

# M66330SP/FP

## BAND COMPRESSION AND EXPANSION CONTROLLER

### DESCRIPTION

The M66330 is a high-speed coder & decoder (CODEC) LSI under the control of a micro-processor unit (MPU). The M66330 supports coding and decoding of MH, MR, and MMR methods.

Commands from the MPU specify and set the scan line length, operating mode, method of coding or decoding, and image processing.

The controller includes three 2048-bit line memories. In addition to the MPU bus, there are serial buses for scanning and recording and MR mode detection circuit. M66330 permits fast coding and decoding of data.

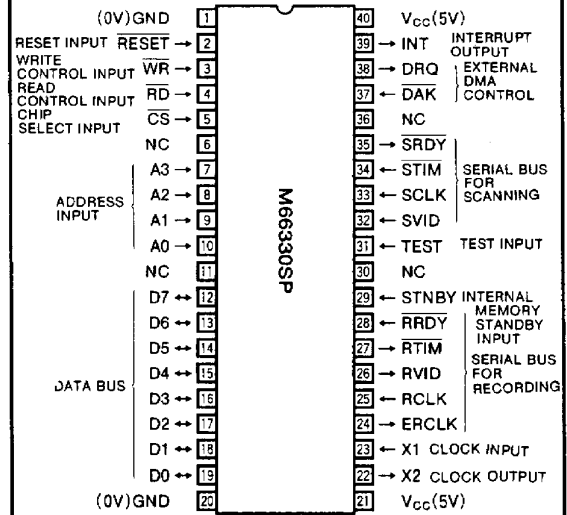
### FEATURES

- Supports MH, MR, and MMR coding methods recommended by CCITT
- Various operating modes
  - G2 send/receive mode
  - G3 send/receive mode (MH/MR/MMR coding and decoding methods)
  - G2 to G3 conversion and vice versa
  - Copy mode
- Image processing functions
  - Up to 2048 pixels per line
  - Reduction (B4 to A4)
  - Addition of sender identification (in G2 to G3 conversion mode)
  - Recording of receiver identification (in G2 receive mode)
  - Journal output (in G2 receive mode)
  - Processing for transfer of image data to a recording system
    - Alignment function (recording with left alignment, right alignment, or centered)
    - Edge blanking (16 or 32 bits)
- High-speed processing
- Three internal 2048-bit line memories for scanning and recording
- Circuits for change point detection, run-length generation, and pixel reproduction (MH method)
- Circuits for MR mode detection and pixel reproduction (MR and MMR methods)
- Control circuit for external DMA
- Efficient bus configurations
  - Serial buses for scanning and recording

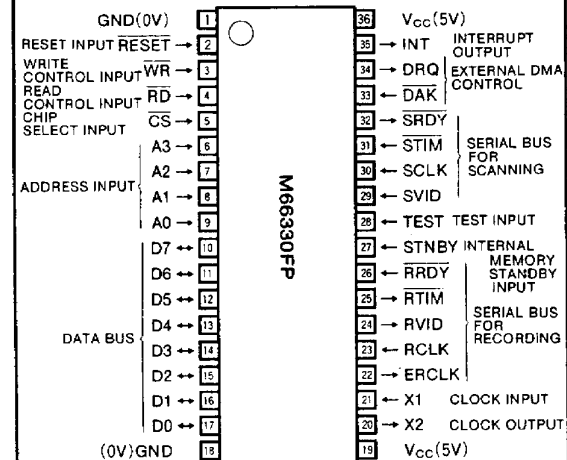
### APPLICATION

Facsimile machines

### PIN CONFIGURATION (TOP VIEW)

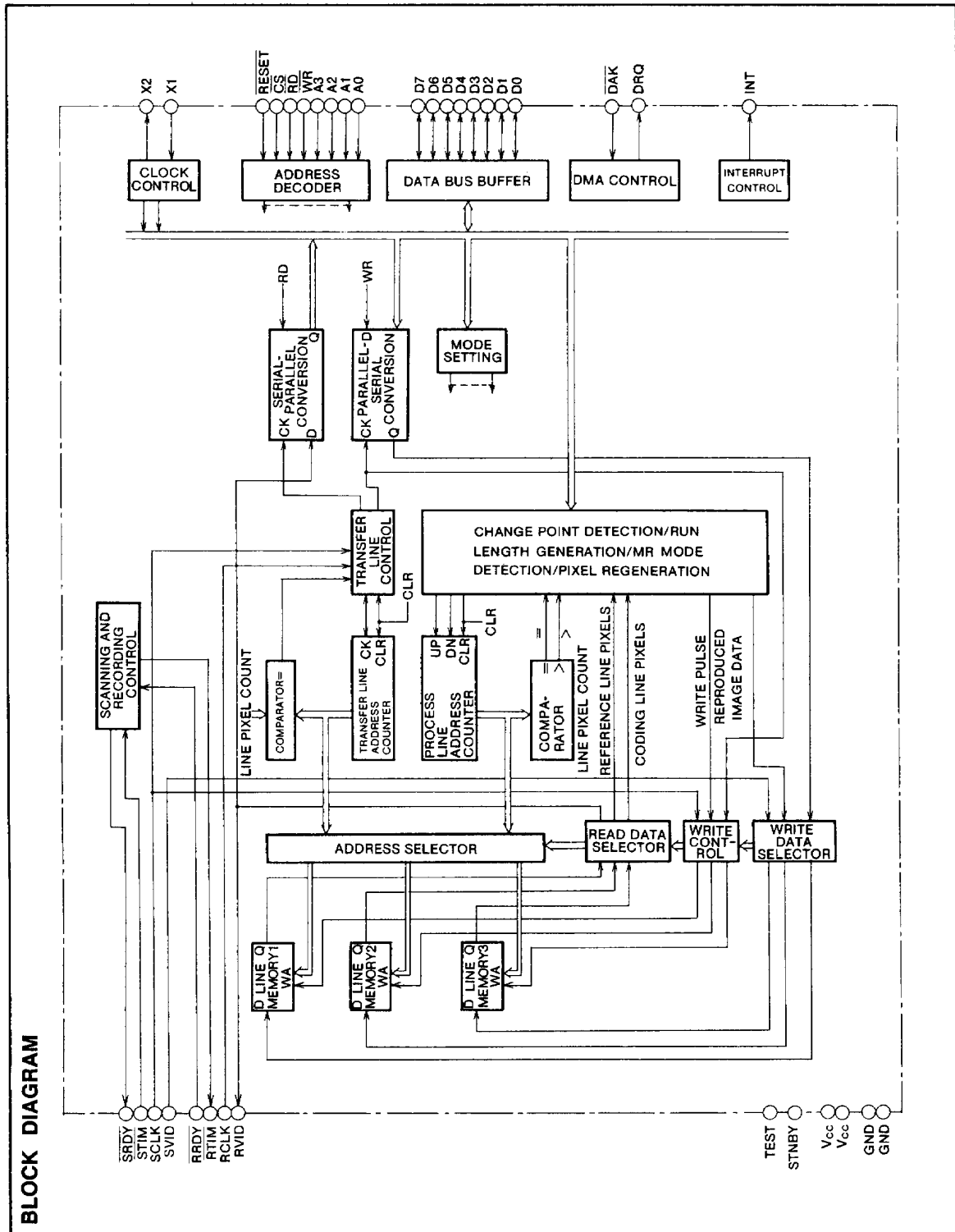


Outline 40P4B



Outline 36P2R-A NC : No Connection

BAND COMPRESSION AND EXPANSION CONTROLLER



**BAND COMPRESSION AND EXPANSION CONTROLLER**

**PIN DESCRIPTIONS**

Pin	Classification	Input/ Output	Descriptions
$\overline{\text{RESET}}$	MPU bus interface	Input	Input for resetting system
$\overline{\text{CS}}$		Input	Chip select signal required by MPU to access M66330
$\overline{\text{RD}}$		Input	Control signal line for input when MPU reads data from M66330
$\overline{\text{WR}}$		Input	Control signal line for input when MPU writes data to M66330
A0~A3		Input	Address signal lines for accessing M66330 registers
D0~D7		Input/ Output	8-bit bidirectional bus buffer
INT		Output	Interrupt request signal output from M66330 to MPU
DRQ		Output	DMA request signal for image data input-output by external DMA controller. DMA transfer is possible in the following modes: G2 send, G2 receive, G2 to G3 conversion, and G3 to G2 conversion.
$\overline{\text{DAK}}$		Input	DAM acknowledge signal from DMA controller. This signal is paired with the above DRQ signal.
$\overline{\text{SRDY}}$	Serial bus for scanning	Output	Outputs ready signal for scanner for starting data transfer
$\overline{\text{STIM}}$		Input	Defines scanner data transfer interval
SCLK		Input	Inputs sync clock signal for image data transfer from scanner
SVID		Input	Serial input of image data from scanner
$\overline{\text{RRDY}}$	Serial bus for recorder	Input	Inputs ready signal for recorder for starting data transfer
$\overline{\text{RTIM}}$		Output	Defines recorder data transfer interval
RCLK		Input	Inputs sync clock signal for image data transfer to recorder
ERCLK		Output	Outputs sync clock signal ( $=f_{X1}/4$ ) for transfer of data to recorder. This pin is connected to pin RCLK during operation.
RVID		Output	Serial output of image data to recorder
X <sub>1</sub>	Others	Input	Connected to quartz oscillator. Also used as input pin for X <sub>1</sub> with external clock input. In such a case, X <sub>2</sub> remains open.
X <sub>2</sub>		Output	
V <sub>CC</sub>		—	Positive power supply pin
GND		—	Ground (GND) pin
STNBY		—	When set to level "H", the internal memory is placed in standby mode. Set to level "L" during operation.
TEST		—	Test pin. Set level permanently to "L".

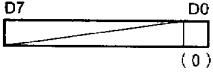
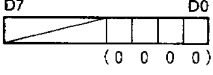
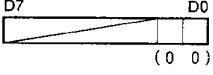
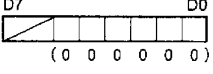
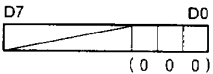
**BAND COMPRESSION AND EXPANSION CONTROLLER**

**REGISTER STRUCTURE**

• The numerics in brackets under the register name are the address in hexadecimal.

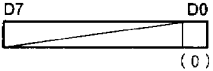
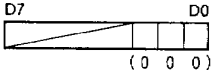
• The numerics in brackets under the bit allocation show the register status after reset. (X : undefined)

(1) Command Registers

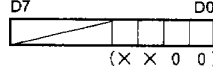
Register name	R/W	Bit allocation	Description																																																												
System reset (6H)	W		Resets the controller D0 0 : Reset off 1 : Reset on Always set the reset off after setting the reset on.																																																												
Interrupt enable (0H)	W		Enables or disables interrupt requests D0 : Transfer line input-output completion interrupt (1 : enable) D1 : Code/decode completion and process line output completion interrupt (1 : enable) D2 : Recorder ready interrupt (1 : enable) D3 : Image data input-output ready interrupt (Note 1) (1 : enable)																																																												
Line pixel count (4H)	W		Sets the pixel count and reduction ratio for the line memory for image data input <table border="1" data-bbox="792 856 1393 1035"> <thead> <tr> <th>D1</th> <th>D0</th> <th>Pixel count and reduction ratio</th> <th>Possible operating modes</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>A4 (1728 bits per line)</td> <td>All modes</td> </tr> <tr> <td>0</td> <td>1</td> <td>B4 (2048 bits per line)</td> <td>All modes</td> </tr> <tr> <td>1</td> <td>0</td> <td>B4 to A4 (9/11 reduction)</td> <td>G3 send G2 send G2 to G3 conversion</td> </tr> <tr> <td>1</td> <td>1</td> <td>B4 to A4 (9/11 reduction)</td> <td>G3 to G2 conversion</td> </tr> </tbody> </table>	D1	D0	Pixel count and reduction ratio	Possible operating modes	0	0	A4 (1728 bits per line)	All modes	0	1	B4 (2048 bits per line)	All modes	1	0	B4 to A4 (9/11 reduction)	G3 send G2 send G2 to G3 conversion	1	1	B4 to A4 (9/11 reduction)	G3 to G2 conversion																																								
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Output image data processing (8H)	W		Sets format of data for output to recorder <table border="1" data-bbox="792 1098 1393 1245"> <thead> <tr> <th colspan="4">Size setting</th> </tr> <tr> <th>D1</th> <th>D0</th> <th>Output image data</th> <th>Recording paper</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>A4 (1728 bits)</td> <td>A4 (216mm)</td> </tr> <tr> <td>0</td> <td>1</td> <td>A4 (1728 bits)</td> <td>B4 (256mm)</td> </tr> <tr> <td>1</td> <td>0</td> <td>—</td> <td>—</td> </tr> <tr> <td>1</td> <td>1</td> <td>B4 (2048 bits)</td> <td>B4 (256mm)</td> </tr> </tbody> </table> <table border="1" data-bbox="792 1266 1393 1392"> <thead> <tr> <th colspan="3">Margin addition setting</th> </tr> <tr> <th>D3</th> <th>D2</th> <th>Output only image data</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Output only image data</td> </tr> <tr> <td>0</td> <td>1</td> <td>After image data, output 320 bit margin : left align</td> </tr> <tr> <td>1</td> <td>0</td> <td>After 320 bit margin, output image data : right align</td> </tr> <tr> <td>1</td> <td>1</td> <td>Output 160 bit margin before and after image data : center</td> </tr> </tbody> </table> <p>Addition of margins can be specified only when D1="0" and D0="1"</p> <table border="1" data-bbox="792 1455 1393 1581"> <thead> <tr> <th colspan="3">Edge blanking setting</th> </tr> <tr> <th>D5</th> <th>D4</th> <th>No processing</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>No processing</td> </tr> <tr> <td>0</td> <td>1</td> <td>—</td> </tr> <tr> <td>1</td> <td>0</td> <td>16-bit blanking (2mm) on both edges of image data</td> </tr> <tr> <td>1</td> <td>1</td> <td>32-bit blanking (4mm) on both edges of image data</td> </tr> </tbody> </table>	Size setting				D1	D0	Output image data	Recording paper	0	0	A4 (1728 bits)	A4 (216mm)	0	1	A4 (1728 bits)	B4 (256mm)	1	0	—	—	1	1	B4 (2048 bits)	B4 (256mm)	Margin addition setting			D3	D2	Output only image data	0	0	Output only image data	0	1	After image data, output 320 bit margin : left align	1	0	After 320 bit margin, output image data : right align	1	1	Output 160 bit margin before and after image data : center	Edge blanking setting			D5	D4	No processing	0	0	No processing	0	1	—	1	0	16-bit blanking (2mm) on both edges of image data	1	1	32-bit blanking (4mm) on both edges of image data
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Operating mode (2H)	W		Sets operating mode <table border="1" data-bbox="792 1644 1393 1854"> <thead> <tr> <th colspan="3">Operating mode</th> </tr> <tr> <th>D2</th> <th>D1</th> <th>D0</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Copy mode</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>G3 to G2 conversion mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>G2 to G3 conversion mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>G3 receive mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>G2 receive mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>G3 send mode</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>G2 send mode</td> </tr> </tbody> </table>	Operating mode			D2	D1	D0	0	0	0	Copy mode	0	0	1	G3 to G2 conversion mode	0	1	0	G2 to G3 conversion mode	0	1	1	G3 receive mode	1	0	0	G2 receive mode	1	0	1	G3 send mode	1	1	0	G2 send mode																										
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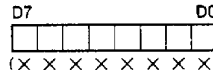
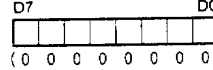
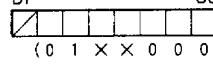
**BAND COMPRESSION AND EXPANSION CONTROLLER**

Register name	R/W	Bit allocation	Description																												
Coding & decoding method (3H)	W		Sets coding-decoding method D0 0 : One-dimensional method (MH) 1 : Two-dimensional method (MR, MMR)																												
Line memory (5H)	W		Allocates line memory <table border="1" data-bbox="792 548 1396 726"> <thead> <tr> <th>D2</th> <th>D1</th> <th>D0</th> <th>Cycle</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>2</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>4</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>5</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>6</td></tr> </tbody> </table> Refer to Table 4 on page 8.	D2	D1	D0	Cycle	0	0	0	0	0	0	1	1	0	1	0	2	1	0	0	4	1	0	1	5	1	1	0	6
D2	D1	D0	Cycle																												
0	0	0	0																												
0	0	1	1																												
0	1	0	2																												
1	0	0	4																												
1	0	1	5																												
1	1	0	6																												

(2) Status register

Register name	R/W	Bit allocation	Description
Internal status (1H)	R		Indicates internal status D0 : Completion of transfer line input-output (1 : completed) D1 : Completion of coding/decoding and process line output (1 : completed) D2 : Recorder ready (1 : ready) D3 : Image data input-output ready (Note 1) (1 : ready)

(3) Data registers

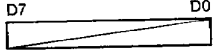
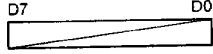
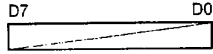
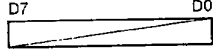
Register name	R/W	Bit allocation	Description																																													
Image data input (7H)	W		Inputs image data from MPU to M66330 in G2 receive mode and G2 to G3 conversion mode. (The least significant bit (LSB : D0) corresponds to the top left on the document.)																																													
Image data output (7H)	R		Outputs image data from M66330 to MPU in G2 send mode and G3 to G2 conversion mode. (The least significant bit (LSB : D0) corresponds to the top left on the document.)																																													
Coded data 1 (9H)	R		Indicates the result of G3 coding <table border="1" data-bbox="797 1566 1401 1797"> <thead> <tr> <th>D2</th> <th>D1</th> <th>D0</th> <th>One-dimensional coding</th> <th>Two-dimensional coding</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>—</td><td>—</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>—</td><td>V (0) mode</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>—</td><td>V<sub>L</sub> mode</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>—</td><td>V<sub>a</sub> mode</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>MH mode</td><td>H mode (a0 a1)</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>—</td><td>H mode (a1 a2)</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>—</td><td>P mode</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>—</td><td>—</td></tr> </tbody> </table> (To be continued)	D2	D1	D0	One-dimensional coding	Two-dimensional coding	0	0	0	—	—	0	0	1	—	V (0) mode	0	1	0	—	V <sub>L</sub> mode	0	1	1	—	V <sub>a</sub> mode	1	0	0	MH mode	H mode (a0 a1)	1	0	1	—	H mode (a1 a2)	1	1	0	—	P mode	1	1	1	—	—
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Register name	R/W	Bit allocation	Description																																																												
			<table border="1"> <tr> <td>D4</td> <td>D3</td> <td>Distance of a1 to b1 in V<sub>R</sub>/V<sub>L</sub> mode</td> </tr> <tr> <td>0</td> <td>0</td> <td>—</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> <td>3</td> </tr> </table> <table border="1"> <tr> <td>D6</td> <td>D5</td> <td>Coding status</td> </tr> <tr> <td>0</td> <td>0</td> <td>Mode detection in progress</td> </tr> <tr> <td>0</td> <td>1</td> <td>Mode detection complete</td> </tr> <tr> <td>1</td> <td>0</td> <td>—</td> </tr> <tr> <td>1</td> <td>1</td> <td>Detection of fast mode complete (end of 1 line)</td> </tr> </table>	D4	D3	Distance of a1 to b1 in V <sub>R</sub> /V <sub>L</sub> mode	0	0	—	0	1	1	1	0	2	1	1	3	D6	D5	Coding status	0	0	Mode detection in progress	0	1	Mode detection complete	1	0	—	1	1	Detection of fast mode complete (end of 1 line)																														
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Coded data 2 (AH)	R	<p>(X X X X X X X X)</p>	Shows terminate run length in MH and H modes of MR D5 to D0 : Terminate run length (0 to 63) D6 : Color specification (1 : black) D7 : Existence of make-up coding (1 : exists)																																																												
Coded data 3 (BH)	R	<p>(X X X X X X X X)</p>	Shows make-up run length in MH and H modes of MR D5 to D0 : Make-up run length (64, 128, 192, ..., 2560) D6 : Color specification (1 : black)																																																												
Decoding data 1 (9H)	W	<p>(0 0 0 0 0 0)</p>	Sets G3 decoding mode <table border="1"> <tr> <td>D2</td> <td>D1</td> <td>D0</td> <td>One-dimensional decoding</td> <td>Two-dimensional decoding</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>—</td> <td>—</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>—</td> <td>V (0) mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>—</td> <td>V<sub>L</sub> mode</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>—</td> <td>V<sub>R</sub> mode</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>MH mode</td> <td>H mode (a0 a1)</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>—</td> <td>H mode (a1 a2)</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>—</td> <td>P mode</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>—</td> <td>—</td> </tr> </table> <table border="1"> <tr> <td>D4</td> <td>D3</td> <td>Distance of a1 to b1 in V<sub>R</sub>/V<sub>L</sub> mode</td> </tr> <tr> <td>0</td> <td>0</td> <td>—</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> <td>3</td> </tr> </table>	D2	D1	D0	One-dimensional decoding	Two-dimensional decoding	0	0	0	—	—	0	0	1	—	V (0) mode	0	1	0	—	V <sub>L</sub> mode	0	1	1	—	V <sub>R</sub> mode	1	0	0	MH mode	H mode (a0 a1)	1	0	1	—	H mode (a1 a2)	1	1	0	—	P mode	1	1	1	—	—	D4	D3	Distance of a1 to b1 in V <sub>R</sub> /V <sub>L</sub> mode	0	0	—	0	1	1	1	0	2	1	1	3
D2	D1	D0	One-dimensional decoding	Two-dimensional decoding																																																											
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0	0	1	—	V (0) mode																																																											
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Decoding status (8H)	R	<p>(0 0 0)</p>	Shows decoding status <table border="1"> <tr> <td>D2</td> <td>D1</td> <td>D0</td> <td>Decoding status</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Decoding in progress</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Normal end of decoding</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Line end (Normal end of processing for one line)</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Decoding error (excess pixels)</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Decoding mode setting error (Note 2)</td> </tr> </table>	D2	D1	D0	Decoding status	0	0	0	Decoding in progress	0	0	1	Normal end of decoding	0	1	1	Line end (Normal end of processing for one line)	1	0	0	Decoding error (excess pixels)	1	0	1	Decoding mode setting error (Note 2)																																				
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**BAND COMPRESSION AND EXPANSION CONTROLLER**

(4) Control registers

Register name	R/W	Bit allocation	Description
Transfer line counter reset (CH)	W	D7  D0	Resets transfer line address counter
Transfer line start (DH)	W	D7  D0	Starts input-output of transfer line data
Process line counter reset (EH)	W	D7  D0	Resets process line address counter
Process line start (FH)	W	D7  D0	Starts or restart process line

Note 1 : Image data input-output ready  
 In the G2 send mode, G2 receive mode, G2 to G3 conversion mode and G3 to G2 conversion mode, this signal indicates that the input-output of image data is enabled on the MPU data bus.

Note 2 : Decoding mode setting error  
 This error is occurred if '000' or '111' is set for D2, D1, and D0 in the G3 decoding mode for decoding data 1.

**FUNCTIONAL OVERVIEW**

(1) Overview

The M66330 is a CODEC LSI for high speed coding and decoding of image data under the control of an MPU.

- Pixels : Maximum 2048 bits/line (for B4-size)  
 Binary image data is treated according to Table 1.
- Coding and decoding methods : MH, MR, and MMR
- Operation in the coding and decoding processes  
 Table 2 and Figure 1 show the operations of the M66330 and MPU during the MH, MR, and MMR coding and decoding processes.

Table 1 Expression of binary data

Pixel	Binary form
White level	0
Black level	1

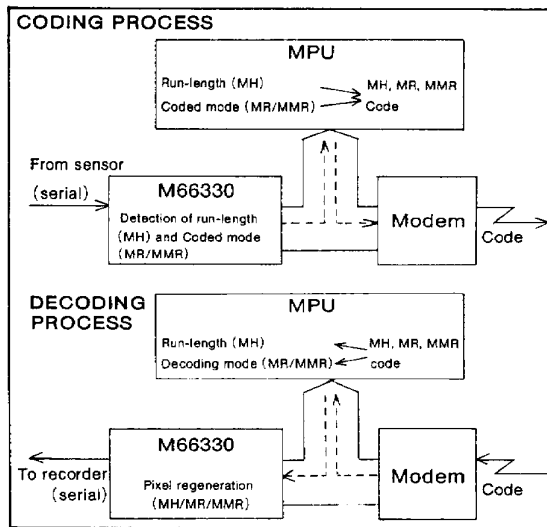


Fig. 1 M66330 operation in G3 coding and decoding processes

Table 2 M66330 operation in coding and decoding processes

Method	Process	M66330	MPU
MH	Coding	Generates black and white run-length data from the image data input from the scanning sensors. This data is sent to the MPU.	Codes the black and white run-length data input from the M66330 using the MH coding method. This coded data is sent to the modem.
	Decoding	Generates image data from the black and white run-length data supplied by the MPU. This image data is sent to the recording device.	Converts the MH-coded string input from the modem into black and white run-length data. This data is sent to the M66330.
MR MMR	Coding	Detects the MR mode of the image data input from the scanning sensors and sends the information to the MPU. In horizontal mode, the run-length data is also sent to the MPU.	Codes the result of MR mode detection input from the M66330. The result is coded by the MR method and sent to the modem.
	Decoding	Regenerates the image data on the basis of the result of MR mode detection input from the MPU. The regenerated image data is sent to the recording device.	Converts the MR-coded string input from the modem to MR mode, and sends the data to the M66330.



**BAND COMPRESSION AND EXPANSION CONTROLLER**

(2) **Operating mode**

The following operating modes can be set using operating mode commands.

- Copy mode
- G3 to G2 conversion mode
- G2 to G3 conversion mode
- G3 receive mode (MH, MR, and MMR methods)
- G2 receive mode
- G3 send mode (MH, MR, and MMR methods)
- G2 send mode

(3) **Internal line memory operation**

The M66330 has three line memories of 2048 bits per line. These are the transfer line memory, process line memory, and reference line memory.

The transfer line memory is used as a data input-output buffer, and the writing or reading position of data is controlled according to the transfer line address counter.

The process line memory is used mainly for handling the line data for the coding and decoding processes. The memory is controlled by the process line address counter.

The reference line memory is used as a reference line data buffer for use in two-dimensional coding and decoding. As with the process line memory, the data writing or reading position is controlled by the process line address counter.

Table 3 shows the operation of each type of line memory in each operating mode.

**Table 3 Internal line memory operation in each operating mode**

Line memory	Transfer line	Reference line	Process line
	Transfer line address counter	Process line address counter	
Copy mode	Data buffer for scanning	—	Data buffer for recording
G3 to G2 conversion mode	Data buffer for MPU output	Reference line data for decoding	Decoded line data
G2 to G3 conversion mode	Data buffer for MPU input	Reference line data for coding	Coding line data
G3 receive mode	Data buffer for recording	Reference line data for decoding	Decoded line data
G2 receive mode	Data buffer for MPU input	—	Data buffer for recording
G3 send mode	Data buffer for scanning	Reference line data for coding	Coding line data
G2 send mode	Data buffer for scanning	—	Data buffer for MPU output

The three line memories (LM1, LM2, and LM3) are allocated cyclically by the line memory commands to the transfer line, reference line, and process line.

Table 4 shows the relationship between the roles of the line memories and the line memory cycle.

**Table 4 Line memory switching cycle**

Line memory	Cycle					
	0	1	2	4	5	6
Transfer line	LM1	LM2	LM3	LM2	LM3	LM1
Reference line	LM2	LM3	LM1	LM1	LM2	LM3
Process line	LM3	LM1	LM2	LM3	LM1	LM2





**BAND COMPRESSION AND EXPANSION CONTROLLER**

(4) **Interrupt requests**

As shown in Table 5, the M66330 has seven interrupt factors. The interrupt enable command is used to enable and disable each interrupt request. When an in-

errupt is generated, the factor is determined by reading the internal status register. Table 6 shows which interrupt factors can be generated in each operating mode.

**Table 5 M66330 interrupt factors**

No.	Interrupt factor	Internal status (1H) bit pattern				Interrupt reset timing
		D3	D2	D1	D0	
1	Completion of transfer line data input/output	0	0	0	1	$\overline{WR}$ of transfer line counter reset (CH)
2	Completion of coding	0	0	1	0	$\overline{RD}$ of coded data 1 (9H)
3	Completion of decoding	0	0	1	0	$\overline{RD}$ of decoding status (8H)
4	Completion of process line data output	0	0	1	0	$\overline{WR}$ of process line counter reset (EH)
5	Recorder ready	0	1	0	0	$\overline{RRDY}$ input inactive
6	Image data output ready	1	0	0	0	$\overline{RD}$ of image data output (7H)
7	Image data input ready	1	0	0	0	$\overline{WR}$ of image data input (7H)

Values in brackets indicate hexadecimal address of the register.

**BAND COMPRESSION AND EXPANSION CONTROLLER**

Table 6 Interrupt factors in each operating mode

Operating mode	No.	Interrupt factor	Internal status bit pattern (1H)				Interrupt set timing	Interrupt reset timing
			D3	D2	D1	D0		
Copy	1	Completion of transfer line input/output	0	0	0	1	Scanning system to M66330 at completion of input of one line of data	$\overline{\text{WR}}$ of transfer line counter reset (CH)
	5	Recorder ready	0	1	0	0	Recording system to M66330 when RRDY input active	RRDY input inactive
	4	Completion of process line data output	0	0	1	0	M66330 to recording system at completion of output of one line of data	$\overline{\text{WR}}$ of process line counter reset (EH)
G3 send	1	Completion of transfer line data input/output	0	0	0	1	Scanning system to M66330 at completion of input of one line of data	$\overline{\text{WR}}$ of transfer line counter reset (CH)
	2	Completion of coding	0	0	1	0	At completion of coding	$\overline{\text{RD}}$ of coded data 1 (9H)
G2 send	1	Completion of transfer line data input/output	0	0	0	1	Scanning system to M66330 at completion of input of one line of data	$\overline{\text{WR}}$ of transfer line counter reset (CH)
	6	Image data output ready	1	0	0	0	When DRQ output for G2 data output is active	$\overline{\text{RD}}$ of image data output (7H)
	4	Completion of process line data output	0	0	1	0	At completion of output of one line of data for G2 data output	$\overline{\text{WR}}$ of process line counter reset (EH)
G3 receive	3	Completion of decoding	0	0	1	0	At completion of decoding	$\overline{\text{RD}}$ of decoding status (8H)
	5	Recorder ready	0	1	0	0	Recorder to M66330 when RRDY input is active	RRDY input inactive
	1	Completion of transfer line data input/output	0	0	0	1	M66330 to recording system at completion of output of one line of data	$\overline{\text{WR}}$ of transfer line counter reset (CH)
G2 receive	7	Image data input ready	1	0	0	0	When DRQ output for G2 data input is active	$\overline{\text{WR}}$ of image data input (7H)
	1	Completion of transfer line data input/output	0	0	0	1	At completion of input of one line of data for G2 data input	$\overline{\text{WR}}$ of transfer line counter reset (CH)
	5	Recorder ready	0	1	0	0	Recording system to M66330 when RRDY input active	RRDY input inactive
	4	Completion of process line data output	0	0	1	0	M66330 to recording system at completion of output of one line of data	$\overline{\text{WR}}$ of process line counter reset (EH)
G3 to G2 conversion	3	Completion of decoding	0	0	1	0	At completion of decoding	$\overline{\text{RD}}$ of decoding status (8H)
	6	Image data output ready	1	0	0	0	When DRQ output for G2 data output is active	$\overline{\text{RD}}$ of image data output (7H)
	1	Completion of transfer line data input/output	0	0	0	1	At completion of output of one line of data for G2 data output	$\overline{\text{WR}}$ of transfer line counter reset (CH)
G2 to G3 conversion	7	Image data input ready	1	0	0	0	When DRQ output for G2 data input is active	$\overline{\text{WR}}$ of image data input (7H)
	1	Completion of transfer line data input/output	0	0	0	1	At completion of input of one line of data for G2 data input	$\overline{\text{WR}}$ of transfer line counter reset (CH)
	2	Completion of coding	0	0	1	0	At completion of coding	$\overline{\text{RD}}$ of coded data 1 (9H)

Values in brackets indicate hexadecimal address of the register.

**BAND COMPRESSION AND EXPANSION CONTROLLER**

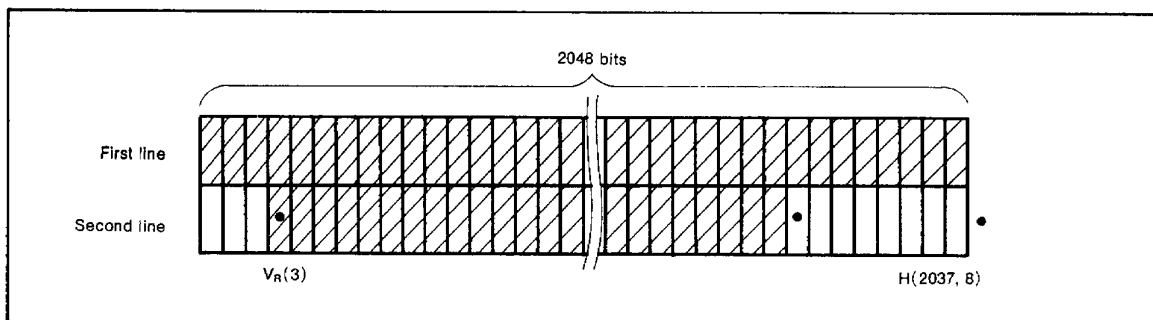
(5) **M66330 data input/output**

The M66330 has three data buses. These are the MPU bus, the serial bus for the scanner, and the serial bus for the recorder.

These buses are used for the input and output of image data, coded data, and decoding data. The input/output sequences for these data types are shown on the subsequent pages.

**Table 7 M66330 data input/output**

No.	Data	Input/output	Data bus	Applicable modes	Fig.
1	image data	Input	Serial bus for scanner	Copy, G2 send, and G3 send	3
2	image data	Output	Serial bus for recorder	Copy, G2 receive, and G3 receive	4
3	Coded data	Output	MPU bus	G3 send and G2 to G3 conversion	5, 6
4	Decoding data	Input	MPU bus	G3 receive and G3 to G2 conversion	7, 8
5	Image data	Input	MPU bus	G2 receive and G2 to G3 conversion	9
6	Image data : DMA transfer	Input	MPU bus	G2 receive and G2 to G3 conversion	10
7	Image data	Output	MPU bus	G2 send and G3 to G2 conversion	11
8	Image data : DMA transfer	Output	MPU bus	G2 send and G3 to G2 conversion	12



**Fig. 2 Image data used in the coding/decoding data I/O sequence**

BAND COMPRESSION AND EXPANSION CONTROLLER

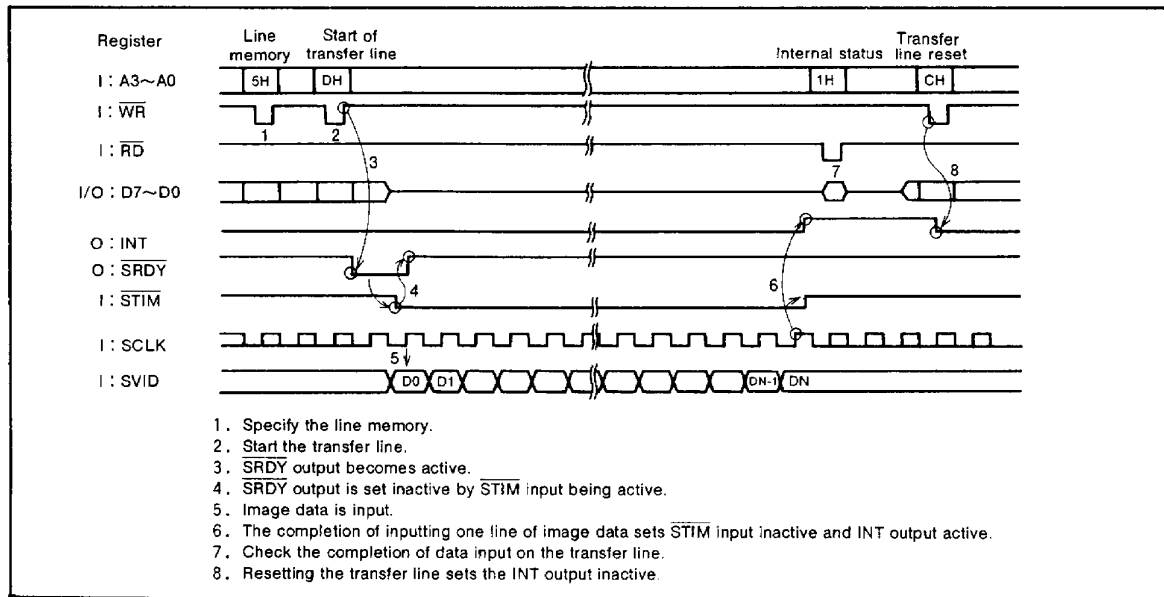


Fig. 3 Input sequence for one line of image data (serial bus for scanning)

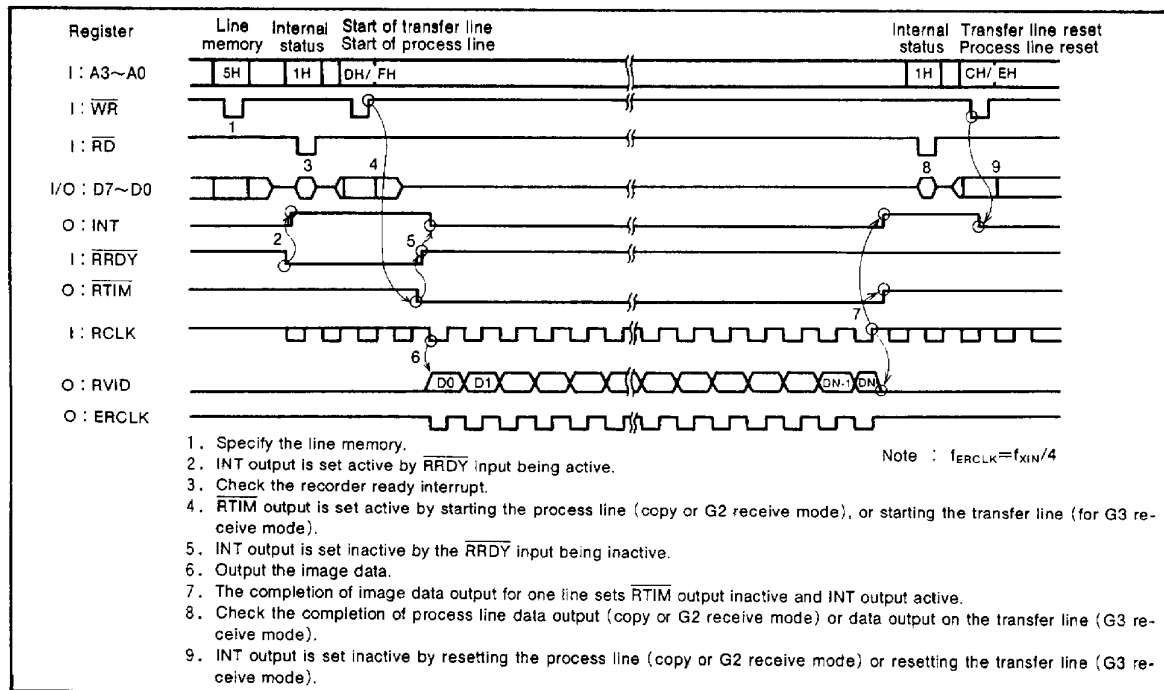


Fig. 4 Output sequence for one line of image data (serial bus for recording)

BAND COMPRESSION AND EXPANSION CONTROLLER

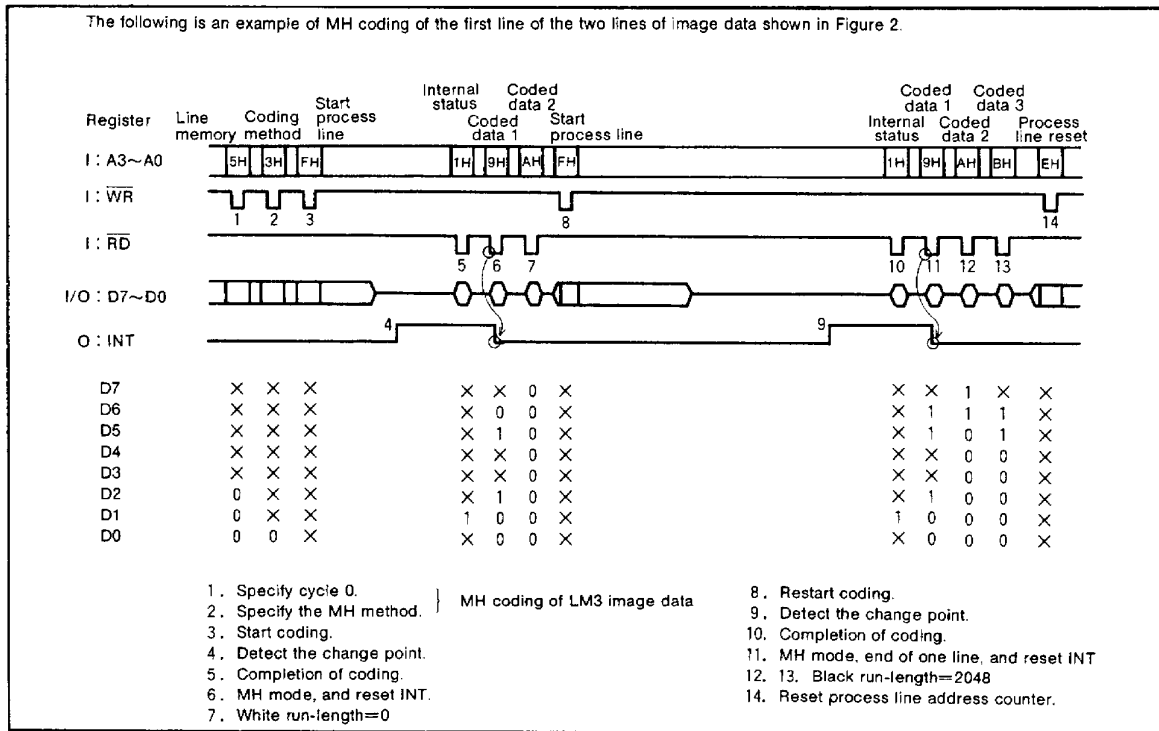


Fig. 5 Output sequence for one line of MH-coded data (MPU bus)

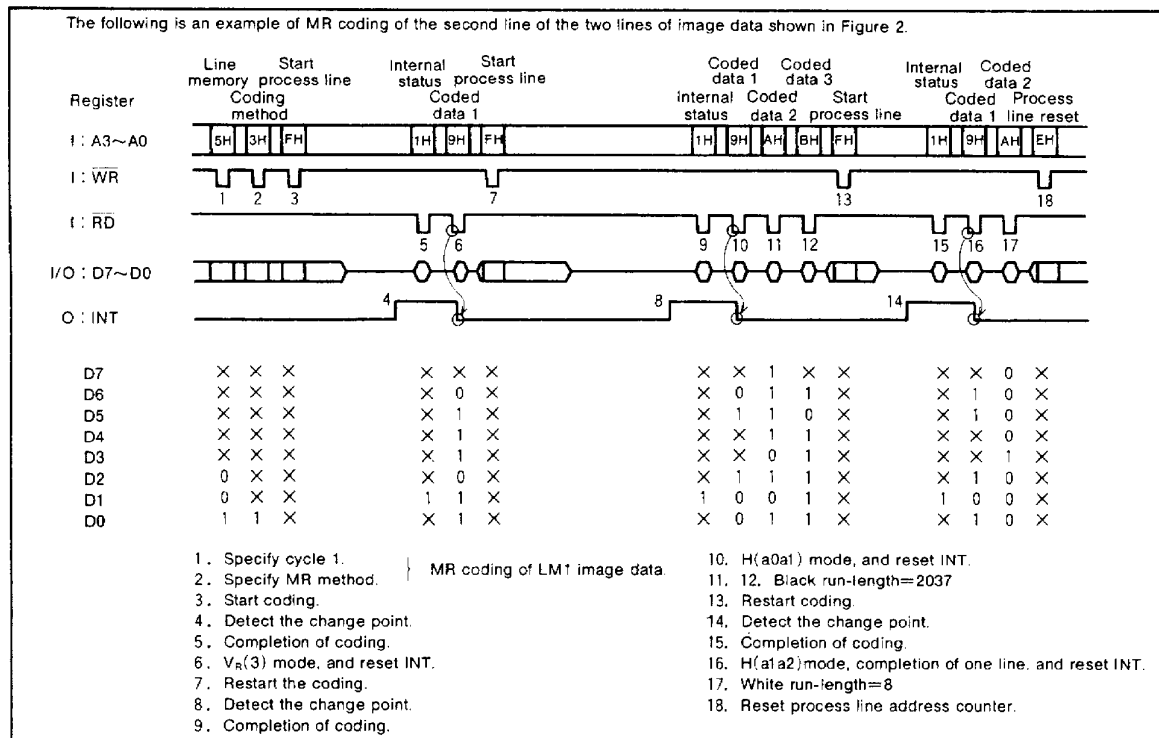


Fig. 6 Output sequence for one line of MR-coded data (MPU bus)



BAND COMPRESSION AND EXPANSION CONTROLLER

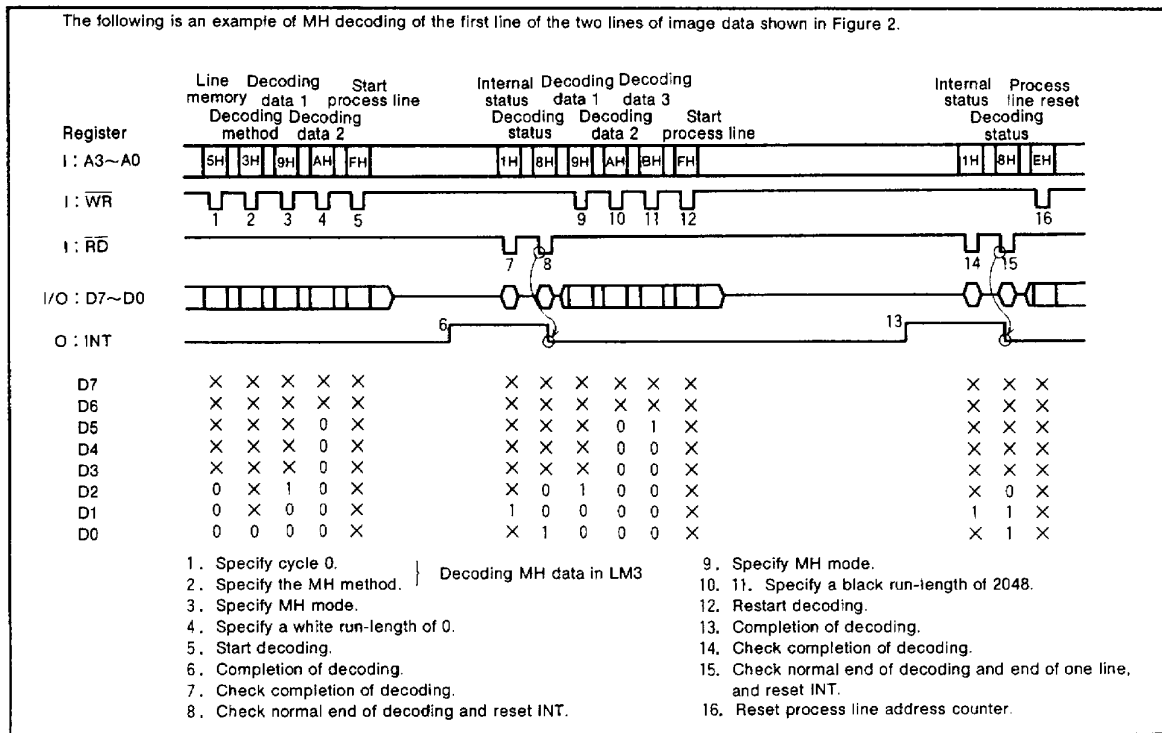


Fig. 7 Input sequence for one line of MH-decoding data (MPU bus)

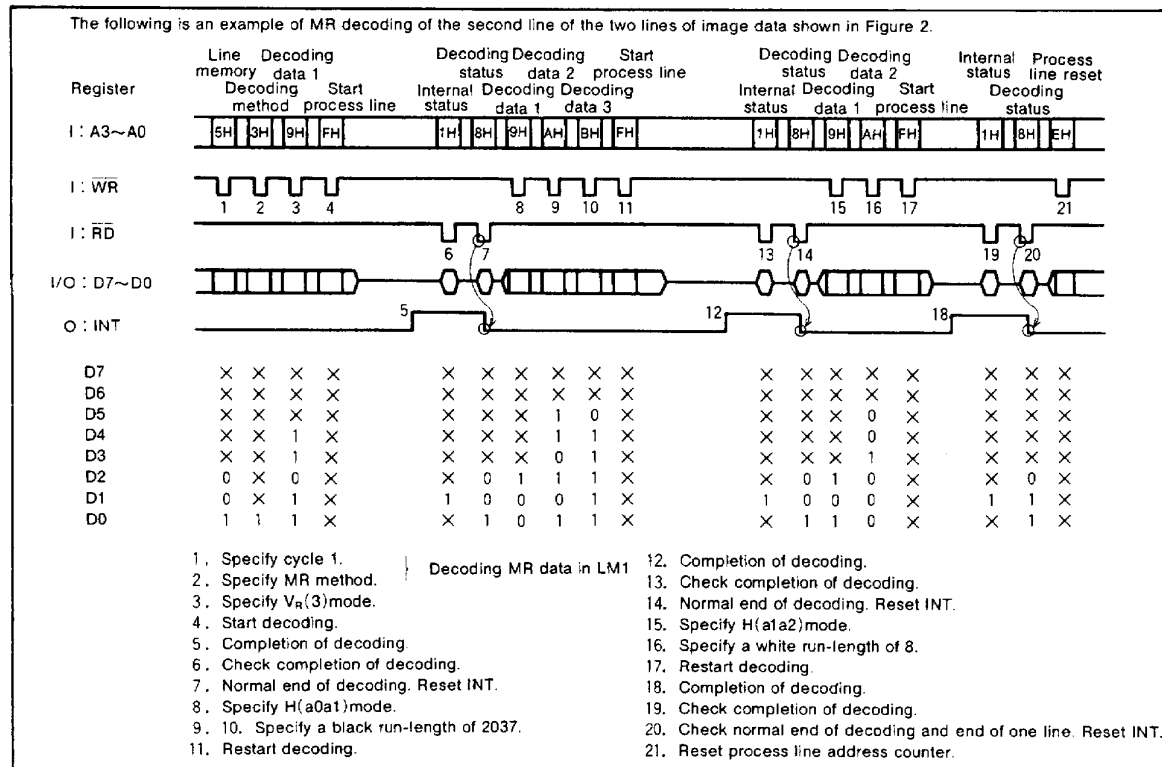


Fig. 8 Input sequence for one line of MR-decoding data (MPU bus)



**BAND COMPRESSION AND EXPANSION CONTROLLER**

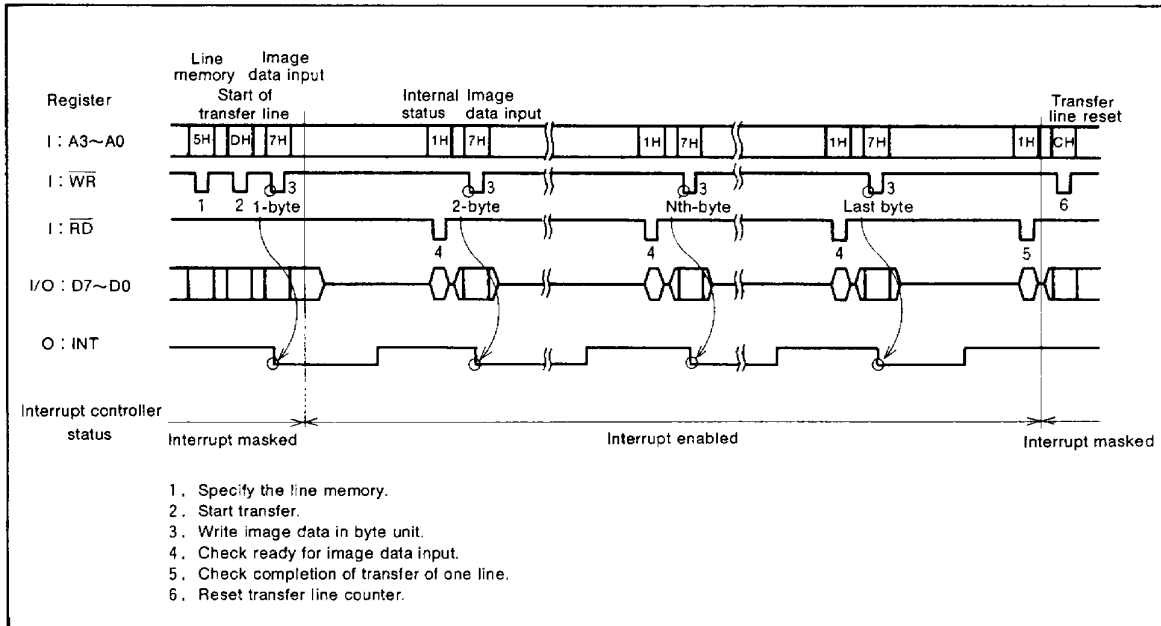


Fig. 9 Input sequence for one line of image data (MPU bus)

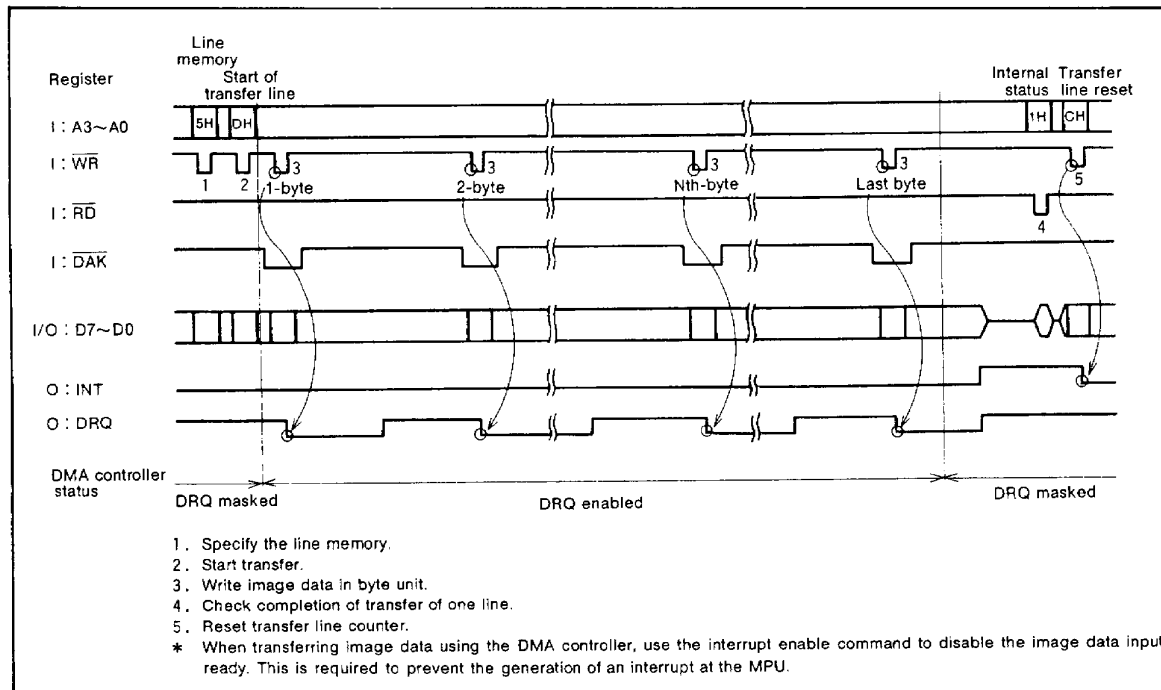


Fig. 10 Input sequence for one line of image data (MPU bus using DMA controller)

BAND COMPRESSION AND EXPANSION CONTROLLER

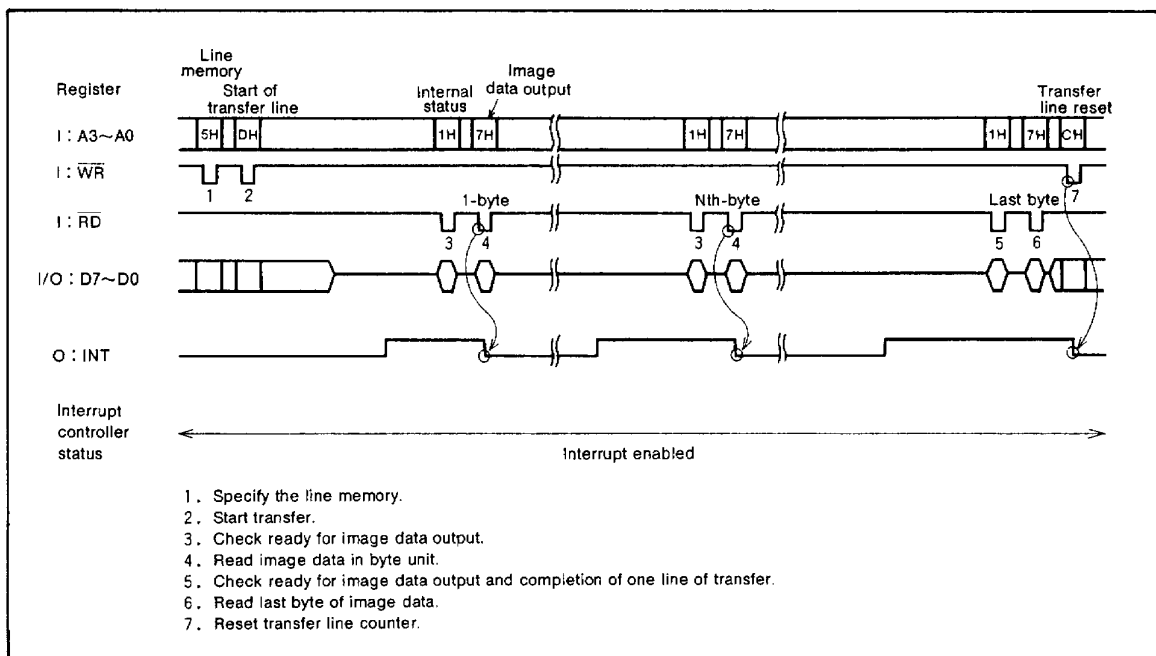


Fig. 11 Output sequence for one line of image data (MPU bus)

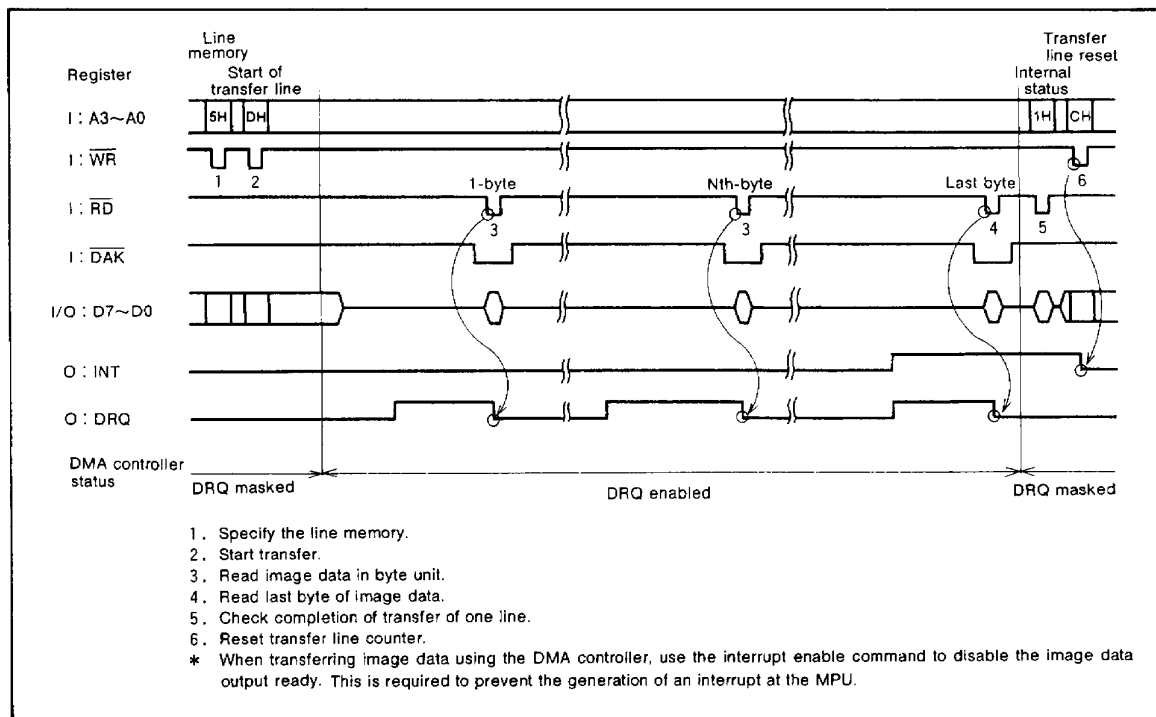


Fig. 12 Output sequence for one line of image data (MPU bus using DMA controller)



**BAND COMPRESSION AND EXPANSION CONTROLLER**

(6) Image processing function

The M66330 has three 2048-bit line memories. This allows the image data up to B4-size. The following describes the image processing functions of the M66330. These functions can be implemented using commands from the MPU.

● Reduction function (B4 to A4)

Use the **line pixel count command** in G2 or G3 send modes to select reduction from B4 to A4 (reduction ratio : 9/11). Image data scanned at the B4-size is reduced in the horizontal scanning direction to A4-size for transfer. An MPU program reduces the dimensions in the vertical scanning direction by the same ratio.

● Addition of sender identification

In G3 send mode, use the **operating mode command** to select the G2 to G3 conversion mode. In this mode, image data of the sender identification is input via the MPU bus of the M66330, is coded, and is sent appended to the coded data for the document. This allows the sender identification to be printed.

● Recording of receiver identification

In G2 and G3 receive modes, use the **operating mode command** to select G2 receive mode. In this mode, receiver identification data is input via the MPU bus of the M66330, is output via the serial bus for the recorder, and is appended to the received image data. This allows the receiver identification to be printed.

● Journal output

Use the **operating mode command** to select G2 receive mode. In this mode, journal data is input via the MPU bus of the M66330 and output via the serial bus for the recorder. This allows journal output.

● Processing for image data transferred to recorder system

Use the **output image processing command** for the following settings.

These settings are possible when image data in the M66330 line memories is output via the serial bus for recording.

① Alignment function

When recording A4-size (1728-bit) images on B4-size (2048-bit) recording paper, a white margin can be added before and after the image data. This allows the image to be right-aligned, centered, or left-aligned. Figure 13 shows examples.

② Edge blanking function

As shown in Figure 14, this function allows forcible blanking of 16 bits (2mm) or 32 bits (4mm) on both side of the output image data.

This function is used in the following cases :

- To correct for the difference between the A4 image sensor width (1728 bits: 216mm) and the JIS standard

A4 paper size (1680 bits : 210mm)

- To delete the shadow around a scanned document when recording A4-size image data on B4-size recording paper
- To prevent the thermal head from burning the platen when the thermal head of the recorder is misaligned with the recording paper. This situation can occur when B4 images are being printed on B4 paper, or A4 images are being printed on A4 paper.

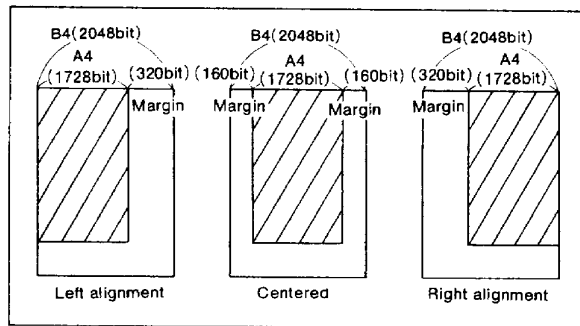


Fig. 13 Alignment function

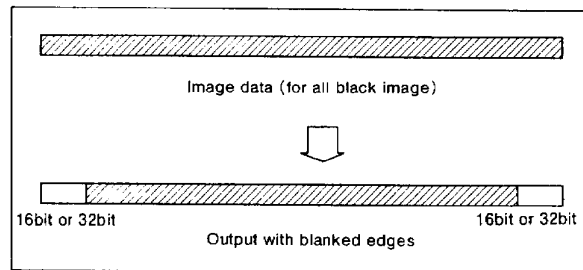


Fig. 14 Edge blanking function

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(7) **G3 to G3 conversion function**

In facsimile machines with memory functions, image data is first compressed and stored in memory. For the data to be transferred, the sender must convert the

coding method and/or recording paper size according to the functions of the receiver. With the M66330, G3 to G3 conversion is achieved by the appropriate commands from the MPU.

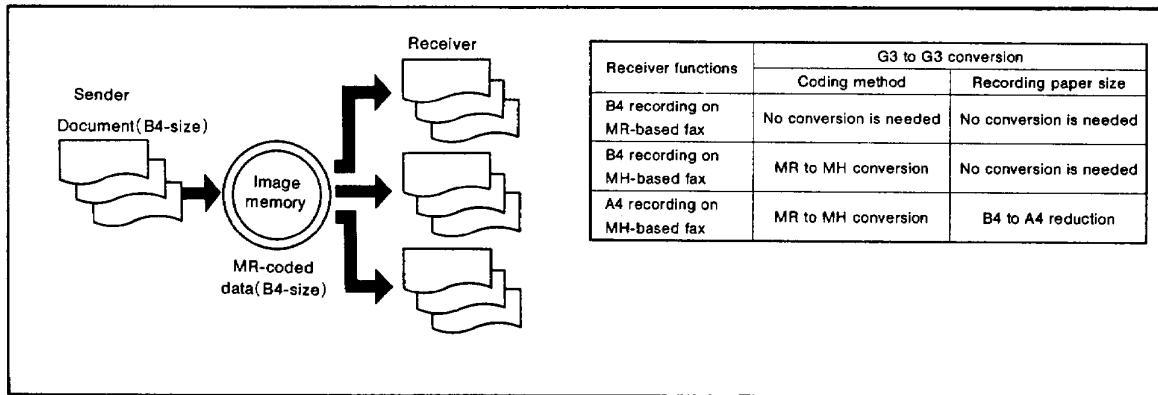


Fig. 15 Conversion functions in facsimile machines with memory functions

● **Coding method conversion**

The G3 to G2 conversion mode of the M66330 is used to decode G3-coded data stored in image memory to image data in the line memory. The G2 to G3 conversion mode is then used to re-code the data into G3 format.

Operating sequences and line memory cycles are shown in Table 8.

● **Paper size conversion**

The G3 to G2 conversion mode of the M66330 is used to decode G3-coded data (B4-size) stored in image

memory to image data in the line memory. The G2 to G3 conversion mode is then used to specify a reduction from B4 to A4 (line pixel count command) and to recode the data into G3 format. This allows the dimensions in the horizontal scanning direction to be reduced from B4 to A4.

An MPU program is used to reduce the dimensions in the vertical scanning direction in the same ratio.

Operating sequences and line memory cycles are shown in Table 9.

**BAND COMPRESSION AND EXPANSION CONTROLLER**

Table 8 G3 to G3 operating sequence (without paper size conversion)

Data I/O	Operating mode	Coding/decoding	Operating sequence											
G3 data input	G3 to G2 conversion	Decoding	0 line (All white image)	1 line	2 line	3 line	.....							Last line
G3 data output	G2 to G3 conversion	Coding	—	1 line	2 line	3 line	.....							Last line
line memory	Line memory cycle		2	0	1	2	Repeat the same line memory cycle as 1st line to 3rd line to last line.							
	Transfer line		LM3(—)	LM1(—)	LM2(0)	LM3(1)								
	Reference line		LM1(—)	LM2(0)	LM3(1)	LM1(2)								
	Process line		LM2(0)	LM3(1)	LM1(2)	LM2(3)								

Table 9 G3 to G3 operating sequence (with paper size conversion)

Data I/O	Operating mode	line pixel count	Coding/decoding	Operating sequence											
G3 data input	G3 to G2 conversion	B4	Decoding	0 line (All white image)	1 line	2 line	3 line	4 line	5 line	6 line	—	7 line	8 line	9 line	10 line
G3 data output	G2 to G3 conversion	B4→A4	Coding	—	1 line	2 line	3 line	4 line	—	—	6 line	7 line	8 line	9 line	—
line memory	Line memory cycle		2	0	1	2	0	1	2	6	0	1	2	0	
	Transfer line		LM3(—)	LM1(—)	LM2(0)	LM3(1)	LM1(2)	LM2(3)	LM3(4)	LM1(5)	LM1(5)	LM2(6)	LM3(7)	LM1(8)	
	Reference line		LM1(—)	LM2(0)	LM3(1)	LM1(2)	LM2(3)	LM3(4)	LM1(5)	LM3(4)	LM2(6)	LM3(7)	LM1(8)	LM2(9)	
	Process line		LM2(0)	LM3(1)	LM1(2)	LM2(3)	LM3(4)	LM1(5)	LM2(6)	LM2(6)	LM3(7)	LM1(8)	LM2(9)	LM3(10)	

(to be continued)

Operating sequence																	
11 line	—	12 line	13 line	14 line	15 line	16 line	17 line	—	18 line	19 line	20 line	21 line	22 line	—	23 line	24 line	25 line
—	11 line	12 line	13 line	14 line	15 line	—	—	17 line	18 line	19 line	20 line	—	—	22 line	23 line	24 line	25 line
1	5	2	0	1	2	0	1	5	2	0	1	2	0	4	1	2	0
LM2(9)	LM3(10)	LM3(10)	LM1(11)	LM2(12)	LM3(13)	LM1(14)	LM2(15)	LM3(16)	LM3(16)	LM1(17)	LM2(18)	LM3(19)	LM1(20)	LM2(21)	LM2(21)	LM3(22)	LM1(23)
LM3(10)	LM2(9)	LM1(11)	LM2(12)	LM3(13)	LM1(14)	LM2(15)	LM3(16)	LM2(15)	LM1(17)	LM2(18)	LM3(19)	LM1(20)	LM2(21)	LM1(20)	LM3(22)	LM1(23)	LM2(24)
LM1(11)	LM1(11)	LM2(12)	LM3(13)	LM1(14)	LM2(15)	LM3(16)	LM1(17)	LM1(17)	LM2(18)	LM3(19)	LM1(20)	LM2(21)	LM3(22)	LM3(22)	LM1(23)	LM2(24)	LM3(25)

(to be continued)

Operating sequence												
26 line	27 line	28 line	—	29 line	30 line	31 line	32 line	33 line	—	.....		Last line
26 line	—	—	28 line	29 line	30 line	31 line	—	—	33 line	.....		Last line
1	2	0	4	1	2	0	1	2	6	Repeat the same line memory cycle as 1st line to 33rd line to last line.		
LM2(24)	LM3(25)	LM1(26)	LM2(27)	LM2(27)	LM3(28)	LM1(29)	LM2(30)	LM3(31)	LM1(32)			
LM3(25)	LM1(26)	LM2(27)	LM1(26)	LM3(28)	LM1(29)	LM2(30)	LM3(31)	LM1(32)	LM3(31)			
LM1(26)	LM2(27)	LM3(28)	LM3(28)	LM1(29)	LM2(30)	LM3(31)	LM1(32)	LM2(33)	LM2(33)			



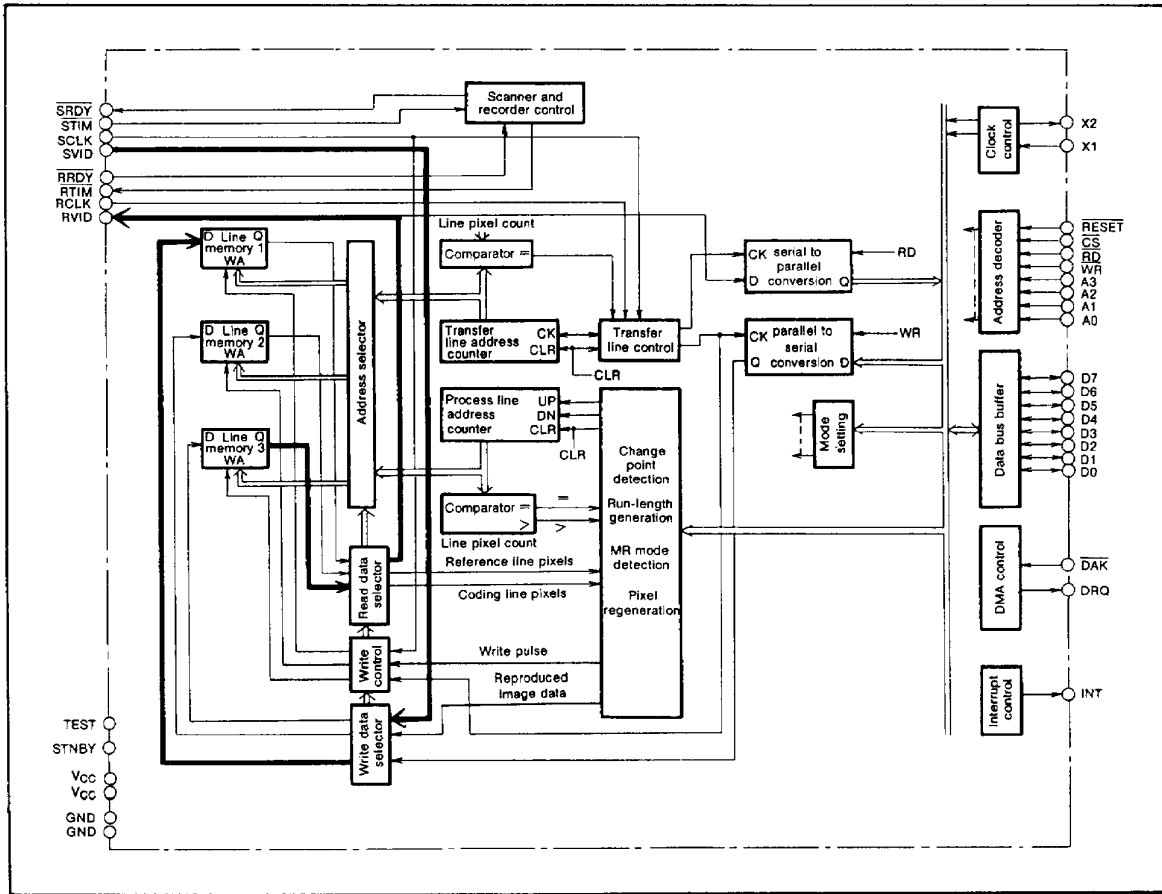
**BAND COMPRESSION AND EXPANSION CONTROLLER**

**DATA FLOW**

The following describes the data flow in each operating mode. Line memory cycle 0 is used for the examples.

**(1) Copy mode**

In the copy mode, image data input from the scanner is output to the recorder via line memory.

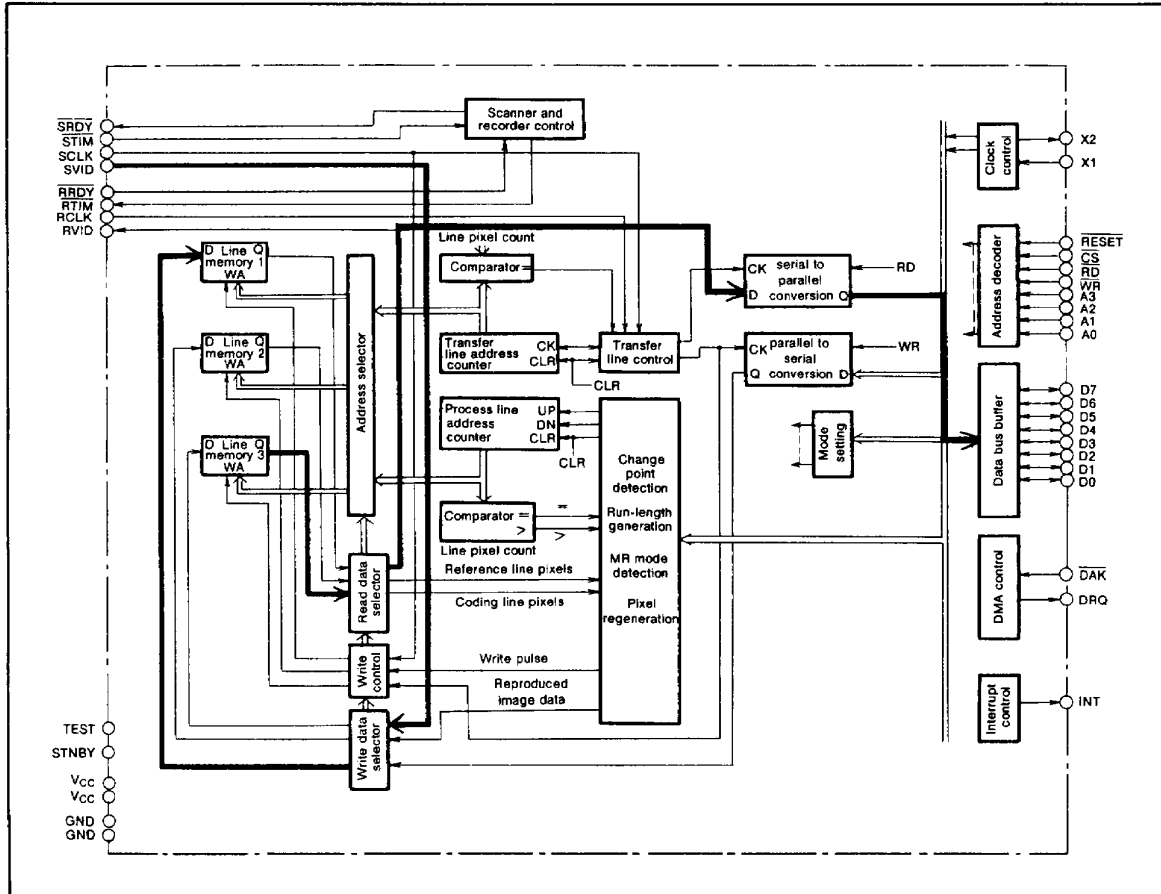


Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for scanner
Reference line	Process line address counter	—
Process line		Data buffer for recorder

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(2) G2 send mode

In the G2 send mode, image data input from the scanner is output to the MPU bus.

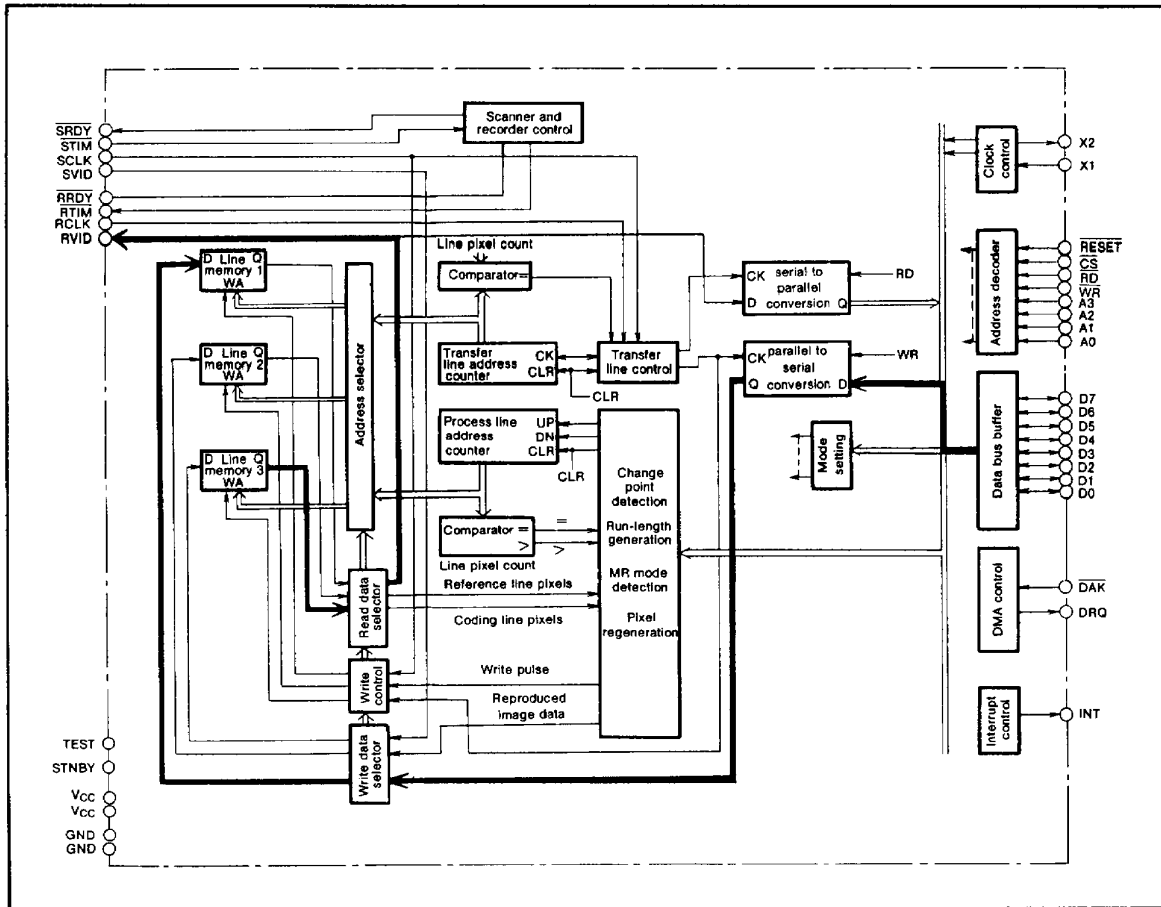


Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for scanner
Reference line	Process line address counter	—
Process line	Process line address counter	Data buffer for MPU output

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(3) **G2 receive mode**

In the G2 receive mode, image data input via the MPU bus is output to the recorder via line memory. This mode allows the recording of journals and data transfer when recording receiver identification.

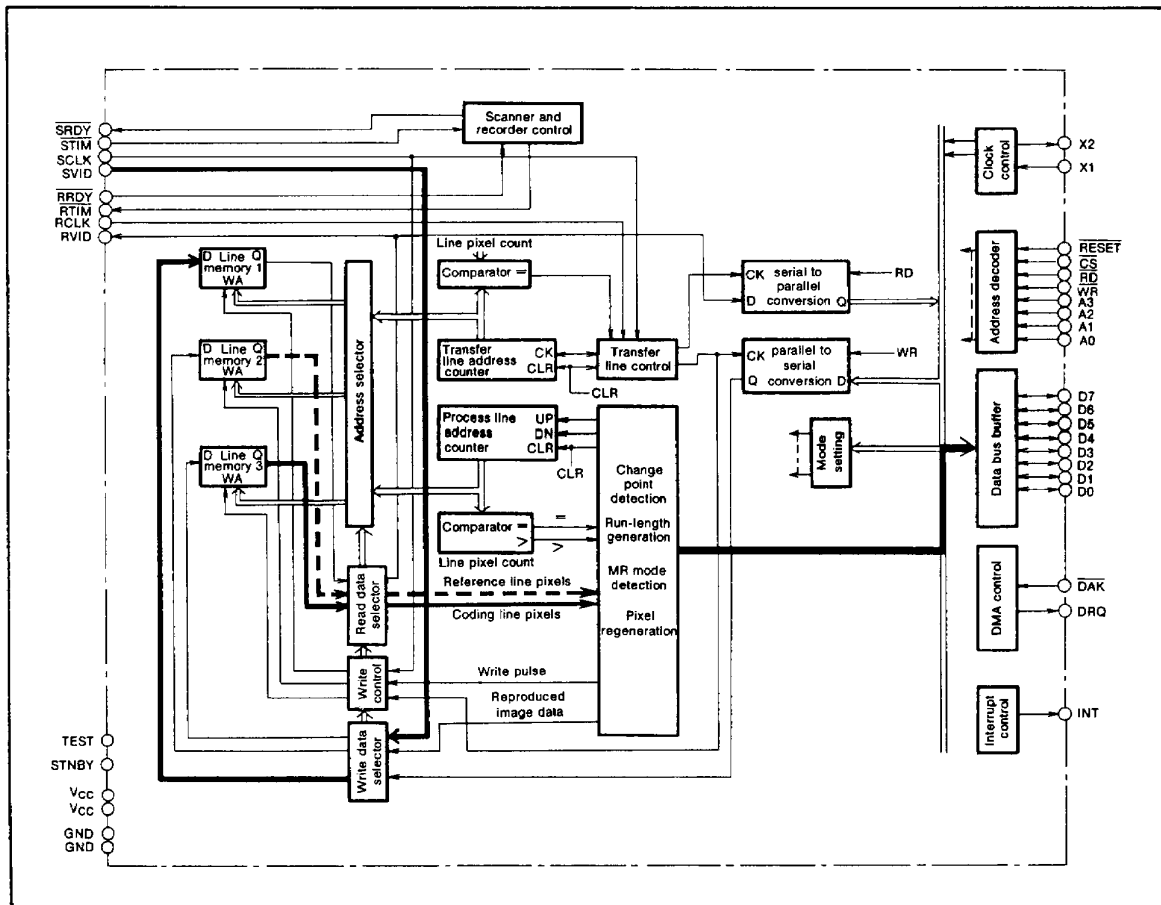


Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for MPU input
Reference line	—	—
Process line	Process line address counter	Data buffer for recorder

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(4) G3 send mode

In the G3 send mode, image data input from the scanner is coded and output as G3 data (coded data 1 to 3) to the MPU bus.



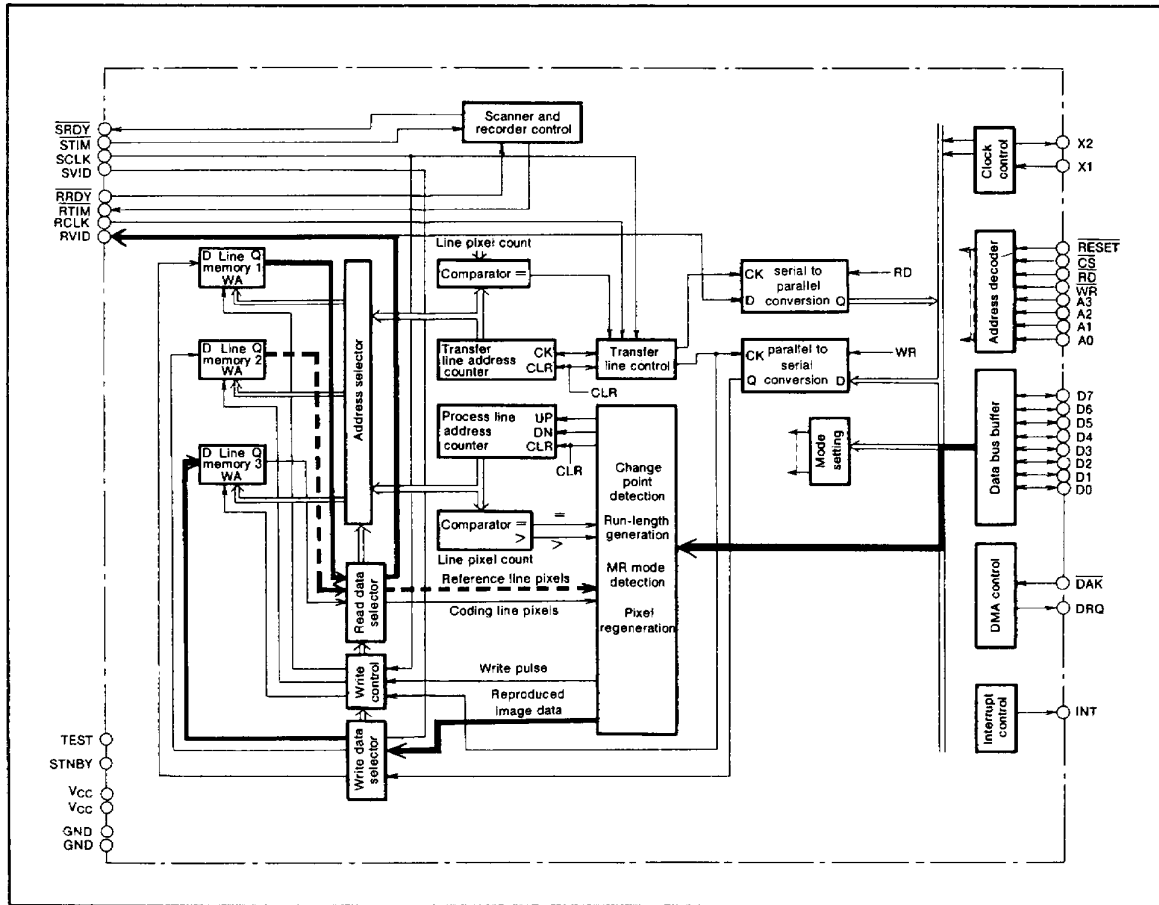
Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for scanner
Reference line	Process line address counter	Reference line data for coding
Process line		Line data to be coded

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(5) G3 receive mode

In the G3 receive mode, image data is regenerated in line memory using the G3 data (decoded data 1 to 3) input from the MPU bus.

This image data is then output to the recorder.



Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for scanner
Reference line	Process line address counter	Reference line data for coding
Process line		Line data to be coded

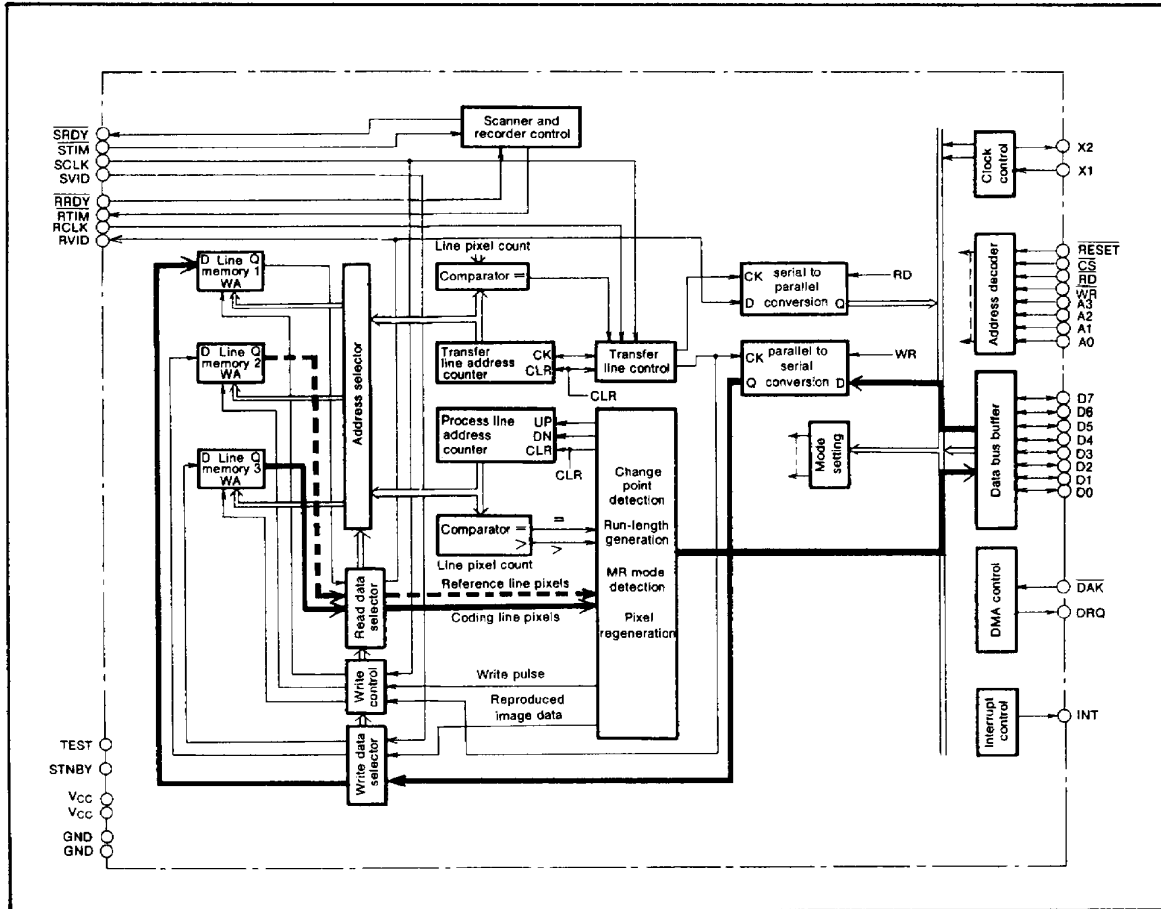


**BAND COMPRESSION AND EXPANSION CONTROLLER**

(6) G2 to G3 conversion mode

In the G2 to G3 conversion mode, image data input from the MPU bus is coded, then output as G3 data (coded data 1 to 3) to the MPU bus.

This mode is used for data transfer of sender identification.



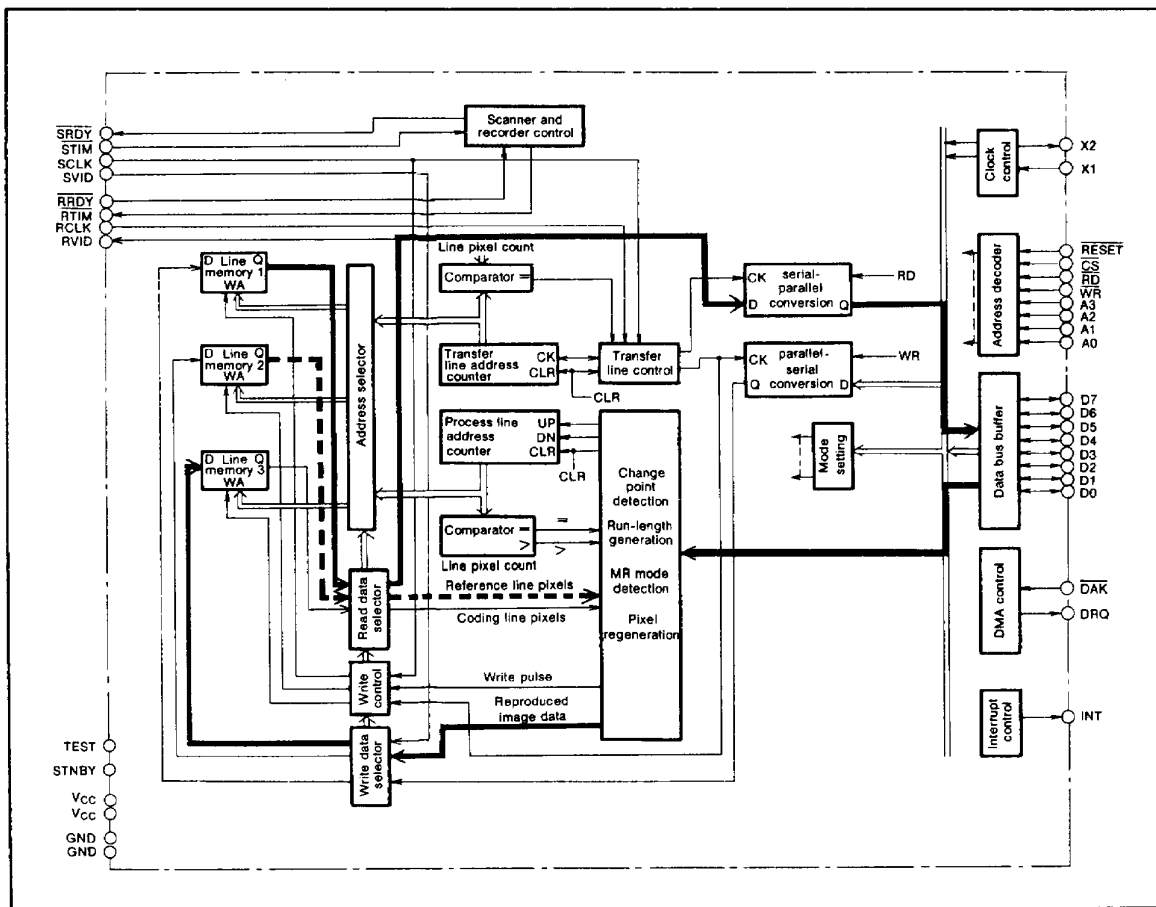
Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for MPU input
Reference line	Process line address counter	Reference line data for coding
Process line		Line data to be coded



**BAND COMPRESSION AND EXPANSION CONTROLLER**

(7) G3 to G2 conversion mode

In the G3 to G2 conversion mode, image data is re-generated in line memory from the G3 data (coded data 1 to 3) input from the MPU bus. This image data is then output again to the MPU bus.



Line memory	Address counter	Role
Transfer line	Transfer line address counter	Data buffer for MPU output
Reference line	Process line address counter	Reference line data for decoding
Process line		Decoded line data

**BAND COMPRESSION AND EXPANSION CONTROLLER**

**RESET CIRCUIT**

Requirements for reset circuit is shown in Figure 16.

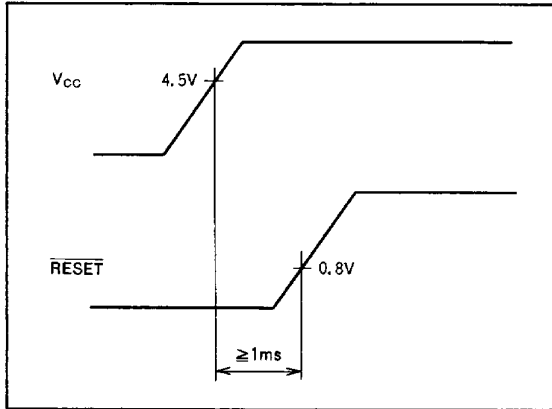


Fig. 16 Requirements for power on reset

**CLOCK GENERATOR**

Clock generator circuit for the ceramic resonator is shown in Figure 17.

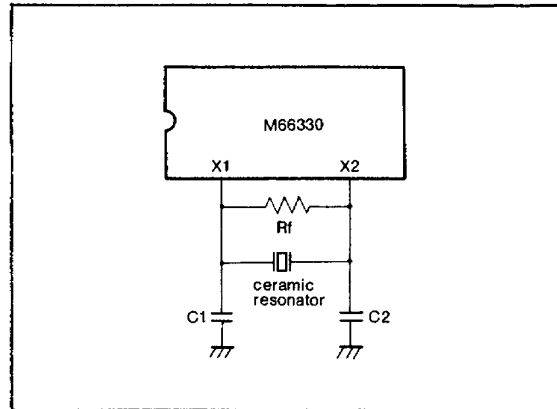


Fig. 17 Clock generator

Supplier	Type	frequency (MHz)	C1 (pF)	C2 (pF)	Rf (MΩ)
Murata Manufacturing Co., Ltd.	CSA4.00 MG 040	4.0	100	100	1.0
	CST4.00 MGW040	4.0	100 (Included)	100 (Included)	1.0
	CSA8.00 MT	8.0	30	30	1.0
	CST8.00 MTW	8.0	30 (Included)	30 (Included)	1.0

**BAND COMPRESSION AND EXPANSION CONTROLLER**

**ELECTRICAL CHARACTERISTICS  
ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Conditions	Ratings	Unit
V <sub>CC</sub>	Supply voltage		-0.3~+7.0	V
V <sub>I</sub>	Input voltage		-0.3~V <sub>CC</sub> +0.3	V
V <sub>O</sub>	Output voltage		0~V <sub>CC</sub>	V
T <sub>stg</sub>	Storage temperature		-65~+150	°C

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
V <sub>CC</sub>	Supply voltage	4.5	5.0	5.5	V
GND	Ground voltage		0.		V
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	V
T <sub>opr</sub>	Operating temperature range	-20		75	°C

**ELECTRICAL CHARACTERISTICS** (T<sub>a</sub>=-20~75°C and V<sub>CC</sub>=5V±10%, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V <sub>IH</sub>	"H" input voltage	RESET, WR, RD, CS, A3~A0.	2.0			V
V <sub>IL</sub>	"L" input voltage	D7~D0, RRDY, SVID, STIM, DAK, STNBY			0.8	V
V <sub>IH</sub>	"H" input voltage	X1	V <sub>CC</sub> X0.8			V
V <sub>IL</sub>	"L" input voltage		V <sub>CC</sub> X0.2			V
V <sub>T+</sub>	Positive threshold voltage	SCLK, RCLK			2.4	V
V <sub>T-</sub>	Negative threshold voltage		0.6			V
V <sub>H</sub>	Hysteresis width		0.2			V
V <sub>OH</sub>	"H" output voltage	D7~D0, ERCLK, RVID	I <sub>OH</sub> =-12mA	V <sub>CC</sub> -0.8		V
V <sub>OL</sub>	"L" output voltage		I <sub>OL</sub> =12mA		0.55	V
V <sub>OH</sub>	"H" output voltage	RTIM, SRDY,	I <sub>OH</sub> =-4mA	V <sub>CC</sub> -0.8		V
V <sub>OL</sub>	"L" output voltage	DRQ, INT	I <sub>OL</sub> =4mA		0.55	V
I <sub>IH</sub>	"H" input current	RESET, WR, RD, CS, A3~A0, STNBY, SVID,	V <sub>I</sub> =V <sub>CC</sub>		1.0	μA
I <sub>IL</sub>	"L" input current	STIM, SCLK, RCLK, RRDY, DAK	V <sub>I</sub> =GND		-1.0	μA
I <sub>OZH</sub>	"H" output current in OFF state	D7~D0	V <sub>O</sub> =V <sub>CC</sub>		5.0	μA
I <sub>OZL</sub>	"L" output current in OFF state	D7~D0	V <sub>O</sub> =GND		-5.0	μA
I <sub>CC</sub>	Static consumption (standby)		STNBY=V <sub>CC</sub> Other input=V <sub>CC</sub> , GND		100	μA
	Static consumption (active)		STNBY=GND Other input=V <sub>CC</sub> , GND		60	mA
	Dynamic consumption		V <sub>I</sub> =V <sub>CC</sub> , GND f <sub>XI</sub> =8MHz	35		mA

**BAND COMPRESSION AND EXPANSION CONTROLLER**

**TIMING REQUIREMENTS** ( $T_a = -20 \sim 75^\circ\text{C}$  and  $V_{CC} = 5V \pm 10\%$ , unless otherwise noted)

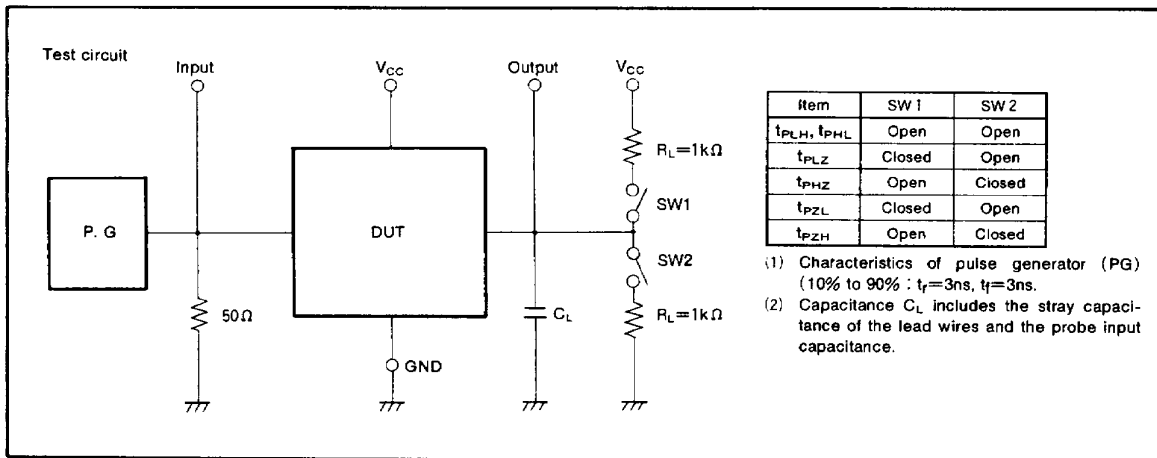
Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
$t_{C(X1)}$	Clock cycle			125		ns
$t_{W+(X1)}$	Clock "H" pulse width			62.5		ns
$t_{W-(X1)}$	Clock "L" pulse width			62.5		ns
$t_{r(X1)}$	Clock rise time				20	ns
$t_{f(X1)}$	Clock fall time				20	ns
$t_{SU(A-\overline{RD})}$	Address setup time before read		0			ns
$t_{H(\overline{RD}-A)}$	Address hold time after read		0			ns
$t_{W(\overline{RD})}$	Read pulse width		100			ns
$t_{SU(A-\overline{WR})}$	Address setup time before write		0			ns
$t_{H(\overline{WR}-A)}$	Address hold time after write		0			ns
$t_{W(\overline{WR})}$	Write pulse width		100			ns
$t_{SU(D-\overline{WR})}$	Data setup time before write		50			ns
$t_{H(\overline{WR}-D)}$	Data hold time after write		0			ns
$t_{C(SCLK)}$	Scanning clock cycle		250			ns
$t_{W+(SCLK)}$	Scanning clock "H" pulse width		100			ns
$t_{W-(SCLK)}$	Scanning clock "L" pulse width		100			ns
$t_{r(SCLK)}$	Scanning clock rise time				20	ns
$t_{f(SCLK)}$	Scanning clock fall time				20	ns
$t_{SU(\overline{STIM}-SCLK)}$	Clock enable setup time before scanning clock		0			ns
$t_{H(SCLK-\overline{STIM})}$	Clock enable hold time after scanning clock		10			ns
$t_{SU(SVID-SCLK)}$	Scanned data setup time before scanning clock		50			ns
$t_{H(SCLK-SVID)}$	Scanned data hold time after scanning clock		50			ns
$t_{SU(RTIM-RCLK)}$	Enable setup time before recording clock		50			ns
$t_{H(\overline{RTIM}-\overline{RDY})}$	Recording ready hold time after print enable		0			ns
$t_{C(RCLK)}$	Recording clock cycle		250			ns
$t_{W+(RCLK)}$	Recording clock "H" pulse width		100			ns
$t_{W-(RCLK)}$	Recording clock "L" pulse width		100			ns
$t_{r(RCLK)}$	Recording clock rise time				20	ns
$t_{f(RCLK)}$	Recording clock fall time				20	ns

**SWITCHING CHARACTERISTICS** ( $T_a = -20 \sim 75^\circ\text{C}$  and  $V_{CC} = 5V \pm 10\%$ , unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
$t_{PZL(\overline{RD}-D)}$	Data output enable time after read	$C_L = 150\text{pF}$			100	ns
$t_{PZH(\overline{RD}-D)}$	Data output disable time after read		10		85	ns
$t_{PHZ(\overline{RD}-D)}$	Data output disable time after read					
$t_{PHL(\overline{RD}-INT)}$	INT output propagation time after read	$C_L = 50\text{pF}$			150	ns
$t_{PHL(\overline{WR}-INT)}$	INT output propagation time after write				150	ns
$t_{PHL(\overline{RD}-DRQ)}$	DRQ output propagation time after read				150	ns
$t_{PHL(\overline{WR}-DRQ)}$	DRQ output propagation time after write				150	ns
$t_{PLH(\overline{STIM}-\overline{SRDY})}$	$\overline{SRDY}$ output propagation time after $\overline{STIM}$ input				50	ns
$t_{PLH(\overline{RDY}-INT)}$	INT output propagation time after $\overline{RDY}$ input				50	ns
$t_{PHL(\overline{RDY}-INT)}$	INT output propagation time after $\overline{RDY}$ input				50	ns
$t_{PLH(RCLK-\overline{RTIM})}$	$\overline{RTIM}$ output propagation time after RCLK input	$C_L = 150\text{pF}$			50	ns
$t_{PHL(RCLK-RVID)}$	RVID output propagation time after RCLK input				100	ns
$t_{a(RCLK-RVID)}$	RVID output propagation time after RCLK input				50	ns

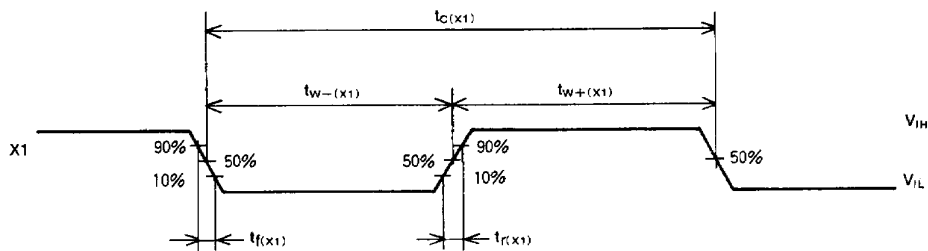


**BAND COMPRESSION AND EXPANSION CONTROLLER**



**TIMING CHARTS**

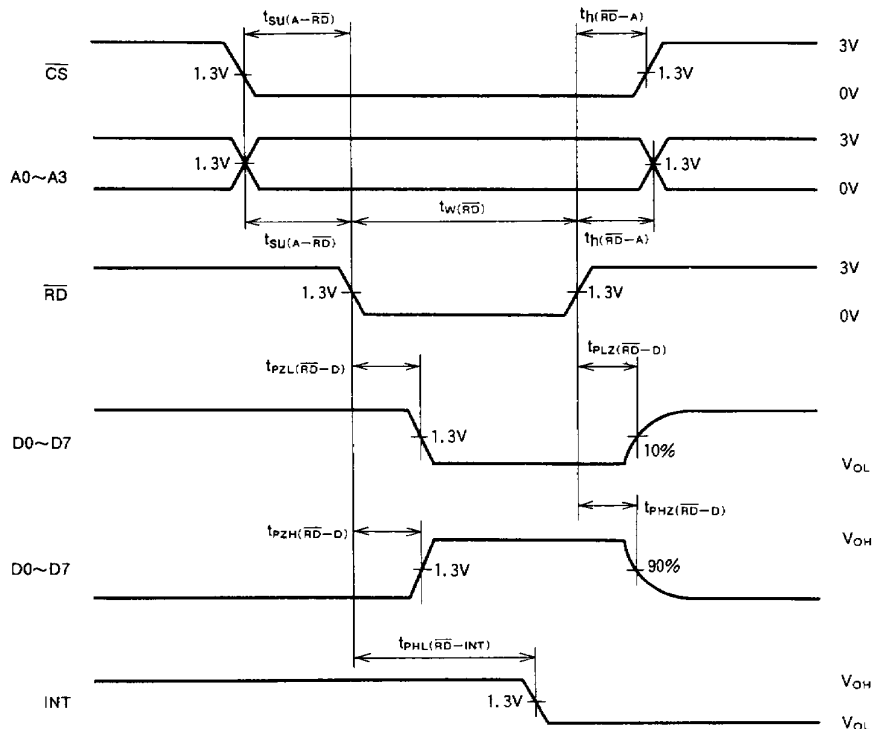
Clock timing



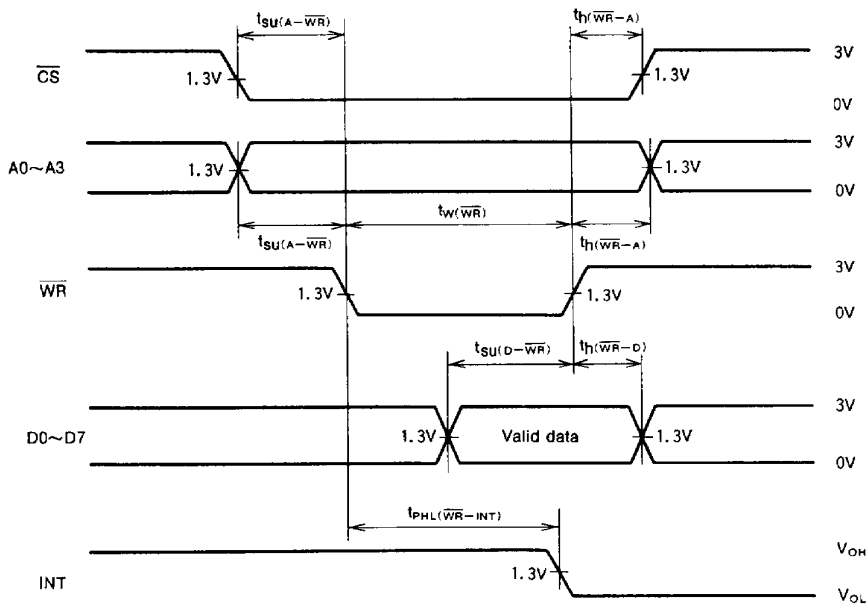
**BAND COMPRESSION AND EXPANSION CONTROLLER**

**MPU bus interface timing**

Read operation timing (M66330 to MPU)



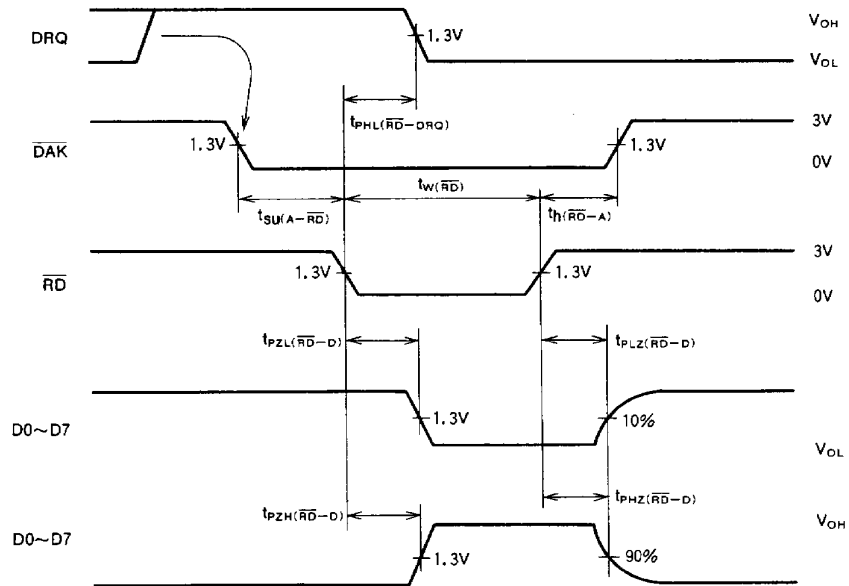
Write operation timing (MPU to M66330)



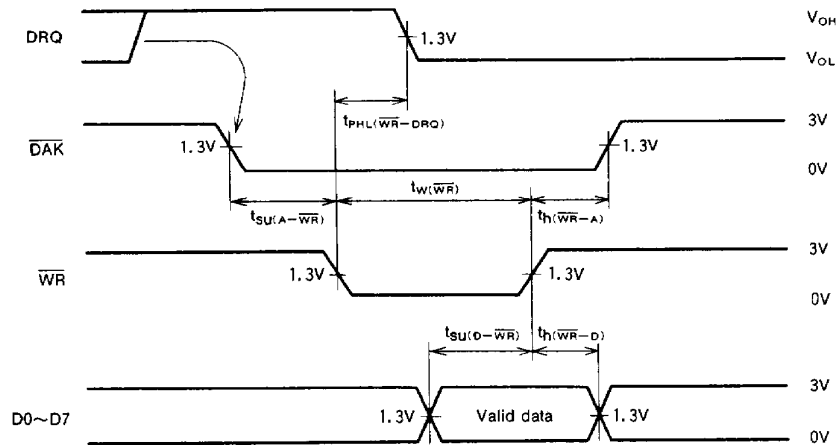
**BAND COMPRESSION AND EXPANSION CONTROLLER**

**MPU bus DMA timing**

Read operation timing (M66330 to system bus)



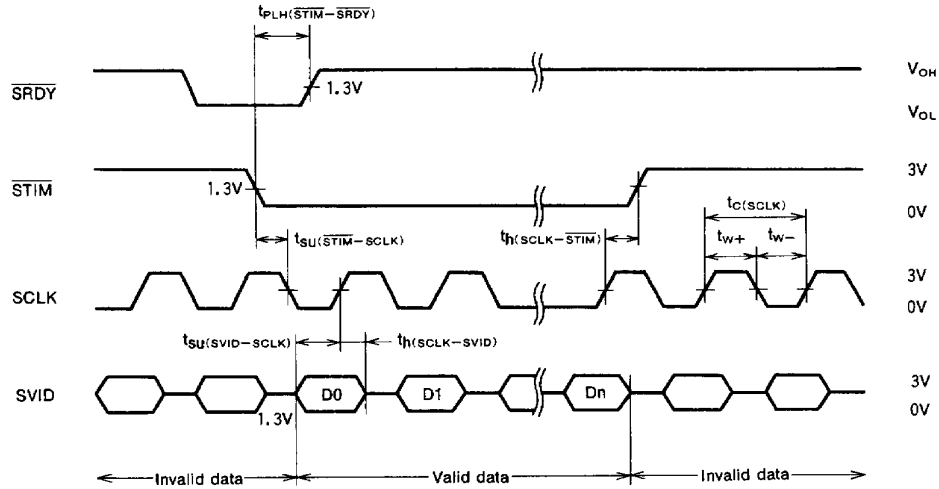
Write operation timing (System bus to M66330)



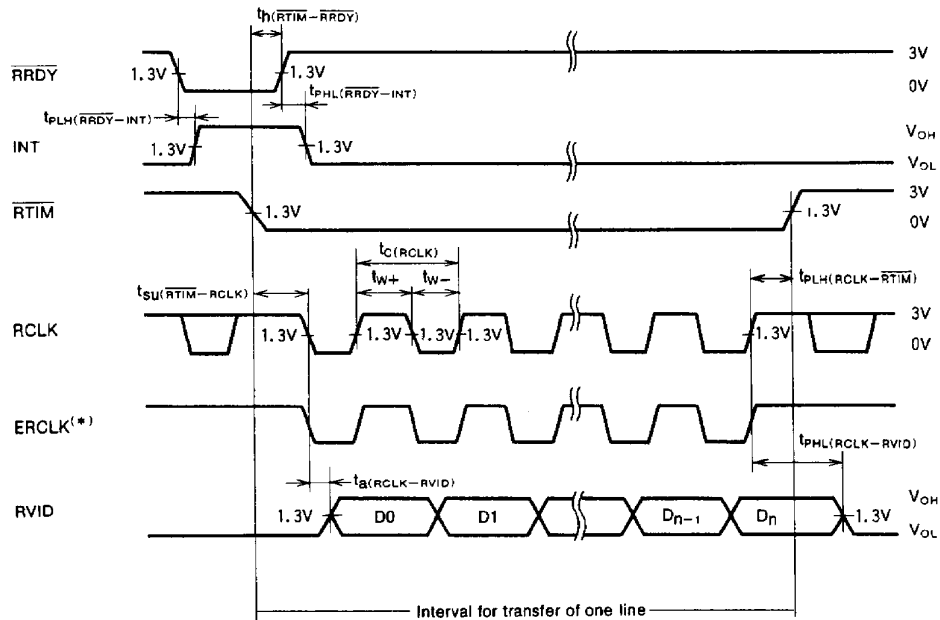


**BAND COMPRESSION AND EXPANSION CONTROLLER**

Serial bus timing for scanning



Serial bus timing for recording

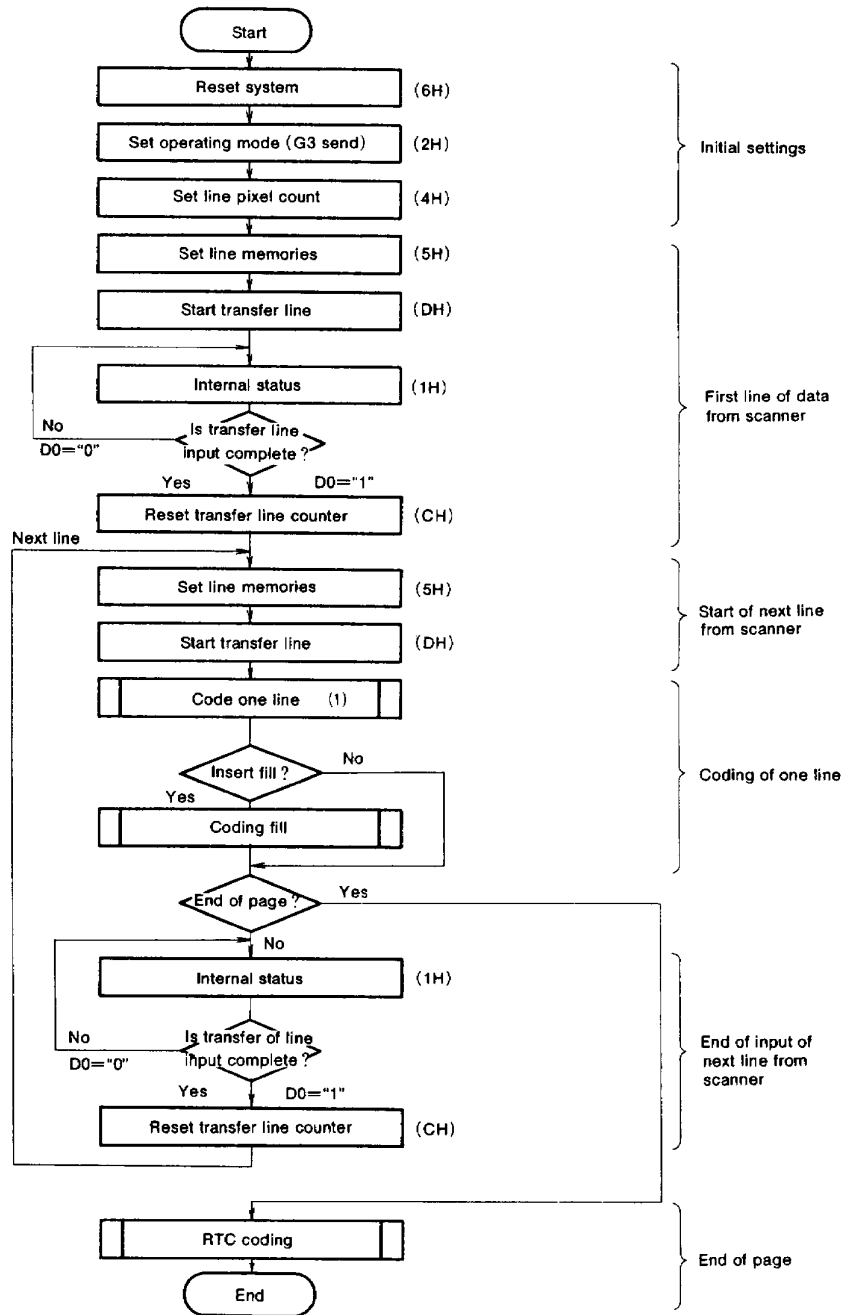


(\*)  $f_{ERCLK} = f_{X1}/4$  When using ERCLK output, connect the ERCLK output to the RCLK input.

BAND COMPRESSION AND EXPANSION CONTROLLER

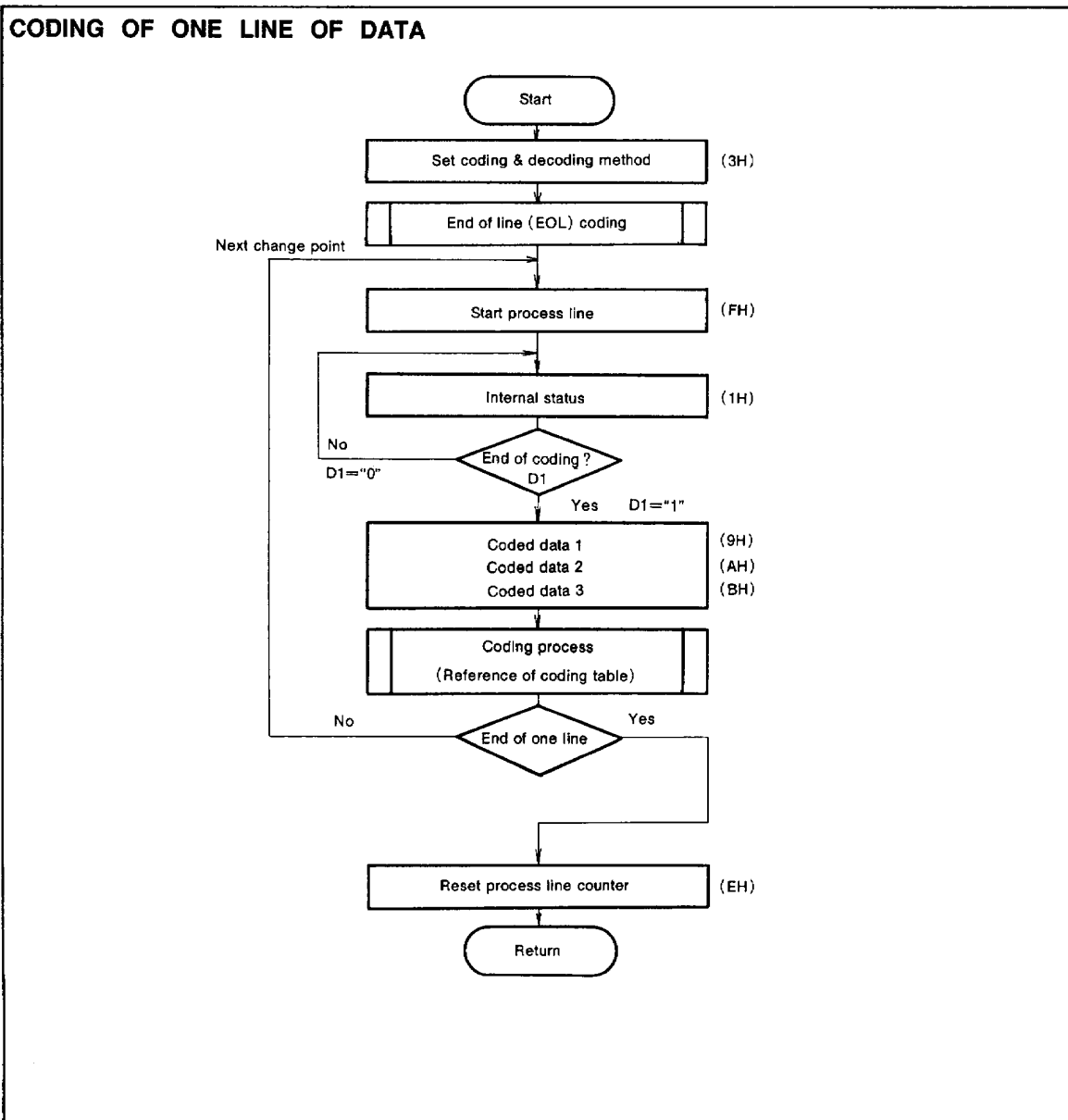
CODING AND DECODING SOFTWARE FLOW CHARTS

G3 SEND MODE

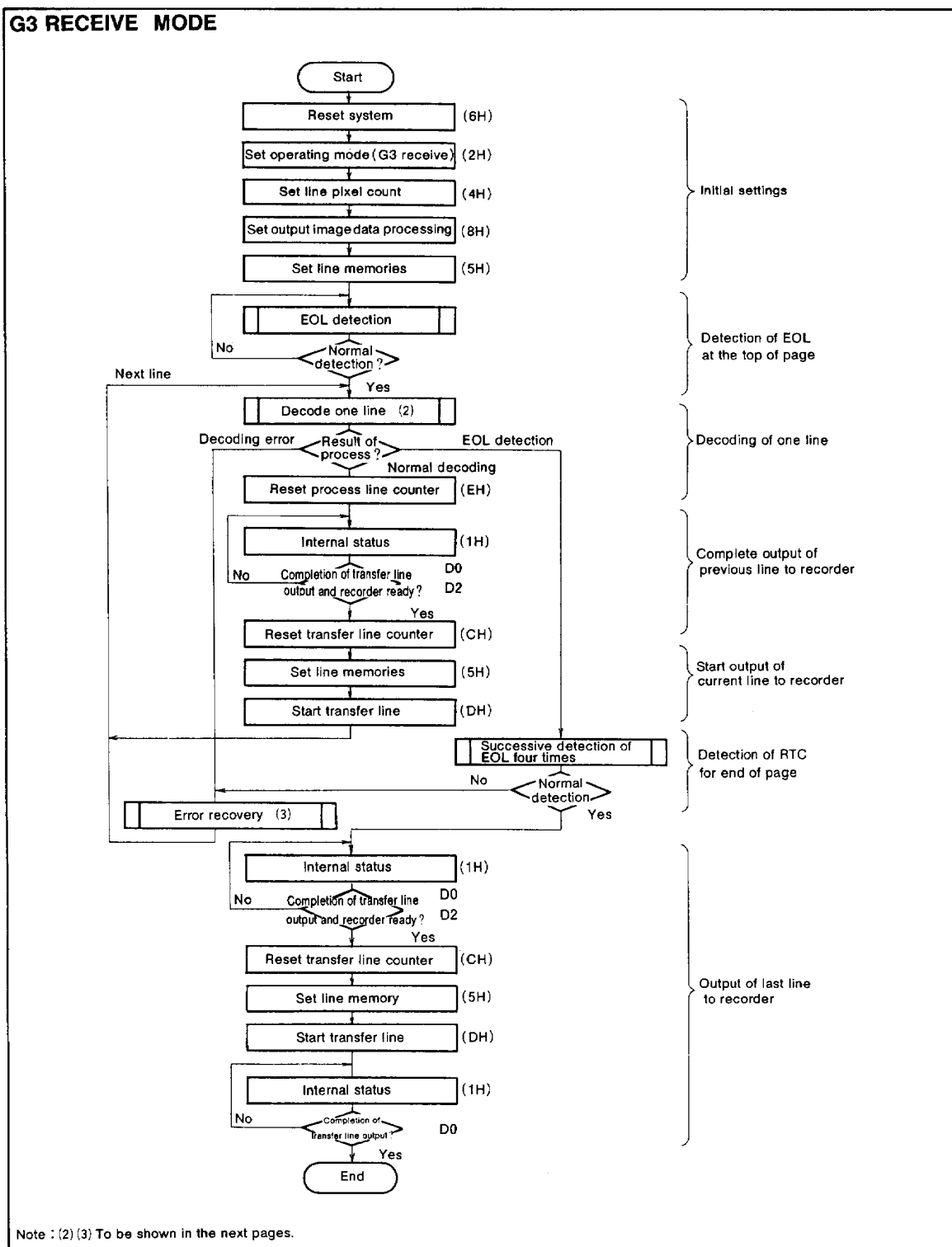


Note : (1) To be shown in the next page.

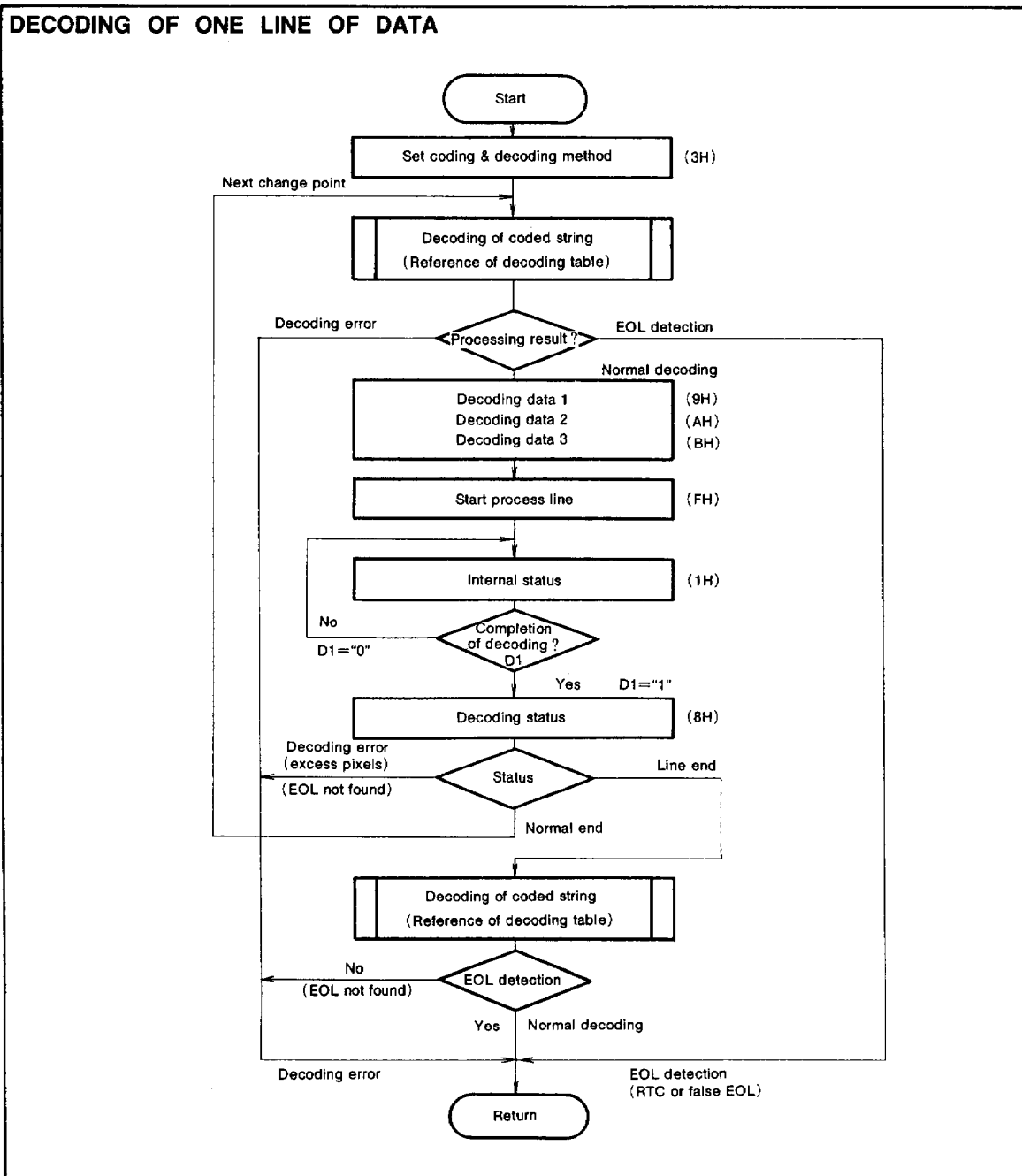
**BAND COMPRESSION AND EXPANSION CONTROLLER**



BAND COMPRESSION AND EXPANSION CONTROLLER

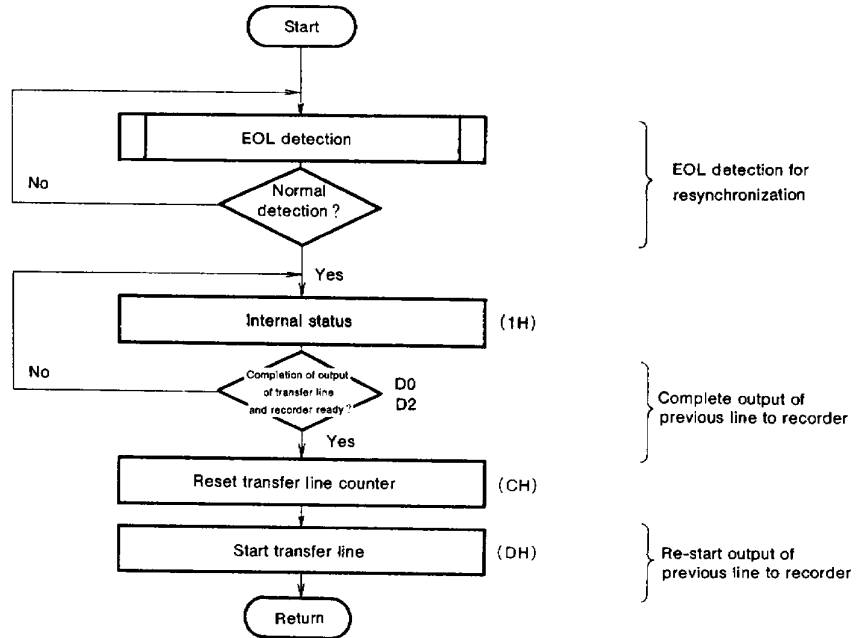


BAND COMPRESSION AND EXPANSION CONTROLLER



**BAND COMPRESSION AND EXPANSION CONTROLLER**

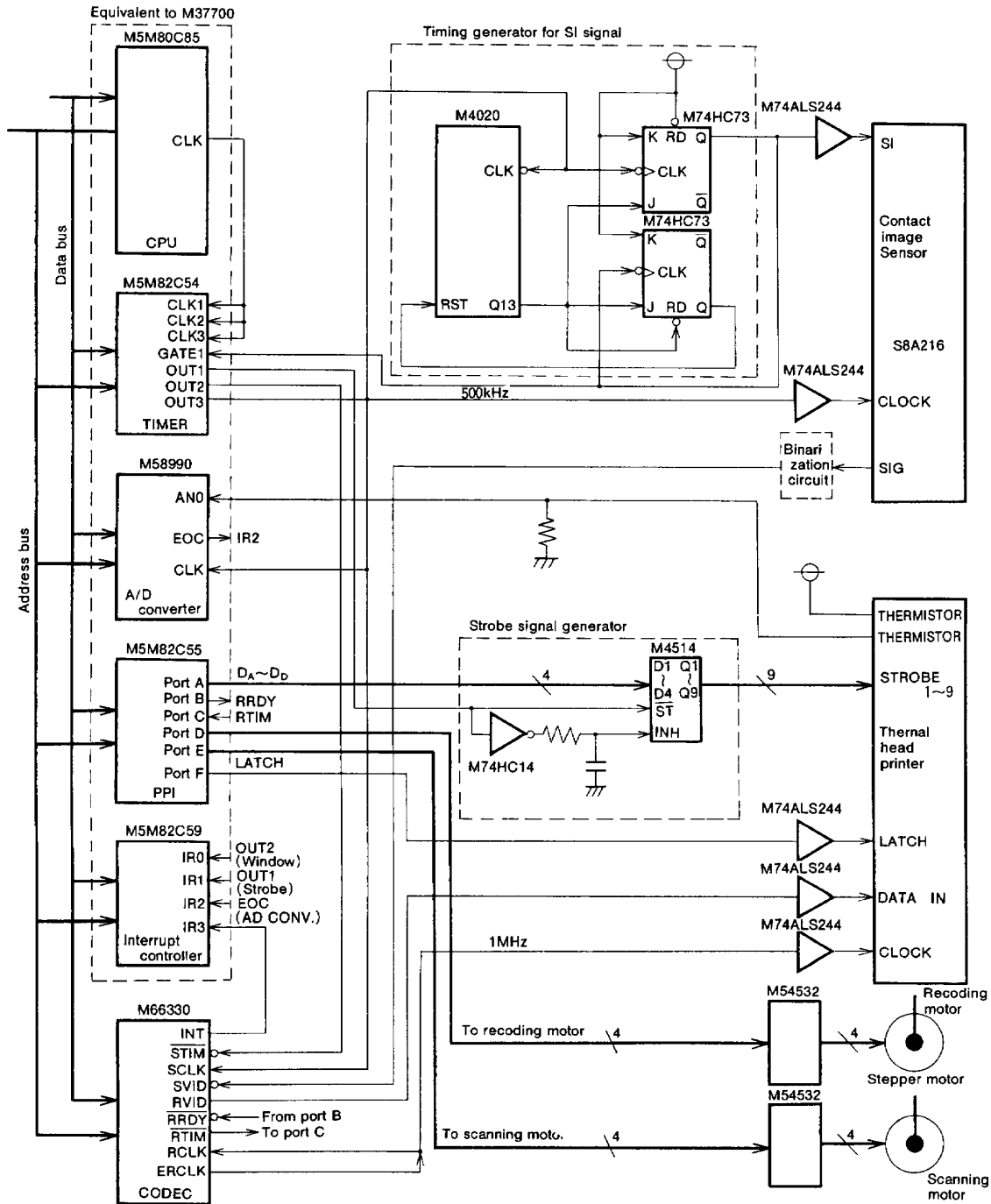
**ERROR RECOVERY**



Note : Error recovery method  
 The scanning line in which an error occurs is replaced by the data printed for the preceding line.

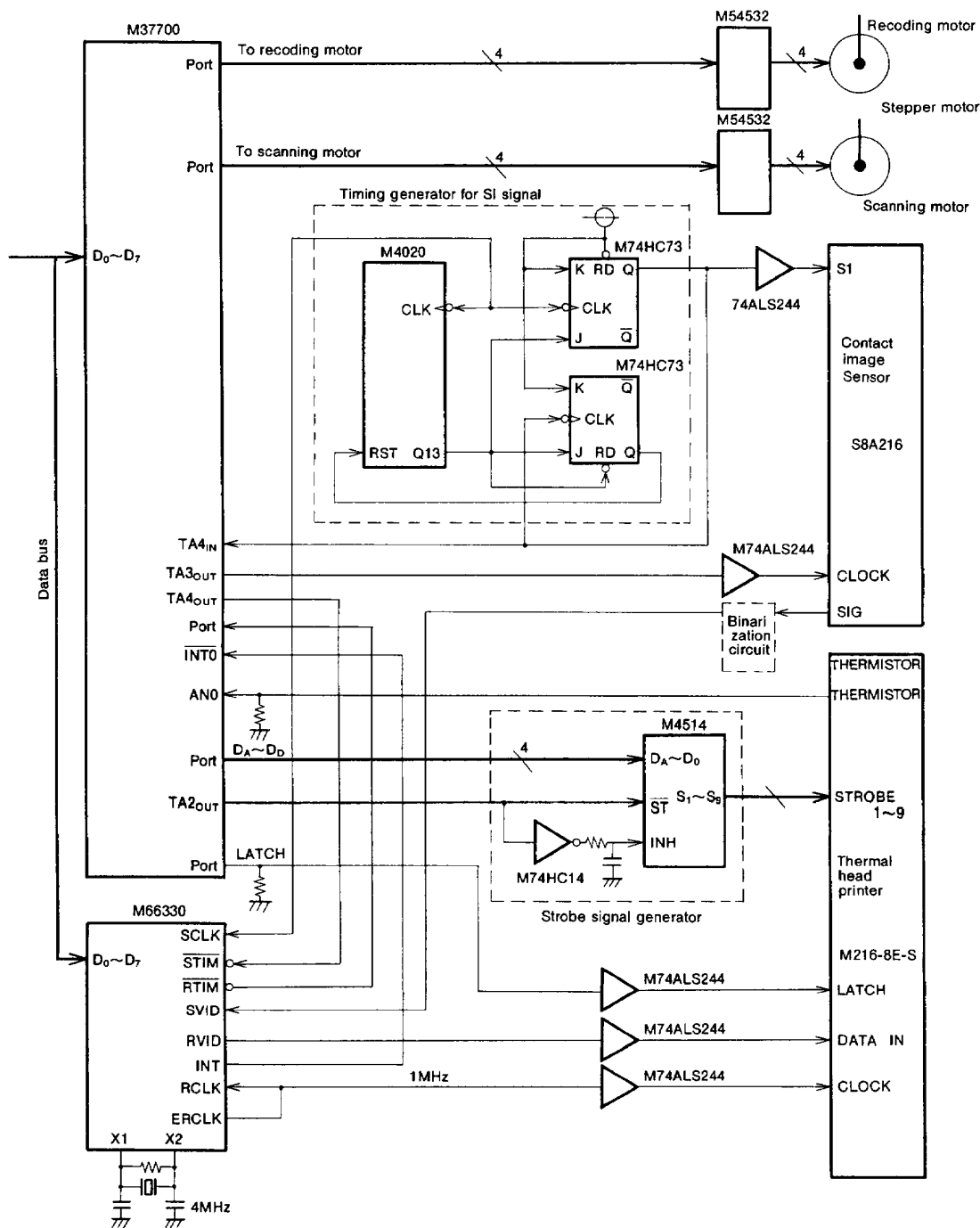
**BAND COMPRESSION AND EXPANSION CONTROLLER**

Example of FAX engine unit with M5M80C85 and M66330



**BAND COMPRESSION AND EXPANSION CONTROLLER**

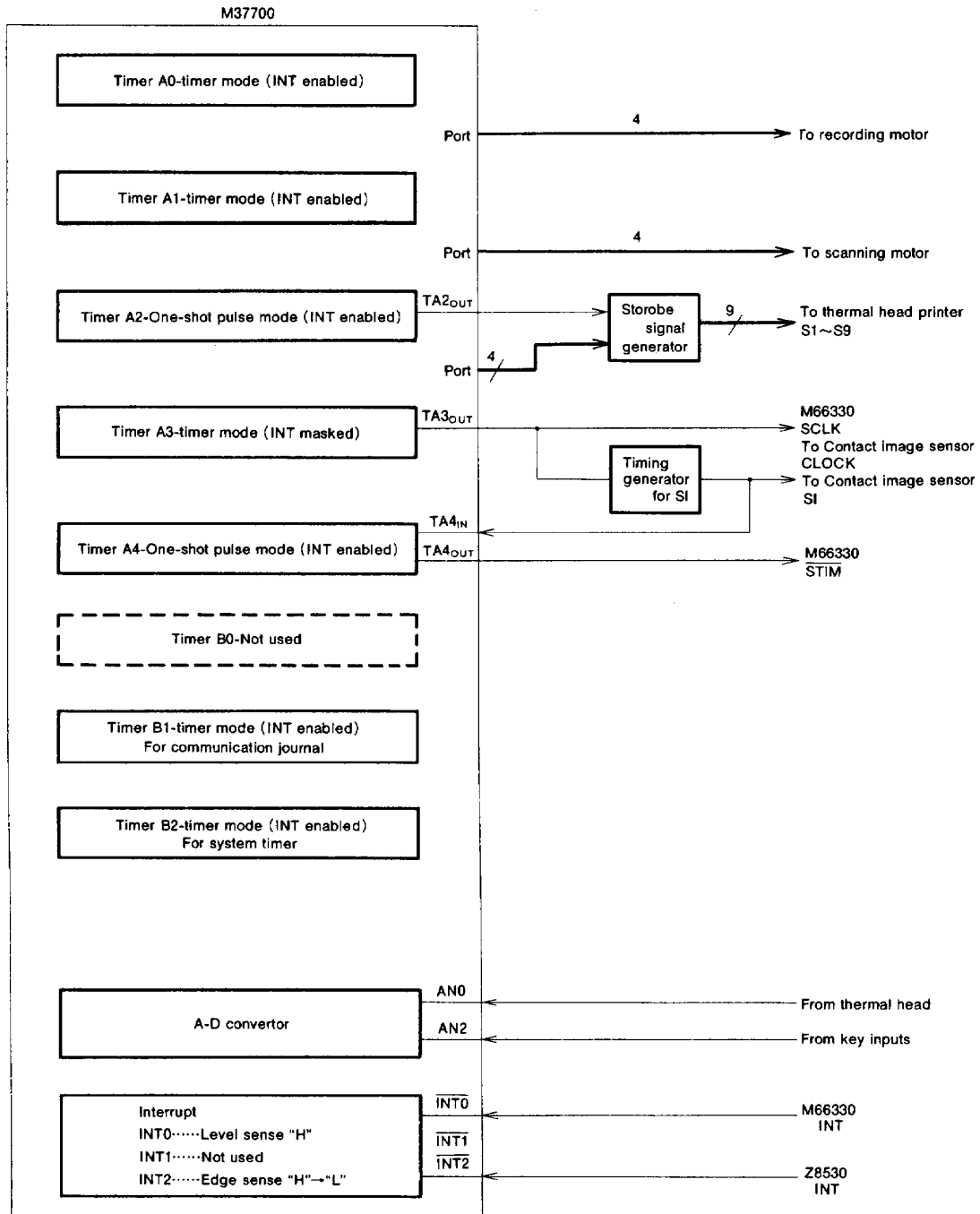
Example of FAX engine unit with M37700 and M66330





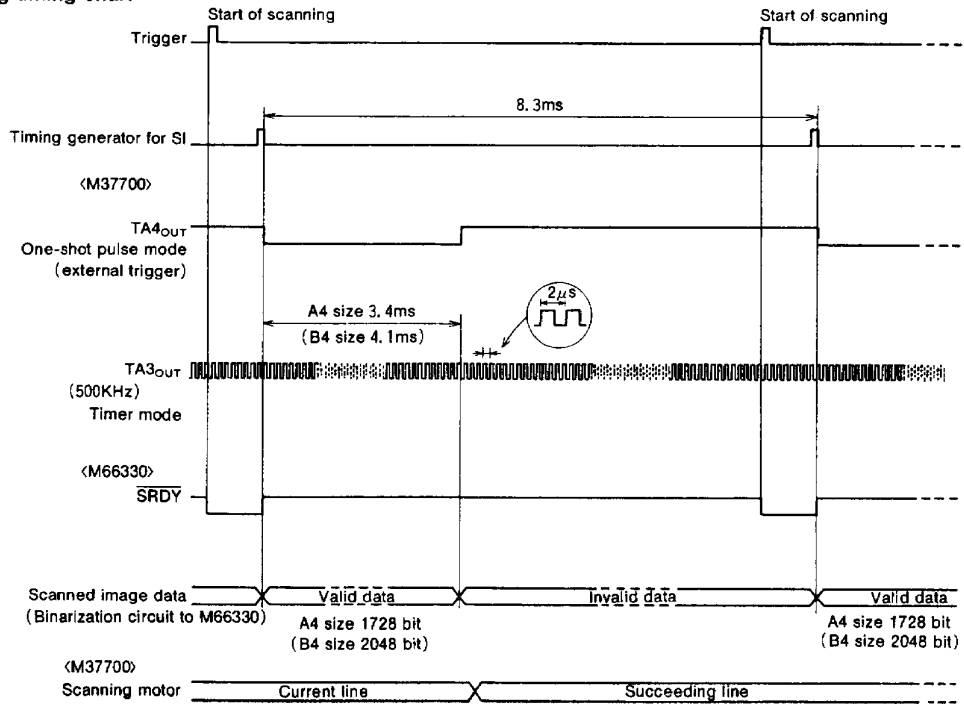
**BAND COMPRESSION AND EXPANSION CONTROLLER**

Example of M37700 functions

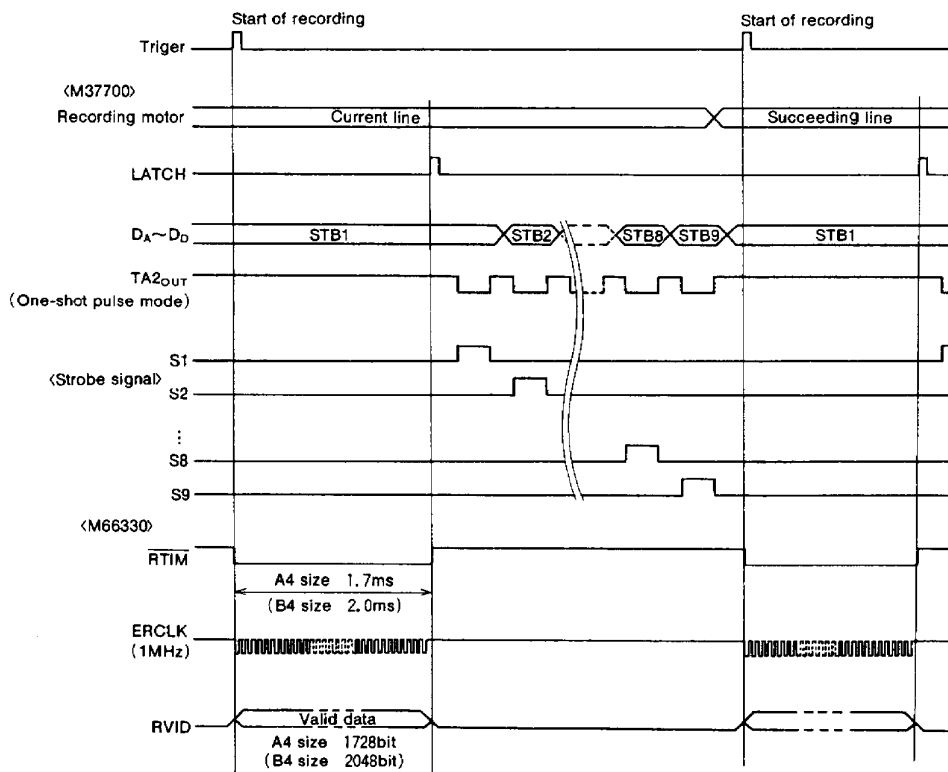


**BAND COMPRESSION AND EXPANSION CONTROLLER**

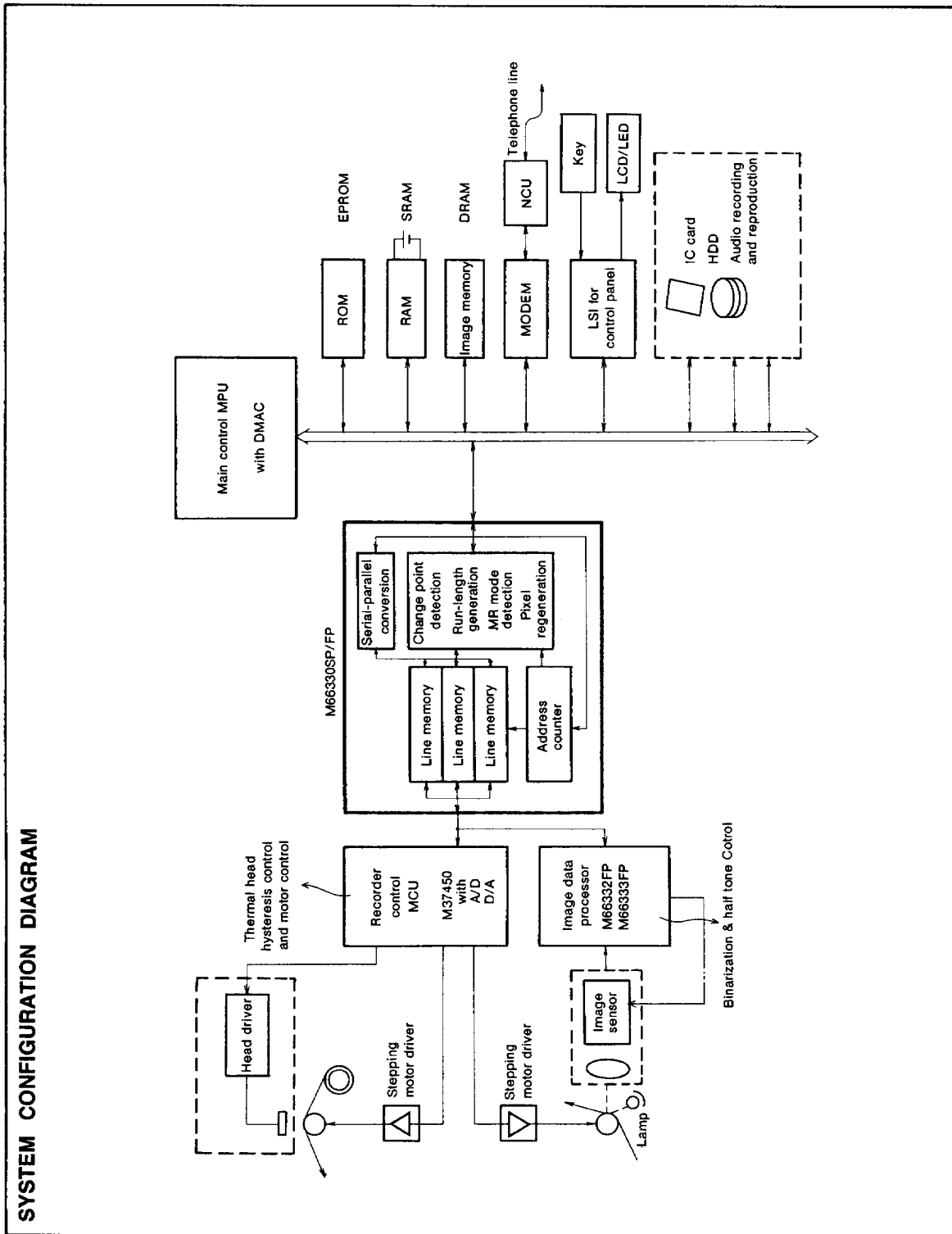
Scanning timing chart



Recording timing chart



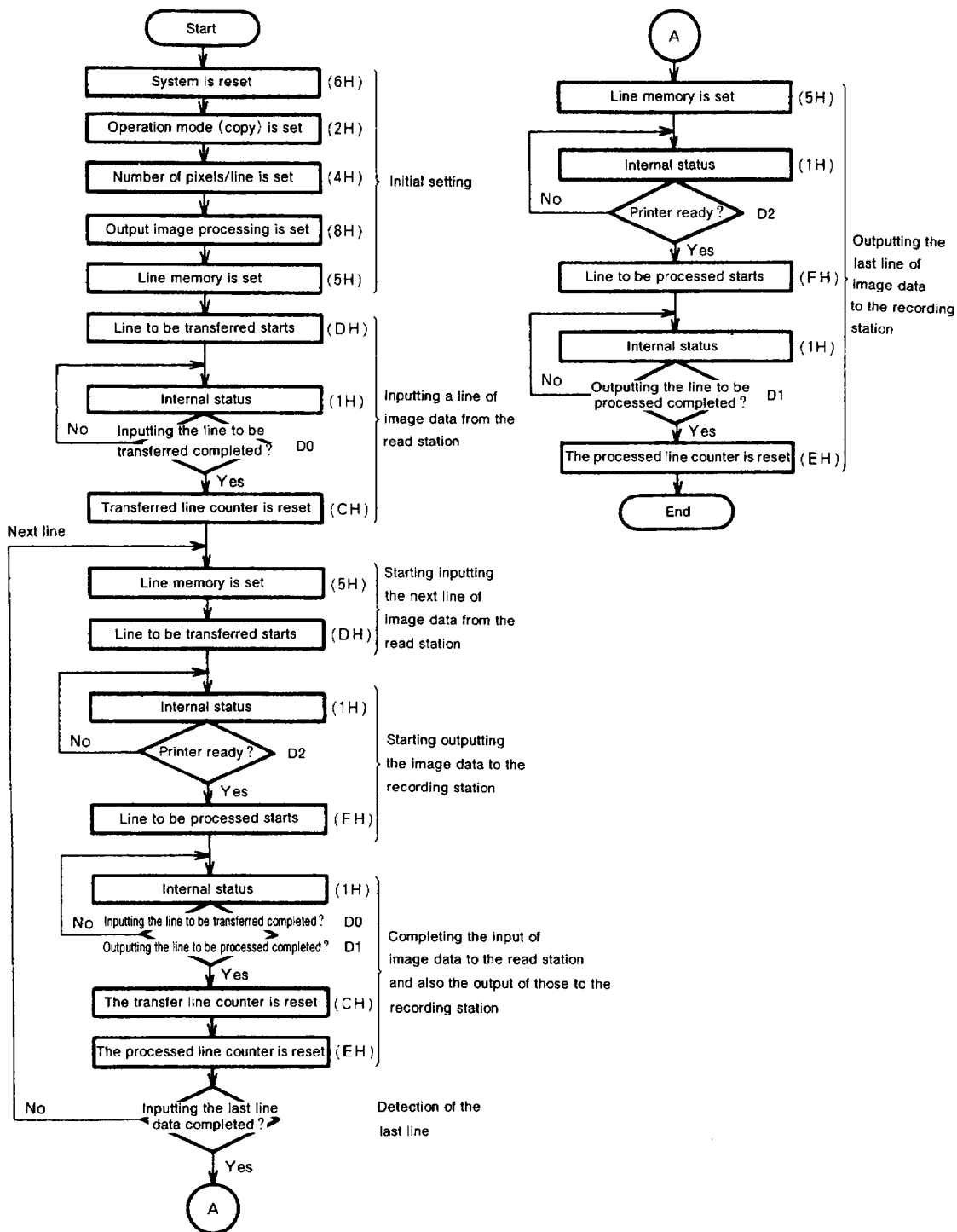
BAND COMPRESSION AND EXPANSION CONTROLLER



BAND COMPRESSION AND EXPANSION CONTROLLER

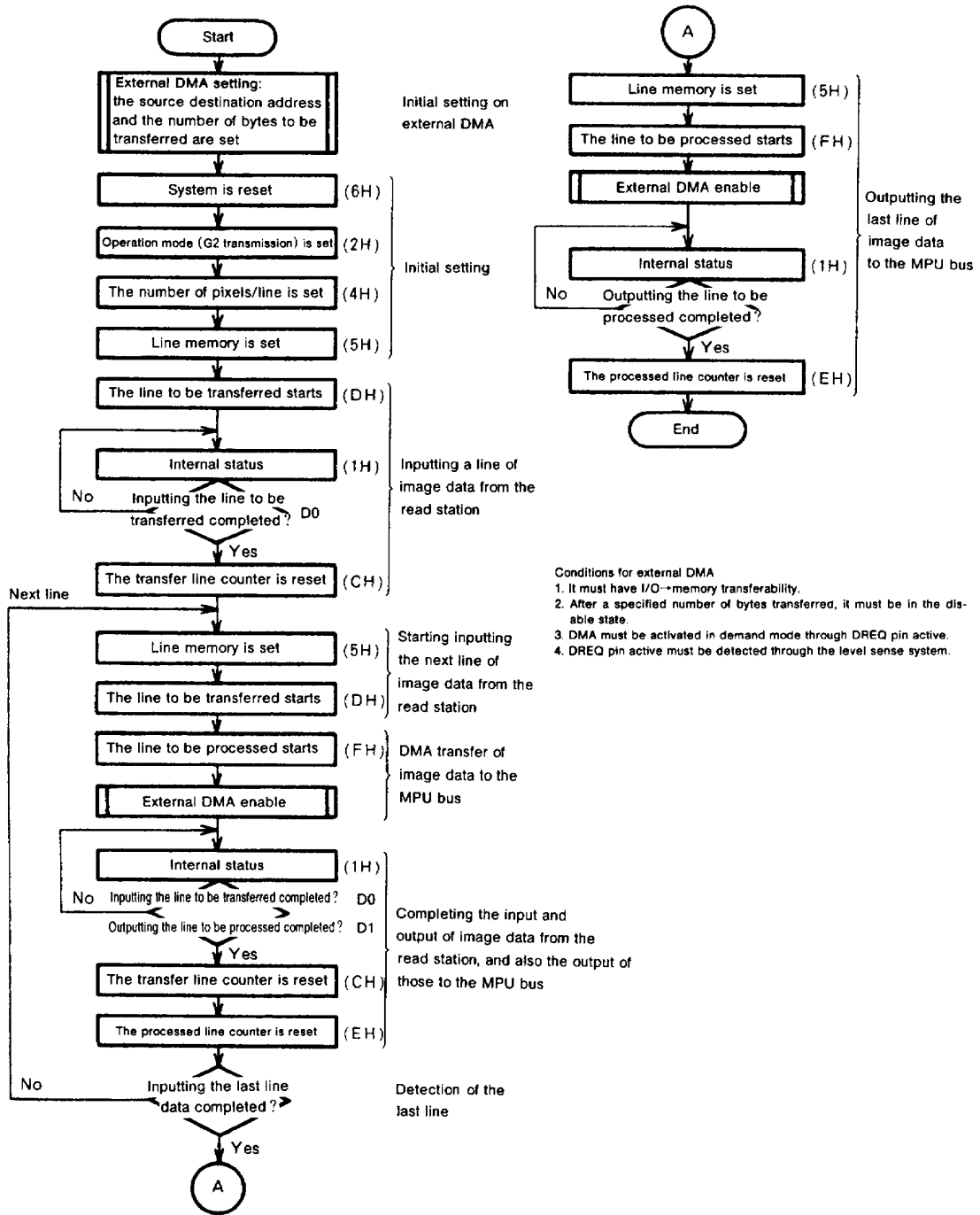
Flowcharts for Various Operations

(1) Copy mode



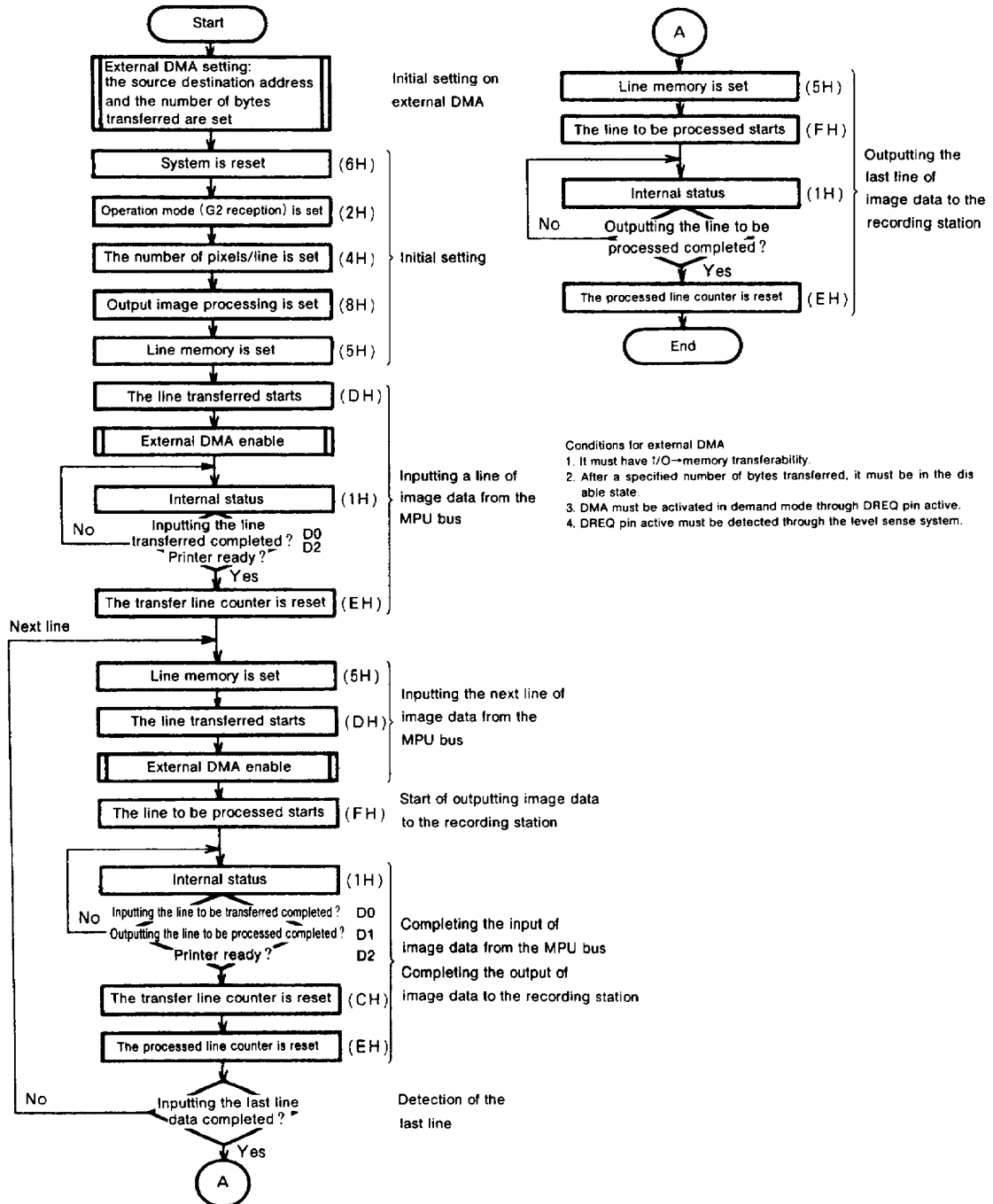
**BAND COMPRESSION AND EXPANSION CONTROLLER**

(2) G2 transmission mode (DMA transfer mode)



**BAND COMPRESSION AND EXPANSION CONTROLLER**

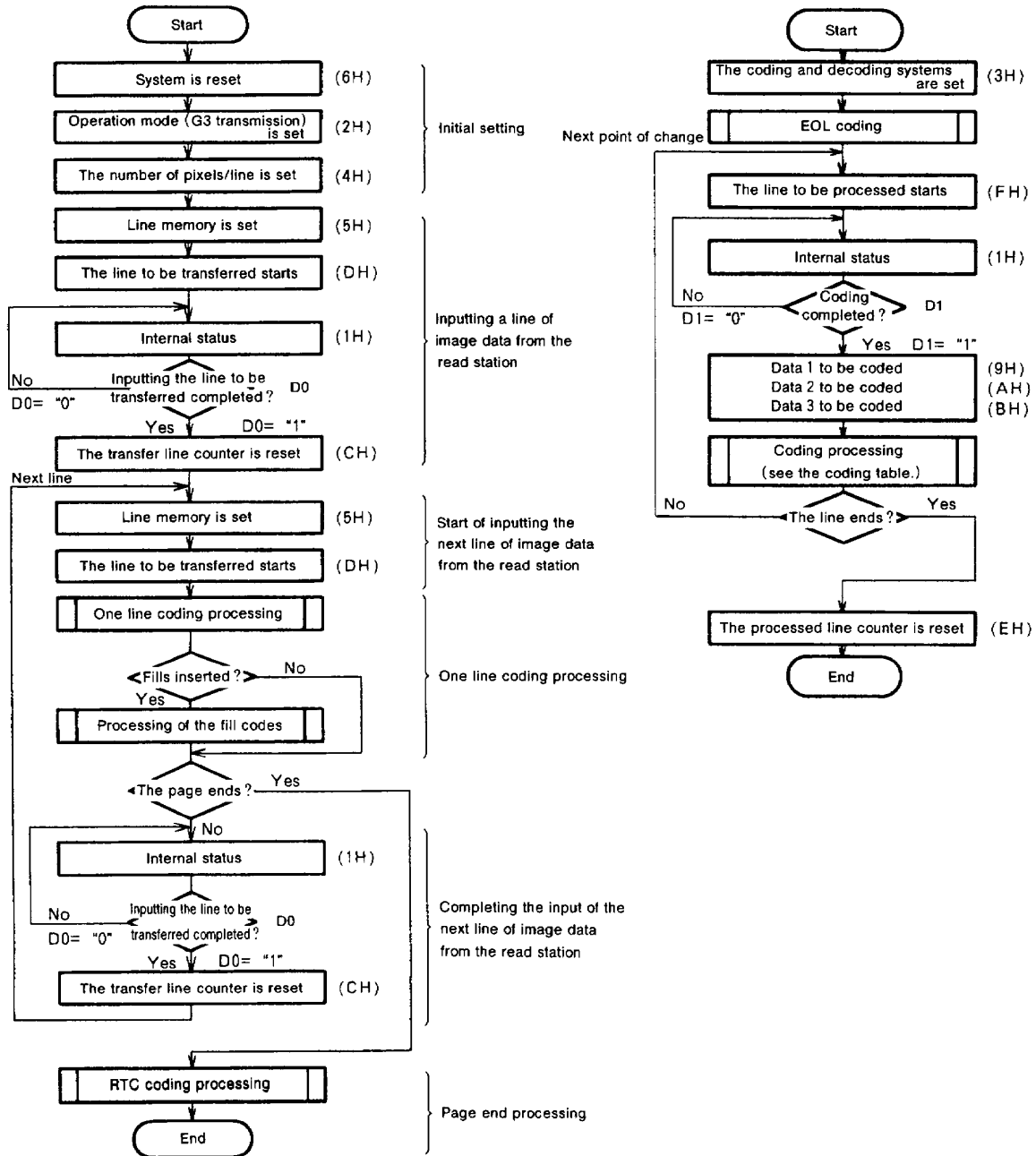
(3) G2 reception mode (journal recording) (DMA transfer mode)



BAND COMPRESSION AND EXPANSION CONTROLLER

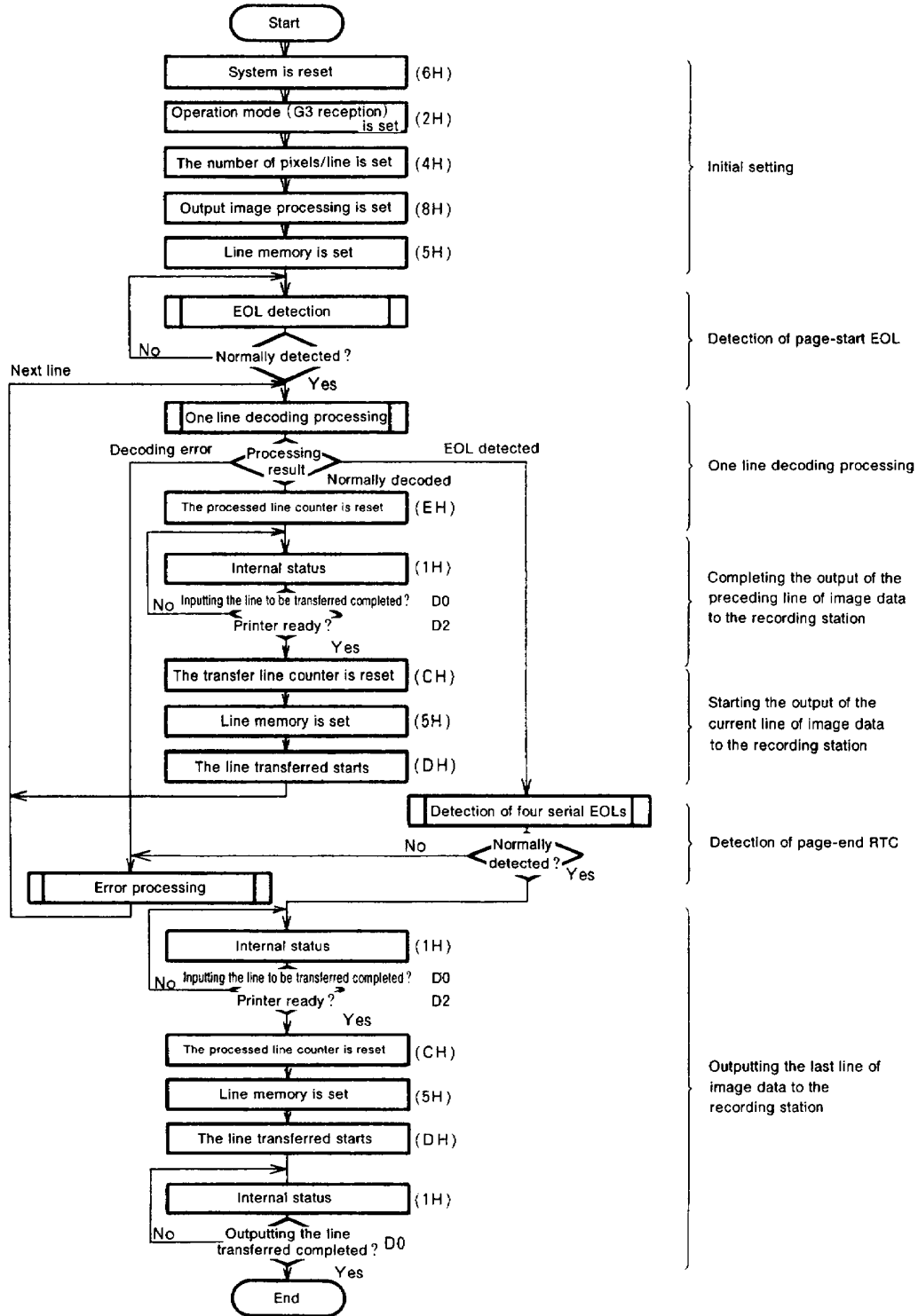
(4) G3 transmission mode

One line coding processing



BAND COMPRESSION AND EXPANSION CONTROLLER

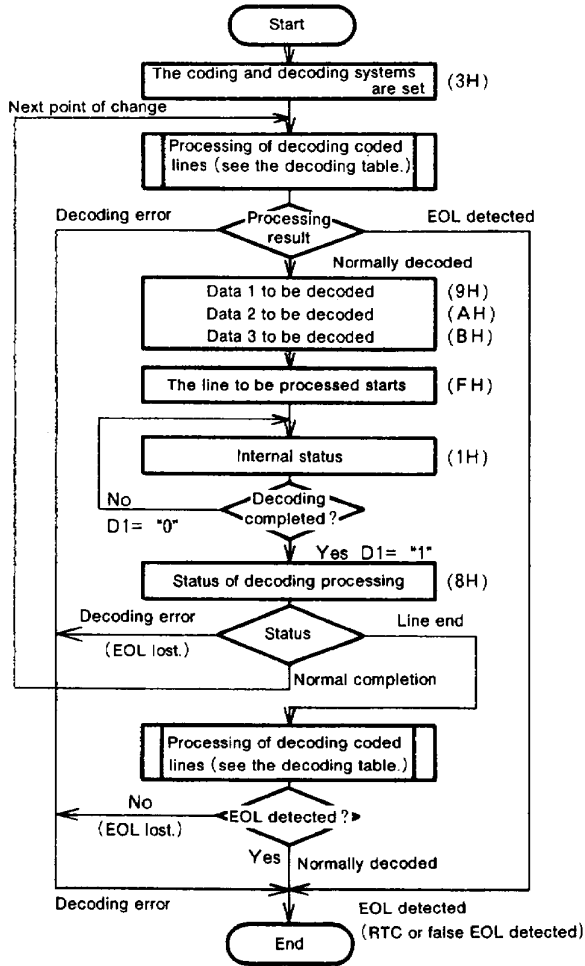
(5) G3 reception mode



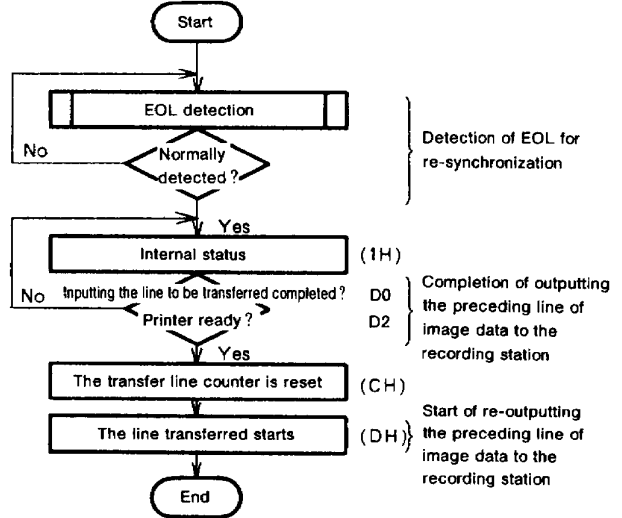


BAND COMPRESSION AND EXPANSION CONTROLLER

One line decoding processing



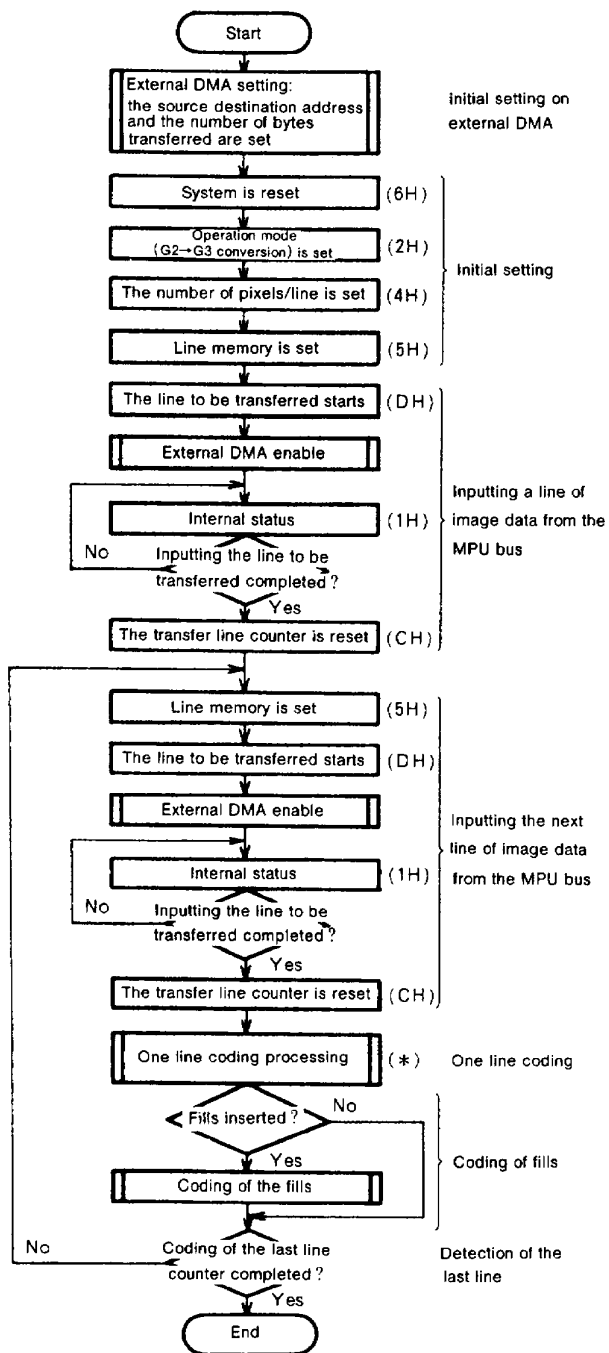
Error processing



Note : Error processing method  
The erred scan line is replaced with the data recorded on the scan line right above it.

**BAND COMPRESSION AND EXPANSION CONTROLLER**

(6) G2→G3 conversion mode (printing of the sender) (DMA transfer mode)

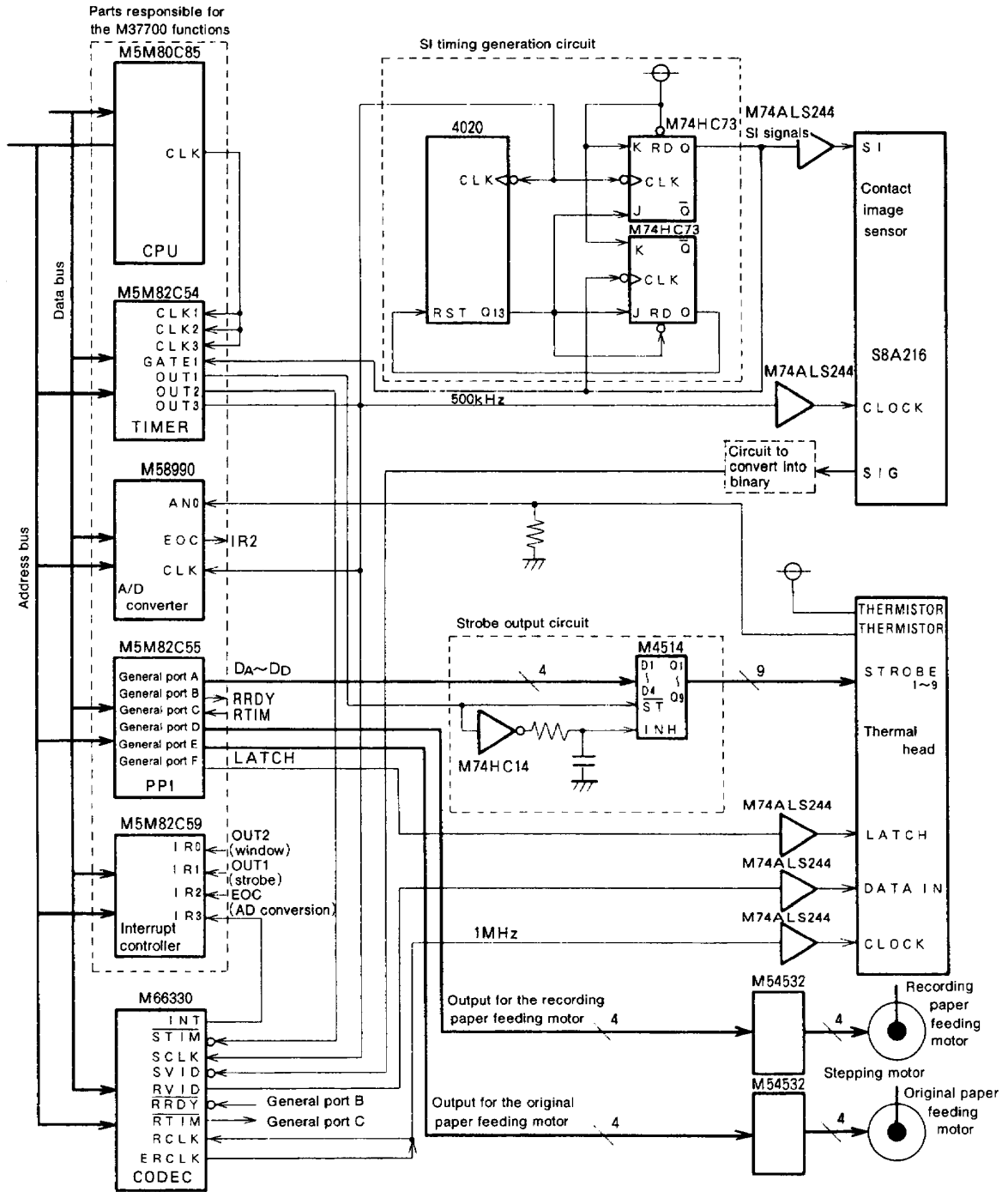


Conditions for external DMA

1. It must have I/O→memory transferability.
  2. After a specified number of bytes transferred, it must be in the disable state.
  3. DMA must be activated in demand mode through DREQ pin active.
  4. DREQ pin active must be detected through the level sense system.
- Note (\*): 4-80 pages  
See the flowchart "One line coding processing".

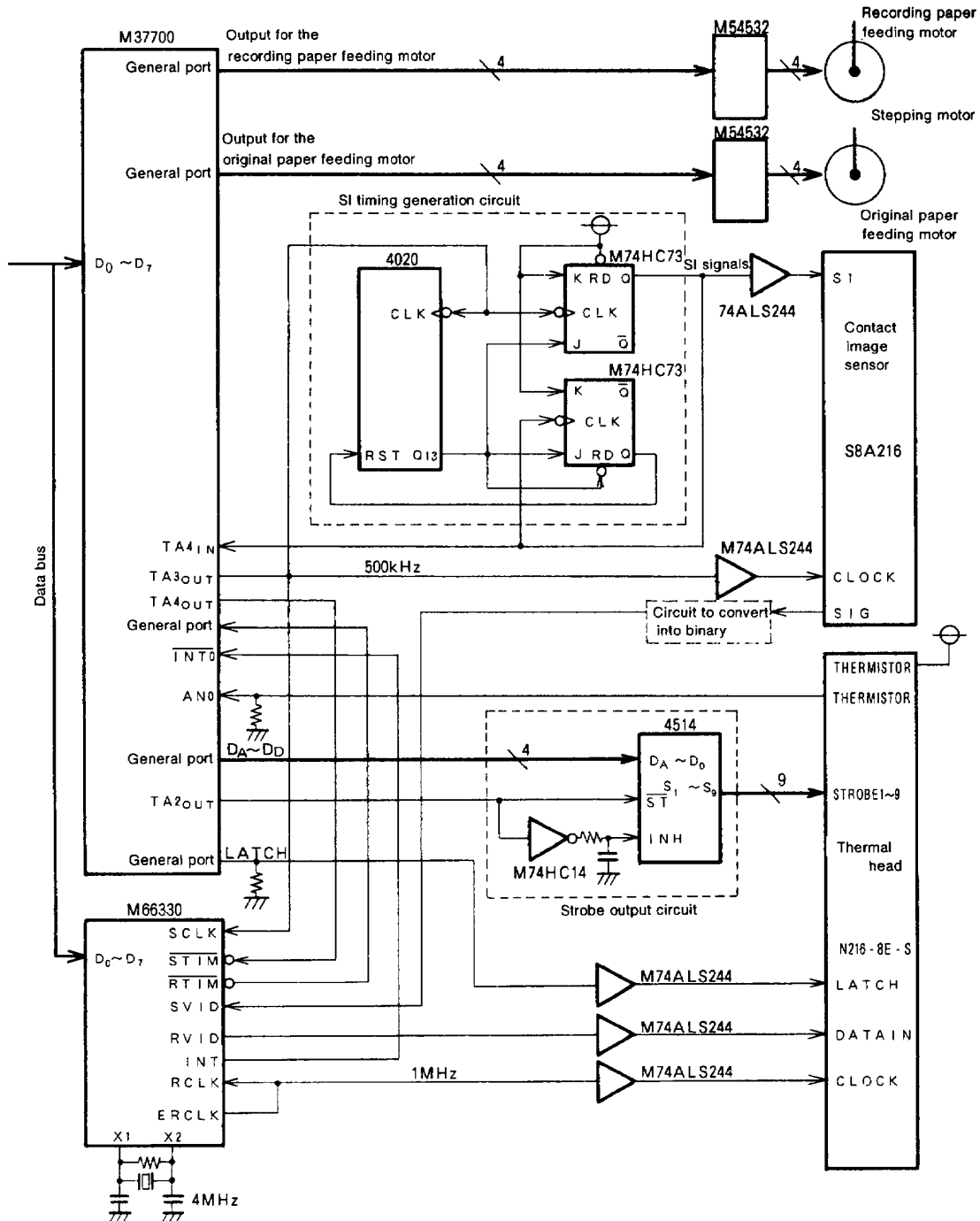
**BAND COMPRESSION AND EXPANSION CONTROLLER**

An example of the facsimile-engine part connection using M5M80C85 and M66330



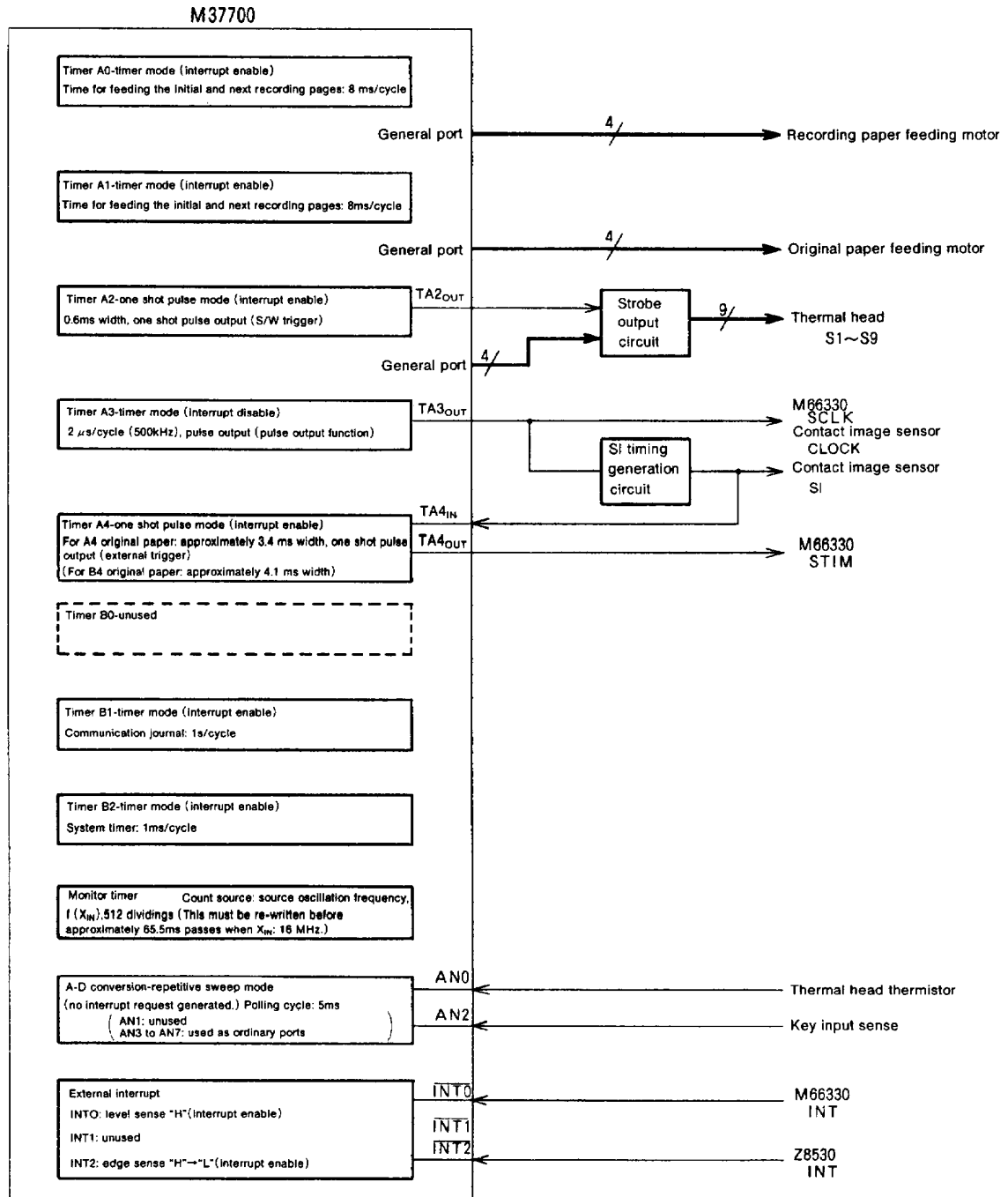
**BAND COMPRESSION AND EXPANSION CONTROLLER**

An example of the facsimile-engine part connection using M37700 and M66330



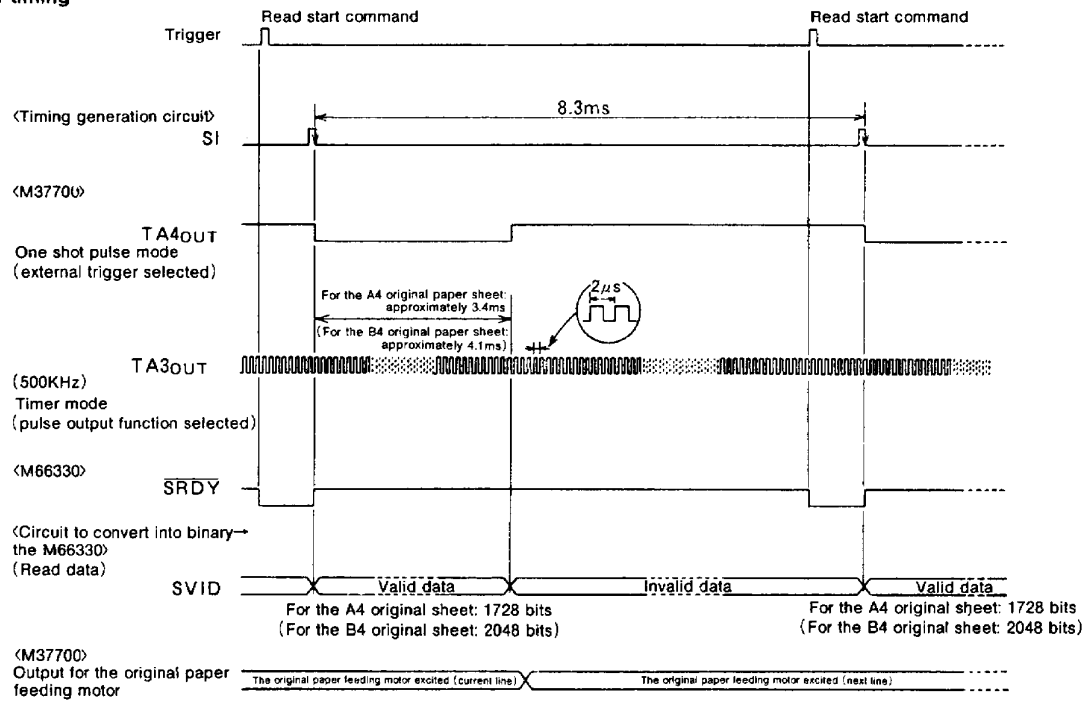
**BAND COMPRESSION AND EXPANSION CONTROLLER**

An example of applications of the M37700 functions



**BAND COMPRESSION AND EXPANSION CONTROLLER**

**Read timing**



**Printing timing**

