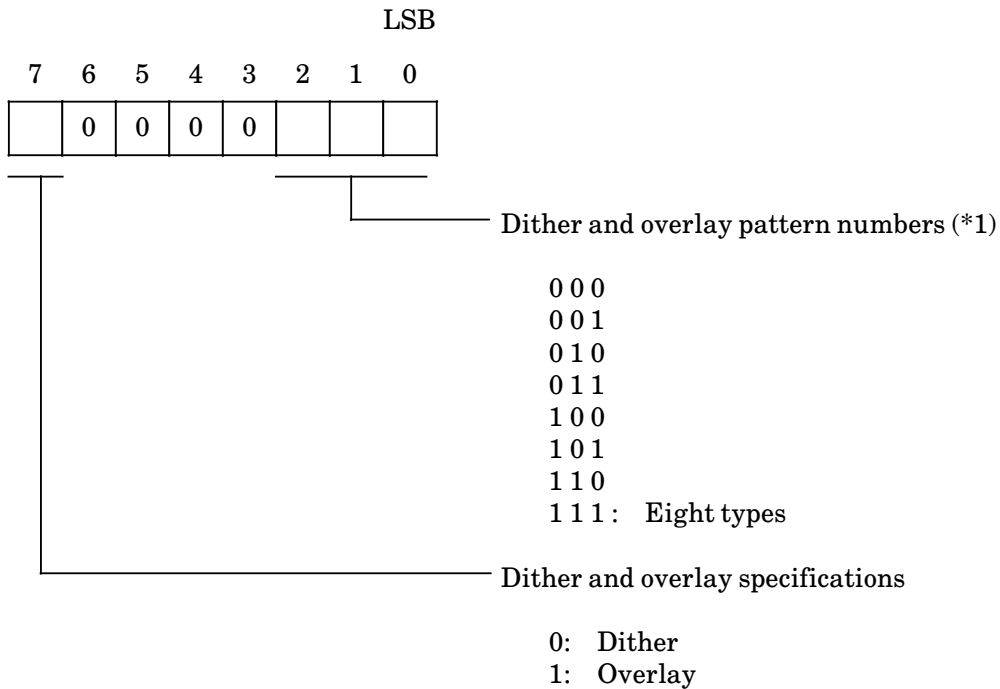
Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT
X'03'	X'43'	X'00'

6.3.10 SEND DITHER 1 command

This command is valid for the scanner with the image processing circuit. By this command, download patterns of dither or overlay pattern can be registered.

Byte 1 CNT	Byte 2 CMD	Byte 3 TEXT	Byte 4 or later
X'43'	X'46'	Dither or overlay pattern number	Pattern data to be registered

Details for Byte 3 (Dither or Overlay patterns)



*1 Up to 8 types, from No. 0 to No. 7, can be registered for dither pattern or overlay pattern. When the power to the scanner is turned off or when the scanner is reset, registration must be done again. When a pattern is built in, registration need not be done again.

Pattern data format

1 byte data corresponds to data for 1 dot.

① For dither pattern

X'00' to X'3F' should be sent as dither pattern.


② For overlay pattern

X'00' or X'FF' should be sent

When the data is X'FF', the data of the dot is changed to white.

When the data is X'00', the data of the dot is not changed.

Transfer the dither and overlay patterns in the order shown below.

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
							
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56
57	58	59	60	61	62	63	64

(8 X 8 matrix)

Download is optional.

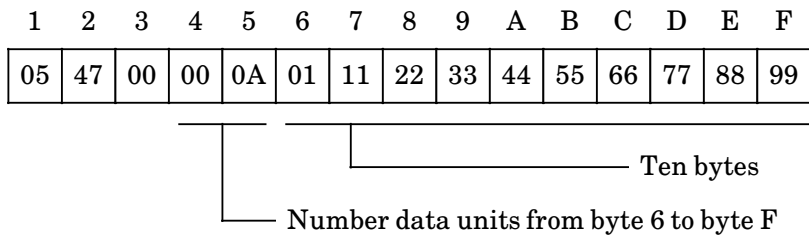
6.3.11 SEND DITHER 2 command

Byte 1	Byte 2	Byte 3	Byte 4, 5	Byte 6	Byte 7 or later
05	47	Reserved (00)	Count A (*1)	Dithering γ , and overlay pattern number	Dithering γ , and overlay pattern (Count A-1) byte

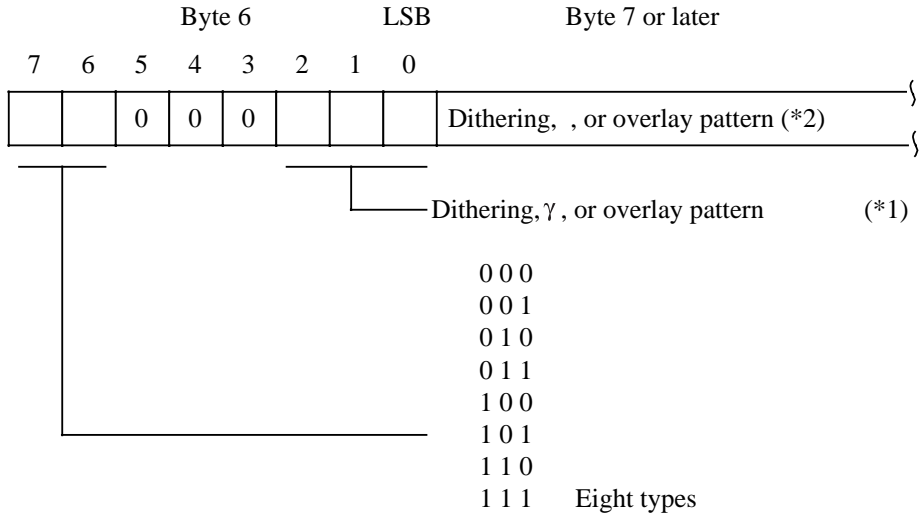
- For the SEND DITHER1 command, the dithered matrix size is always 8×8 .
- For the SEND DITHER2 command, the dithered matrix size is variable ($n \times n$). ($n \leq 32$) Data can also be downloaded.

*1 Count A (bytes 4 and 5) contains the number of data units from byte 6 or a subsequent byte. (256 bytes or more data can be transferred.)

Example: SEND DITHER2 command



Byte 6: Dithering, γ , or overlay pattern number, and the corresponding pattern

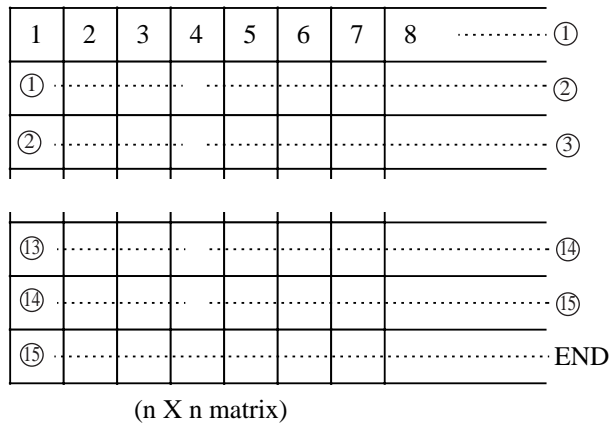


Dithering or overlay specification

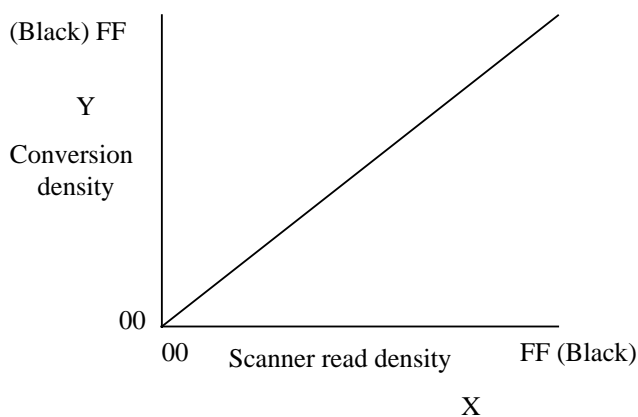
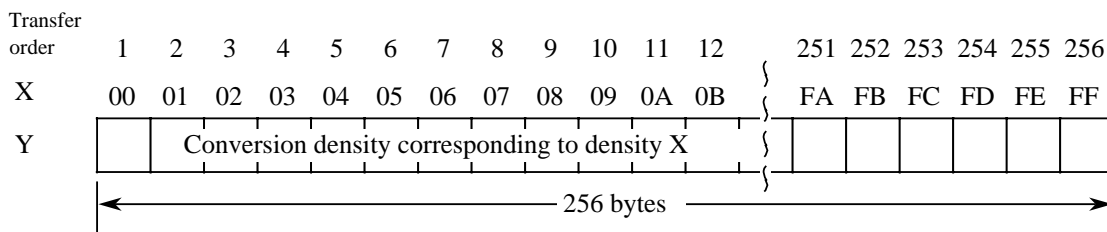
- 0 0 Dithering
- 0 1 γ
- 1 0 Overlay
- 1 1 Undefined

*1 Eight dithering, eight γ , and eight overlay patterns (0 to 7) can be registered. If the scanner is turned off, or reset, they must be registered again. If the patterns built into the scanner are used, they need not be registered.

*2 Dithering and overlay patterns must be transferred in the following order:



The γ patterns must be transferred in the following order and format (SEND DITHER2 is used):



Note:

For overlay pattern matrix data, X`FF' or X`00' must be set.

X`FF': Forces the corresponding pixel to be white.

X`00': Binarizes the corresponding pixel based on the specified slice (density). For a floating slice, it is binarized based on the normal density.

Example:

00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
~~~~~							
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF
00	00	00	00	FF	FF	FF	FF

For an 8 X 8 matrix

## 6.4 Response

Table 6.3 lists the response for the commands sent from the scanner to the host computer.

**Table 6.3 Response**

Response	Response code	Details
Ready	52	Completion of scanner initialization
Normal status	4E	Response to command reception
Image status	4C	Reporting the image processing mode for each main window and the number of bytes per line in the X-axis direction
Read complete	46	Completion of READ command reception
Operation error	55	Occurrence of error related to operation specification program
Temporary error	54	Occurrence of Temporary error
Equipment error	50	Occurrence of device fault

Byte Response	1	2	3	4	5 and later
Ready	02	52			
Normal status	04	4E	Device information I	Device information II	
Image status	0C	4C	Device information III to device information XII (10 bytes)		
Read complete	04	46	Device information I	Device information II	
Operation error	03	55	Detailed error information I		
Temporary error	03	54	Detailed error information II		
Equipment error	03	50	Detailed error information III		

### 6.4.1 Ready

This response indicates that the scanner initialization is complete.

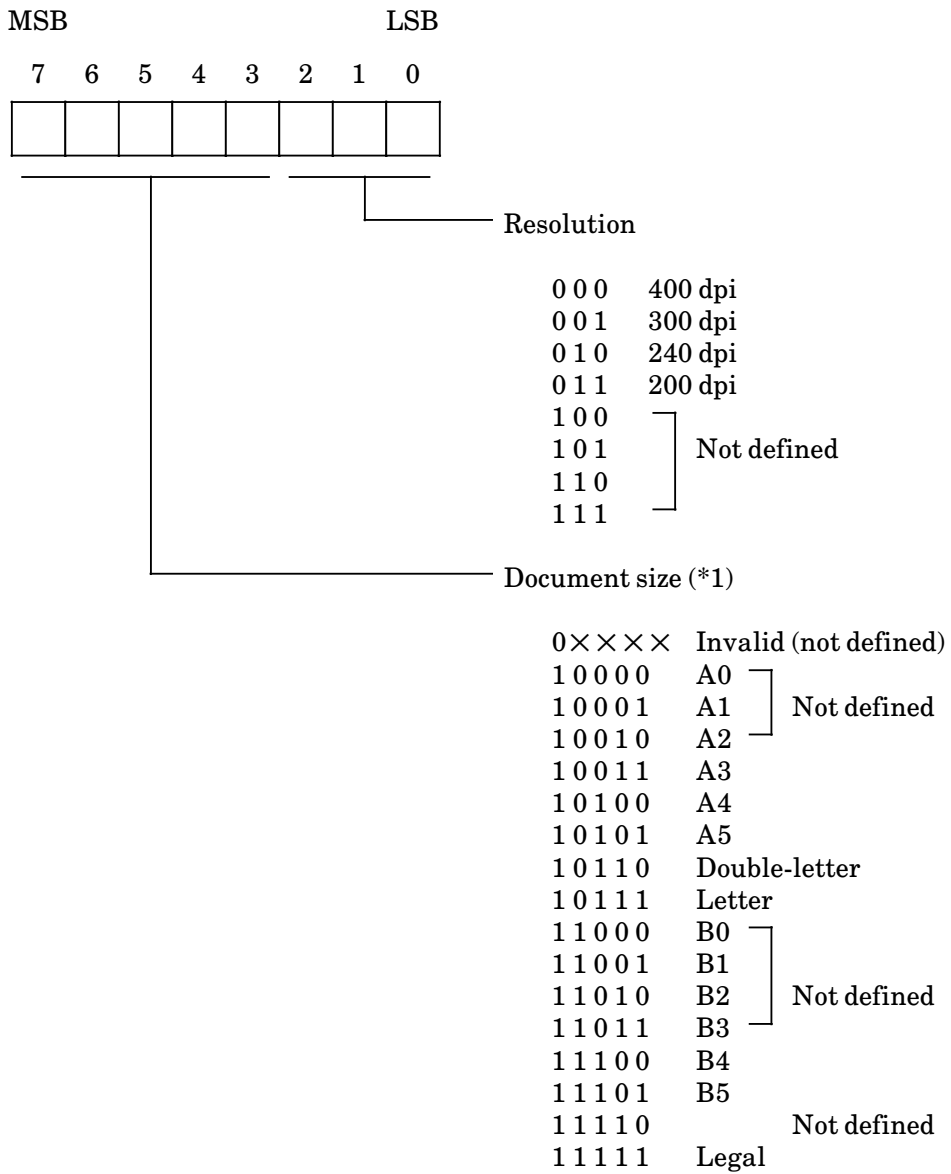
Byte 1 CNT	Byte 2 CMD	Byte 3 and later
X'02'	X'52'	-

### 6.4.2 Normal status

This response is for command reception and includes device information. Device information indicates the status of scanner operation.

Byte 1 CNT	Byte 2 CMD	Byte 3	Byte 4
X'04'	X'4E'	Device Information I	Device Information II

## Device information I



*1 The document size is no longer valid when a nonstandard size is specified.



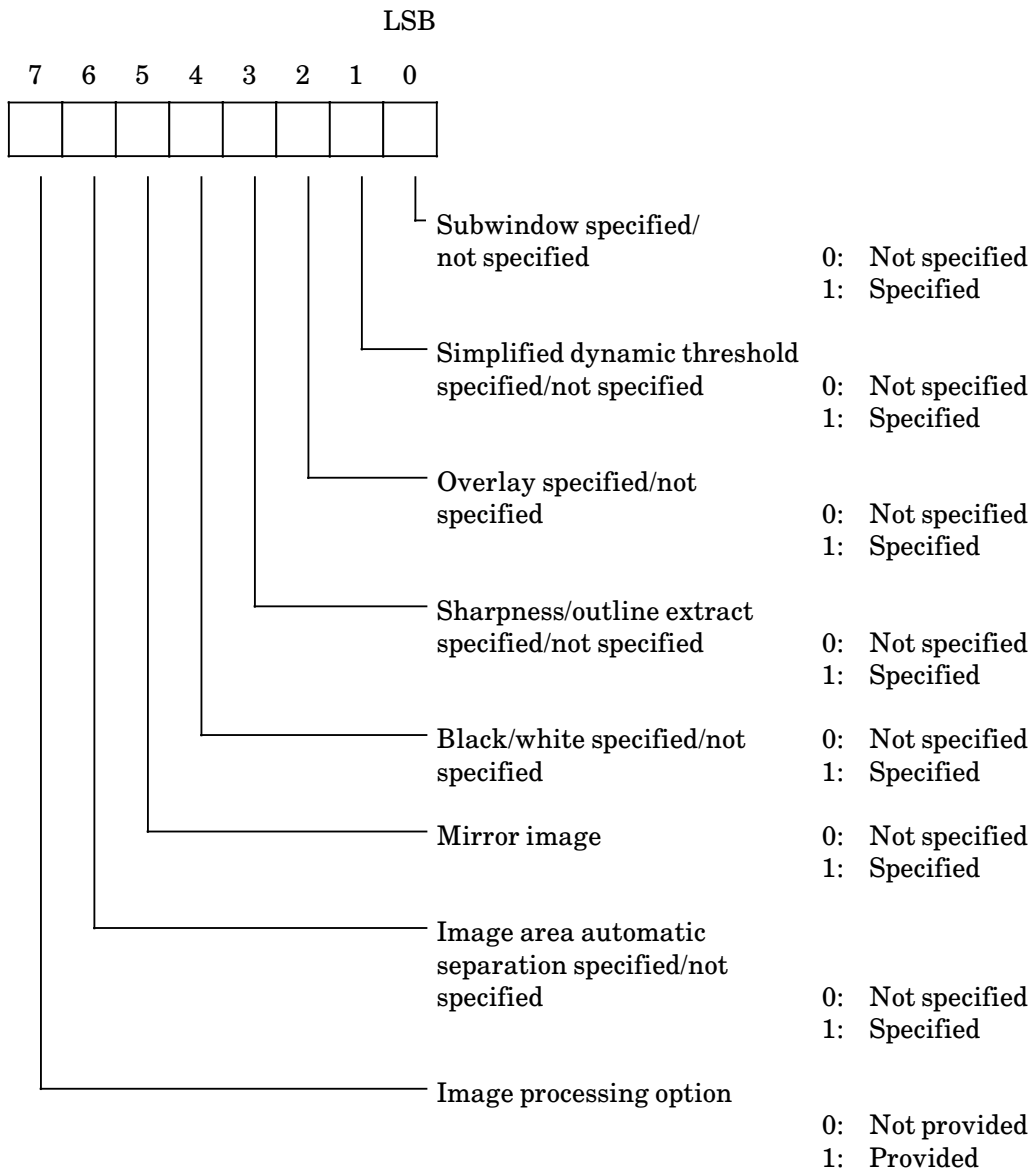


### 6.4.3 Image status

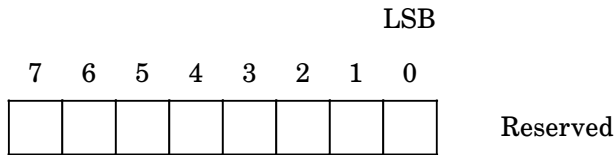
This response reports the status of the image processing function.

Byte 1 CNT	Byte 2 RPS	Byte 3 or later
X'0C'	X'4C'	Device Information III to XII

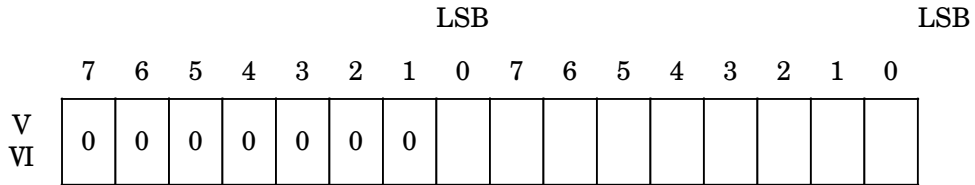
#### Device information III



Device information IV



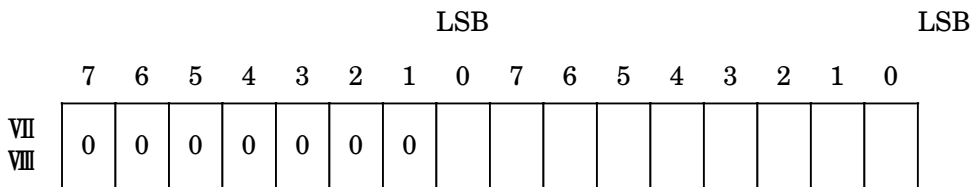
Device information V and VI



└─ Vertical magnification

000011001	25%
to	to
110010000	400%

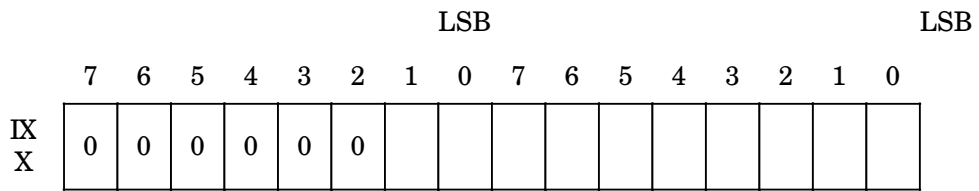
Device information VII and VIII



└─ Horizontal magnification

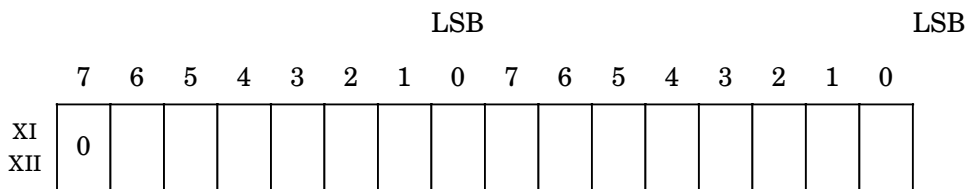
000011001	25%
to	to
110010000	400%

Device information IX and X



└───┬───┘  
 Number of bytes per line in the  
 X-axis direction  
  
 000000001  
 to  
 1001100000    Maximum 608 bytes

Device information XI and XII



└───┬───┘  
 Number of lines in the Y-axis  
 direction

**Note:**

X '0000' is sent when ADF mode is selected.

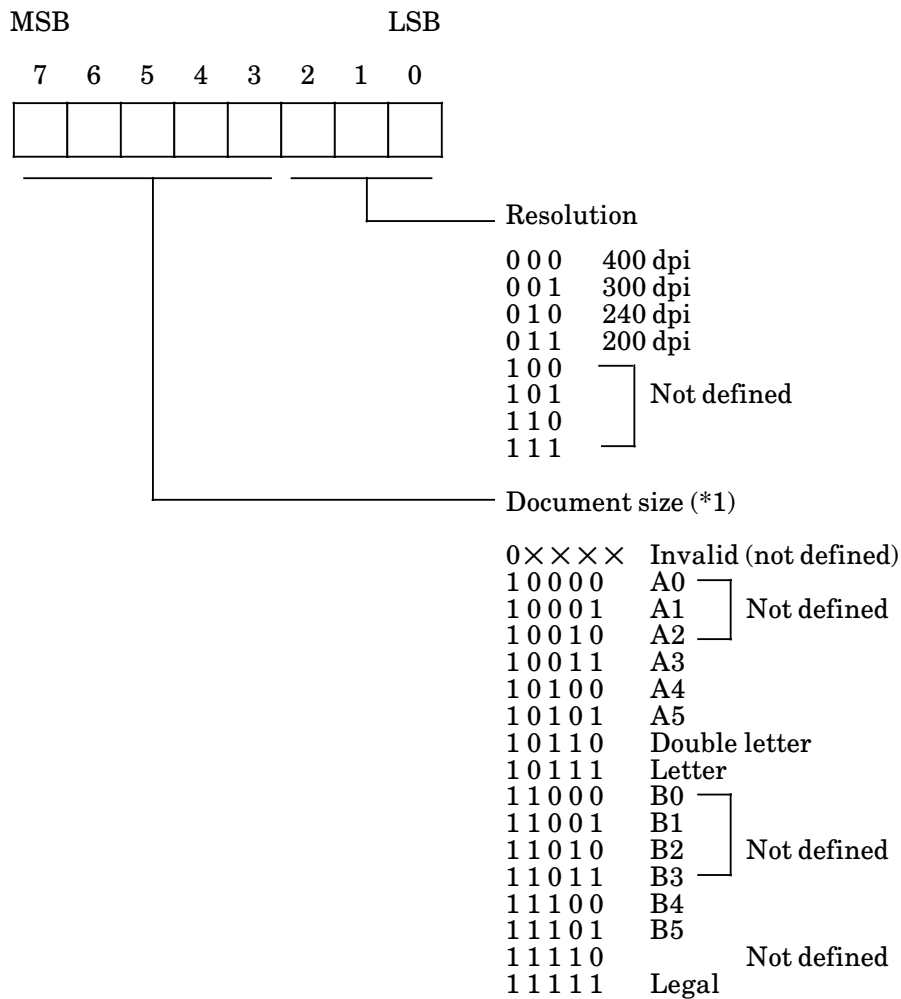
#### 6.4.4 Read complete

This response indicates that READ command execution terminated normally.

Byte 1 CNT	Byte 2 RPS	Byte 3 TEXT	Byte 4
X'04'	X'46'	Device Information I	Device Information II

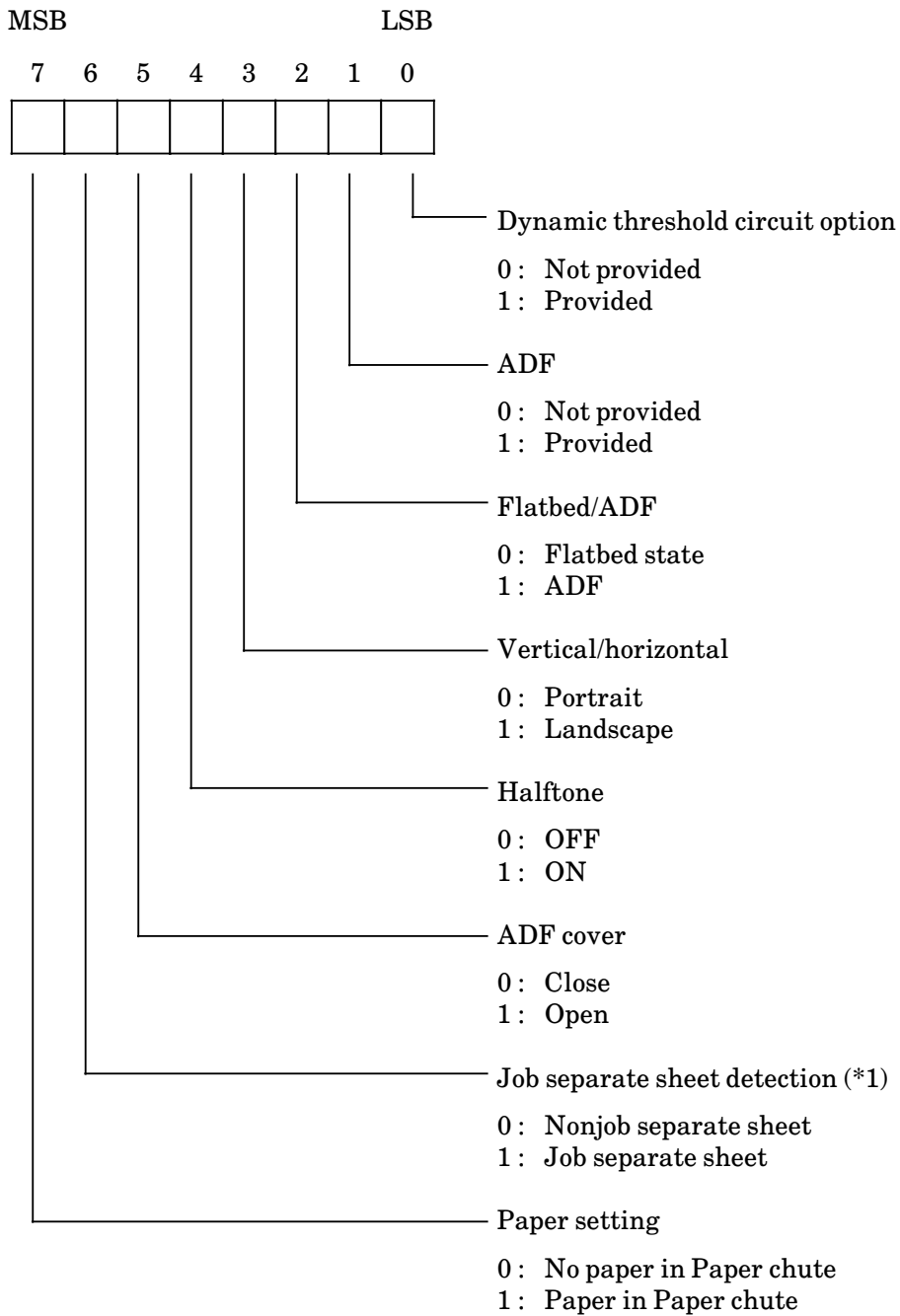
Device information indicates the status of the scanner operation.

#### Device information I



*1 The document size is no longer valid when nonstandard size is specified.

## Device information II



*1 This bit is valid when it is specified in normal status response for the START command.

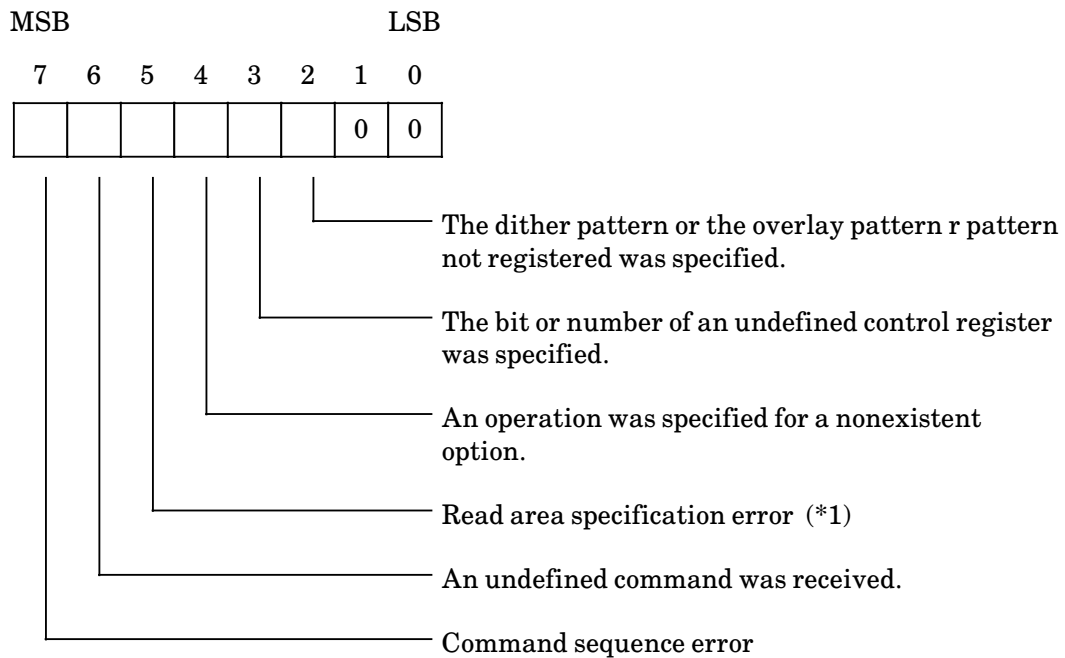
### 6.4.5 Operation error

This response indicates that the error related to operation specification program occurs.

Byte 1 CNT	Byte 2 RPS	Byte 3 TEXT
X'03'	X'55'	Detailed error information I

#### Detailed information I

Detailed information I gives details on errors in command/response transmission and reception to and from the host computer.



*1 Although standard paper size bit on control register 5 is on (Bit 7 takes "1" and bit 6 takes "0"), the size specifying bits (bits 0 to 4) are not defined.

Control register contents do not change even if the above errors are detected.



(4) STOP button pressed

The Stop button was pressed during reading or while the scanner was waiting for the operator to press the Start button.

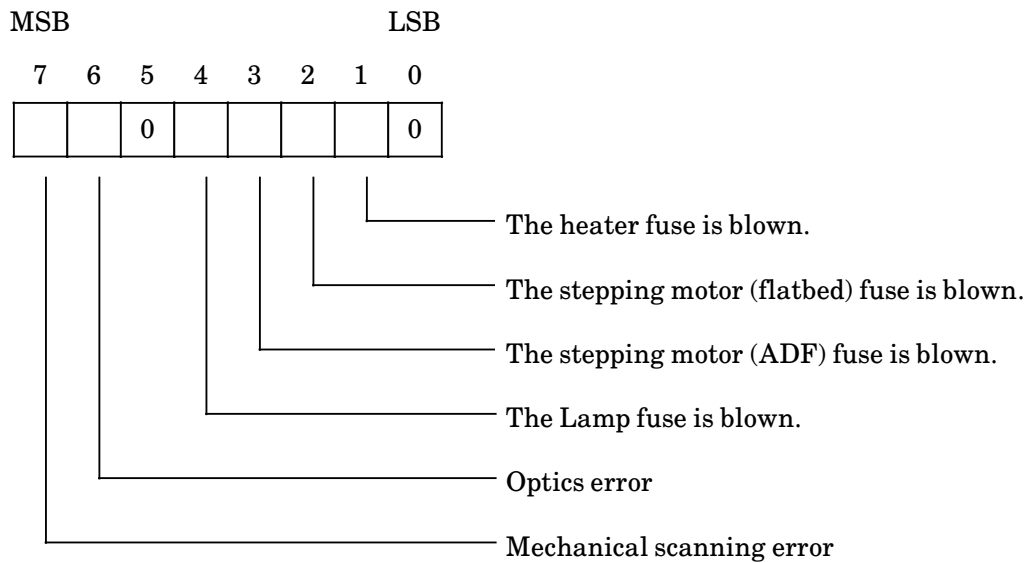
### 6.4.7 Equipment error

This response indicates that the device fault occurs.

Byte 1 CNT	Byte 2 RPS	Byte 3 TEXT
X'03'	X'50'	Detailed error information III

#### Detailed error information III

Detailed error information III provides details of device errors that require a call to CE.

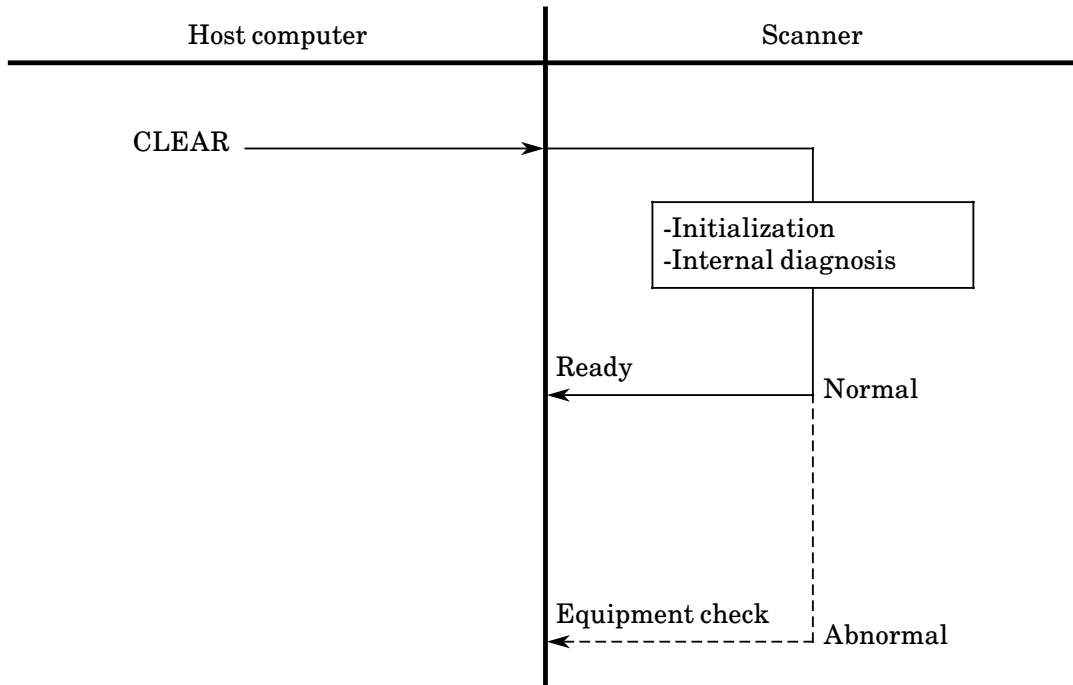




## 6.5 Details Sequence

### 6.5.1 Initialization

Figure 6.2 shows the command/response sequence for initialization.



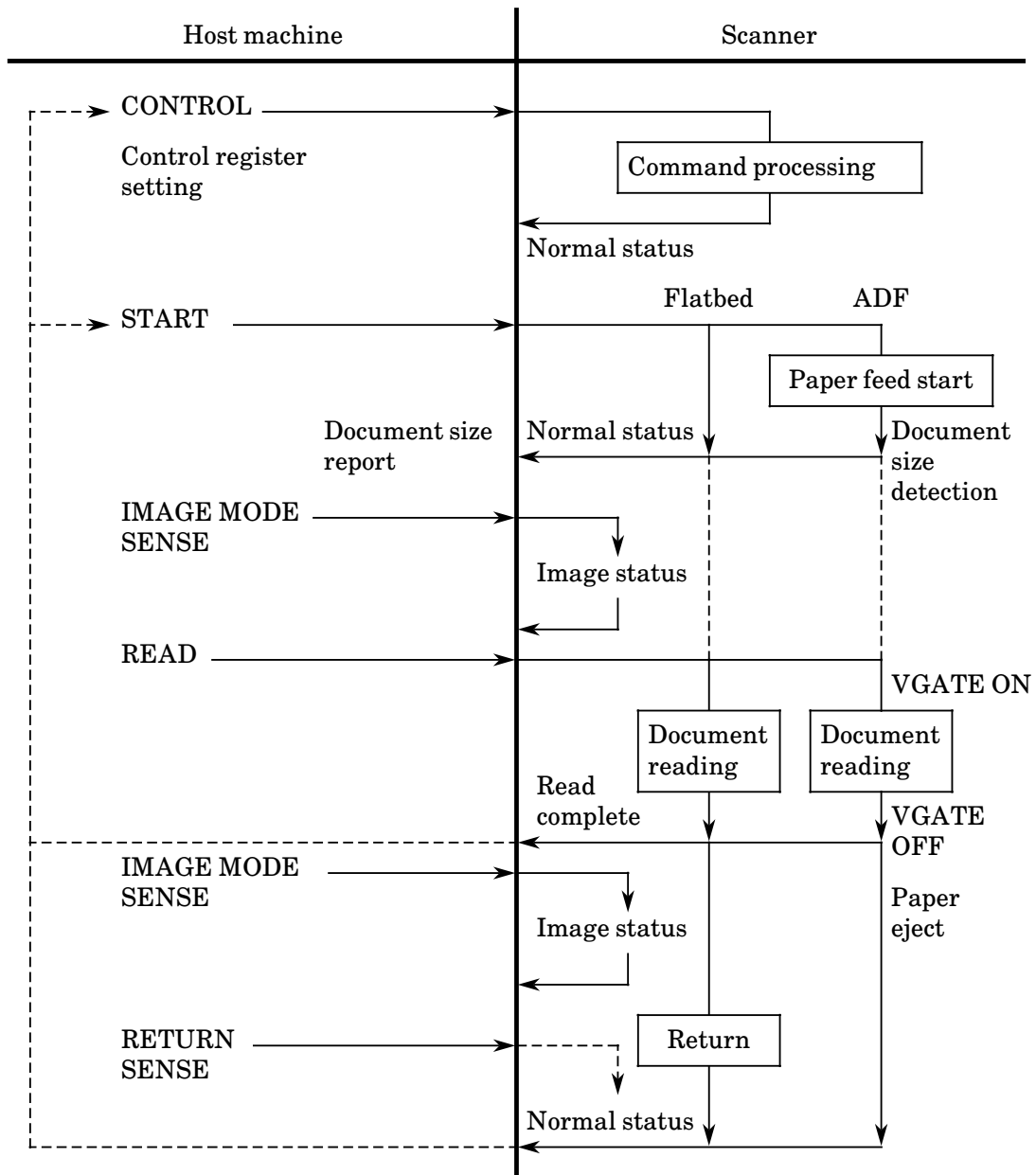
**Note :**

The maximum time from the CLEAR command reception to the returning of a response is 10 seconds after warm up is complete.

**Figure 6.2 Initialization sequence**

## 6.5.2 Read operation

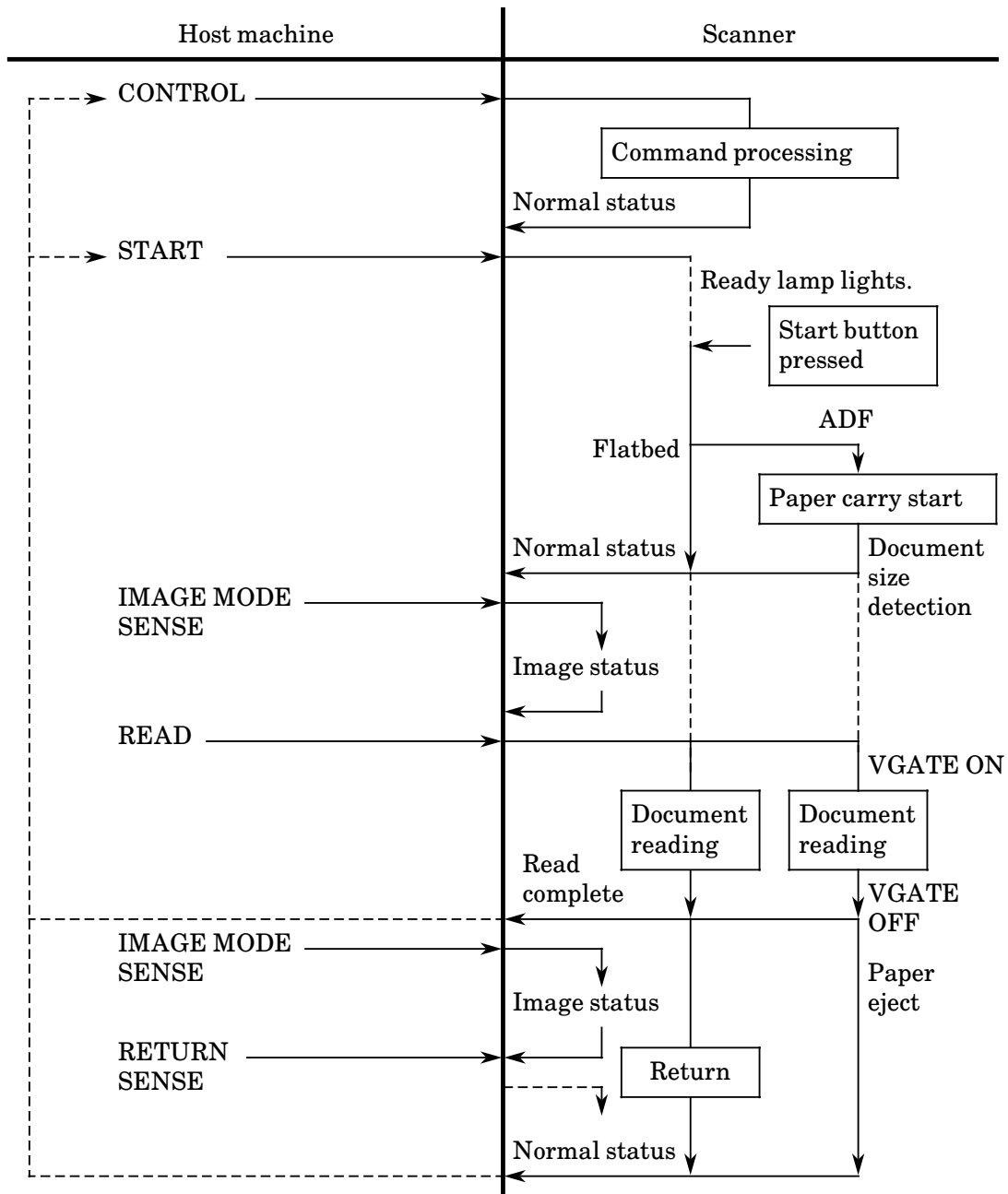
Figures 6.3 and 6.4 show the command/response sequences for the read operation.



### Notes:

1. The CONTROL command can be issued more than once.
2. The response to the RETURN SENSE command is made after returning.
3. The RETURN SENSE or IMAGE MODE SENSE command need not always be issued.

**Figure 6.3 Read operation sequence (automatic mode)**



**Notes:**

1. The CONTROL command can be issued more than once.
2. The response to the RETURN SENSE command is made after returning.
3. The RETURN SENSE or IMAGE MODE SENSE command need not always be issued.

**Figure 6.4 Read operation sequence (manual mode)**

## 6.6 Command/Response Correspondence

Response Command	Normal				Abnormal		
	Ready	Normal status	Read complete	Image status	Operation error	Temporary error	Equipment error
CLEAR	(1)				(2)		(3)
CONTROL		(4)			(5)		
IMAGE.CTL		(4)			(5)		
SUB.W.CTL		(4)			(5)		
START		(6)			(8)	(9)	(14)
READ			(7)		(8)	(9)	(10)
SENSE		(11)			(12)	(13)	(14)
RETURN SENSE		(15)			(8)		(14)
IMG.MODE SNS				(4)	(8)		(14)
SEND DITHER		(4)			(5)		

- (1) Initialization was completed normally.
- (2) The command was destroyed by a transmission error.
- (3) Equipment abnormality was detected during initialization.
- (4) Command processing ended normally.
- (5) The command was destroyed due to an operation error or transmission error.
- (6) Command processing ended normally.
- (7) Reading operation ended normally.
- (8) The command was destroyed because a sequence error or transmission error was detected.
- (9) Jam, hopper empty, or ADF cover open was detected.
- (10) Equipment abnormality was detected during read operation.
- (11) Answer when no error was generated
- (12) The command was destroyed due to a transmission error.

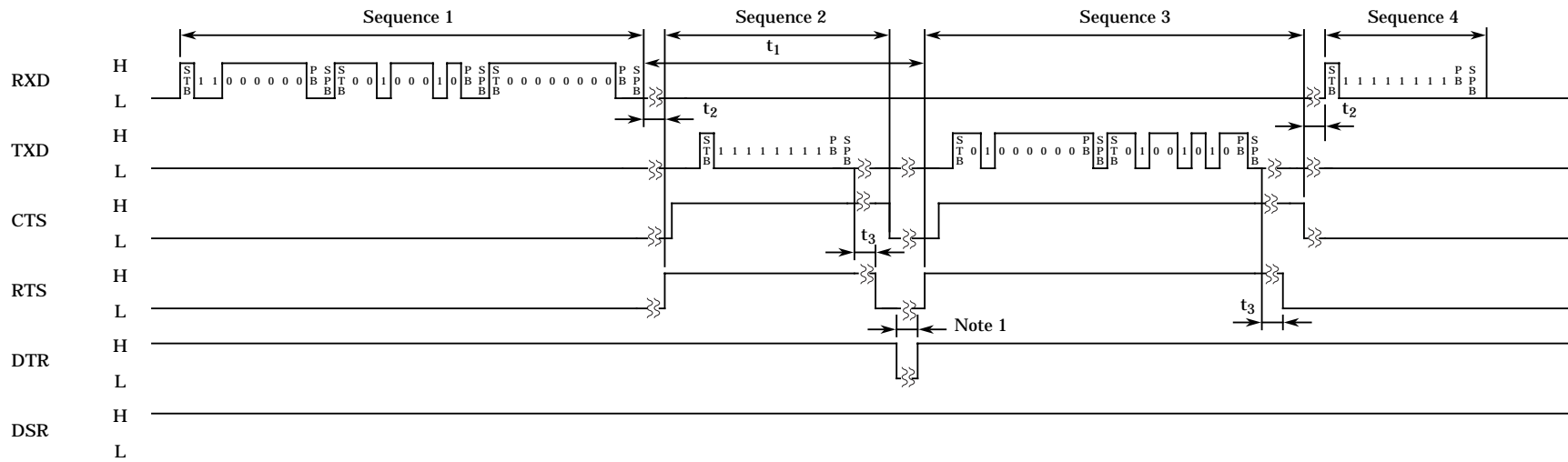
- (13) Paper jam not yet recovered.
- (14) A device fault has been detected. (The fault has already been reported by the last CLEAR or READ commands.)
- (15) Return operation was completed normally.

## **6.7 Command/Response Timing Chart**

These timing charts are in the normal sequence at connector pins of the scanner. In these charts, STB, PB, and SPB mean start bit, parity bit, and stop bit respectively.

Figures 6.5 to 6.10 show the timing chart for each command.

- Figure 6.5 CLEAR command sequence
- Figure 6.6 CONTROL command sequence
- Figure 6.7 START command sequence
- Figure 6.8 READ command sequence
- Figure 6.9 SENSE command sequence
- Figure 6.10 RETURN SENSE command sequence



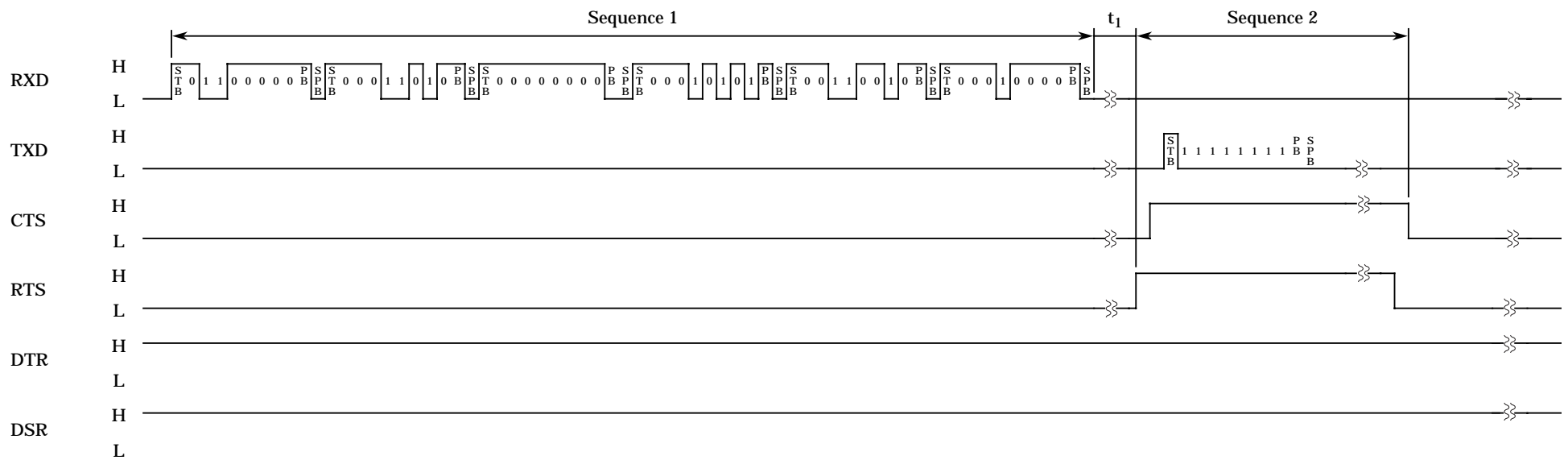
$t_1$ : more than 1 word length (changed by data transfer rate)  
 $t_2$ : less than 500 ms  
 $t_3$ : less than 5 s

- Sequence 1: The host computer sends the CLEAR command to the scanner.  
X'03', '44', '00'
- Sequence 2: ACK for the CLEAR command is sent to the host computer.  
X'FF'
- Sequence 3: Response for the CLEAR command is sent to the host computer.  
X'02', '52'
- Sequence 4: ACK for the response (issued at Sequence 3) is sent to the scanner.  
X'FF'

**Note 1:**

During the CLEAR command execution, DTR signal takes low level.

**Figure 6.5 Clear command sequence**

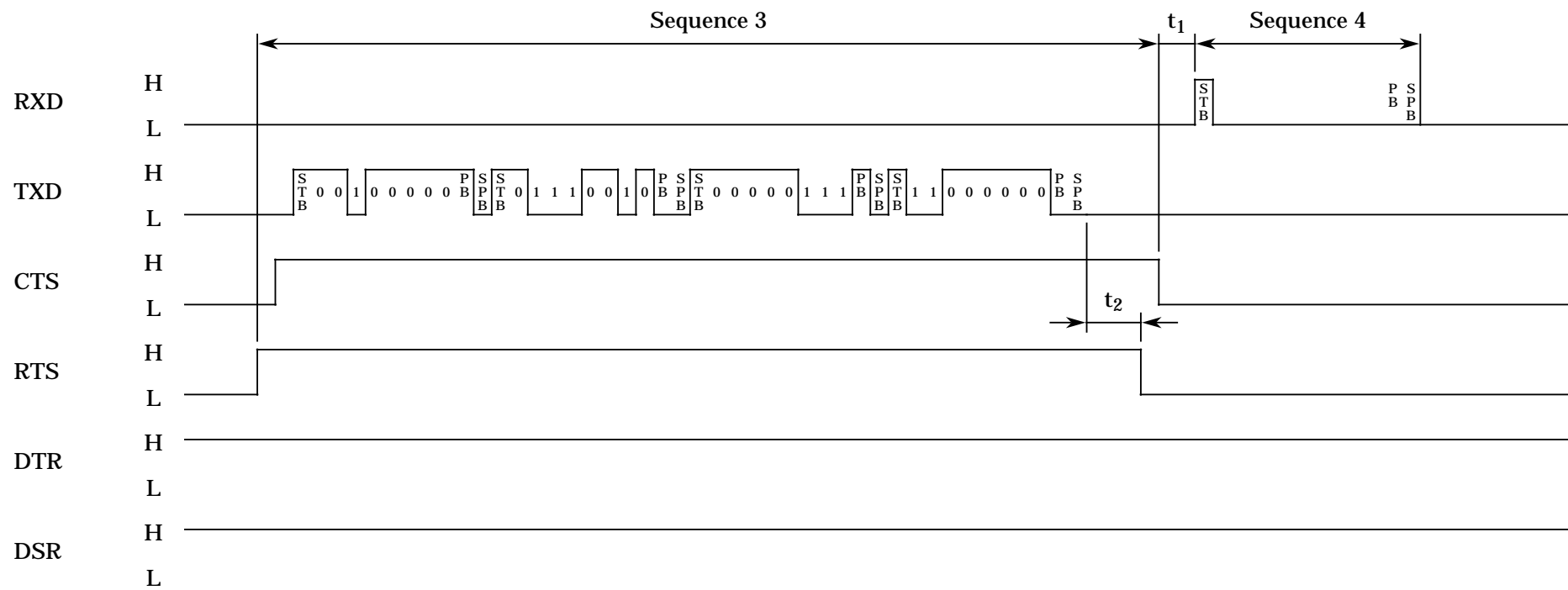


$t_1$ : Less than 500 ms  
 $t_2$ : More than 1 word length

Sequence 1: The host computer sends the CONTROL command to the scanner.  
 X'06', '58', '00', 'A8', '4C', '08'

Sequence 2: ACK for the CONTROL command is sent to the host computer.  
 X'FF'

**Figure 6.6 Control command sequence (1/4)**



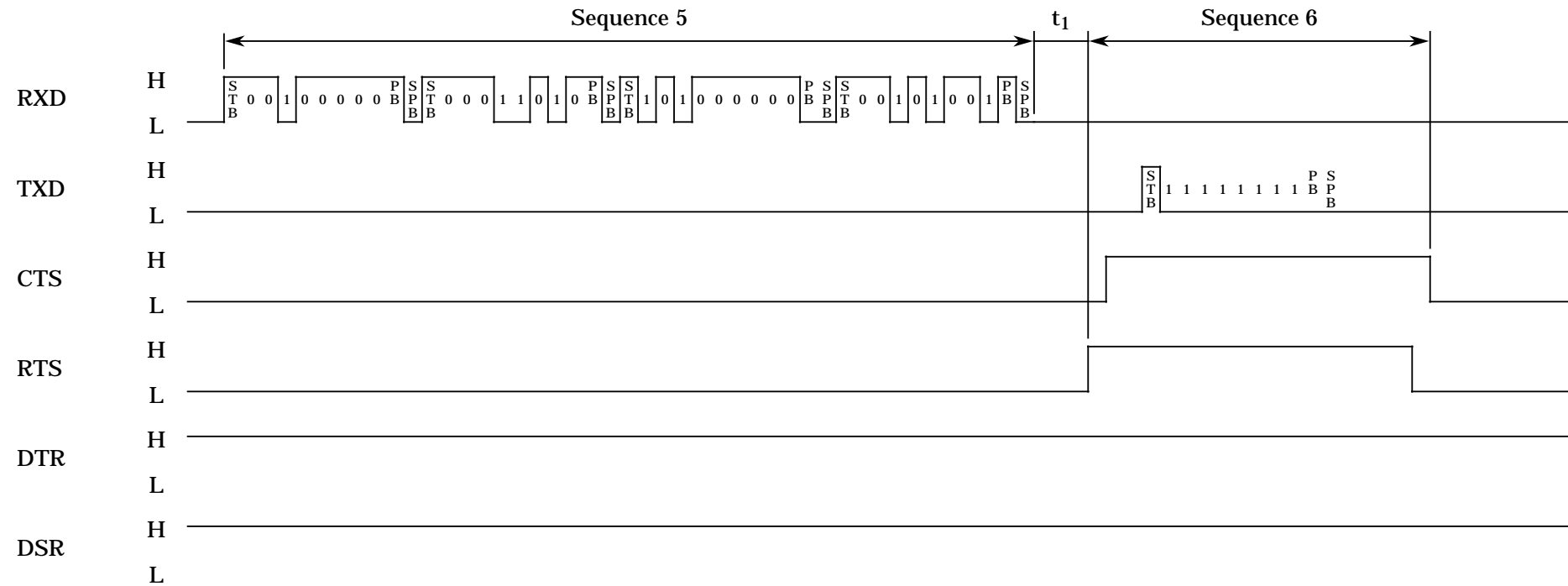
t₁: Less than 500 ms  
t₂: More than 1 word length

Sequence 3: Response for the CONTROL command is sent to the host computer.  
X'04', '4E', 'E0', '03'

Sequence 4: ACK for the response (issued at Sequence 3) is sent to the scanner.  
X'FF'

**Figure 6.6 Control command sequence (2/4)**



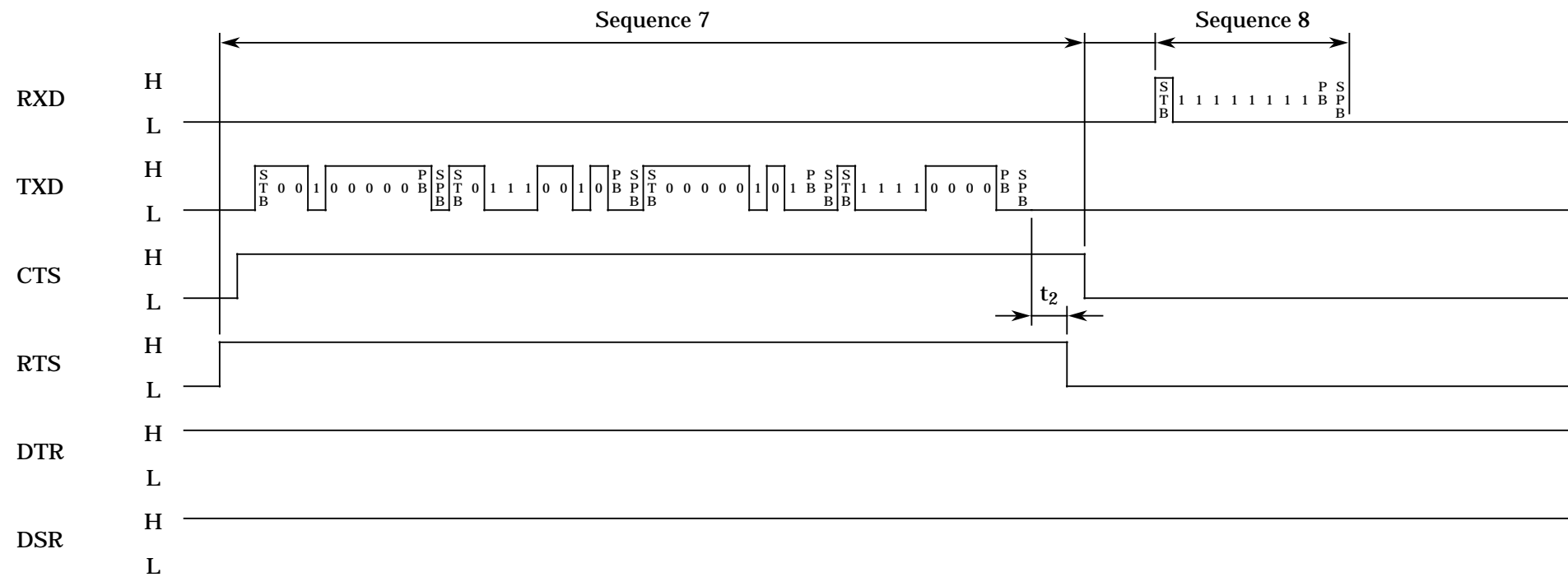


$t_1$ : Less than 500 ms  
 $t_2$ : More than 1 word length

Sequence 5: The host computer sends the CONTROL command to the scanner again.  
 X'04', '58', '05', '94'

Sequence 6: ACK for the CONTROL command is sent to the host computer.  
 X'FF'

**Figure 6.6 Control command sequence (3/4)**



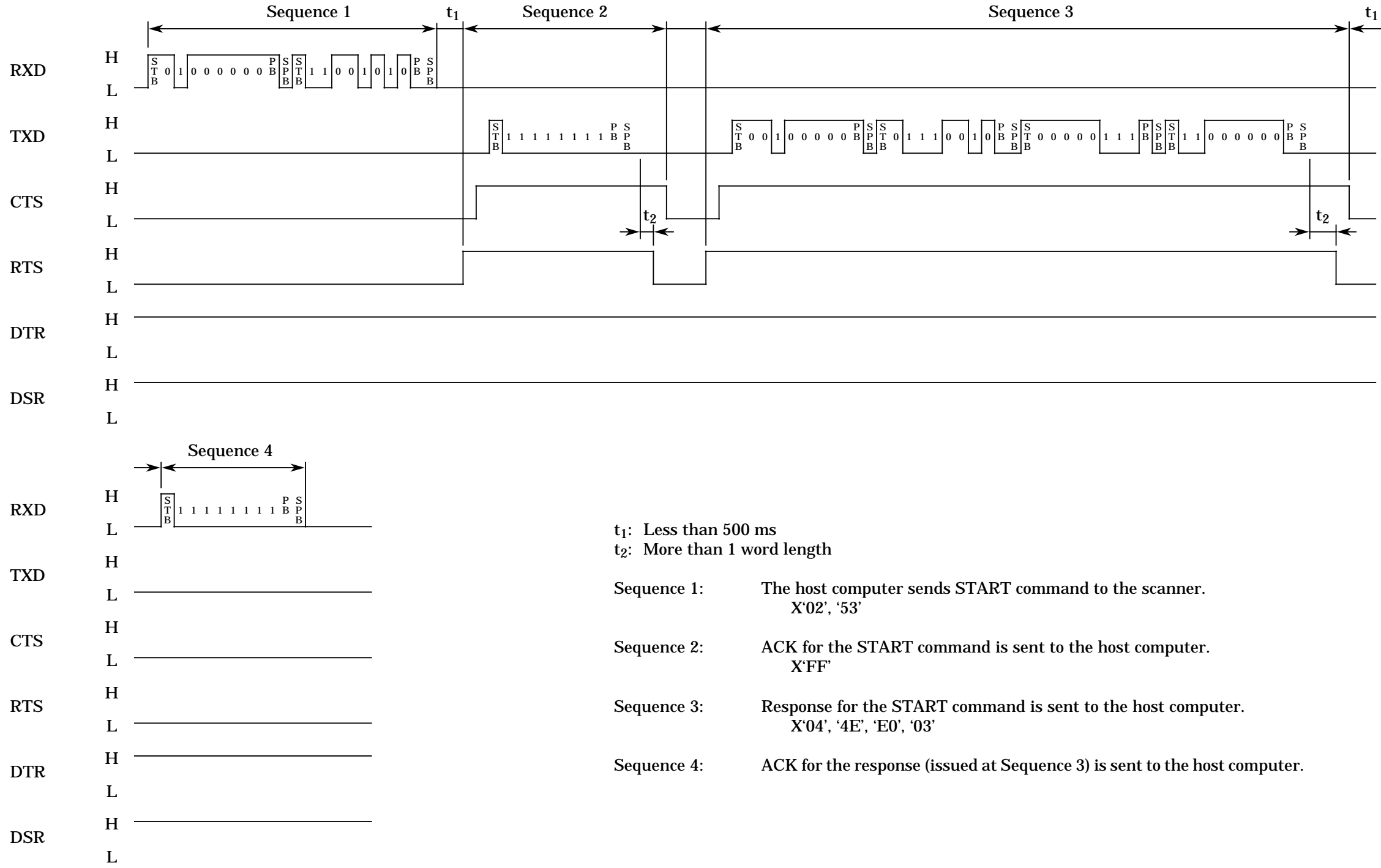
$t_1$ : Less than 500 ms

$t_2$ : More than 1 word length

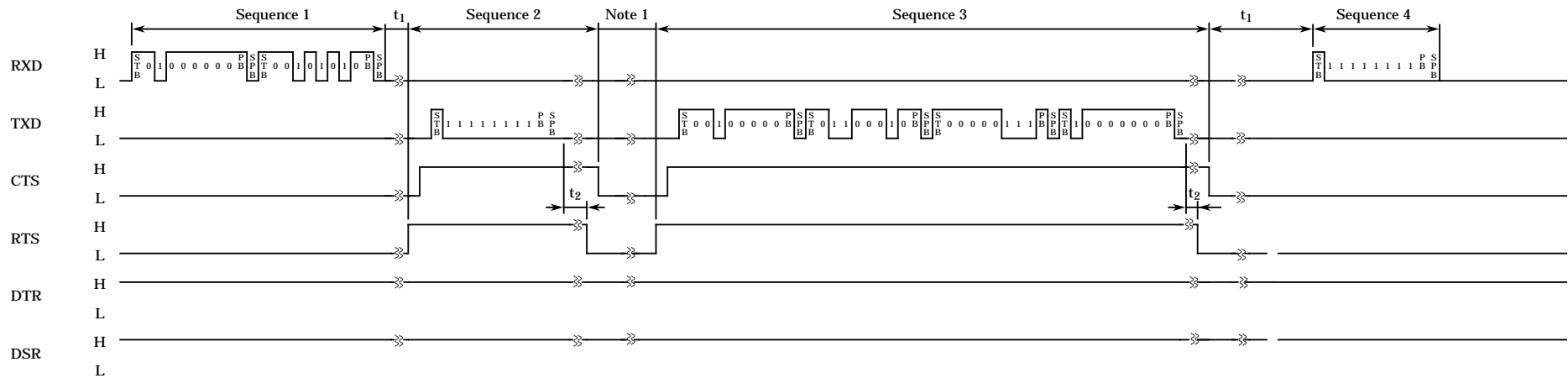
Sequence 7: Response for the CONTROL command (Issued at Sequence 5) is sent to the host computer.  
X'04', '4E', 'E0', '03'

Sequence 8: ACK for the response (issued at Sequence 7) is sent to the scanner.  
X'FF'

**Figure 6.6 Control command sequence (4/4)**



**Figure 6.7 Start command sequence**



$t_1$ : Less than 500 ms  
 $t_2$ : More than 1 byte

Sequence 1: The host computer send the READ command to the scanner.  
 X'02', '5A'

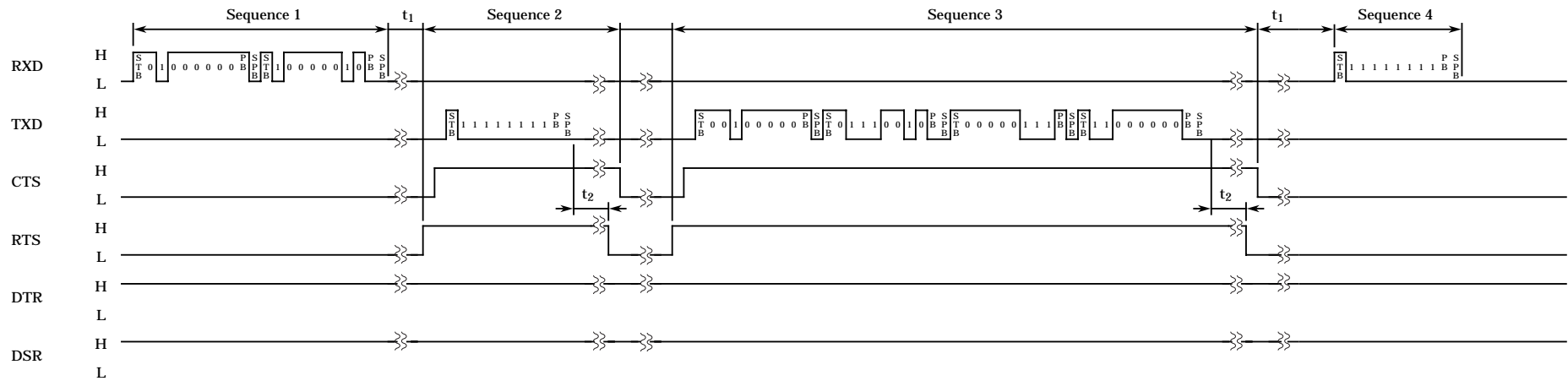
Sequence 2: ACK for the READ command is sent to the host computer.  
 X'FF'

Sequence 3: Response for the READ command (read complete) is sent to the scanner.  
 X'04', '46', 'E0', '01'

Sequence 4: ACK for the read complete is sent to the scanner.

**Note 1:**

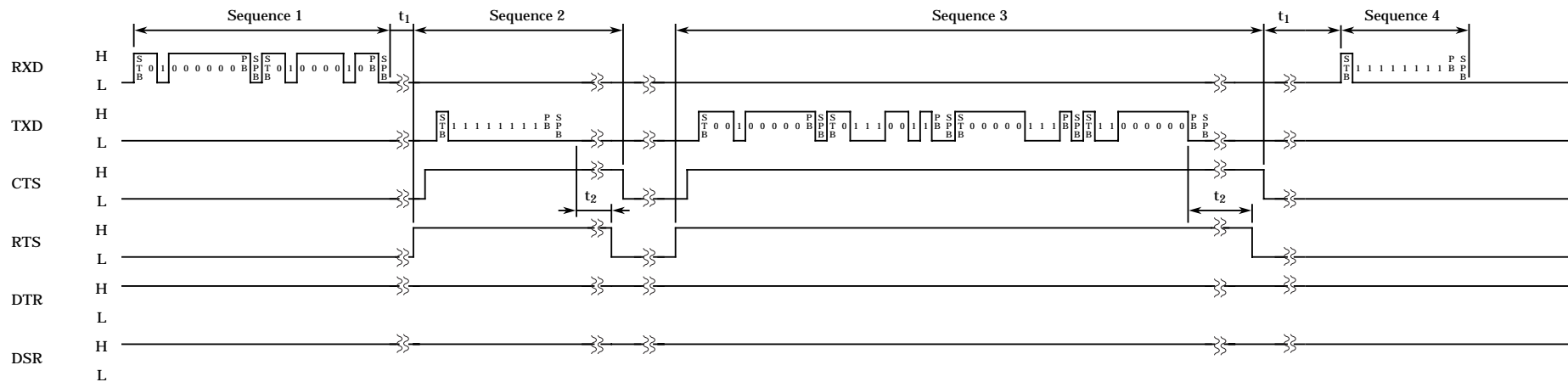
Expect issuing read complete, the RTS signal is inhibitory taking low level.



$t_1$ : Less than 500 ms  
 $t_2$ : 1 byte

- Sequence 1: The host computer sends the SENSE command to the scanner.  
X'02', '42'
- Sequence 2: ACK for the SENSE command is sent to the host computer.  
X'FF'
- Sequence 3: Response for the SENSE command is sent to the host computer.  
X'04', '4E', 'E0', '03'
- Sequence 4: ACK for the response (issued at Sequence 3) is sent to the scanner.  
X'FF'

Figure 6.9 Sense command sequence



$t_1$ : Less than 500 ms  
 $t_2$ : more than 1 word length

Sequence 1: The host computer sends the RETURN SENSE command to the scanner.  
 X'02', '42'

Sequence 2: ACK for the RETURN SENSE command is sent to the host computer.  
 X'FF'

Sequence 3: Response for the RETURN SENSE command is sent to the host computer.  
 X'04', '4E', 'E0', '01'

Sequence 4: ACK for the response (issued at Sequence 3) is sent to the scanner.  
 X'FF'

**Figure 6.10 Return Sense command sequence**

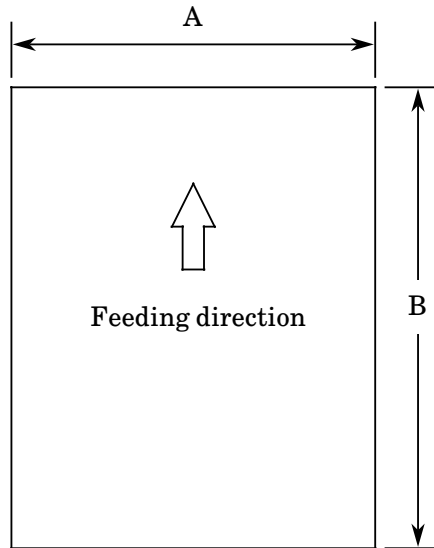
## **APPENDIX A PAPER SPECIFICATIONS**

- |                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li><b>A.1 Paper Size</b></li><li><b>A.2 Paper Conditions</b></li><li><b>A.3 Paper Limitations</b></li><li><b>A.4 Grounding Color Area</b></li><li><b>A.5 Job Separation Sheet</b></li></ul> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

This appendix provides the readable paper specification when using the automatic document feeder (ADF).

When using the flatbed, any condition paper can be read. Only ground color specification (Section A.4) must be met.

## A.1 Paper Size



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

(Unit : mm)

**Figure A.1 Paper size specification**



## **A.2 Paper Conditions**

### **A.2.1 Paper type**

- Woodfree paper
- PPC paper; Specified by XEROX Corporation
- Pressure-fixing paper; specified by Fujitsu
- OCR paper

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

### **A.2.2 Ream weight**

45 kg to 110 kg/ream

**Note:**

Ream weight is a weight of 1,000 pieces of paper whose size is 788 mm × 1,091 mm.

### **A.2.3 Paper quality**

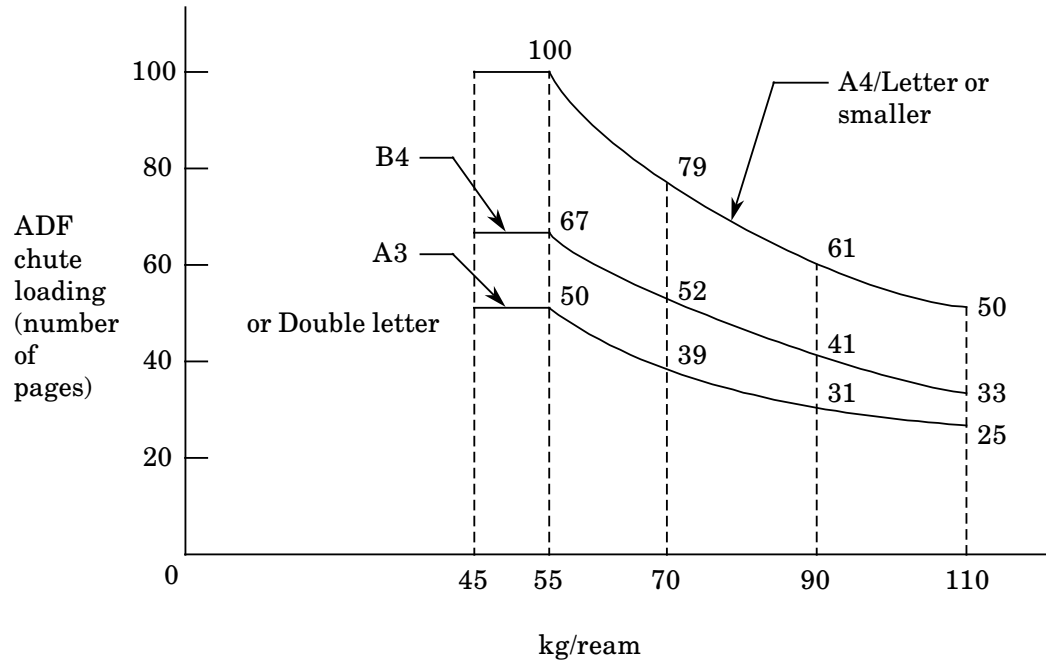
Following paper cannot be fed by ADF.

- ① Paper has clips or staples, etc.
- ② Ink, etc. is not dry.
- ③ Paper thickness is not constant. (like envelope)
- ④ Paper has large rumples or curl.
- ⑤ Paper has folds or tears.
- ⑥ Tracing paper
- ⑦ Coating paper
- ⑧ Carbonless paper
- ⑨ Paper size; smaller than A6 size, or larger than A3 width.
- ⑩ Other than paper; clothes, metal sheet, or OHP film.
- ⑪ Photographic paper
- ⑫ Paper has notches on its side.
- ⑬ Shape is other than square.

When reading the paper in items ③ to ⑬ use the flatbed.

### A.2.4 ADF document feeder 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 graph:



**Ream weight conversion table**

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

### A.3 Paper Limitations (for ADF Reading Only)

#### A.3.1 Areas that must not be perforated

Perforations in the shaded areas may cause malfunctions. If you must read data from such paper, use the flatbed:

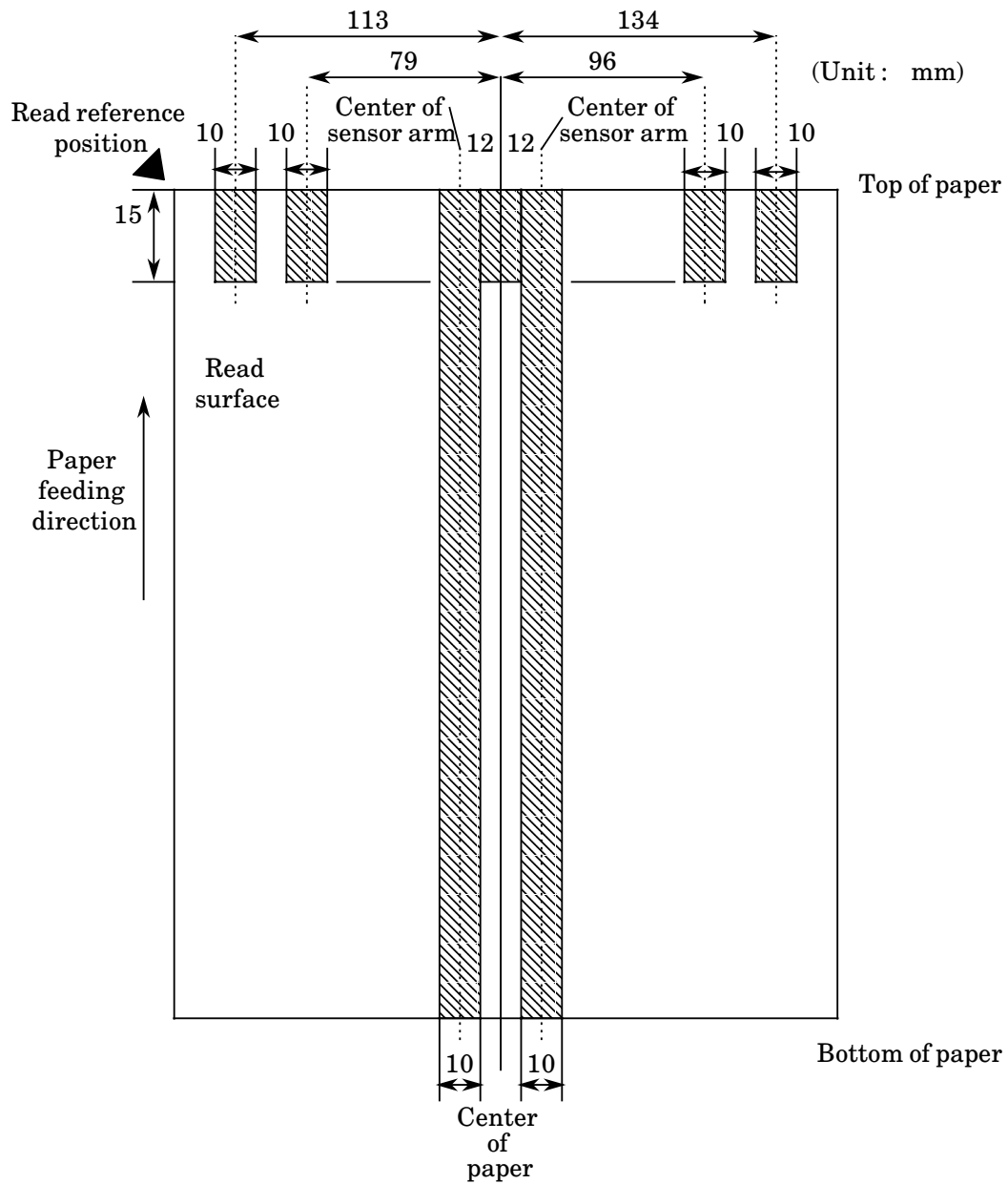


Figure A.2 Areas that must not be perforated

### A.3.2 Reverse unprintable areas

If data is printed on the reverse of the page, confirm that no printing is in the areas shown shaded. A paper jam may result if printing exists in the shaded areas. Read data from these paper on the flatbed.

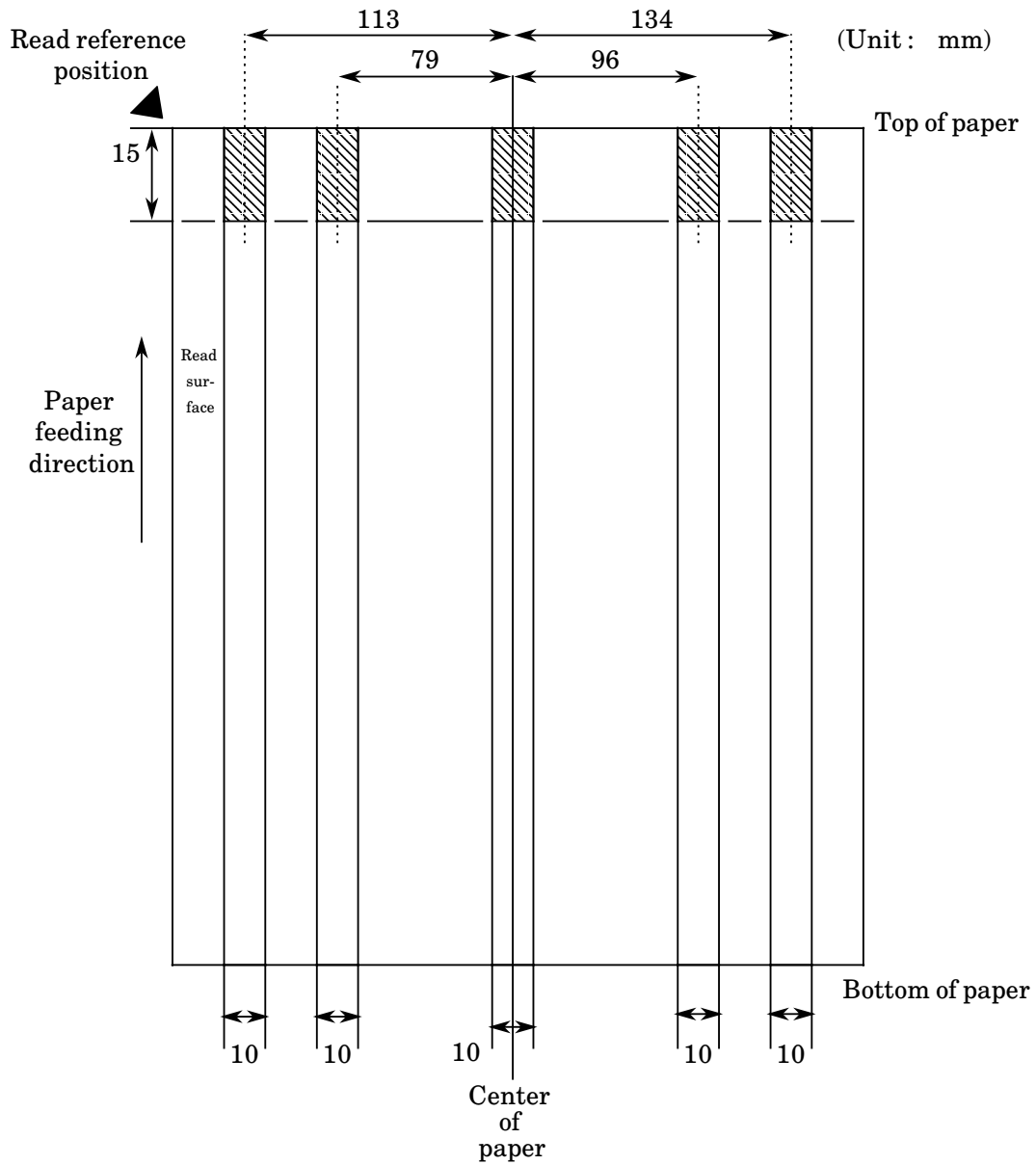


Figure A.3 Reverse unprintable areas

**Note:**

Figure A.3 shows the paper as viewed from the read surface.

#### A.4 Grounding Color Area

The color of the shaded area shown in Figure A.4 should be paper grounding color (white) or drop-out color. If not, select the “photograph” on the operator panel when reading.

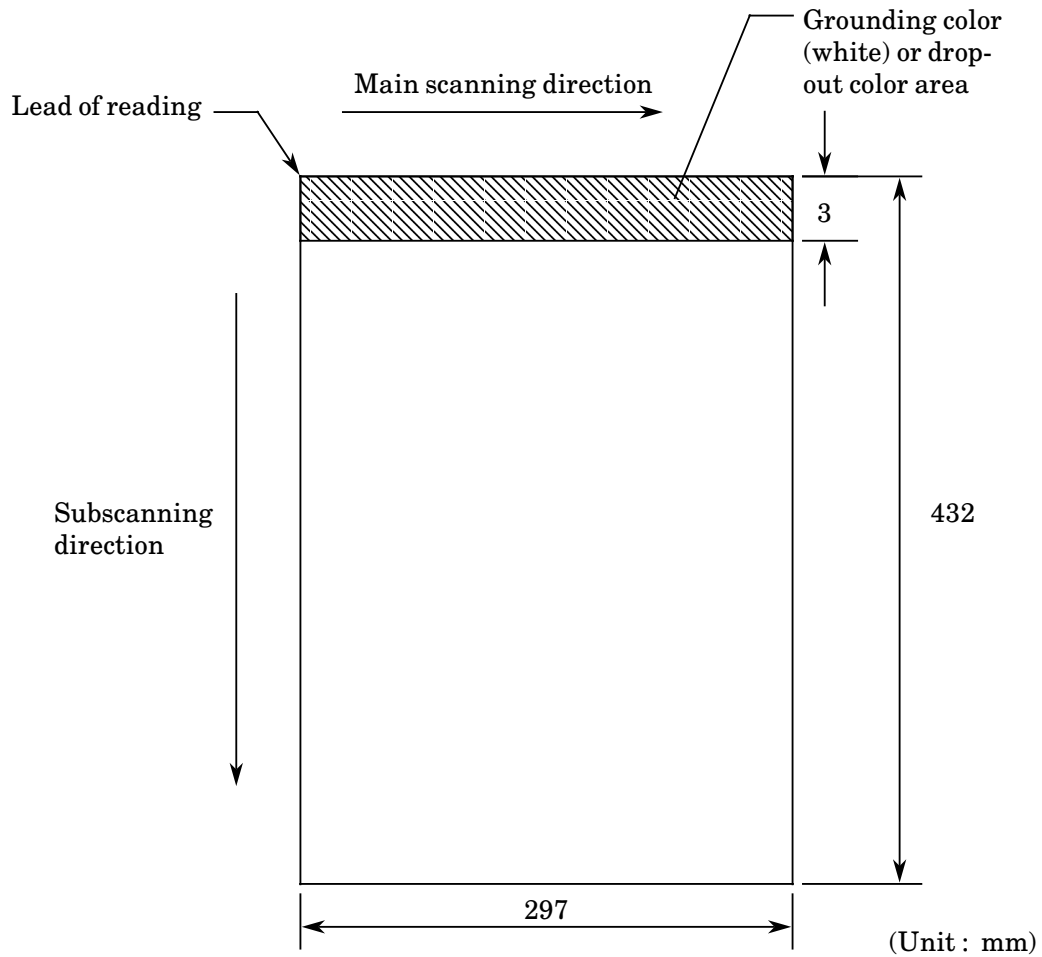
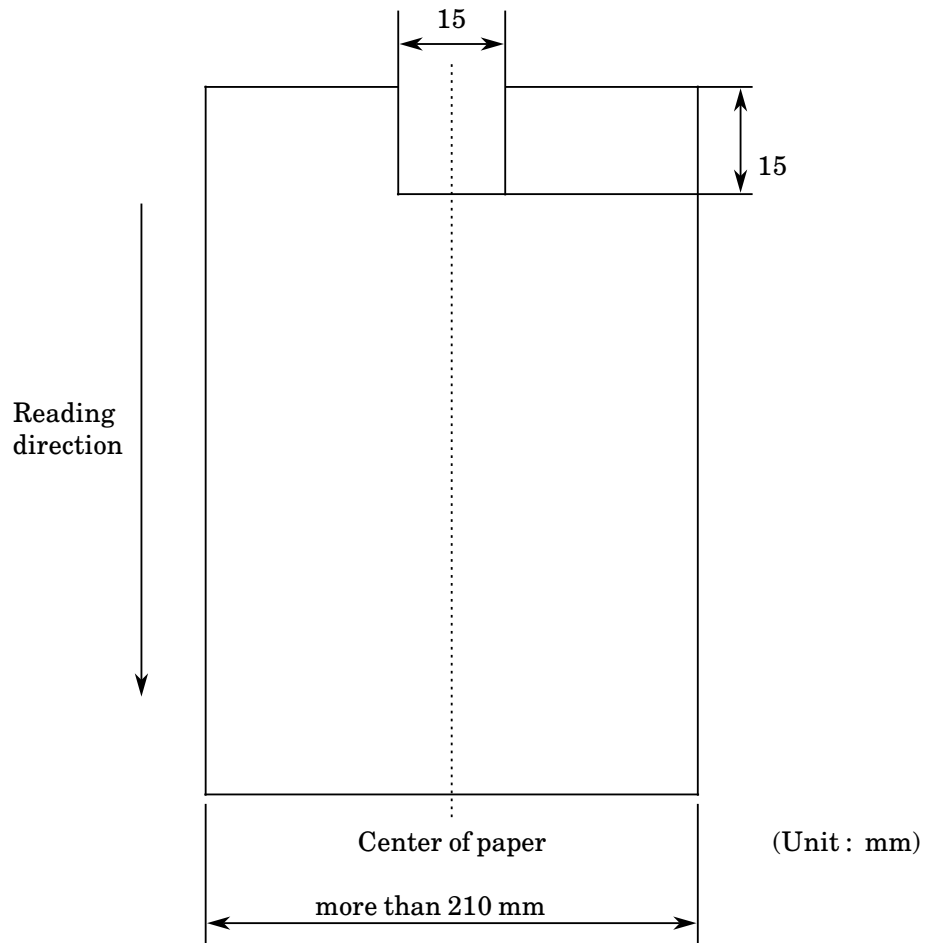


Figure A.4 Grounding color area

## A.5 Job Separation Sheet

### A.5.1 Shape

The following figure shows the basic shape of the paper.



### A.5.2 Paper conditions

- (1) Appendixes A.2.1 and A.2.2 describe the conditions of use. The paper size must be A4 or larger (210 mm or wider).

## APPENDIX B ADF SCANNING SPEED

This appendix provides information on the scanning speed of ADF.

Following table is the ADF scanning speed in the case of the temperature more than 15°C.

Unit: Sheets/min.

Scanning mode	Resolution	A4	A3	Letter
Line mode	400 dpi	20	15	21
	300 dpi	26	19	27
	240 dpi	31	23	32
	200 dpi	36	28	38
Photo mode	400 dpi	19	14	20
	300 dpi	25	19	26
	240 dpi	30	23	31
	200 dpi	35	27	36

**Note:**

The above is measured data.

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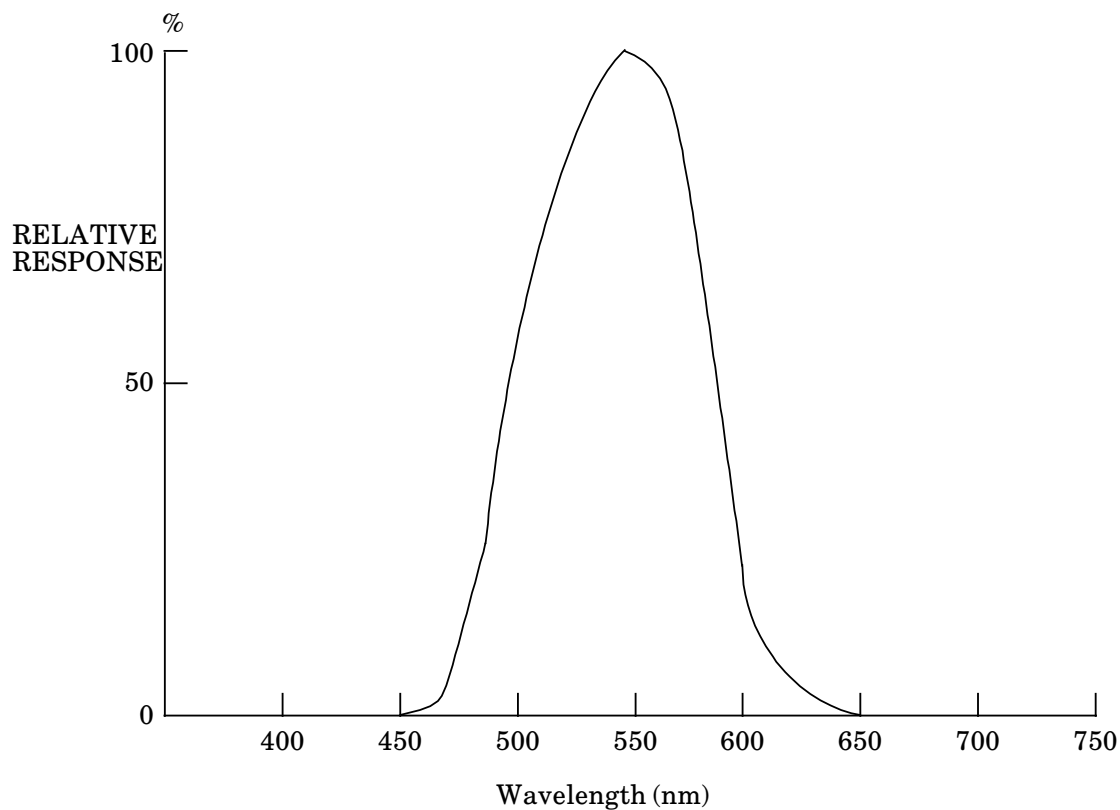
## APPENDIX C DROP-OUT COLOR

**C.1 Print Density Measurement**

**C.2 Drop-out Color**

### **C.1 Print Density Measurement**

- (1) The spectrum band shown in Figure C.1 is used to measure print density.
- (2) The measurement must be made in one of the following ways :
  - a. A light source using fluorescent material G54 is used.
  - b. Macbeth PCS meter PCMII is used, which requires special filter.



**Figure C.1 Spectrum band**

**C.2 Drop-out Color**

The drop-out color refers to a printing color visible to people but which cannot be recognized by the scanner. If characters other than the read characters are printed in the ground color area, they must be printed in the drop-out color.

Maximum PCS value of 0.14 or less and an average value of 0.10 or less.

Comments concerning this manual can be directed to one of the following addresses:

FUJITSU LIMITED  
International Marketing  
Marunouchi 1-6-1, Chiyoda-ku, Tokyo 100 JAPAN  
TEL: 03-216-3211  
FAX: 03-213-7174, 03-216-9353  
TLX: J22833  
Cable: "FUJITSU LIMITED TOKYO"

FUJITSU COMPUTER PRODUCTS OF AMERICA, INC.  
2904 Orchard Parkway, San Jose, California 95134-2009, U.S.A.  
TEL: 1-408-432-6333  
FAX: 1-408-432-3908

FUJITSU CANADA INC.  
2800 Matheson Blvd. East, Mississauga, Toronto,  
Ontario L4W 4X5, CANADA  
TEL: 1-416-673-8666  
FAX: 1-416-673-8677  
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FUJITSU EUROPE LIMITED  
2, Longwalk Road, Stockley Park,  
Uxbridge, Middlesex UB11 1AB, ENGLAND  
TEL: 44-81-573-4444  
FAX: 44-81-573-2643  
TLX: 263871FEL SP G

FUJITSU DEUTSCHLAND GmbH  
Frankfurter Ring 211, 8000 München 40, F.R. GERMANY  
TEL: 49-89-323780  
FAX: 49-89-32378100  
TTX: 897106 FDG D

FUJITSU NORDIC AB  
Torggatan 8, 171 54, Solna, SWEDEN  
TEL: 46-8-764-76-90  
FAX: 46-8-28-03-45  
TLX: 13411 FNAB S

FUJITSU ITALIA S.p.A.  
Via Melchiorre Gioia, 8, 20124 Milano, ITALY  
TEL: 39-2-6572741  
FAX: 39-2-6572257  
TLX: 350142 FJITLY I

FUJITSU FRANCE S. A.  
17, rue Olof Palme-94006 Créteil cedex, FRANCE  
TEL: 33-1-43-99-40-00  
FAX: 33-1-43-99-07-00  
TLX: 262661

FUJITSU AUSTRALIA LIMITED  
475 Victoria Avenue, Chatswood, N.S.W. 2067, AUSTRALIA  
TEL: 61-2-410-4555  
FAX: 61-2-411-8603, 8362  
TLX: 25233

FUJITSU HONG KONG LIMITED  
R.M. 1831, Sun Hung Kai Centre, 30 Harbour Road, HONG KONG  
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TLX: 62667

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