DR-3020

SERVICE MANUAL

REVISION 0

Canon

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CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

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Use of this manual should be strictly supervised to avoid disclosure of confidential information.

This Service Manual contains necessary basic information for after-sales service and maintenance of DR-3020.

Contents

Chapter 1: General description
Broad features, specifications, name of each unit, and operation

Chapter 2: Basic description
Outline on principle of image processing

Chapter 3: Outline of operation
Description of the principle of operation of the electrical and mechanical systems, their functions, and timing of operations

Chapter 4: Mechanical System
Description of the mechanical system, its disassembly, assembly, and adjustment

Chapter 5: Installation
Location and installation procedure

Chapter 6: Maintenance and servicing
Parts requiring periodic replacement, consumable parts, and periodic servicing

Chapter 7: Troubleshooting
Troubleshooting and service modes

Appendix: General circuit diagram
Information in this manual is subject to change. Notification of such changes will be given in Service Information Bulletins.

The information contained in the Service manual, and the Service Information Bulletins is essential to proper maintenance of the canofile.

Quality Assurance Center
Canon Electronics Inc.

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

CONTENTS

CHAPTER 1 GENERAL DESCRIPTION

CHAPTER 2 BASIC DESCRIPTION

CHAPTER 3 OUTLINE OF OPERATION

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

CHAPTER 4 MECHANICAL SYSTEM

CHAPTER 5 INSTALLATION

CHAPTER 6 MAINTENANCE AND SERVICING

CHAPTER 7 TROUBLESHOOTING

APPENDIX

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

CHAPTER 1

GENERAL DESCRIPTION

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I. FEATURES

1. High speed input

A4 size documents: approx. 40 sheets/minute (300 dpi X 150 lpi: single side)

2. Simultaneous front/back recording capability

For simultaneous front/back scanning of document, for instance a check, it is possible only by setting the document once.

3. Automatic separation adjustment function

Documents can be picked up one by one by the automatic paper thickness adjustment/separation mechanism.

Windows is a registered trade mark of Microsoft in the U.S. and other countries.

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II. SPECIFICATIONS

A. Main body

Model
Main body : Desk top

B. Paper feed assembly

Method
Paper feed : • Automatic paper feed by auto-feeder
• Manual feed (sheet by sheet)
Feed direction : A4R direction
Function
Document size :
• Auto-feed
Width : 55 mm - 257 mm
Length : 70 mm - 364 mm
Thickness : 0.06 mm - 0.15 mm
• Manual feed
Width : 55 mm - 257 mm
Length : 70 mm - 364 mm
Thickness : 0.05 mm - 0.20 mm
Read Area
Width : 254 mm
Length : 364 mm
Document requirements
- The back carbon paper cannot be used.
- Pressure sensitive paper cannot be used.
- Those with perforations for binding can be used (round perforations only).

Separation adjustment : Automatic separation
Paper storage : Height 10 mm (approx. 100 sheets of 80 g/m²)
Feed speed : High speed 241.9 mm/sec (300 dpi in horizontal scanning/ 150 lpi in vertical scanning)
Medium speed 181.4 mm/sec (200 dpi in horizontal scanning/ 200 lpi in vertical scanning)
Low speed 121.0 mm/sec (300 dpi in horizontal scanning/ 300 lpi in vertical scanning)

C. Scanner

Method
Scanning : Movement of document
Image scanning : Photosensitive device (BASIS)
Light source : LED array (yellow green, peak emission wave length: 570 nm)
Function
Scan resolution : 300 dpi/200 dpi in horizontal scanning
300 lpi/200 lpi/150 lpi in vertical scanning
Slice level : Changeable
Scanner mode : Binary in character mode
Error dispersion in photograph mode

D. Delivery assembly

Method
Delivery : Face down
Function
Tray : Movable tray
Tray storage : Approx. 100 sheets of 80 g/m²

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E. Image processing section

Image processing : • γ compensation
• Edge emphasis
• Compensation for shading
• Dust picture element erase
• Error diffusion
• Decode

Decoding image: • MH
• MR
• MMR
• Not decoded

F. Others

Interface : SCSI
Electricals : 100 V 50/60 Hz
120 V 50/60 Hz
220 - 240 V 50/60 Hz
Max. power consumption : 65 W
Dimensions : With pick-up/delivery tray closed
362 mm wide
336 mm deep
196 mm high
With pick-up/delivery tray open
362 mm wide
596 mm deep
196 mm high
Weight : Approx. 10 kg (22.0 lb)

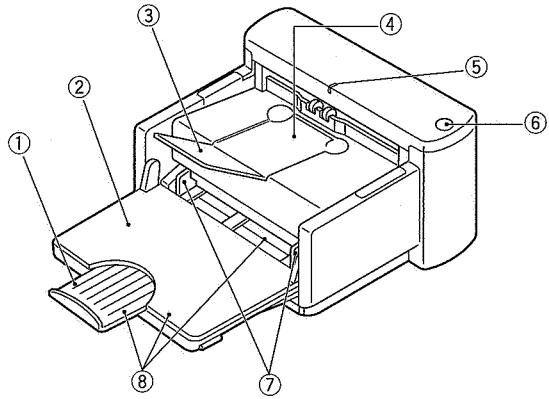
Environment
Temperature: 10 - 32.5°C(50 - 90.5°F)
Humidity : 20 - 80%RH

These specifications are subject to change without notice for improvement of the machine.

III. PARTS OF THE DR-3020

A. Appearance

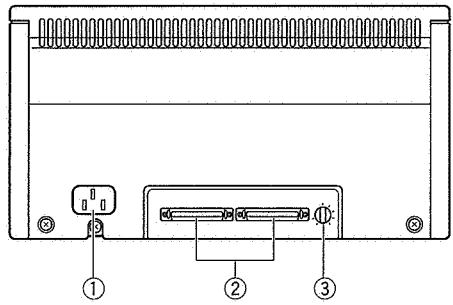
1. Front view



① Pick-up tray guide
② Pick-up tray
③ Document delivery tray guide
④ Document delivery tray
⑤ Power indicator
⑥ Power switch
⑦ Document guide
⑧ Document board

Figure 1-1

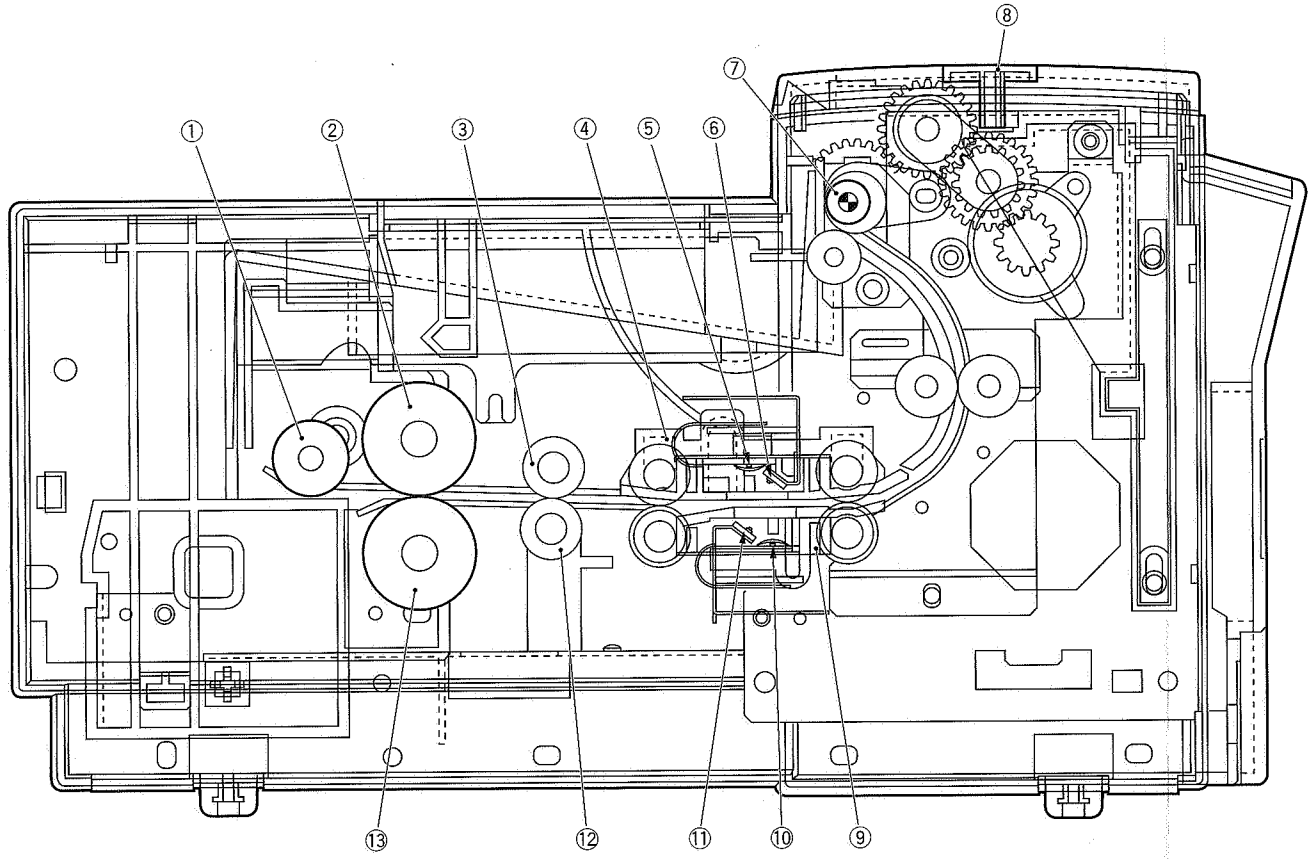
2 Rear view



① Inlet
② SCSI interface connectors
③ SCSI ID switch

Figure 1-2

B. Sectional view



① Pick-up roller
② Feed roller
③ Registration roller
④ Front scanner unit
⑤ Front BASIS
⑥ Front LED array
⑦ Delivery roller
⑧ Power switch
⑨ Back scanner unit
⑩ Back BASIS
⑪ Back LED array
⑫ Registration roller
⑬ Separation roller

Figure 1-3

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IV. DESCRIPTION OF OPERATION

A. Basic Operation

The following are the basic operation of this machine.

1. Turn the power to the peripheral devices (including this machine) on.
2. Turn the power to the personal computer on.
3. Open the pick-up tray.
4. Open the delivery tray.
5. Initiate the application software.
6. Place a document onto the pick-up tray.
7. Execute the operations.
   Execute all the necessary operations in accordance with the operation sequence.
8. End of operation
9. End of application software
10. Turn the power to the personal computer off.
11. Turn the power to the peripheral devices (including this machine) off.

B. Setting the document

a. Open the pick-up tray.

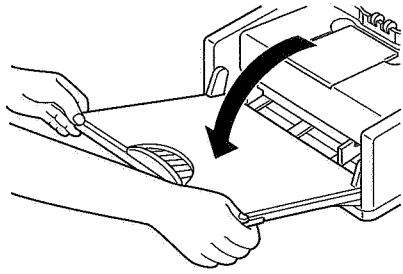

Figure 1-4

b. Pull the pick-up tray guide out.

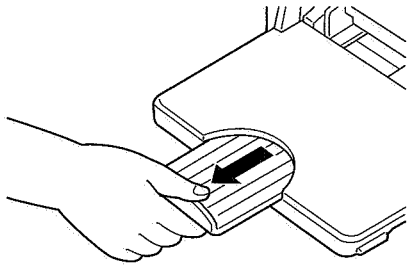

Figure 1-5

c. Open the delivery tray guide.

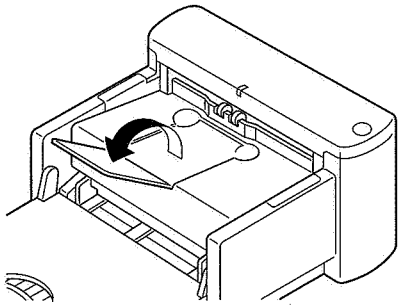

Figure 1-6

d. Set the document guide according to the width of the document.

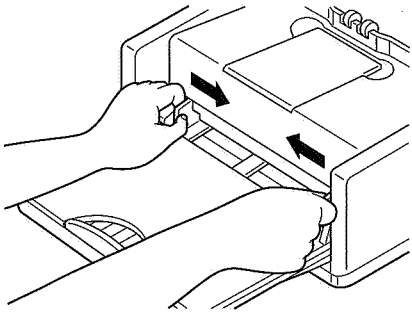

Figure 1-7

e. Set the document onto the pick-up tray.

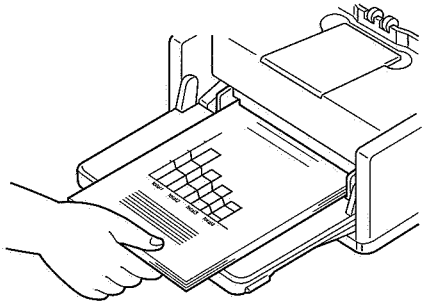

Figure 1-8

f. Set the document guide for the document again.

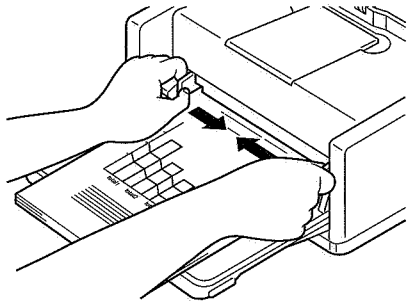

Figure 1-9

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V. PAPER JAM ALARM

If the documents jam in the machine during document scanning, take corrective action in accordance with the following procedure.

a. Remove the documents on the delivery tray, and remove the delivery auxiliary guide, if mounted.

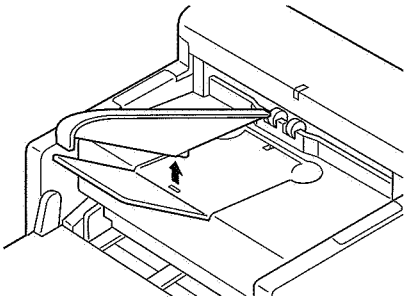

Figure 1-10

b. Close the delivery tray guide.

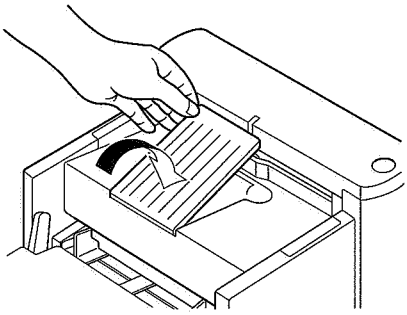

Figure 1-11

c. Open the delivery assembly.

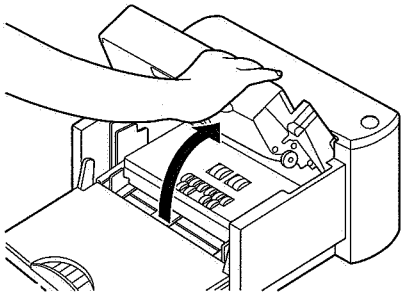

Figure 1-12

d. Remove the jammed document.

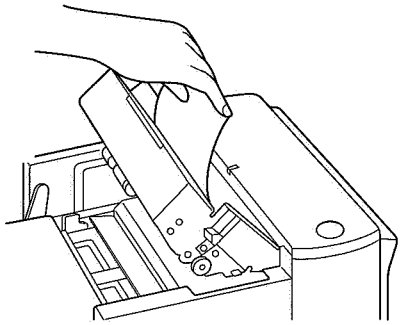

Figure 1-13

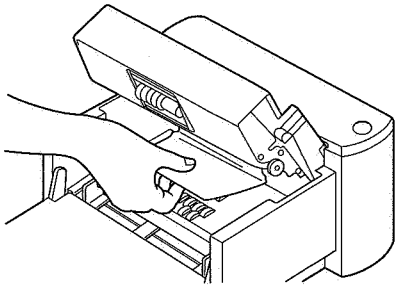

Figure 1-14

e. Close the delivery assembly.

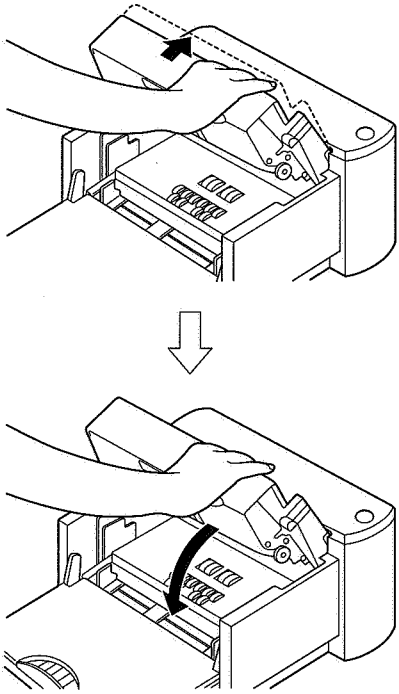

Figure 1-15

VI. REGULAR INSPECTION BY USERS

A. Cleaning

Instruct the user clearly to clean the following items at least once a week.

1. Document feeder assembly
   - Read glass
     Wipe the read glass with a clean soft cloth.
   - Pick-up roller
     Wipe the pick-up roller with a wet cloth before dry-wiping.
   - Registration roller
     Wipe the registration roller with a wet cloth before dry-wiping.
   - Feed roller
     Wipe the feed roller with a wet cloth before dry-wiping.
   - Separation roller
     Wipe the separation roller with a wet cloth before dry-wiping.

Note: Clean each roller, rotating it in the feed direction.

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CHAPTER 2

BASIC DESCRIPTION

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I. OUTLINE

1. Outline

Figure 2-1 shows the main component parts of the scanner assembly.

The front and back of a document are illuminated by two, upper and lower, LED arrays. The reflected light is detected by a photosensitive device and converted into electrical signals. (This process is called photo-electric conversion.)

During this process, the image of the document is broken down into picture elements by the photosensitive device, and the electrical signals, which correspond to the density of each picture element, are processed in the image processor, and then sent to the Personal Computer.

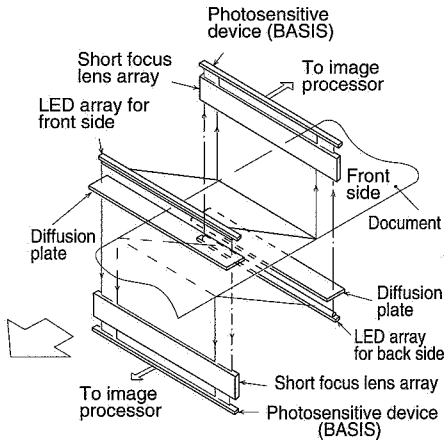

Figure 2-1

2. Photo-electric Conversion

The process of converting light into electricity, which is shown in Figure. 2-1, is called photo-electric conversion, and the device used for photo-electric conversion is called a "photo-electric conversion device".

The photo-electric conversion device used in this machine is a BASIS (Base Stored Image Sensor).

3. BASIS

A BASIS is a single chip photo-electric conversion device which consists of several thousand photosensitive elements of several tens of microns square arranged in a row, combined with a circuit which provides the scanning function.

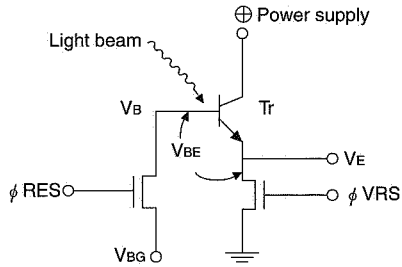

Figure 2-2

Figure 2-2 shows the equivalent circuit of BASIS consisting of one photosensitive device (single picture element).

Figure 2-3 shows the timing of BASIS and Figure 2-4, the internal operation of BASIS.

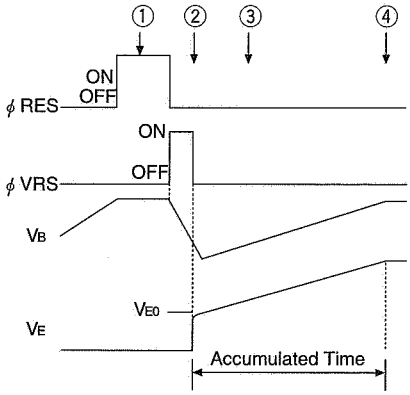

Figure 2-3

Reset signal (H) is input in ø RES terminal and V_B terminal is made the same potential as V_{BG}. ①

After making ø RES terminal "L" øVRS terminal is made "H" and V_E is reset.

At this point, if light is irradiated on i layer shown in Figure 2-4, i layer will act to transmit the light. Therefore, the p layer electrons are sent to n1 layer and flow to the ⊕ power supply. And, the base voltage V_B gradually becomes higher. ②

When n2 (emitter) electrons move to p layer, the emitter voltage V_E is $V_E=V_B-V_{BE}$ and is accumulated in the base capacity. ③

Then when the maximum value of all bits of the line sensor reaches a certain level, accumulation is ended. Voltage to the amount of light irradiation becomes $V_E=V_{EO}$.

As described in the foregoing, the scanning of the accumulated image data is scanned successively after being amplified for each bit.

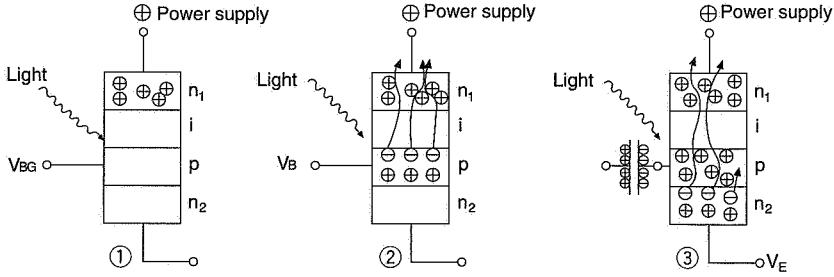

Figure 2-4

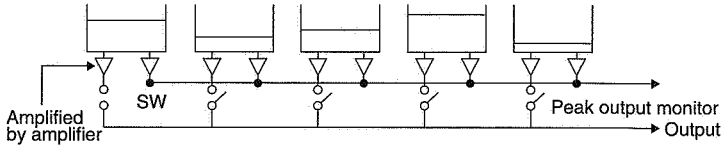

Figure 2-5

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The switch (SW) in Figure 2-5 is equivalent to the shutter of a camera. Opening and closing speed of the switch (equivalent to the shutter speed of a camera) determines the vertical scanning line density.

Normally, the opening and closing speed of the switch (SW) is electrically controlled in such a way that the vertical scanning line density is the same as the horizontal scanning line density (determined by the size of the photosensitive elements).

In this way, the image of the document is broken up into picture elements of several tens of microns square.

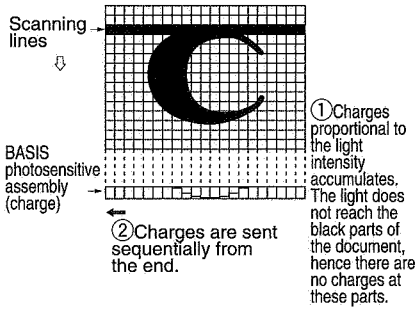


Figure 2-6

4. Picture Elements

During an actual scanning operation, a single scanning line is sub-divided into finer elements.

These elements constitute the building blocks of the image, hence are called 'picture elements' (also 'pixels' or 'pels').

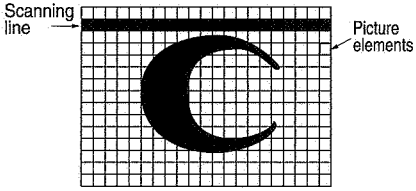
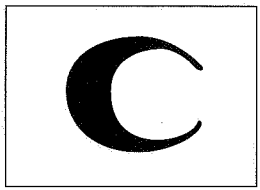


Figure 2-7

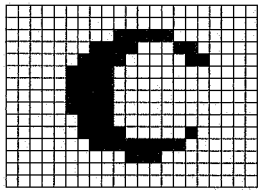
Each square shown in Figure 2-7 is called a picture element.

The smaller a picture element is, the more faithful the reproduction of the image of the document will be.



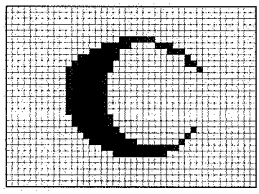
Document

Figure 2-8



For larger picture element

Figure 2-9



For smaller picture element

Figure 2-10

From the foregoing, it can be seen that the smaller the picture elements are, the better the resolution is.

Resolution is expressed in scanning line density. The unit of resolution is dots/25.4 mm or raster lines/25.4 mm.

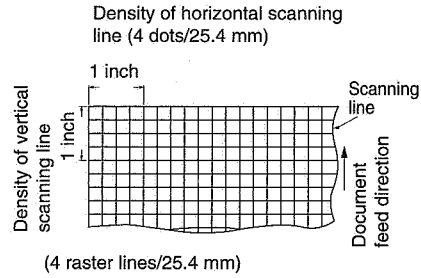


Figure 2-11

Scanning line density
- Horizontal scanning line density:
  This is the number of picture elements per inch along a scanning line in the horizontal scanning direction.
  (Unit: dpi)
- Vertical scanning line density:
  This is the number of picture elements per inch in the vertical scanning direction.
  (Unit: lpi)

II. IMAGE PROCESSING

1. Image Processing Section

Figure 2-12 shows a block diagram of the main functions of the image processing section.

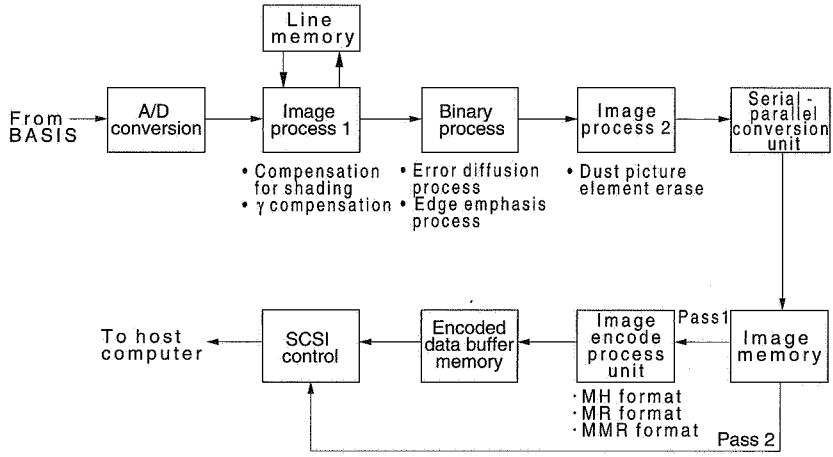


Figure 2-12

Image scanning (input)

Electrical signals (analog) proportional to the density of each picture element are sent one after another from the BASIS to the A/D converter where they are converted to digital signals (6-bit) of a level corresponding to the density.

Next, the following multi-value image processing takes place in image processing section 1.

• Compensation for shading

Compensation is made for random variations in the light distribution of the LED array and also random variations in the sensitivity of each element of the BASIS.

• γ compensation

Compensate the gradation to the document.

After digital signals are processed with image processing section 1, they are binary-processed (density processed) as well as edge-emphasized.

The slice level (density adjustment) for this binary process can be varied from the outside.

After data is processed with image processing section 1, it is binary-processed and image-processed.

• Edge Emphasis Process

This process is to emphasize the edge of the image when converting the image signals to digital signals in order to suppress a loss of fine details of the image.

• Error Diffusion Process

This provides reproducibility of photograph documents and other half tones.

Binarized image signals are sent to image processing section 2.

At image processing section 2, dust picture element erasing process can be selected.

Dust image element erasing is the process of erasing unwanted fine dots on the document for rasing the image encoding rate in the picture encoding (codifying) process of the next stage, the image encoding rate is raised.

The image signals processed as above are temporarily stored in the image memory.

When the image is not required to be encoded, the data is sent to the SCSI controller via pass 2.

However, when picture encoding is necessary, the image is encoded by either the MH, MR, or MMR method mode at the image encoding processor.

The encoded image data, after being stored in the encoded data buffer memory, are sent, via the SCSI controller, to the personal computer.

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2. A/D Conversion

As mentioned previously, the signals sent from the BASIS are analog signals, hence they are converted into digital signals (to enable them to be processed by a microprocessor).

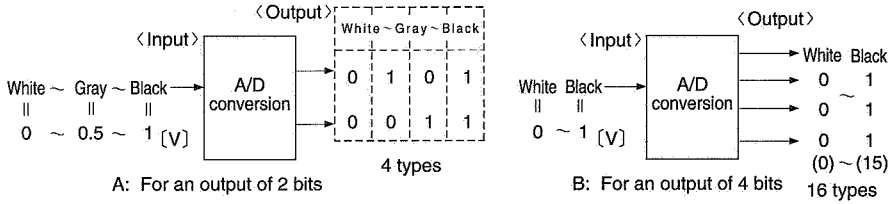


Figure 2-13

Figure 2-13 shows a comparison between the case where the digital signal output after A/D conversion are 2-bit signals, and the case where they are 4-bit signals. (The input voltages shown differ from the actual values).

If it were only necessary to judge whether the image density of the document was black or white, the output need only be one bit. In actual fact, however, it is necessary to reproduce halftones such as gray.

If the output is two bits, it is possible to output four values "00," "01," "10," and "11." Consequently, the input signal (analog) which changes from 0 [V] to 1 [V] as the image of the document changes progressively through white, gray, and black, is converted to a digital signal of one of the above four levels corresponding to the particular analog level.

If the output is four bits, a total of 16 values can be obtained.

In other words, as the number of output bits increases, the resulting digital signal represents the changes in density of the document image more faithfully (good tonality).

This machine uses 6-bit signals which can represent a total of 64 tonal gradations.

3. Compensation for Shading

The BASIS output corresponding to each picture element is not necessarily a uniform value, even if all the light reflected on a document of uniform density in the scanning line direction is detected. The reasons for this are as follows:

Reasons: 1. The light intensity of each LED array is different.
2. The sensitivity of each photosensitive element of the BASIS (several thousand) is different.

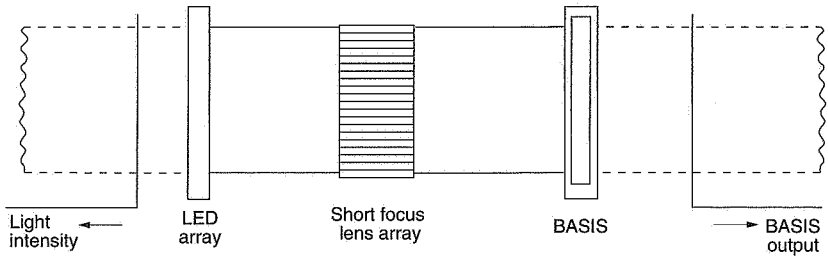


Figure 2-14

Compensation for the above-mentioned variations in the output of the BASIS is called "compensation for shading".

In other words, when light reflected on a document of uniform density is detected, the output of each BASIS differs, hence compensation is applied by multiplying each BASIS (corresponding to each picture element) so that all the outputs are equal.

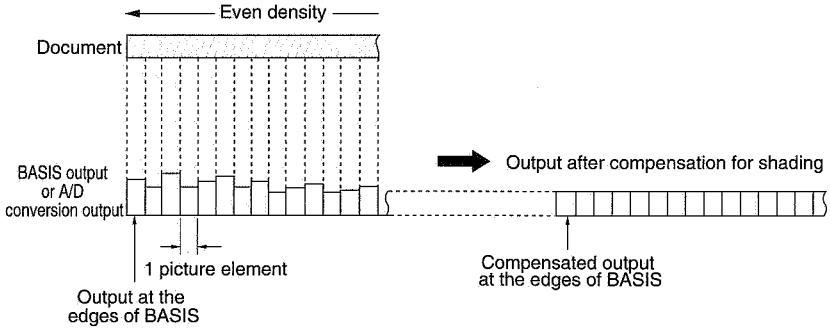


Figure 2-15

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

For instance, when the image changes from white to black, the individual output of BASIS becomes as shown in Figure 2-16.

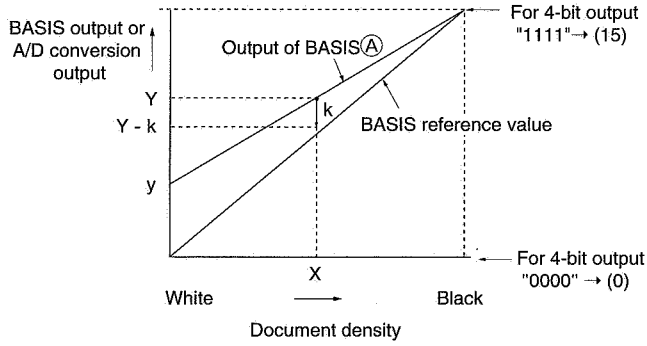


Figure 2-16

An explanation of the principle of shading compensation where only the output of a certain single picture element Ⓐ of BASIS is taken into consideration is given below. (Note that, here, it is assumed that the A/D-converted output is four bits.)

At the time of shipment from the factory, white paper is scanned and the respective BASIS output data stored in memory. Next, the compensation coefficients for making the level of all the individual BASIS data uniform are calculated. The value (y) of a certain scanned picture element of BASIS, Ⓐ, is measured, and, in accordance with that value, all the respective compensation coefficients from "y" to "1111" (15) are calculated and memorized.

During an actual document scan, if the density of its image is "X", the output value (Y-k) after compensation for shading can be obtained by the pre-compensation output Y by the compensation coefficient.

For reference: The RAM that memorizes the compensation coefficient for shading compensation is called "Index Table RAM".

Short Focus Lens (fiber optic lens):

A short focus lens has a fiber-shape configuration as shown in Figure 2-17. The characteristic of this lens is that the focal length can be kept short.

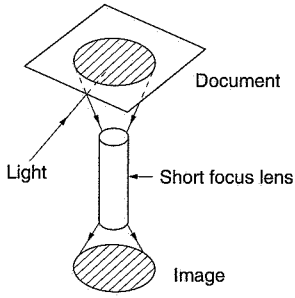


Figure 2-17

Light rays entering the lens are repeatedly reflected inside the lens as shown in Figure 2-18. The interval between these light ray reflections is proportionate to the wave length of the incident light.

For instance, when the lens is shorter than the ratio of the light wave length as in ① of Figure 2-18, the emerging light rays are focused, and when it is long as in ②, the emerging light rays are diffused. When the lens length matches the ratio of the wave lengths as in ③, the emerging light rays are parallel rays, and the image of the document is focused in its original size on the image plane.

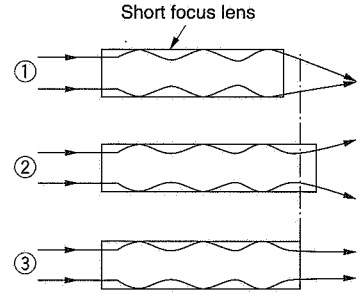


Figure 2-18

4. Line Memory

The line memory is used to memorize one scanning line of data. The shading-compensated data (signal) is temporarily stored in this memory.

Data cannot be read from the memory while a "write" operation is taking place. Consequently, in order to change the "write" and "read" processing timing, a 2-line memory is provided, and "read" and "write" performed alternately, data being written to one line of memory while data is being read from the other memory.

The line memory is used mainly for comparing the image density of the line being read with that of the previous line before edge emphasis image processing takes place.

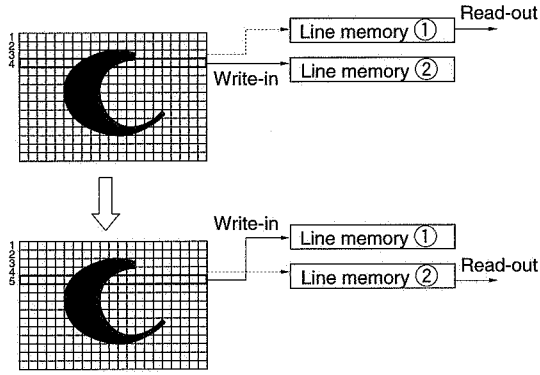


Figure 2-19

5. Edge Emphasis Processing

Edge emphasis is a kind of electrical processing which emphasizes light and shade in order to make the image appear sharp.

Figure 2-20 shows the waveform of the image signal obtained after edge emphasis.

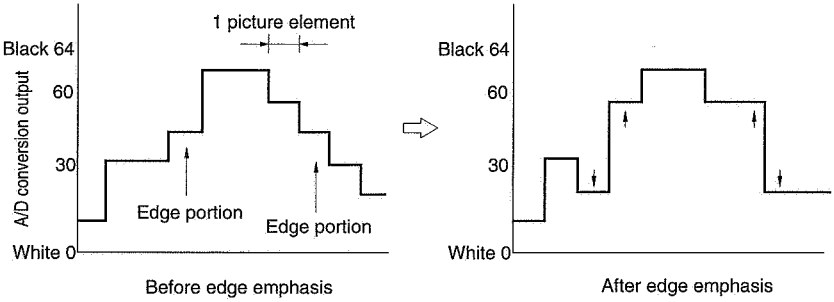


Figure 2-20

Principle: Density processing is performed by comparing the data in the conversion table provided for performing edge-emphasis, with the target picture element.

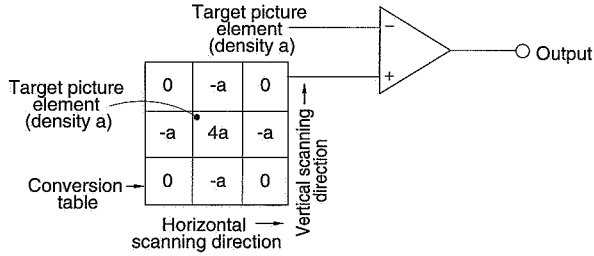


Figure 2-21

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

If the density of the target picture element is increased fourfold and the density at the other four points multiplied by -1, the overall density will remain unchanged.

Arithmetic processing in the horizontal scanning direction takes place simultaneously with data read. Arithmetic processing in the vertical scanning direction takes place by using the line memory to convert the data in the previous line.

Figure 2-22 shows the principle of edge-emphasis processing in the case where the A/D converted data consists of two bits.

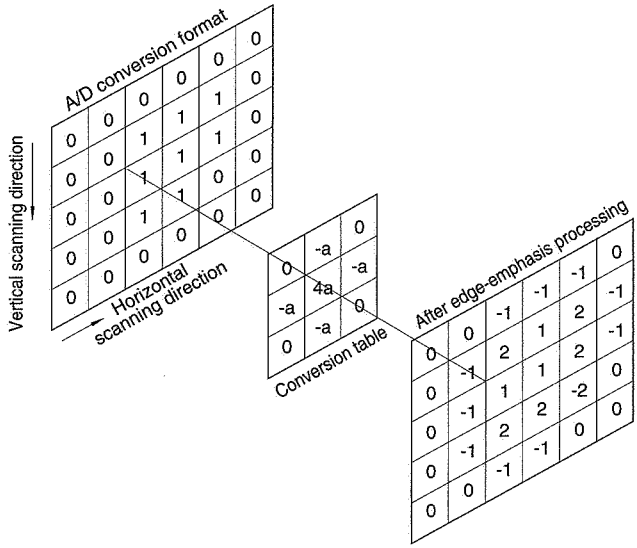


Figure 2-22

6. Dust Picture Element Erase Processing

Dust picture element erase is a kind of electrical processing which erases small black specks (noise) on the document that have nothing to do with the image.

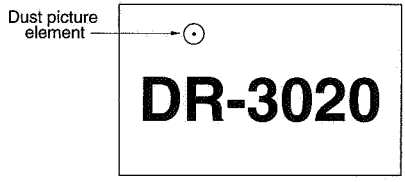


Figure 2-23

This function removes fine grainy specks that result from the above-mentioned edge emphasis processing if a document with a blue background or a dirty document is read.

It removes noise components from the image, thus making the image easier to view, and also raises the encoding rate during image encoding, thus enabling recording to an external recording medium to be carried out efficiently.

Principle: The table below is used to perform dust picture element erasure.

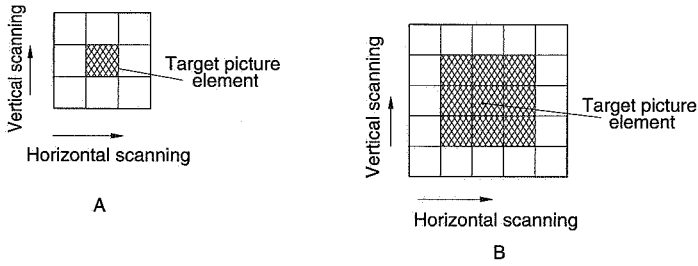


Figure 2-24

For Figure 2-24 A:

If all the 8 dots surrounding the target picture element differ in color from the target picture element, the target picture element will be judged to be dust, and erased.

For Figure 2-24 B:

If all the 16 dots of the one course surrounding the target picture elements differ in color from the target picture elements, the target picture elements will be judged to be dust, and erased.

7. Slice Level Processing

As mentioned previously, the image can only be expressed as "black" or "white" when seen in terms of the potential of each picture element.

In order to classify a picture element as either black or white, it is necessary to cut the signals corresponding to the image density of the document, at a certain level, and to judge signals above that level as black and those below it as white. (This is called binarizing.)

For reference: The level at which a picture element is divided into white or black is called the "slice level".

The slice level is normally compared with the digital signal obtained after compensation for shading.

For example, if the BASIS output is converted to a 4-bit digital signal during the digital conversion process, the slice level will be set at a value somewhere between "0" and "15", and compared with the shading-compensated output (a value between "0" = "0000" and "15" = "1111").

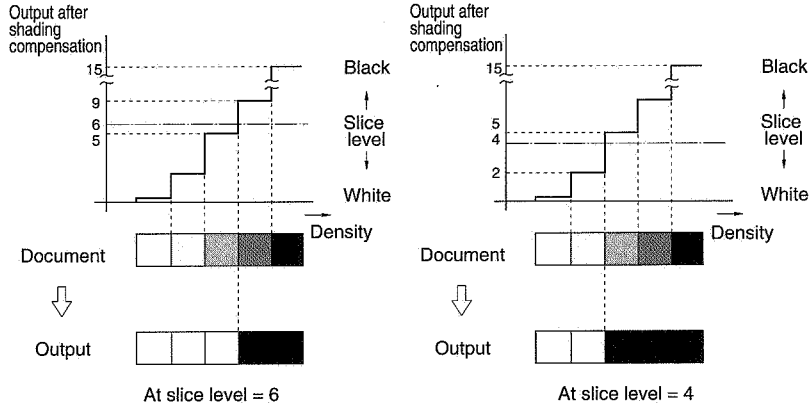


Figure 2-25

Figure 2-26 shows an example of the case where the A/D-converted digital signal output is four bits and the slice level is "6." (This machine uses 6-bit digital signals.)

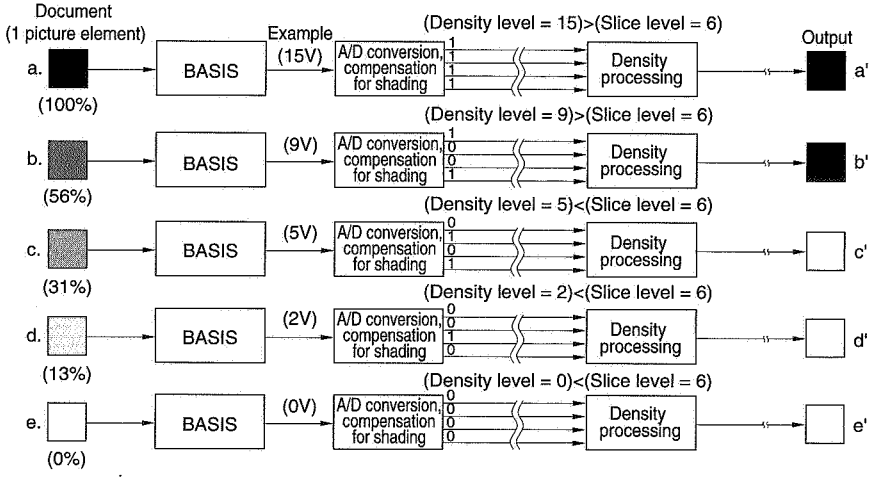


Figure 2-26

8. Tone Compensation (γ Compensation)

When data read with the BASIS is being sent to the image processing section 1, the level of the image data is converted for each picture element in accordance with certain rules and then output.

This is called tone compensation process, the concept of which is explained below.

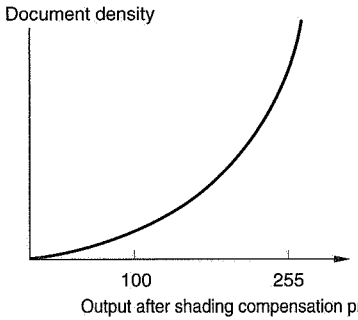


Figure 2-27

The relationship between this document density and the level of output after shading compensation process, or the level of input to γ compensation process is not a straight line. If the level of input from the shading compensation process section is recorded without being subjected to tone compensation, and printed, the result will be a dark printed image.

Accordingly, the level is converted so that an appropriate density is obtained.

① Tone Compensation in Character Mode

Figure 2-28 shows the relationship of tone compensation in character mode.

In character mode, the output level is tone-compensated on the dark side so that the characters are clearly recorded.

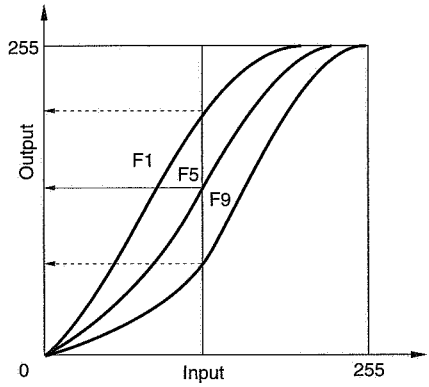


Figure 2-28 Tone Compensation Process in Character Mode

② Tone Compensation in Photograph Mode

Tone compensation in photograph mode, unlike that of character mode, is processed so that light and dark images are faithfully reproduced.

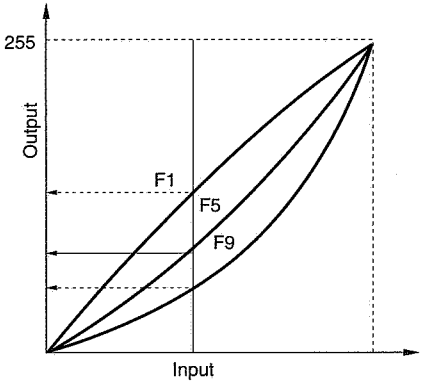


Figure 2-29 Tone Compensation Process in Photograph Mode

9. Error Diffusion

The error diffusion process compares the value of one picture element (in the case of 4 bits, dark ones are "0" and the brighter ones, "15": since it is 8 bits in this machine, the values are 0 and 225) of input image data with the threshold value of a certain standard and if it is smaller than the threshold value, outputs it as "0" and if larger, outputs it as 15.

The difference between the values of the input and output picture elements is then added to the next picture element to be processed.

The resultant picture element value with the added value is successively subjected to the next process as the input picture element value. As a result, the input picture element made simply into a binary value and the average value of the overall density of the output image that has been processed using the error diffusion process, are practically the same.

A concrete example of this is as shown in Figure 2-30.

Process the density slice level as "8." First, when processing the first row of Line 1, since density (3) is smaller than the slice level "8," the output density is "0" and the resultant error is +3(=3-0).

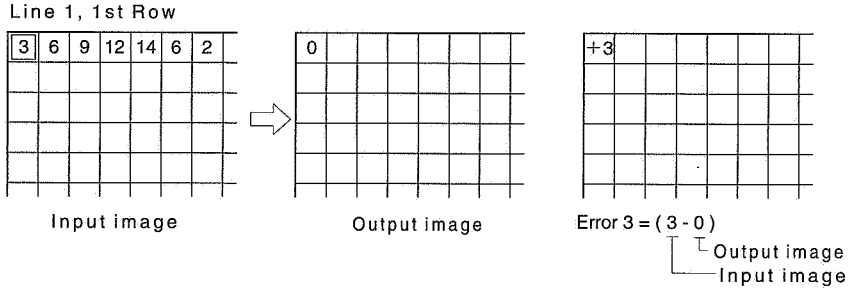


Figure 2-30

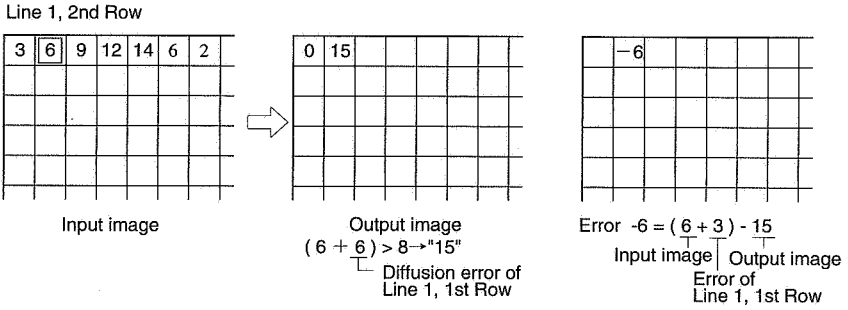


Figure 2-31

Next, when processing the second row of Line 1, since the error is diffusion to the right, the density of the picture element of Line 1, 2nd Row becomes "9" (=3+6).

As this value is bigger than the slice level, the output density is "15" and the error becomes "-6" [= (6+3) - 15]. (Figure 2-31)

The picture element density of Line 1, 3rd Row is "3" (=9-6) and smaller than the slice level "8", so the output density becomes "0" and the error "3" [= (9-6) - 0]. (Figure 2-32)

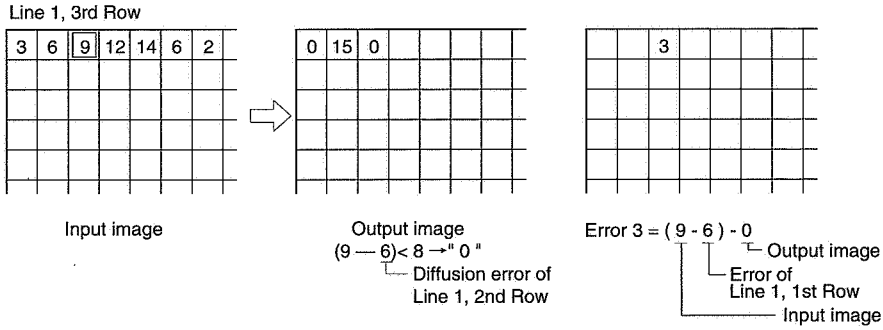


Figure 2-32

If the rest is processed in the same manner, the images become as Figure 2-33:

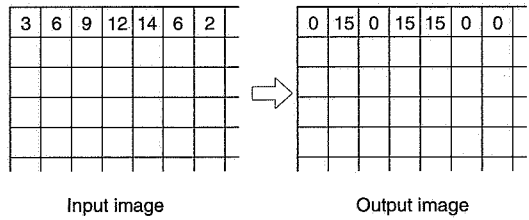


Figure 2-33

In the case of Line 2, the processing is carried out using the density Line 2, 1st Row as the standard. If the rest is processed in the same manner, the images become as Figure 2-34:

3	6	9	12	14	6	2
5	2	10	11	13	8	2
6	3	9	12	14	5	6
4	7	10	15	12	10	5
3	6	13	8	9	6	4

0	15	0	15	15	0	0
0	0	15	15	15	0	0
0	15	0	15	15	0	15
0	15	0	15	15	15	0
0	15	0	15	15	0	0

Figure 2-34

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

10. Resolution Changing

Resolutions can be selected in this machine from among 300/200 dpi in the horizontal scanning direction and 300/200/150 lpi in the vertical scanning direction.

Principle:

- Changing of Vertical Scanning Resolution
  The document is scanned in the vertical direction, changing the feed speed of the document. In the case of 200 dpi, feed speed is made 1.5 times that of 300 dpi, and in the case of 150 dpi, twice the speed.

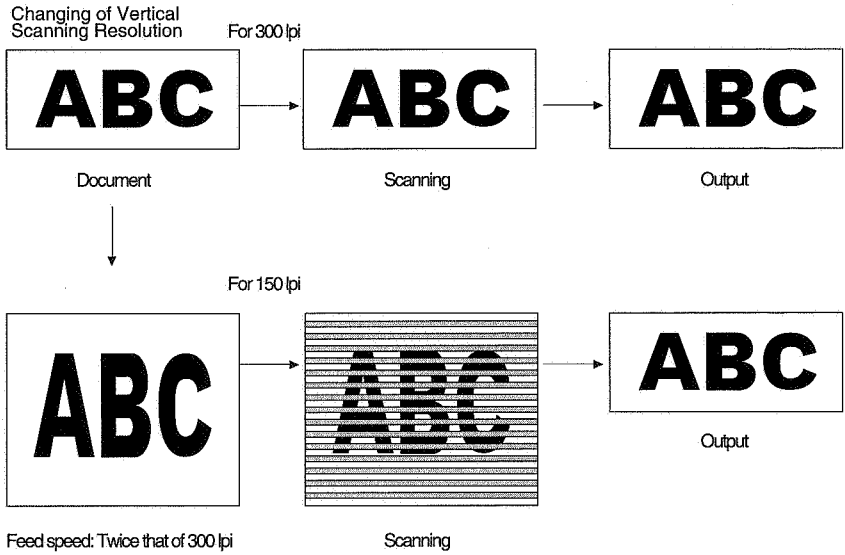


Figure 2-35

• Changing of Horizontal Scanning Resolution

Horizontal scanning resolution is changed by temporarily storing the data in memory and then when reading out the data, skip-reading (thinning-out) picture elements in accordance with the resolution.

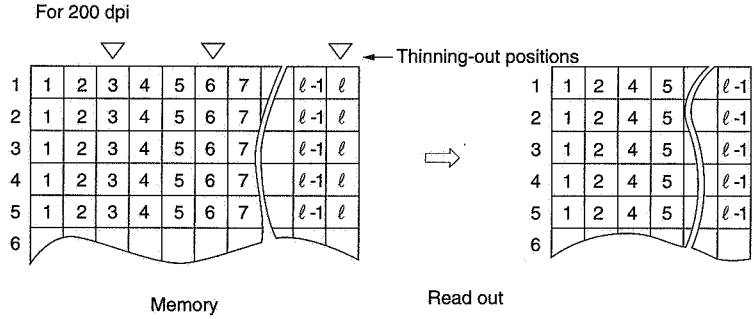


Figure 2-36

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

III. IMAGE ENCODING

1. Outline

As mentioned previously, the image data consists of "black" and "white" picture elements. The image data read by the BASIS can be output directly to a personal computer without problem. However, when it is recorded onto an external recording medium through the personal computer, the amount of data that can be recorded on a single disk is limited due to the capacity of the disk.

To overcome this, it is necessary to reduce the amount of data in the image of the document.

The reduction of the data contained in the image is called "encoding". The opposite process of restoring the encoded data to its original form is called "decoding".

2. Explanation

a. Outline

① Encoding rate

The encoding rate is the ratio of the number of bits of data after encoding to the number of bits before encoding.

$$\text{Decoding rate} = \frac{\text{Number of bits of data after encoding}}{\text{Number of bits of data before encoding}}$$

② One-dimensional encoding format (MH format)

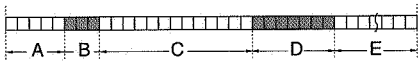


Figure 2-37

One "read" scanning line can be divided alternately into white parts and black parts. This corresponds to A to E in Figure 2-37. The number of picture elements in each of these sections is called the run length, or simply the run. The format of encoding used for encoding and sending the color (white or black) and run length of each of these sections is called run length encoding. The code used is a modified Huffman code, hence it is called Modified Huffman encoding format. (Also abbreviated to MH format.) This format is called a one-dimensional encoding format because it can only be encoded in the horizontal scanning direction (i.e. in one dimension) of a document which widens in one dimension.

③ Two-dimensional encoding (MR format)

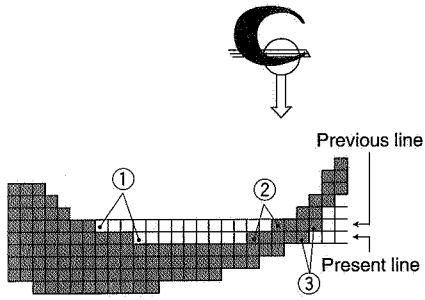


Figure 2-38

By enlarging two continuous scanning lines such as those shown in Figure 2-38, then comparing the positions of the black/white boundary squares on the respective scanning lines, it can be seen that they are offset in the left-right direction. Specifically, this refers to parts ①, ②, and ③ in the figure. The format of encoding whereby the positions of the black/white boundary squares on one line are compared with the corresponding positions on the previous line, and the offset encoded, is called two-dimensional encoding.

The name "two-dimensional encoding" comes from the fact that the positions of the black/white boundary squares in the horizontal (left-right) scanning direction in one line are compared with those of the previous line in the vertical scanning direction.

This is called Modified Read encoding format. The word "READ" is an acronym meaning Relative Element Address Designative.

This format is used for documents with squarish characters such as Chinese characters.

This encoding format has the disadvantage that because encoding always proceeds while the data on one line is compared with that on the previous line, once an encoding error occurs it will affect the subsequent lines as well.

④ MMR format

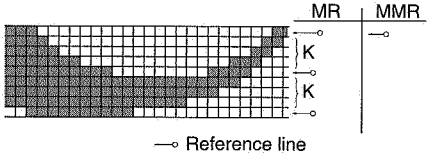


Figure 2-39

In the MR format, one line in every K lines (k parameter: described later) is encoded by one-dimensional encoding, and the remaining lines are encoded by two-dimensional encoding. In the MMR format (Modified Modified Read), all the lines will be encoded by two-dimensional encoding on the basis that there is one imaginary white line in all before the first line.

This encoding method results in a higher image compression rate than that of the MR format.

b. One-dimensional encoding formats

① Run length

Looking at a single scanning line, it can be seen that it can be divided alternately into several white and black sections.

The sections A, B, C, D, and E in Figure 2-40 below are called runs. For example, section A is a white run.

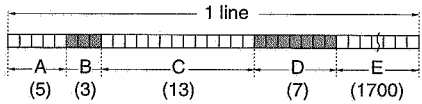


Figure 2-40

Run length of Figure 2-40 is as shown in Table 2-1.

Area	Run	Run Length
A	White run	5
B	Black run	3
C	White run	13
D	Black run	7
E	White run	1700
Total	—	1728

Table 2-1

② Terminating code and make-up code

When image data is being encoded, each line is encoded using Huffman code. A Huffman code consists of a terminating code and a make-up code.

Terminating codes

White run length	Code	Black run length	Code
0	00110101	0	0000110111
1	000111	1	010
2	0111	2	11
3	1000	3	10
4	1011	4	011
5	1100	5	0011
6	1110	6	0010
7	1111	7	00011
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
54	00100[illegible]	54	0000001[illegible]1000
55	01011000	55	0000000100111
56	01011001	56	0000000101000
57	01011010	57	0000001011000
58	01011011	58	0000001011001
59	01001010	59	0000001011011
60	01001011	60	0000000101100
61	00110010	61	0000001011010
62	00110011	62	0000001100110
63	00110100	63	0000001100111

Table 2-2

Make-up codes

White run length	Code	Black run length	Code
64	11011	64	0000001111
128	10010	128	0000011001000
192	010111	192	0000011001001
256	0110111	256	0000001011011
[illegible]	[illegible]	[illegible]	[illegible]
1600	010011010	1600	0000001011011
1664	011000	1664	0000001100100
1728	010011011	1728	0000001100101
EOL	000000000001	EOL	000000000001

Table 2-3

Make-up Codes (added)

Run length (white or black)	Make-up code
1792	00000001000
1856	00000001100
1920	00000001101
[illegible]	[illegible]
2496	[illegible]
2560	000000011111

Table 2-4

③ Method of encoding

A read scanning line is divided into runs (A to D) as shown in Table 2-5, then each run is encoded as follows:

- When the run length is 63 or less

The sections with a run length of 63 or less are A, B, C, and D. These sections are encoded using only terminating codes.

In other words, the Huffman code for these runs consists of only a terminating code.

Part run	Run length	Make-up code	Terminating code	Huffman code
A White run	⑤	None	1100	1100
B Black run	③	None	10	10
C White run	3	None	000011	000011
D Black run	7	None	00011	00011

White run length	Code	Black run length	Code
0	00110101	0	0000110111
1	000111	1	010
2	0111	2	11
3	1000	③	10
4	1011	4	011
⑤	1100	5	0011
6	1110	6	0010
7	1111	7	00011
8	10011	8	000101
9	10100	9	000100
10	00111	10	0000100
11	01000	11	0000101
12	001000	12	0000111
13	000011	13	00000100
14	0100	14	00000111
		15	000011000
		16	0000011000
		17	0000001000

Table 2-5

- When the run length is 64 or more

These sections are encoded using one make-up code and one terminating code.

First, the machine refers to the make-up code table and finds a run length which is either smaller than or the same as the actual run length. Next, it refers to the terminating code table and finds the difference between the actual run length and the run length of the make-up code, then encodes the section.

Part	Actual run length	Make-up code: Terminating code	Make-up code: Terminating code	Huffman code
E	White 1700	1664	011000	011000 00010101
		36	00010101	

Terminating Codes

White run length	code	Black run length	code
0	00110101	0	0000110111
1	000111	1	010
2		2	11
	000110	3	10
32	00011011		011
33	00010010		
34	00010011	34	000011010010
35	00010100	35	000011010011
36	00010101	36	000011010100
37	00010110	37	000011010101
38	00010111	38	000011010110
39	00101000	39	000011010111
40	1001	40	000001101100
		41	000001101101
		42	00001101

Make-up Codes

White run length	code	Black run length	code
64	11011	64	0000001111
128	10010	128	000011001000
192	010111	192	000011001001
256		256	000001011011
	0110	320	000000110011
1280	011011001	384	000000110100
1344	011011010		
1408	011011011	1408	
1472	010011000	1472	0000001010101
1536	010011001	1536	0000000011010
1600	010011010	1600	0000001011011
1664	011000	1664	0000001100100
1728	010011011	1728	0000001100101
EOL	000000000001	EOL	000000000001

Table 2-6

The encoding of one scanning line is as follows:

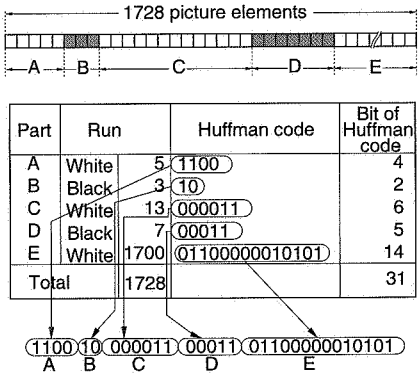


Table 2-7

In the above example, 1728 bits (one line of picture elements) are encoded into 31 bits, that is, the compression rate is

31 bits/1728 bits = approx. 1/56.

- When the run length agrees with the make-up code

Both a white run of 640 and a black run of 1088 correspond with values in the make-up code table. However, it is not possible to encode data using a make-up code alone, hence it is necessary to use a terminating code (run length 0) at the end run length of the make-up code.

White run 640 = White run 640 + White run 0
Make-up code Terminating code

- When the beginning of a scanning line is a black run

This machine is designed so that the encoding of a scanning line starts from white when a scanning line starts with a black run, as shown in Figure 2-41, a white run of run length zero, that is, a dummy run is inserted in front of the first run of the first scanning line before encoding takes place.

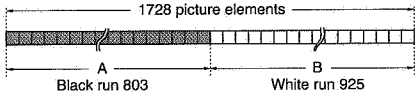


Figure 2-41

Run			Code	No. of data bits
Dummy	White	0	00110101	8 bits
A	Black	803	000000100110000 0011010011	25 bits
B	White	925	011010011000000 10	17 bits
Total run length		1728	No. of data bits	50 bits

When scanning line starts with black line

Table 2-8

- EOL

The EOL (End of Line) shown in the make-up code table is called a line terminating code. It is code which indicates the end of a line.

c. Two-dimensional encoding format

① Reference line and encoding line

In a two-dimensional encoding method, encoding proceeds while the present line is compared with the previous line. Consequently, the line presently being encoded is called the encoding line, and the previous line is called the reference line.

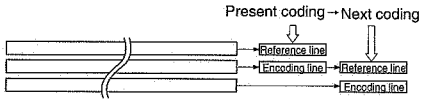


Figure 2-42

② Parameter K

As mentioned above, two-dimensional encoding takes place while the present line is compared with the previous line. Consequently, the scanning lines on one page are gathered into groups of several lines each. The first line is encoded by one-dimensional encoding, as mentioned above, and the subsequent lines are encoded by two-dimensional encoding while the data in the present line is compared with that of the previous line. The number of lines in a group is called parameter K. (Used with the MR format.)

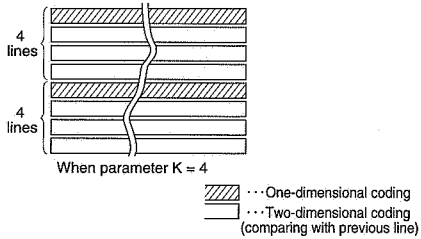


Figure 2-43

③ Change picture element

A picture element whose immediately preceding picture element and color (white or black) are different is called a change picture element. In other words, a change picture element is the first picture element of each run.

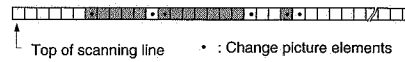


Figure 2-44

④ Relative distance

Relative distance is the distance between one picture element, taken as a datum, and another.

The side to the right of the datum picture element is the plus side, and the side to the left of it is the minus side. The two picture elements may sometimes lie on the same scanning line, or on different scanning lines.

For example, in Figure 2-45, if "a" is taken as the reference, the relative distances of "b," "c," and "d" from "a" are as follows:

ab = 4

ac = -5

ad = 0

Assume, for example, that the absolute value of a relative distance is |5|.

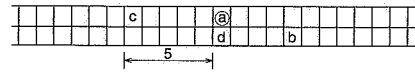


Figure 2-45

The absolute value of the relative distance is simply the distance between two picture elements, without using either of them as a datum.

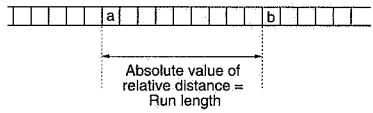


Figure 2-46

The absolute value of the relative distance is the same as the run length from "a," including "a," to a point immediately before "b," as shown in Figure 2-46.

⑤ Necessary picture elements for encoding

Encoding takes place after the picture elements a0, a1, a2, b1, and b2 on the encoding line and reference line have been determined.

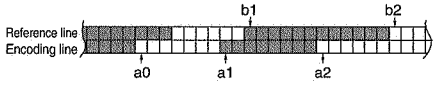


Figure 2-47

First, the position of a0 is determined, then the positions of the remaining picture elements (a1, a2, b1, and b2) are determined.

a0: This is the reference picture element or starting point change picture on the encoding line. This position is determined by the previously executed encoding mode.

Assume that the white picture element immediately before the actual picture element is a white picture element and that it is a0.

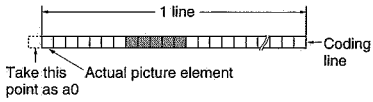


Figure 2-48

a1: First change picture element to the right of a0 on the encoding line

a2: First change picture element to the right of a1 on the encoding line

b1: First change picture element of the opposite color to a0 on the right of a0, on the reference line.

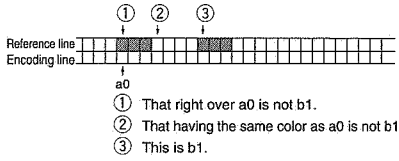


Figure 2-49

d. Encoding mode

From the positional relationship between a0, a1, a2, b1, and b2 on the reference line and encoding line, encoding takes place in one of three encoding modes.

① Pass mode

This mode is used when b2 is on the left of a1, as shown in Figure 2-50. Encoding in this mode takes place with the code "0001" (P is used as a symbol). After encoding has taken place, a0 is moved to the picture element on the encoding line immediately below b1 (i.e. 0') in preparation for the next encoding operation.

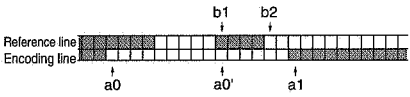


Figure 2-50

However, if b2 is directly above a1, the pass mode is not used.

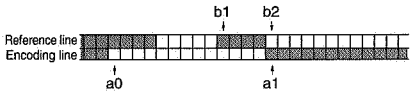


Figure 2-51

② Vertical mode

This mode is used when the pass is not used and the absolute value | a1 b1 | of the relative distance between b1 and a1 is no more than 3.

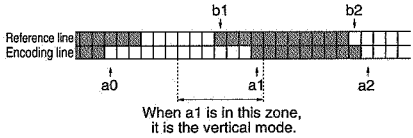


Figure 2-52

During the encoding process, the relative distance between a1 and b1 is expressed using the following symbols.

V(0)...a1 is directly beneath b1

VR(n)...a1 is on the right of b1

VL(n)...a1 is on the left of b1

Where n is the absolute value of the relative distance between a1 and b1.

n = 1,2,3

After encoding, the position of a1 becomes the position of the new a0, in preparation for the next encoding operation.

③ Horizontal mode

This mode is used when neither the pass mode nor the vertical mode is used and the absolute value | a1b1 | of the relative distance between b1 and a1 is 3 or more.

In this mode, encoding is performed by inserting the absolute value of the relative distance | a0a1 | and |a1a2 | with Huffman code M (a0a1) and M (a1a2) after code "001" (expressed using symbol H) which represents the horizontal mode.

M(a0a1) is the Huffman code of run length of the color which contains a0, and M(a1a2) is the Huffman code of run length of the color which contains a1.

The Huffman code is exactly the same code as that used in one-dimensional encoding.

After encoding, the position of a2 becomes the position of a0, in preparation for the next encoding operation.

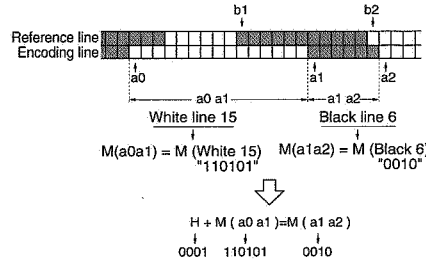


Figure 2-53

e. Encoding procedure

The encoding procedure determines which of the following three encoding modes is to be used. After the encoding mode has been determined, encoding takes place using the code in Table 2-9. The encoding procedure is shown in the flowchart of Figure 2-54.

Procedure 1

① When the pass mode is detected, encoding takes place with code "0001". Subsequently, picture element a0' directly below b1 becomes the new a0, in preparation for the next encoding operation.

② If the pass mode is not detected, the program proceeds to procedure 2.

Procedure 2

① The absolute value of the relative distance a1b1 is calculated.

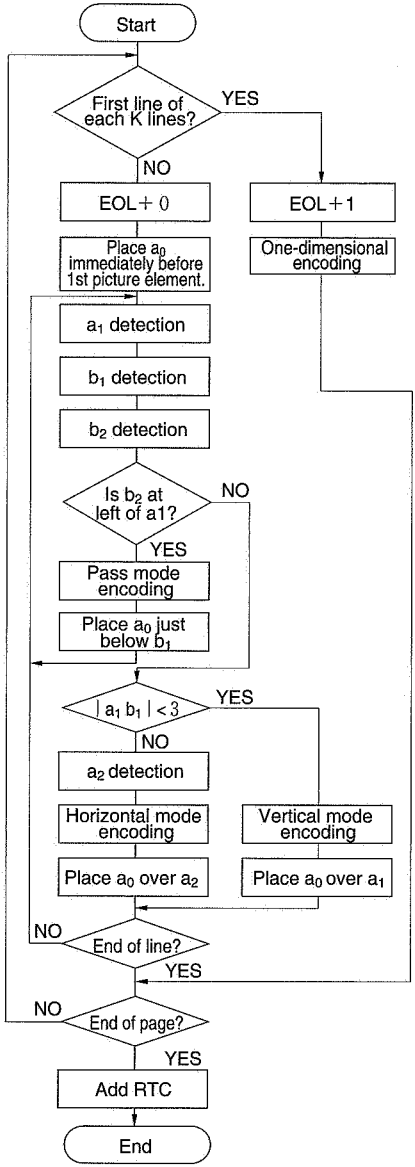
② If | a1b1 ≦3, a1b1 is encoded using the vertical mode. After encoding, a1 becomes the new a0, in preparation for the next encoding operation.

③ If | a1b1 ≧3, run lengths a0a1 and a1a2 are encoded using one-dimensional encoding after code "001" which indicates the horizontal mode. Subsequently, a2 becomes the new a0, in preparation for the next encoding operation.

Mode	Code		Mark	Code
Pass	b1b2		P	0001
Horizontal	a0a1, a1a2		H	001+M (a0a1) +M (a1a2) Note
Vertical	a1 just below b1	a1b1=0	V (0)	1
	a1 is at right of b1	a1b1=1	VR (1)	011
		a1b1=2	VR (2)	000011
		a1b1=3	VR (3)	0000011
	a1 is at left of b1	a1b1=1	VL (1)	010
		a1b1=2	VL (2)	000010
		a1b1=3	VL (3)	0000010

Note: Those in parenthesis refer to the code in Tables 2-2, -3, and -4.

Table 2-9



RTC means the signal that indicates end of one page of image.

Figure 2-54

f. Start and end of encoding line

① Processing at the start of the encoding line

At the start of the encoding line, it is assumed that a white picture element exists immediately before an actual picture element, and a0 is placed immediately over it.

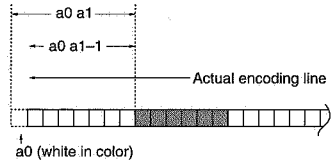


Figure 2-55

Because a0 is not located above an actual picture element, the first run length, a0a1, of the line is replaced by a0a1-1. As shown in Figure 2-55, a0a1 is white run length 8, however the actual number of picture elements is only 7. Consequently, a0a1 is replaced by a0a1-1, that is, by 7.

As a result, the first picture element of the encoding line is black, as shown in Figure 2-56, and if the line is encoded in the horizontal mode, M(a0a1) will be white run 0.

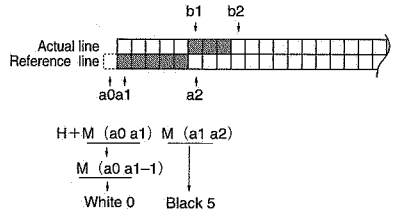


Figure 2-56

When the encoding line shown in Figure 2-57 starts with a black picture element:

Figure 2-57 shows an example of encoding the first part of the scanning line.

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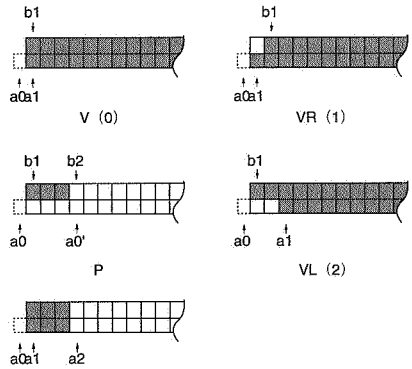

Figure 2-57

② Processing at the end of the encoding line

At the end of the encoding line, it is assumed that a picture element of the opposite color to that of the last picture element on the actual encoding line exists. Encoding continues until the opposition of this picture element is encoded.

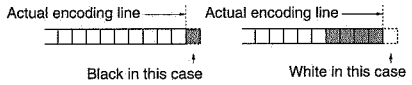

Figure 2-58

This picture element is encoded as a1 in the vertical mode, and as a1 or a2 in the horizontal mode. If neither b1 nor b2 is detected at an actual picture element on the reference line, or if b2 only is detected, b1 or b2 will be replaced immediately after the last picture element on the reference line.

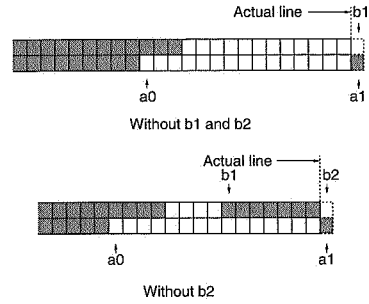

Figure 2-59

An example of encoding of the scanning line end is shown in Figure 2-60.

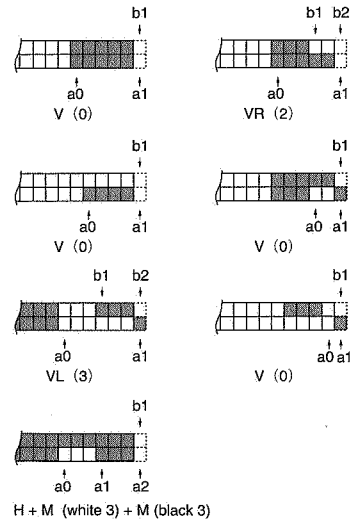

Figure 2-60

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CHAPTER 3

OUTLINE OF OPERATION

In outline diagrams, ▭▭▭ represents mechanical drive paths, and ⟶ indicates electrical signal paths.

Signals in digital circuits are identified as 'H' for High and 'L' for Low. The voltage of signals in Low is very close to zero; that of signals in High depends on the circuit.

Nearly all operations of the carrier are controlled by microprocessors. As the processors are not a part relevant to the serviceman's work, their internal operations are not described here. Further, as PCBs are not repaired at the customer's premises, the operation of the circuits are explained by means of block diagrams rather than circuit diagrams.

For the purpose of explanation, circuits are divided into the following: from sensors to controller PCB input ports and from controller output ports to loads. Discussion, further, is by function.

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I. SYSTEM CONFIGURATION

System configuration is as follows:

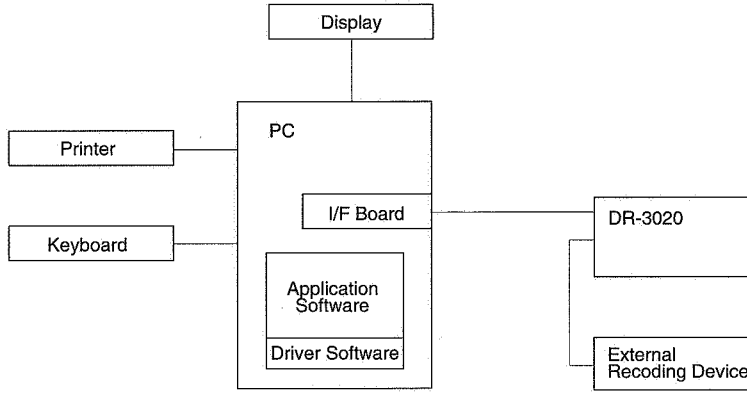

Figure 3-1

PC (Personal Computer)	: Controls the system
CPU	: Equal to or higher than 486, Clock 66 MHz, RAM 8MB Windows® 3.1
Display	: Displays image, and displays retrieved, registered screen.
Printer	: Prints out image
Keyboard	: Instructs image input, retrieving, etc.
DR-3020 (this machine)	: Carries out image input
External Recoding Device	: Records image, and retrieve ID
I/F Board	: Interfaces with SCSI Adaptec · AHA-1542CF ISA 154x · AHA-2742 EISA 2700 Series · AHA-2842 VL Local Bus card · AHA-2940 PCI PCI card
Application Software	: Software for recording and retrieving image
Driver Software	: Software for operating DR-3020

II. EXPOSURE SYSTEM

A. Scanner

Figure 3-2 shows the scanner used in this machine.

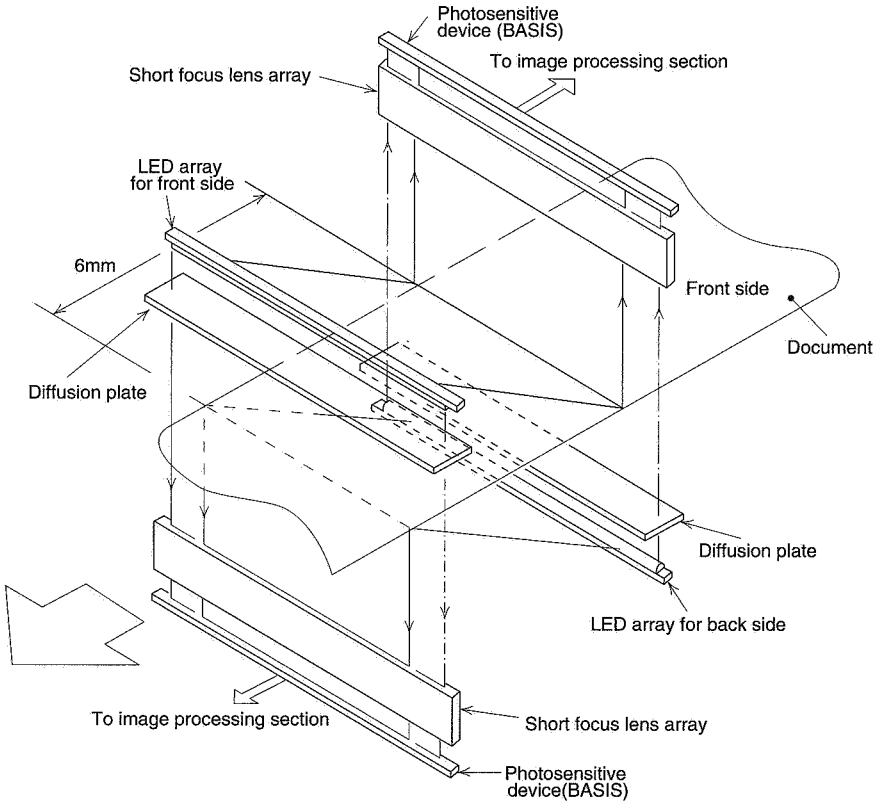

Figure 3-2

The document is illuminated back and front at the image readout area by two LED arrays while being conveyed at either high speed (241.9 mm/sec), midium speed (181.4 mm/sec) and low speed (121.0 mm/sec).

The light reflected on the document converges, via the short focus lens arrays (fiber optic lens array), on to the BASIS to form an image of equal size.

The front and back sides of the document are read at points that are offset by 6 mm in order to prevent the image on the back side of the document from being read through to the front side.

Light reflected off the document is photo-electrically converted by the BASIS and the resulting signals are variously processed by the image processing section.

While the image is being scanned, light from the LED arrays are diffused by the diffusion plates, and light is illuminated from the back of the document. By this means, the background area of the document is made "white".

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III. BASIC OPERATION

A. Functions

The functions of this machine can be broadly classified into the following three sections: read-out assembly, feeder assembly, and control assembly.

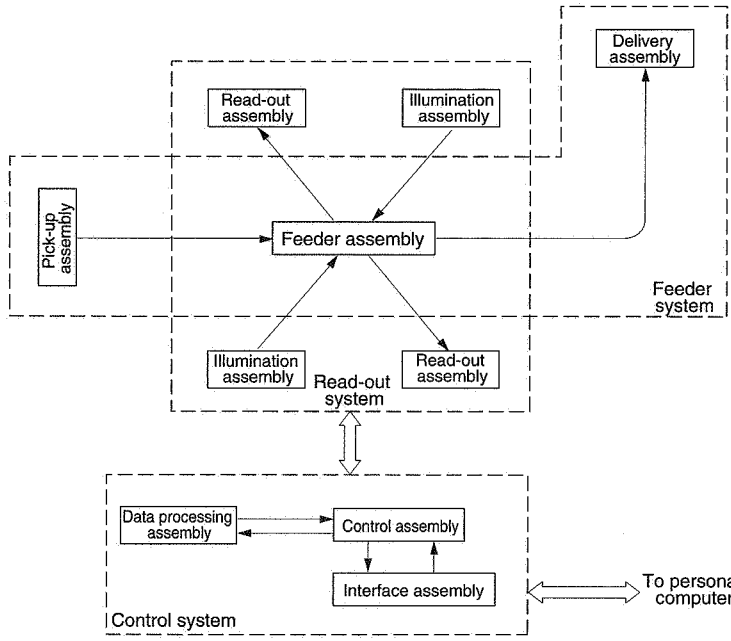

Figure 3-3

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B. Main Drive

This machine has a main motor (M1) which is used to convey the document and a document board motor (M2) which is used to raise and lower the document board.

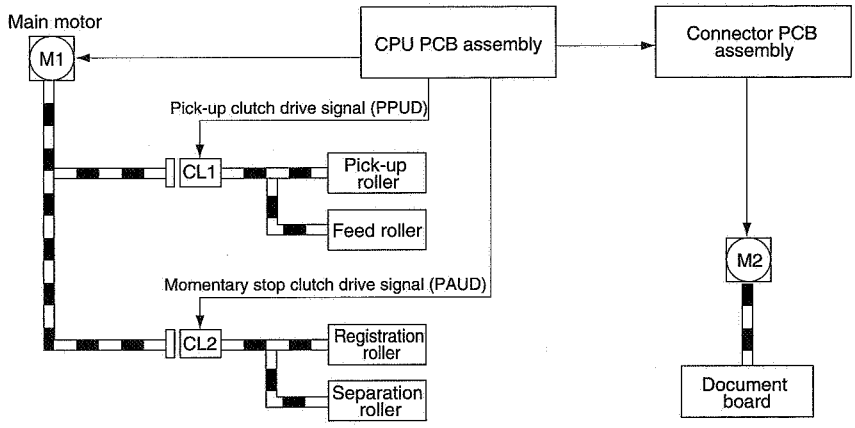

Figure 3-4

C. Power ON Sequence

Figure 3-5 shows the power ON sequence of this machine.

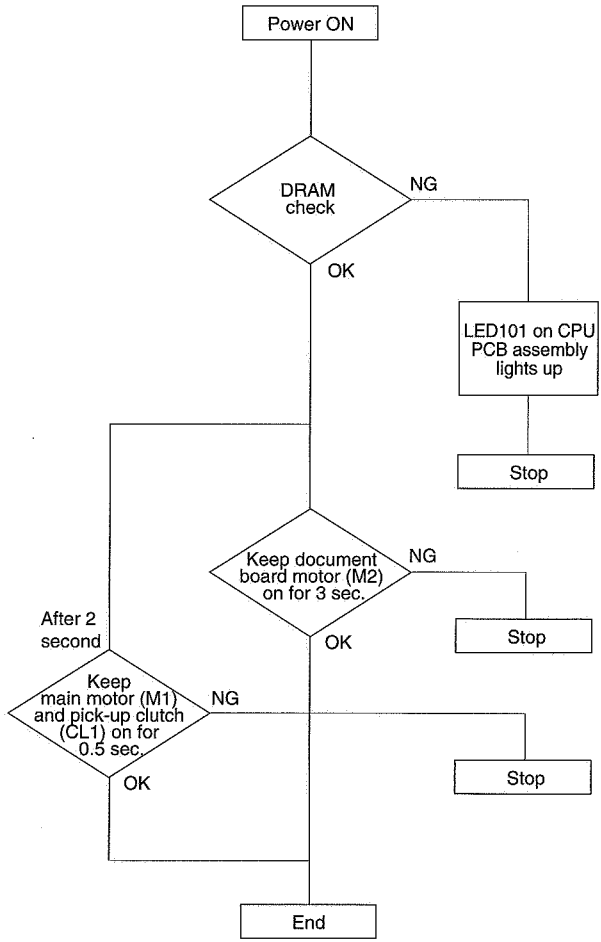

Figure 3-5

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D. Timing Chart

Figure 3-6 shows a timing chart for each of double-sided, A4 sheets whith, 300 dpi x 300 lpi without momentary stop.

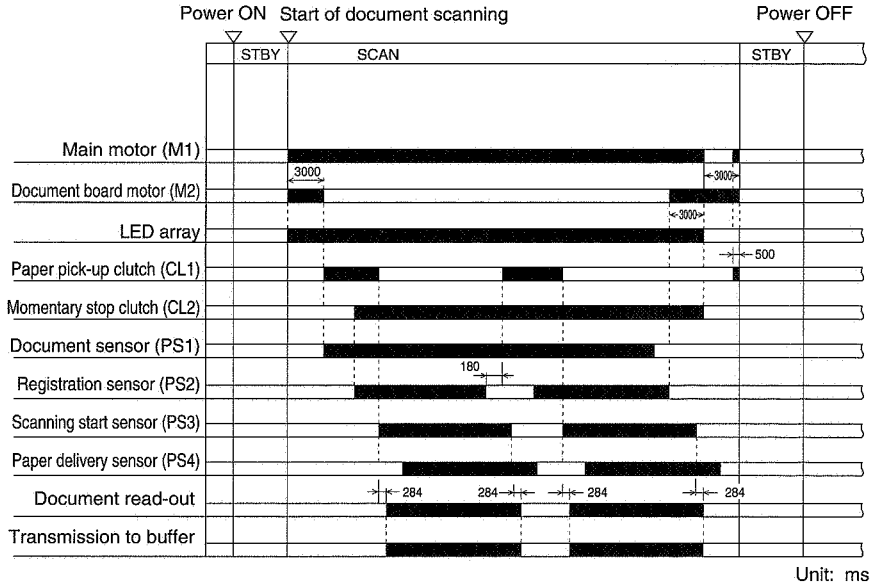

Figure 3-6

Duration		Purpose
SCAN	Time during which the main motor is ON	• Picking up the document • Illuminating the document by the LED array and projecting its reflected light onto BASIS
STBY	Time during which the command can be accepted	Preparing for receiving document scanning

Table 3-1

IV. OUTLINE OF ELECTRICAL CIRCUITS

The main electrical control of the machine is performed by a single microprocessor on the CPU PCB assembly.

CPU PCB assembly

IC115

- Control of document feed
- Control of image data
- Communication with external devices

This microprocessor, in accordance with a pre-stored program, outputs the necessary signals to loads such as motors and solenoids, and circuits in other PCB assemblies, in compliance with commands from sensors and the personal computer.

A frash ROM is connected to the microprocessors on the CPU PCB.

The frash ROM is used to store communications exchanged with external devices, programs of this machine sequence, etc., and other data.

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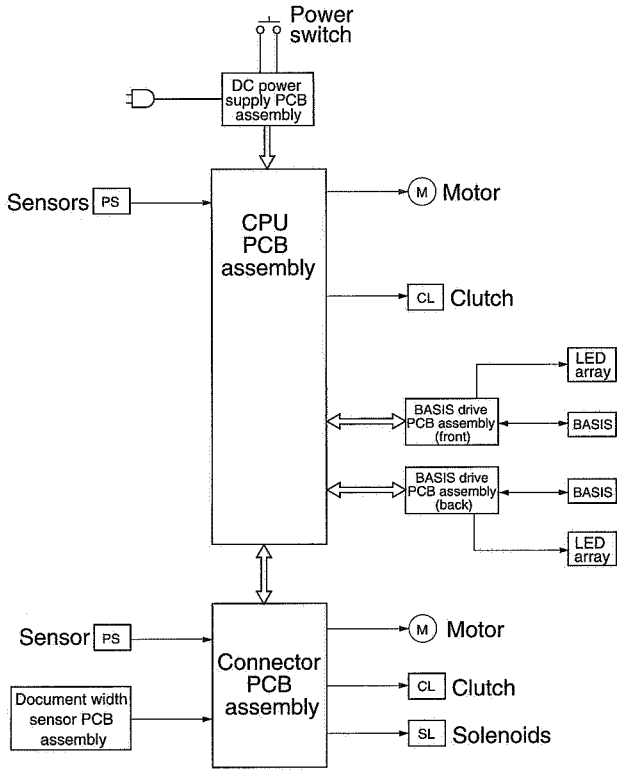

Figure 3-7

V. INPUT TO AND OUTPUT FROM MAIN PCB ASSEMBLIES

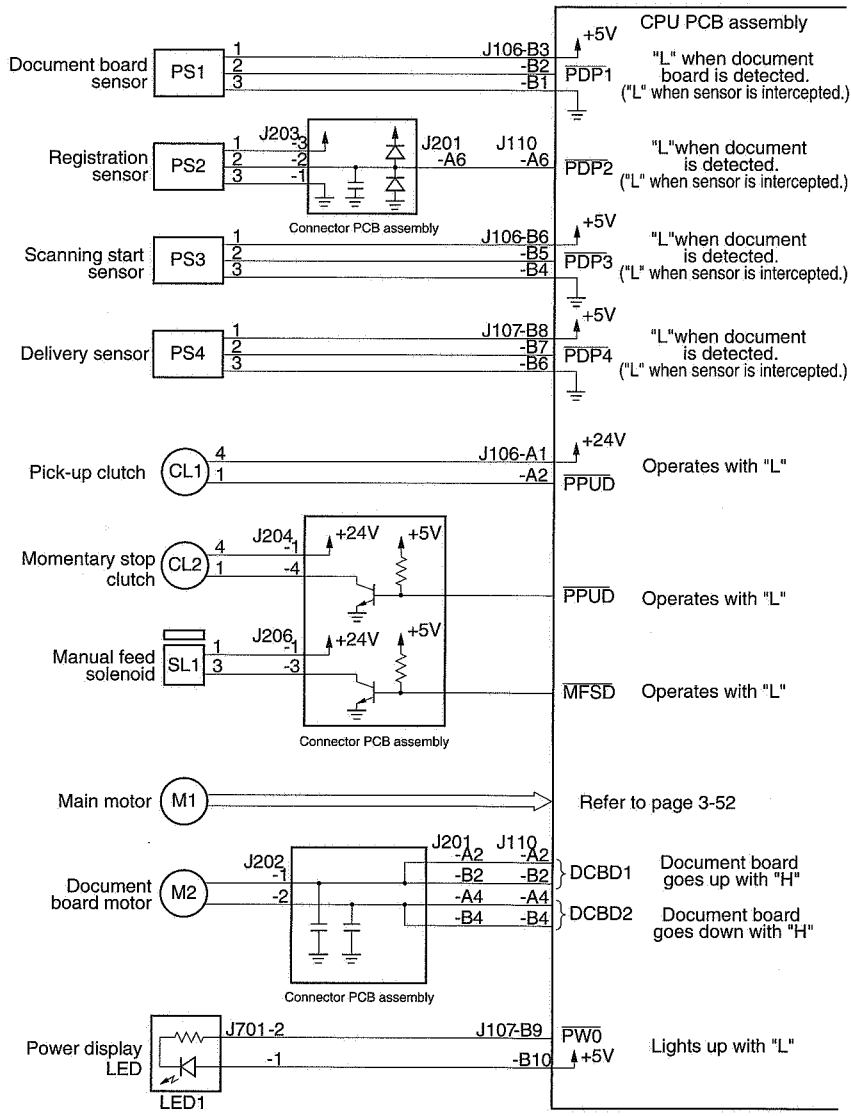

Figure 3-8

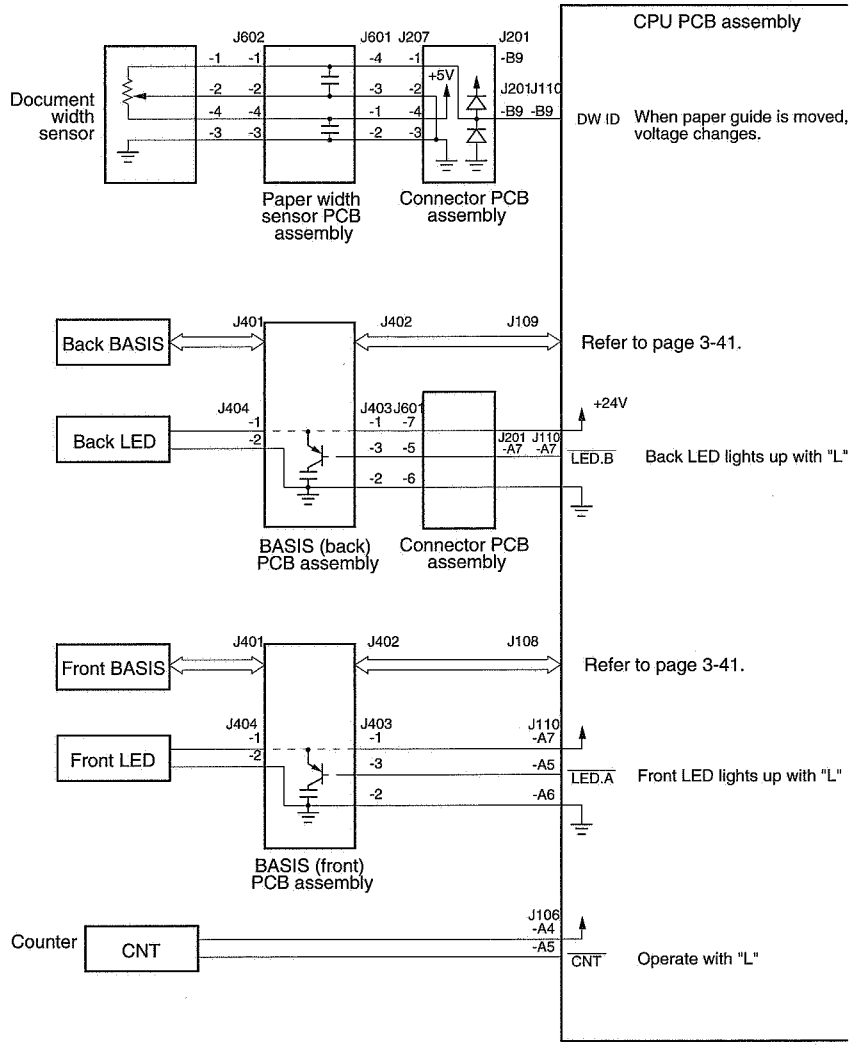

Figure 3-9

VI. DOCUMENT PICK-UP ASSEMBLY

A. Outline

The document pick-up assembly of this machine consists of the following assemblies.

- Document board drive assembly
  During automatic pick-up, this assembly pushes up the document board automatically, and when pick-up is finished, returns it to its original position.
- Manual feed switchover assembly
  This unit is designed to switch over from document paper pick-up to manual feed.
  This also stops the drive of the separation roller to cancel the separation function.
- Automatic adjust/separation assembly
  This assembly automatically changes the space between the pick-up roller and separation roller in accordance with the thickness of the document, and separates/feeds one document one by one without any jamming and double feeding.

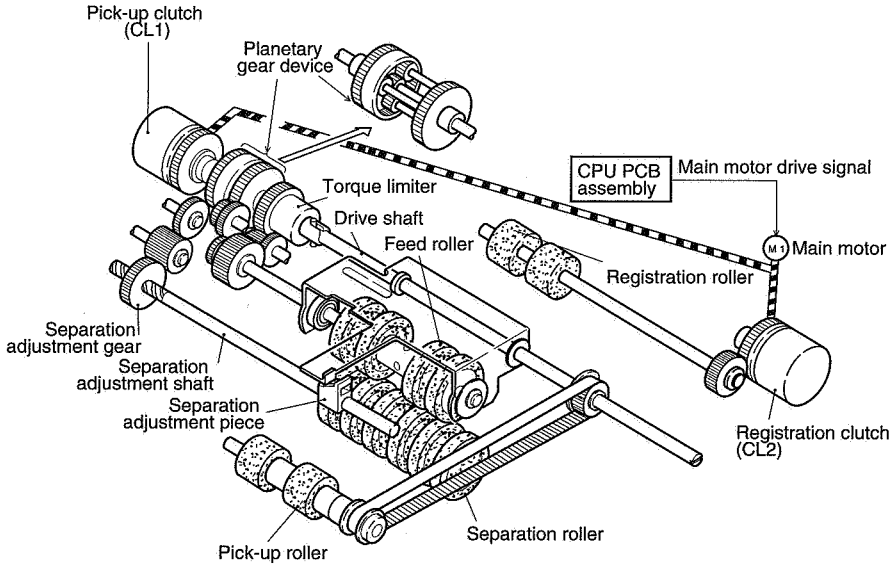

Figure 3-10

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B. Automatic Adjust/Separation Assembly

Figure 3-10 shows the outline of the document pick-up assembly.

The pick-up assembly consists of a pick-up roller, feed roller, torque limiter registration roller, planetary gear device, and other components.

An outline of the planetary gear device is shown in Figures 3-11 and 3-12.

1. Planetary Gear Device

a. The planetary gear device consists of a sun gear that transmits the drive of the drive shaft, a carrier that transmits the drive from the feed roller, an internal gear that drives the separation adjustment piece, and three planetary gears that transmit the drive from the sun gear and carrier.

b. The carrier and internal gear of the planetary gear device have been installed to rotate freely on the drive shaft and the planetary gears too have been installed to rotate freely relative to the planetary shaft.

c. The sun gear is directly connected to the drive shaft.

d. The internal gear of the planetary gear device is driven by the carrier and the sun gear.

e. The carrier rotates the three planetary gears attached to the planetary shafts.

f. On the other hand, the sun gear drives the planetary gears.

g. The rotation of the internal gear is as follows:
   - When rotation speed of carrier > rotation speed of sun gear (planetary gears)
     → Turns in counterclockwise direction.
   - When rotation speed of carrier < rotation speed of sun gear (planetary gears)
     → Turns in clockwise direction.

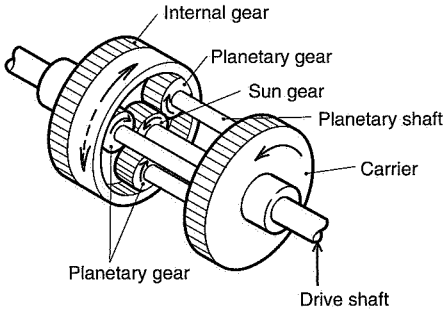

Figure 3-11

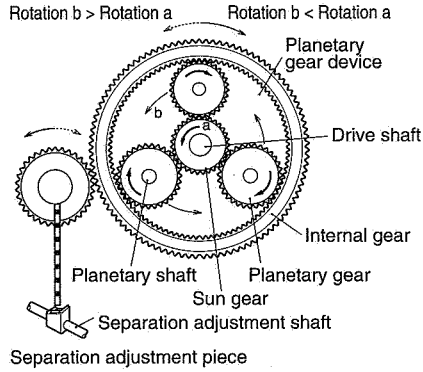

Figure 3-12

2. At Start of Pick-up

a. At start of pick-up, first the pick-up clutch (CL1) goes ON. ①

b. Since, at start of pick-up, the document has not been conveyed to the feed roller section, there is no load on the feed roller, and so the drive power from the main motor is transmitted to the feed roller and they rotate. ② → ③ → ④

c. The drive transmitted to the feed roller is transmitted to the carrier and turns the planetary gears of the planetary gear device. ④ → ⑤ → ⑥ → ⑦

d. On the other hand, the rotation of the sun gear of the planetary gear device is transmitted to the planetary gears and turns the internal gear. ⓐ → ⓑ

e. However, since there is no load acting on the feed roller, the rotation speed of the feed roller → carrier that is transmitted to the internal gear of the planetary gear device, is faster than the rotation speed from the planetary gears, so the internal gear turns in counterclockwise direction. ⑦

f. The rotation of the planetary gear device is transmitted to the separation adjustment gear, moving the separation adjustment shaft to the right. ⑧ → ⑨ → ⑩ → ⑪

g. Due to that, the separation adjustment piece moves to the right so that the feed roller descends to the bottommost end. ⑫

h. By descending the feed roller to the bottommost end, the space between the feed roller and the separation roller becomes minimum.

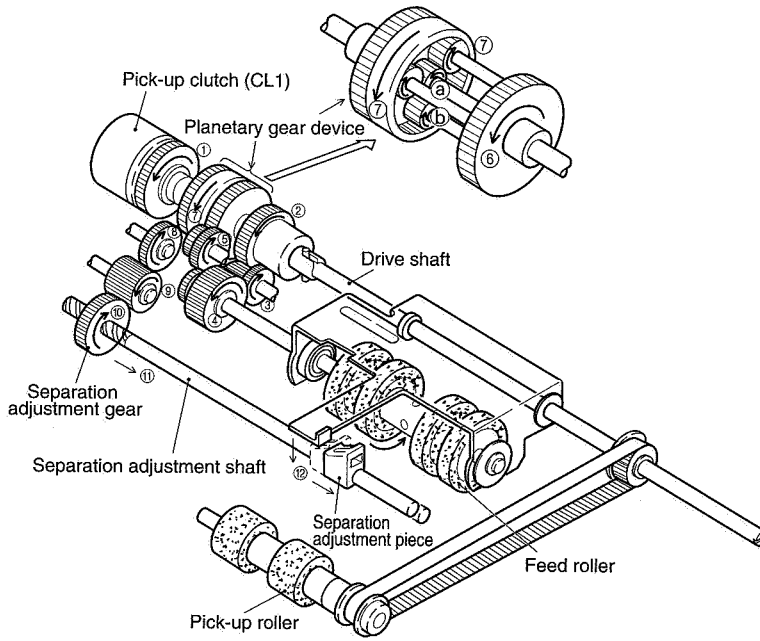

Figure 3-13

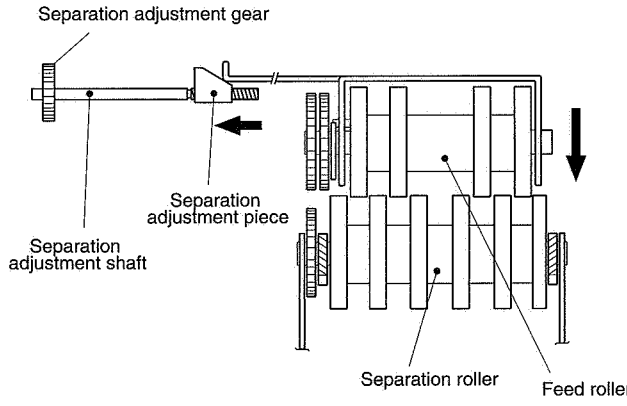

Figure 3-14

3. Document Pick-up

a. When the document, due to the rotation of the pick-up roller, is conveyed up to the feed roller section, it is not conveyed any further as the space between the feed roller and the separation roller is at its minimum.
b. Although the feed roller is rotating, there is a load on the feed roller because of the thrust of the document. ①
c. The feed roller stops when its load becomes greater than the value set by the torque limiter. ② → ③ → ④
d. Because the rotation of the feed roller stops, the rotating drive to the carrier of the planetary gear device stops. ⑤
e. Therefore, the drive to the planetary gears themselves also stops.
f. On the other hand, since the drive of the sun gear is always in rotation, the planetary gears rotate. ⓐ
g. As the drive transmitted to the internal gear of the planetary gear device rotates through of the sun gear planetary gears, the internal gear begins to rotate in the clockwise direction. ⓐ → ⓑ
h. Reverse rotation is transmitted to the separation adjustment gear and the separation adjustment shaft moves to the left. ⑧ → ⑨ → ⑩ → ⑪
i. Due to that, the separation adjustment piece now moves to the left, and the feed roller starts to rise. ⑫
j. The space between the feed roller and separation roller begins to widen and when the space becomes equal to the thickness of the document, the document is fed.
k. When the thickness of the second and subsequent documents is the same as the first document, the rotation of the internal gear of the planetary is stopped as the load on the feed roller is uniform.
l. Therefore, the separation adjustment shaft does not rotate, the adjustment piece too stops, and the documents are fed at all times.

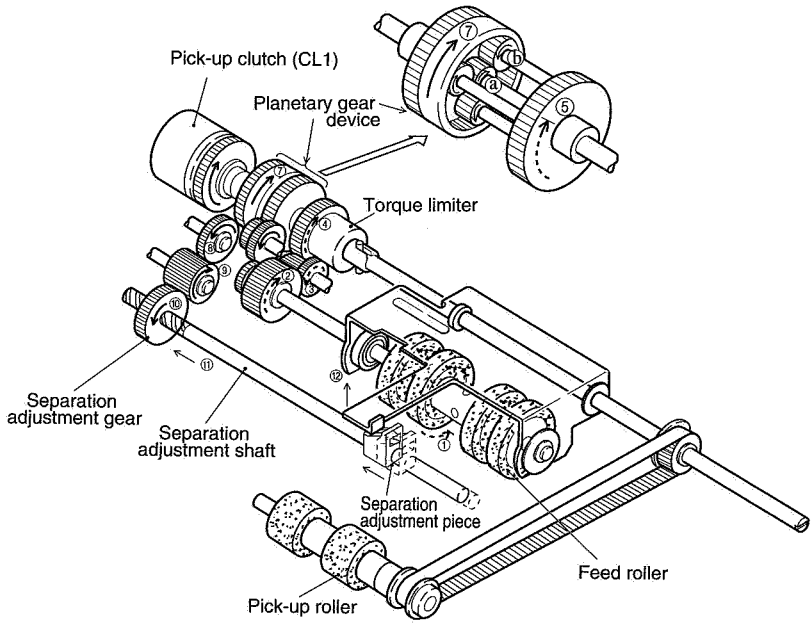

Figure 3-15

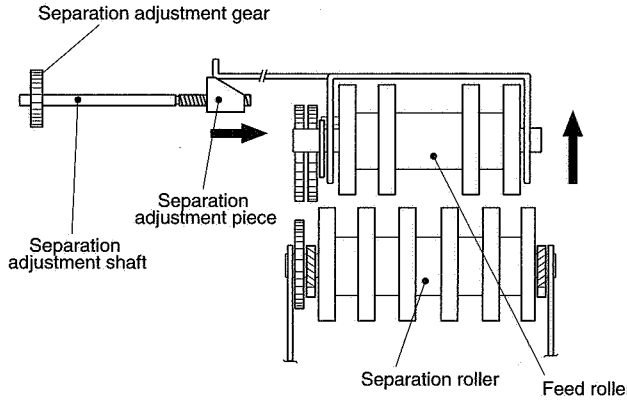

Figure 3-16

4. Pick-up Action Due to change in Document Thickness

- When the document thickness becomes thinner.

a. The load on the feed roller becomes smaller and the rotation of the feed roller becomes faster.

b. The rotation of the carrier of the planetary gear device becomes faster and the internal gear turns in the counterclockwise direction.

c. The separation adjustment gear rotates in reverse, the separation adjustment shaft moves to the right, the separation adjustment piece moves to the right, and the feed roller begins to descend.

- When the document thickness becomes thicker.

a. Action in reverse to that when the document thickness becomes thinner is taken.

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C. Detection of Faulty Document Feed

This machine has sensors installed in it to detect whether or not a document has been fed properly.

No.	Name of Sensor	Name of Signal
PS1	Document board sensor	PDP1
PS2	Registration sensor	PDP2
PS3	Scanning start sensor	PDP3
PS4	Delivery sensor	PDP4

Table 3-2

Judgment as to whether or not a document is fed properly is by whether or not the document is present in the sensor section at the check timing being output from the microprocessor.

1. Pick-up Assembly Jams

a. Pick-up Assembly Delay Jam

When the document, after passing the document board sensor (PS1), does not reach the registration sensor (PS2) within the specified time (T1).

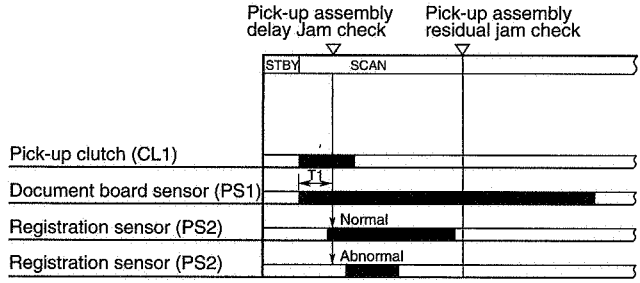

Figure 3-17

	Vertical Scanning Resolution		
	300LPI	200LPI	150LPI
T1	6000	4000	3000

Unit: ms

Table 3-3

2. Feeder Assembly Jams

a. Feeder Assembly Delay Jam

When the document, after passing the registration sensor (PS2), does not reach the scanning start sensor (PS3) within the specified time (T2).

b. Feeder Assembly Residual Jam

When the document, after passing the scanning start sensor (PS3), does not pass the scanning start sensor (PS3) within the specified time (T3).

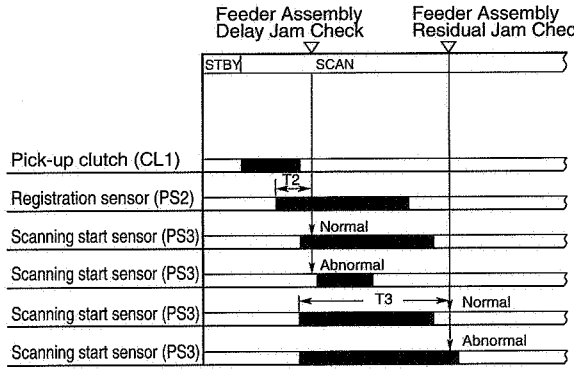

Figure 3-18

	Vertical Scanning Resolution		
	300LPI	200LPI	150LPI
T2	3000	2000	1500
T3	3423	2282	1712

Unit: ms

Table 3-4

3. Delivery Assembly Jams

a. Delivery Assembly Delay Jam

When the document, after passing the scanning start sensor (PS3), does not reach the delivery sensor (PS4) within the specified time (T4).

b. Delivery Assembly Residual Jam

When the document, after passing the delivery sensor (PS4), does not pass the delivery sensor (PS4) within the specified time (T5).

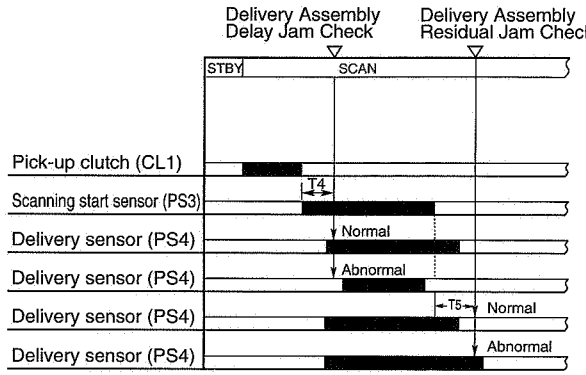

Figure 3-19

	Horizontal Scanning Resolution		
	300LPI	200LPI	150LPI
T4	1710	1140	855
T5	1710	1140	855

Unit: ms

Table 3-5

VII. HARDWARE CONFIGURATION

1. Outline

Figure 3-20 shows the configuration of the hardware of this machine.

The bus line of the CPU is connected to the gate array, RAM, and CPU shown in Figure 3-20 below.

BASIS-CHIP	: Multi-image processing controller
NOAH-CHIP	: Binarizing image controller
IF III-CHIP	: Binary image controller (IF: Image Flow)
SPC-CHIP	: SCSI Protocol controller (SPC: SCSI Protocol)
SORAMAME-CHIP	: Encoded image data transmission controller (SORAMAME: SCSI Operating Replay and Memory Access Management Engine)
ENC-CHIP	: Encoding controller (ENC: Encode)

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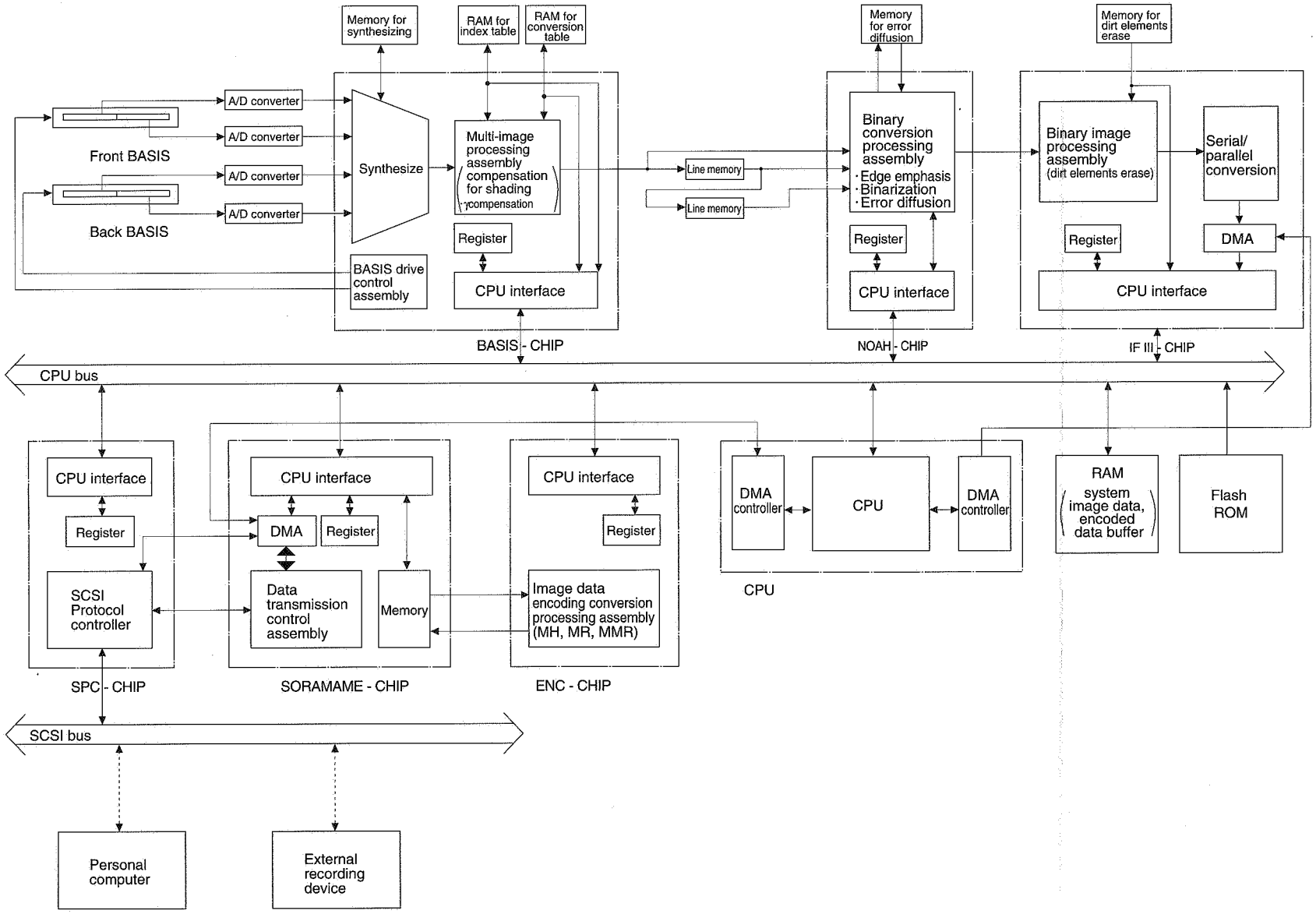

Figure 3-20

VIII. FLOW OF IMAGE DATA

A. Outline

Figure 3-21 is a block diagram showing the flow of image data in this machine.

The CPU controls the flow of image signals by setting each register.

Signals from BASIS are output by being divided into the former half and the latter half.

Electrical signals (analog) which are proportional to the density of each picture element are transmitted serially from BASIS. These signals are first converted by the A/D converter to digital signals of a level proportional to the density.

Subsequently, the data transmission speed is converted from 2.5 Mbit/second to 10 Mbit/second in the data transmission speed conversion memory.

Next, the front/back and the former half and latter half data of each BASIS are made composite by the multi serial circuit.

The composite 6-bit digital signals are subjected to compensation for shading and γ compensation through the multivalue image processing circuit.

They are further subjected to edge emphasis and error diffusion processing by the binarizing circuit and converted into binary signals.

The binarized image data are subjected to dust picture element erasure (when dust picture element erase function is selected) by the binary image processing circuit. Also, when the scan resolution is 300 dpi or less, thinning out is done in accordance with the resolution.

Every 16 bits of the binarized image data that have been subjected to various image processing is converted to parallel signals by the serial/parallel converter and stored each time in image memory through DMA transmission.

When the image data is to be encoded, they are subjected to encoding by the image encoding circuit, accumulated in the image data buffer memory, and transmitted by DMA transmission again to the SCSI bus via the SCSI control circuit.

On the other hand, when the image data are not to be encoded, they are transmitted directly from image memory by DMA transmission to the SCSI bus via the SCSI control circuit.

The image data that have been transmitted to the SCSI bus are sent to an external recording device via the personal computer and recorded in the external recording medium.

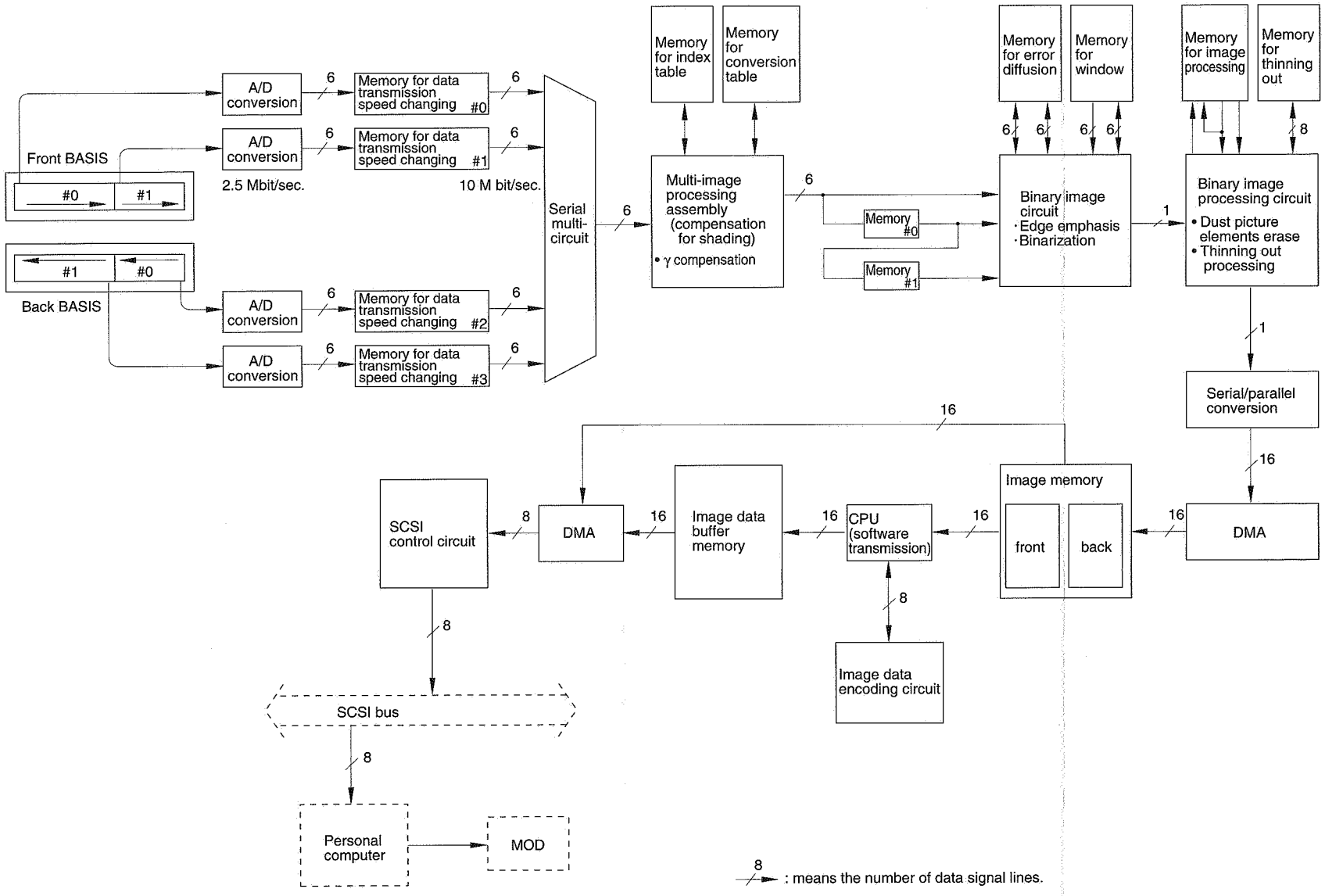

Figure 3-21

B. Flow of Image Data

1. Signals from BASIS

This machine has two BASIS which respectively read the images on the front and back sides of the document.

These BASIS are offset by 6 mm to prevent the image on the back side of the document from being read through to the front side.

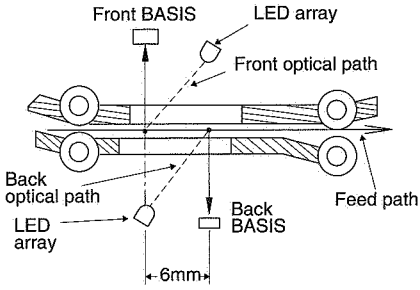

Figure 3-22

In order to speed up the scanning of image data, the former half and latter half of BASIS separately and, moreover, simultaneously read the image. (Figure 3-23)

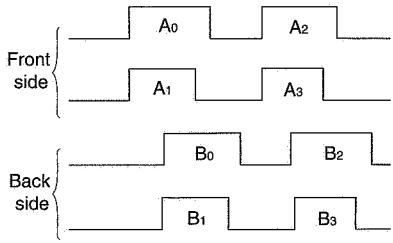

Figure 3-23

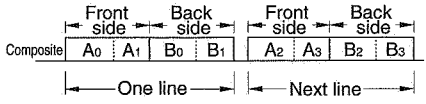

Figure 3-24

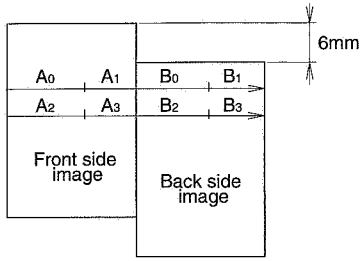

Figure 3-25

Image signals of the former half and latter half of the front side and back side are respectively converted by an A/D converter from analog signals to digital signals.

The image of the front side and back side in one line is made composite. (Figure 3-24)

The composite digital signals are subjected to shading compensation and γ compensation image processing at the multivalue image processing circuit.

This image processing is carried out by a conversion table RAM with a capacity of 8 kbits.

The digital signals output from the multivalue image processing circuit become white and black binarized signals in an image binarizing circuit based on the density processing level (slice level) used during recording.

The binarized signals undergo dust picture element erasure by a dust picture element erase memory with a capacity of 64 kbits.

A detailed explanation is given here from the time the image data are accumulated in image memory until they are output to the SCSI bus.

The flow of image data is shown in Figure 3-26.

The serial/parallel converted 16-bit image data are DMA transmitted via the CPU bus, encoded by the image encoding controller (ENC-CHIP), and stored in the memory of the encoded image data transmission controller (SORAMAME-CHIP).

When encoded image data are sent out as they are to the SCSI bus, the following processing is carried out as the data occupies the whole SCSI. When the memory of this encoded image data transmission controller (SORAMAME-CHIP) becomes full, the data is stored each time in the encoded image buffer zone of the buffer memory (DRAM).

When a certain amount of data is accumulated in the encoded image buffer zone, the data is DMA-transmitted again, via the SCSI controller zone of the encoded image data transmission controller (SORAMAME-CHIP), to the SCSI protocol controller (SPC-CHIP).

Subsequently, the data is transmitted to the SCSI bus.

Also, when the slow-processing personal computer is used, since the transmission speed to the personal computer, compared to the image data input, becomes slow, the following processing is carried out.

The image is not transmitted to the image encoding controller (ENC-CHIP), but is stored temporarily in the raw image buffer zone of the buffer memory (DRAM). The feeding of documents is then stopped and the data is transmitted to the image encoding controller (ENC-CHIP).

As soon as there is no data in the buffer memory (DRAM), the feeding of documents is resumed and the above processing is repeated.

The processing of image data encoded by the image encoding controller (ENC-CHIP) is the same as normal processing.

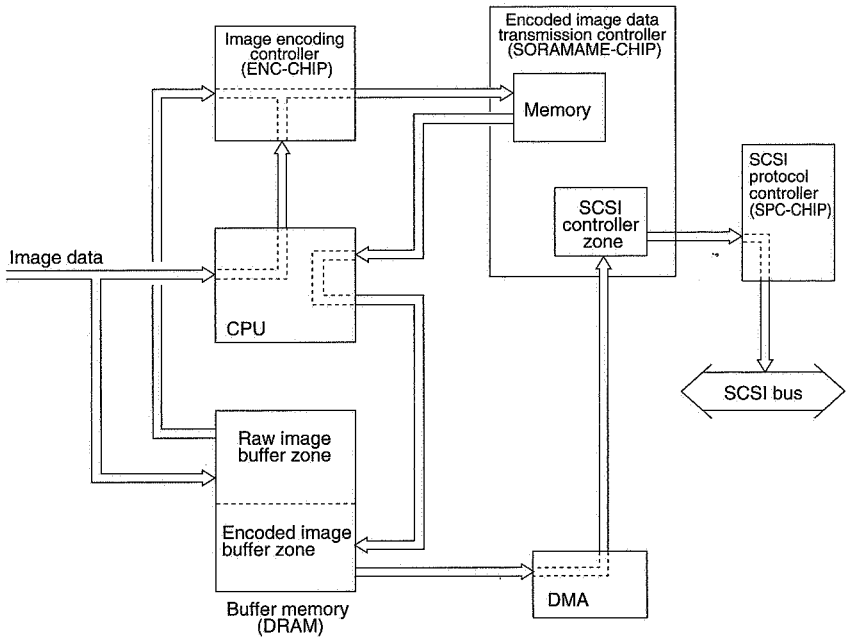

Figure 3-26

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C. DMA

DMA is an abbreviation for Direct Memory Access. It refers to the operation whereby data is transmitted directly between the memory and peripheral devices without going via the CPU.

When data from a peripheral device is to be written to the memory using commands from the CPU, the write operation takes place according to the read and memory write procedure. In the case of DMA-transmission, the data is transmitted directly from the peripheral device to the memory, enabling the process to take place is less time.

When such a DMA operation is carried out, address output to the memory, selection of peripheral devices, and system bus control of the read and write output, etc., take place in a circuit called a DMA controller which is separate from the CPU.

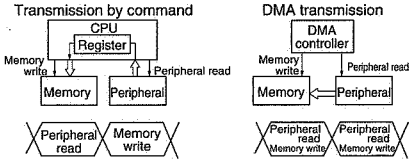

Figure 3-27

IX. DESCRIPTION OF ELECTRICAL CIRCUITS

A. Outline

Figure 3-28 shows the block diagram of the CPU circuit based on the flow of image data.

A series of the analog signal output from the BASIS and output to external devices through the image processor is shown.

The block diagram indicates the main functions of the machine in units of devices.

The ☐ in the frame indicates the name of the device used in each gate array.

1. Description of Operation of Block Diagram

The electrical signals input serially from the BASIS are first amplified and A/D-converted by the A/D converter, then input as 6-bit digital signals to the multivalue image controller (BASIS-CHIP), where four digital signals are composed via the composing RAM.

The white picture element data is arithmetically processed in the multivalue image controller, and then stored in the conversion table RAM, in preparation compensation for shading. The conversion table RAM contains the compensation data table which is used to compensate for the level of each BASIS. Thus, during image readout, the BASIS signal is first compensated and before being set as output to convert the resolution in the horizontal scanning direction.

The shading-compensated 6-bit image signals output from the multivalue image controller (BASIS-CHIP) are input to the image binarizing controller (NOAH-CHIP).

These image signals undergo edge emphasis and error diffusion process in the vertical scan direction using two line memories, and are binarized.

The image signals binarized in the image binarizing controller (NOAH-CHIP) are input to the binary image controller (IF III-CHIP).

In the binary image processing controller, dust picture element erase takes place.

The image signals output from the binary image processing controller are encoded in the image data encoding controller (ENC-CHIP).

The 8-bit image data output from the image data encoder controller (ENC-CHIP) is transmitted to external devices via the SCSI controller (SPC-CHIP) by the compressed image data transmission controller (SORAMAME-CHIP).

The compressed image data transmission controller (SORAMAME-CHIP) performs DMA transmission via buffer memory.

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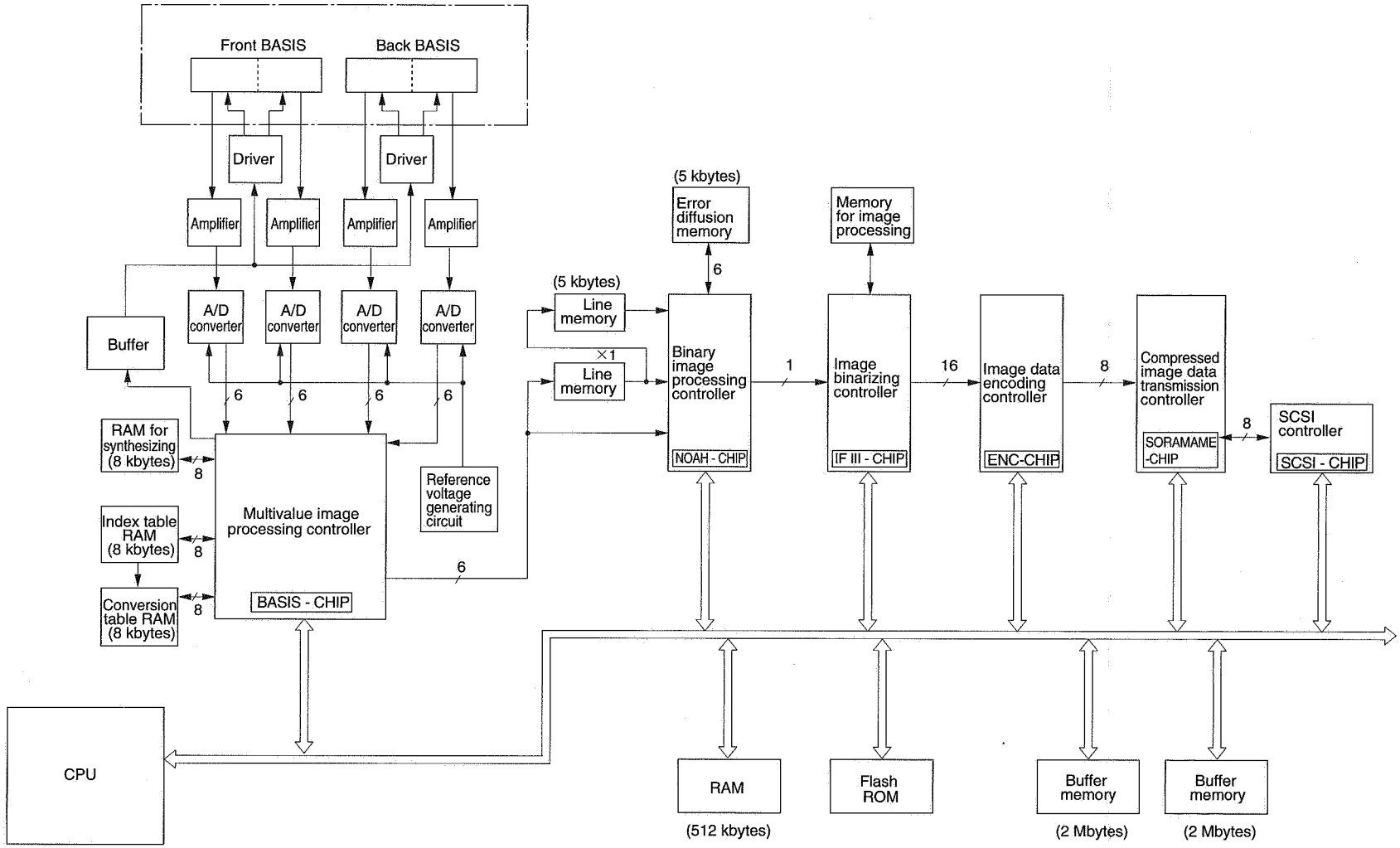


Figure 3-28

B. CPU Circuit

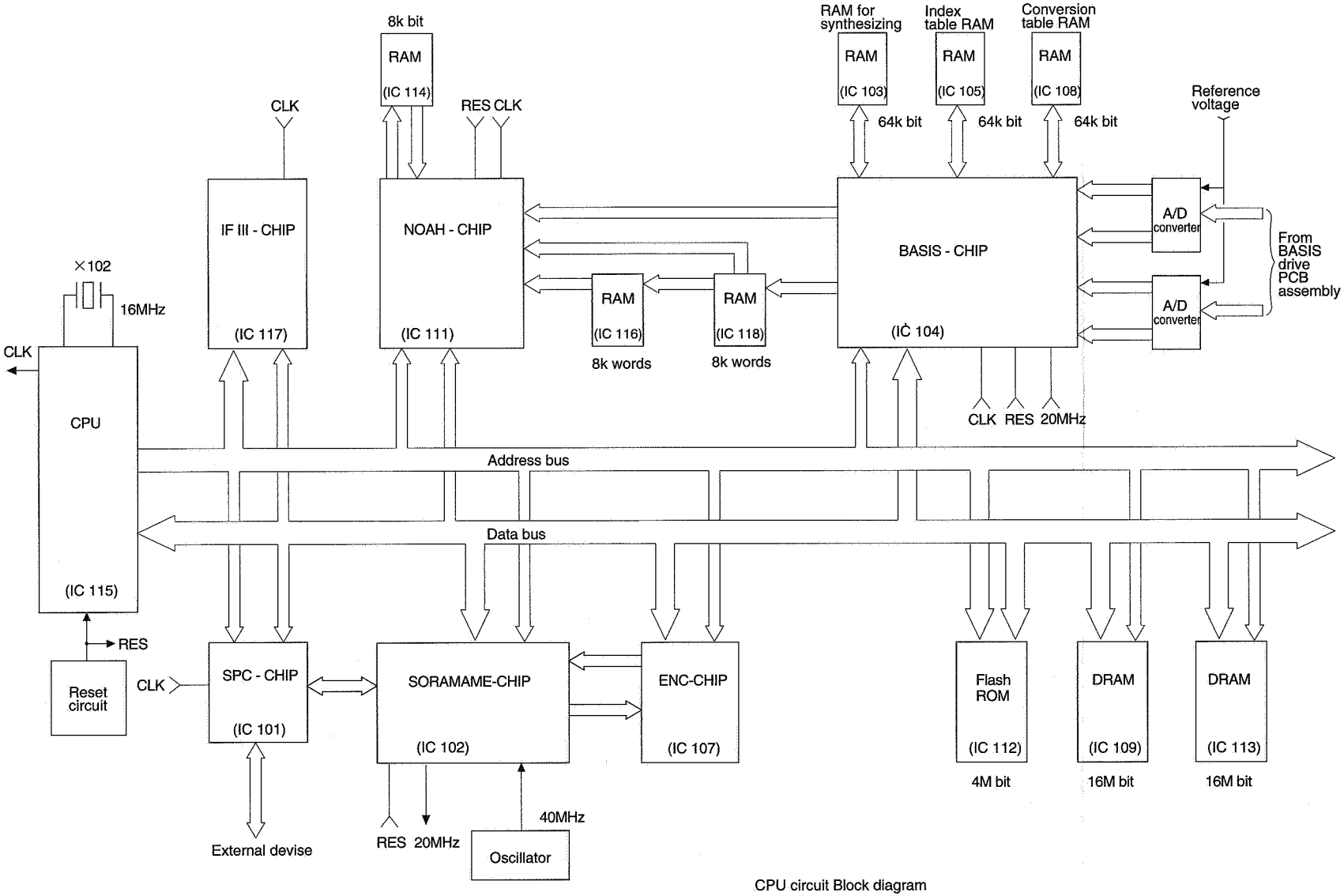
Figure 3-29 shows the block diagram of the CPU PCB.

The control of this machine is performed by a 32-bit microprocessor of the IC115 single chip RISC.

A Flash ROM (IC112:4 Mbit) is connected to the CPU.

Also connected to the CPU are the following elements whose roles are as follows.

- IC101: SPC-CHIP (SCSI protocol controller)
  This is the control gate array for SCSI interface.
- IC102: SORAMAME-CHIP (Encoded image data transmission controller)
  This is the control gate array for interfacing the interface with the image data encoding controller (IC107: ENC-CHIP) and with the SCSI protocol controller (IC101: SPC-CHIP).
- IC107: ENC-CHIP (Image data encoding controller)
  This is the gate array for encoding image data.
- IC117: IF III-CHIP (Binary image processing controller)
  This is the gate array for dust picture element erase image processing.
- IC111: NOAH-CHIP (Image binarizing controller)
  This is the gate array for carrying out edge emphasis and error diffusion.
- IC114: RAM
  This is the memory for error diffusion processing.
- IC116 and IC118: RAM
  These are memories for edge emphasis processing.
- IC104: BASIS-CHIP (BASIS controller)
  This is the gate array for driving BASIS shading compensation, and γ compensation.
- IC103, IC105, and IC108 (RAM)
  These are memories for making composites of the front and back sides of documents and for shading.
  IC103 is the RAM for combining the front and back side data, IC105 for the index table, and IC108 for the conversion table.
- IC112: RAM
  This is the flash ROM for working this machine and for writing various data.
- IC109 and IC113: DRAM
  These are buffer RAM's for transmitting image data.



CPU circuit Block diagram

Figure 3-29

C. BASIS Drive Circuit

1. Outline

The circuit shown in Figure 3-30 amplifies the voltage (analog) corresponding to each picture element output from the BASIS, combines the front image signal with the back image signal and converts the resulting signal into a 6-bit digital signal.

2. BASIS Operation

The BASIS (Base Stored Image Sensor) used in this machine has 3042 picture element bits and consists of a photosensitive assembly, transmitter assembly, and output assembly.

The BASIS is constructed so that it is divided into former and latter blocks in the ratio of 7:6.

The BASIS consists of 13 chips. Each chip has 234 sensors (phototransistors) arranged in it.

The first nine bits of the left end chip 1 and the last nine bits of the right end chip 13 of the BASIS are dummy bits and not used.

The total number of sensors in the BASIS is:

13 (No. of chips) x 234 (No. of bits per chip) - 18 (sensors not being used) = 3024 (pieces).

Resolution is:

3024 ÷ 257 (width: mm) = 11.8 (lines/mm) = Approx. 300 DPI

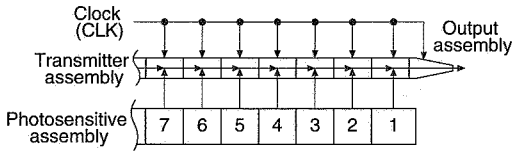


Figure 3-30

① Construction of BASIS

Figure 3-17 (3-31) shows the construction of BASIS

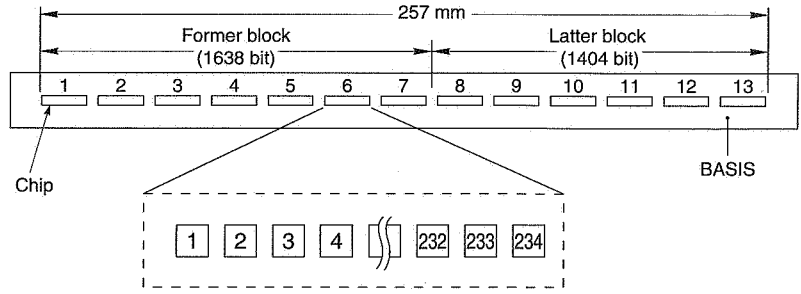


Figure 3-31

Figure 3-32 is the block diagram of the BASIS drive circuit.

Two BASIS are used, one for reading the front side of documents and the other, the back side.

In order to read documents at high speed, the BASIS read the former and latter blocks simultaneously.

The analog voltage of the former block (10 - 1638 bits) and the analog voltage of the latter block (1639 - 3024 bits) are output respectively as Vout1 and Vout2 to the CPU PCB.

Clock signals (FSP and BSP) are input into BASIS.

The analog signals output from BASIS are amplified by amplifiers and are converted by 6-bit A/D converters into 6-bit digital signal.

After that, shading compensation is carried out at the multivalue image processing assembly.

- BASIS transmitter assembly

When SP signal becomes ON, the potential held at the preceding time synchronizes with CLK and is transmitted successively to the output assembly.

(Analog shift register)

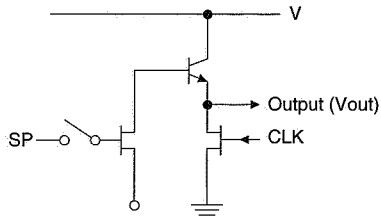


Figure 3-33

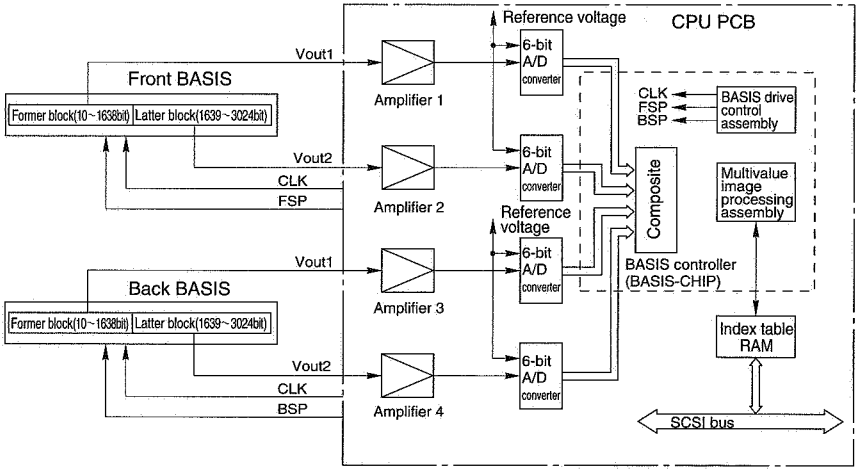


Figure 3-32

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

Figure 3-34 is the timing chart of the operation of BASIS.

SP is the line interval signal indicating a one line interval.

CLK is the BASIS drive clock and operates at 1.25 MHz.

Vout1 indicates the output of the former block and Vout2, the output of the latter block of BASIS.

The intervals between CLK signal pulses 1 - 26 of the Vout1 output are the clamp intervals (52 bits). The intervals between pulses 27 - 31 are the dummy bits (9 bits), and are invalid bits (1 - 9 bits) of BASIS.

The intervals between CLK signal pulses 31 - 851 are the valid bits of BASIS and the 10th bit to the 1629th bit are output as image signals (S1 - S1629).

In the same manner, the intervals between CLK signal pulses 1 - 26 of the Vout2 output are the clamp intervals (52 bits).

The intervals between pulses 27 - 671 are the valid bits of the latter block of BASIS and the 1639th bit to the 3024th bit are output as image signals (S1630 - S3024).

The intervals between CLK signal pulses 671 - 676 are the invalid bits of the back end of BASIS.

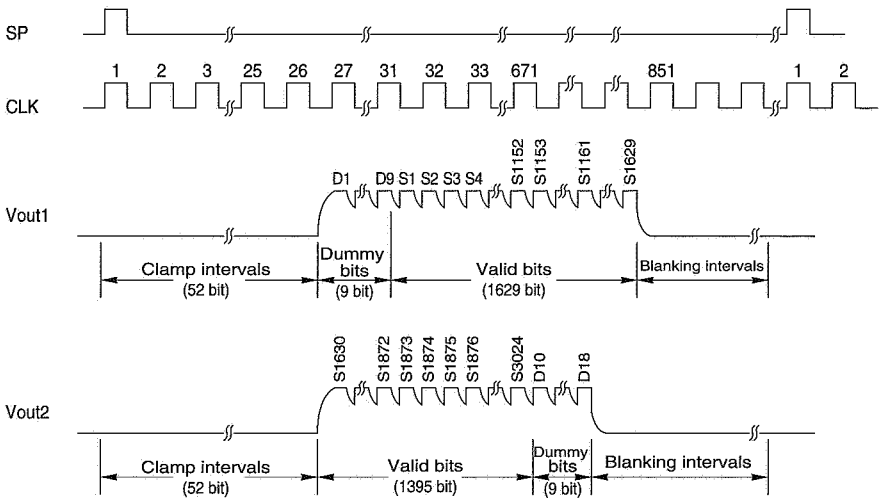


Figure 3-34

D. Multivalue Image Processing Control (BASIS-CHIP) Circuit

1. Outline

This circuit has the following functions.

- It generates the drive timing signals for the two BASIS which read the front and back sides of the document.
- It controls access to the index table RAM and the conversion table RAM from the BASIS side and the CPU side at shading compensation.

2. Explanation of Operation

Figure 3-35 is a block diagram of the multivalue image processing controller (BASIS-CHIP).

Figure 3-36 is the timing chart of image data read by BASIS.

The former and latter block of the front side/back side of BASIS are read simultaneously.

The read timing of the back side starts a half line after the reading of the front side.

The data read from the front and back sides, after being converted by A/D converters into digital signals, are combined at the data speed conversion assembly/combining assembly.

Also data input at a transmission speed of 2.5 Mbit/second are converted to 10 Mbit/second.

After that, shading compensation is done by the shading compensation assembly and the data is output to the binarizing controller (NOAH-CHIP).

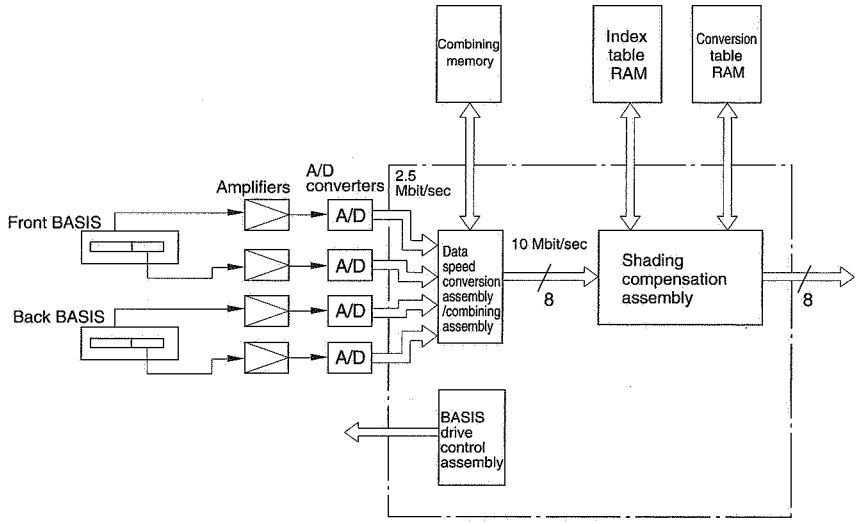


Figure 3-35

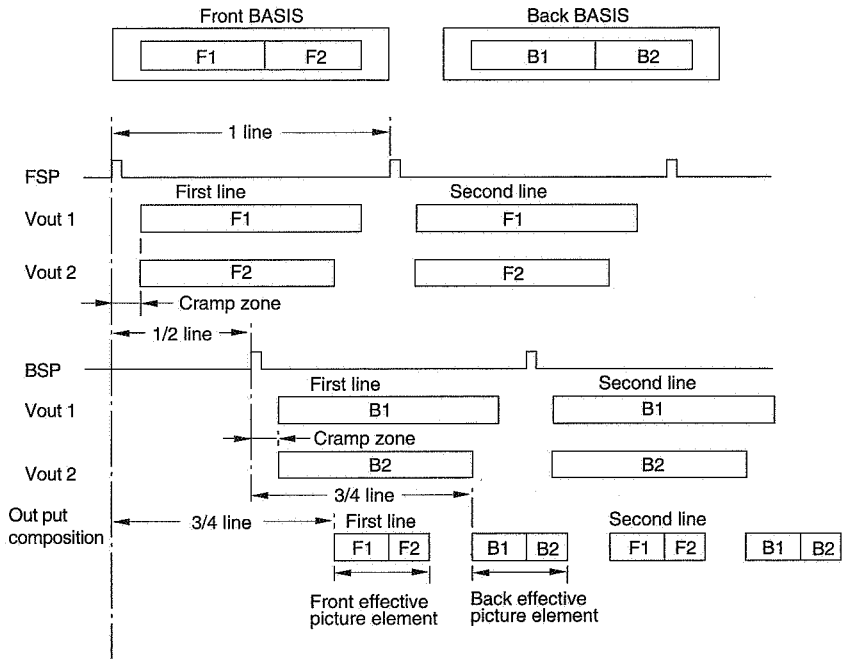

Front BASIS
F1
F2
Back BASIS
B1
B2
1 line
FSP
First line
Second line
Vout 1
F1
F1
Vout 2
F2
F2
Cramp zone
1/2 line
BSP
First line
Second line
Vout 1
B1
B1
Cramp zone
Vout 2
B2
B2
3/4 line
Out put composition
3/4 line
First line
F1
F2
B1
B2
Second line
F1
F2
B1
B2
Front effective picture element
Back effective picture element

Figure 3-36

E. Image Binarizing Controller (NOAH-CHIP) Circuit

1. Outline

This circuit binarizes the 8-bit image data that is output from the multivalue image processing controller (BASIS-CHIP) by carrying out the following image processing.

- Edge Emphasizing
  Emphasizes the differences in light and dark areas in order to reproduce the image distinctly.
- Error Diffusion
  Reproduces the halftones of photographs, etc.

2. Explanation of circuit

Figure 3-37 shows an outline of the circuit of the image binarizing controller (NOAH-CHIP).

The 8-bit image data that is output from the multivalue image processing controller (BASIS-CHIP) is input to the image binarizing controller (NOAH-CHIP) via two line memories.

Edge emphasizing is performed with this signal.

Memory #2 is used for error diffusion processing.

The data is image-processed, and then binarized and output.

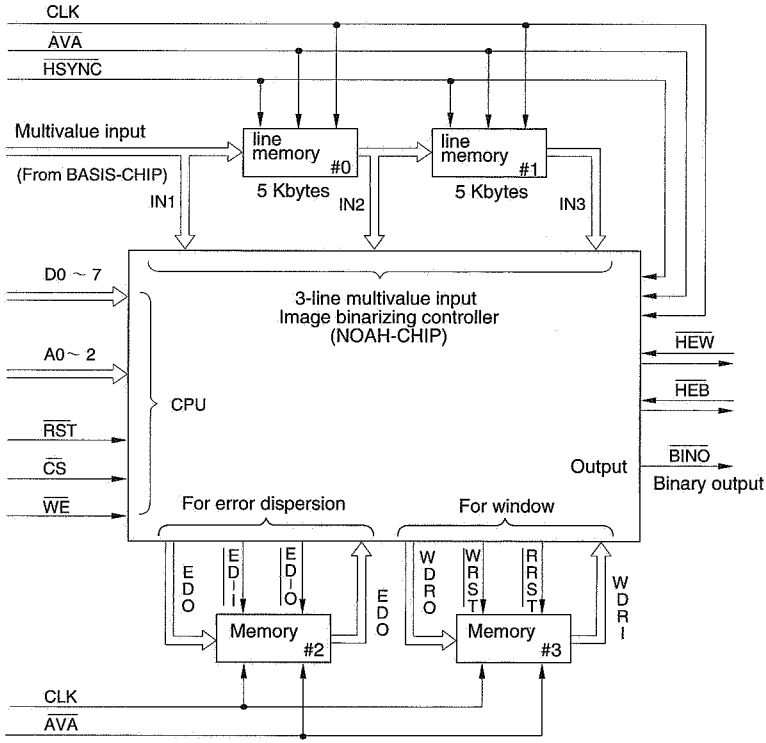


Figure 3-37

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

The following gives the names of signals and their meanings.

- CLK : Reference clock
- $\overline{\text{PAG}}$: Interval signal indicating the length of 1 page of the document.
- $\overline{\text{HSYNC}}$: Horizontal synchronizing signal.
- $\overline{\text{AVA}}$: IC operation control signal.
- $\overline{\text{F/B}}$: Input front/back (threshold value) switching signal.
- $\overline{\text{HEW}}$: Indicates the effective interval of the input image.
- $\overline{\text{HEB}}$: Indicates the effective interval of the input image.
- INx : Input image bus of 8 bits x 3 lines. Line in which IN 1 is first processed.
- $\overline{\text{BINO}}$: Binary image output data.
- DLIx : General purpose input signal for synchronizing delay.
- DLOx : General purpose output for synchronizing delay.
- $\overline{\text{PAGO}}$, $\overline{\text{HYSNCO}}$, $\overline{\text{F/BO}}$, $\overline{\text{HEWO}}$, $\overline{\text{HEBO}}$: Signals that delay the respective input signals by 20 clocks.
- EDI : Error data input from the error diffusion memory.
- EDO : Error data output from the error diffusion memory.
- WDRI : Binary data input from the windows memory.
- WDRO : Binary data output from the windows memory.
- $\overline{\text{ED\_O}}$: Read reset of error diffusion memory.
- $\overline{\text{ED\_I}}$: Write reset of error diffusion memory.
- $\overline{\text{WRST}}$: Write reset of Windows memory.
- $\overline{\text{RRST}}$: Read reset of Windows memory.
- A : Internal register selection address.
- D : CPU data bus.
- $\overline{\text{CS}}$: Chip select signal.
- $\overline{\text{WE}}$: Write enable signal.
- $\overline{\text{RST}}$: Reset signal.
- Tx : IC text signal.

F. Binary Image Processing Controller (IF III-CHIP) Circuit

1. Outline

The binary image processing controller (IF III-CHIP) performs the following processing on image data binarized by the image binarizing controller (NOAH-CHIP).

- Dust picture element erasure
- Serial/parallel conversion
- Thinning out of picture elements

2. Processing Details

a. Performs the following processing on image signals input from each device.

- Dust picture element erasure

It treats independent and isolated picture element data in the input image data as dust picture elements (image noise) and forcibly converts them into "background" picture elements.

This function is mainly to make it easier to see a binarized image of a soiled document or background as many fine dots and also to reduce the lowering of the encoding rate of the image data.

- Thinning out of picture elements

This function is to thin out picture elements in accordance with the resolution and to reduce the size.

b. Converts image-processed binarized data into 16-bit parallel signals in order to transmit them to the image buffer memory at high speed.

3. Explanation of Circuit

Figure 3-38 is a block diagram of the binary image processing controller (IF III-CHIP).

Although the input selector is shown as a circuit which selects one signal system from four, actually it supports only one system.

The auxiliary signal generation circuit generates the following signals.

- $\overline{\text{PAG}}$: Page interval signal
  Level signal indicating the valid interval (length of one page) of the document.
- $\overline{\text{HSYNC}}$: Horizontal synchronizing signal
  Pulse signal indicating the leading position of one scanned line of the image.

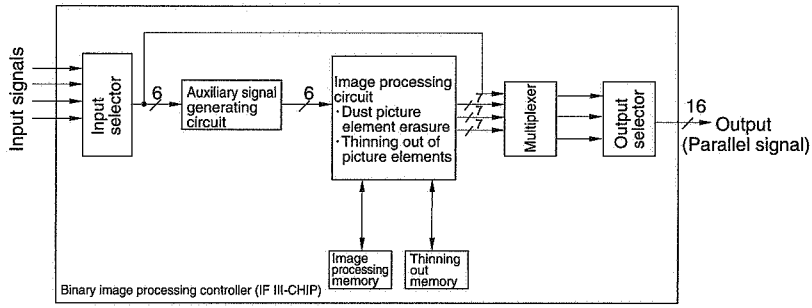


Figure 3-38

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

- $\overline{AVA}$: Valid image interval signal
  Level signal indicating the interval of the valid picture element data in one scanned line.

- LN $\overline{F}$/B : Front side/back side designation signal
  Level signal indicating front/back interval of a double-sided document when the document is handled by combining the data as one scanned line. For a single sided document, the front is fixed at "0" and the back at "1."

Data is subjected to dust erasure and thinning out of picture elements by the image processing circuit and output as 16-bit parallel signals via the output selector.

G. Encoded Image Data Transmission Controller (SORAMAME-CHIP) Circuit

1. Outline

Figure 3-39 shows the block diagram of the encoded image data transmission controller (SORAMAME-CHIP) and the functions of the surrounding devices.

The encoded image data transmission controller (SORAMAME-CHIP) has the following functions.

- Interface between the CPU and the image date encoding controller (ENC-CHIP) in order to provide a high speed image data encoding operation.
- Interface between the CPU and the SCSI protocol controller (SPC-CHIP) in order to make it possible to give and take image data with the SCSI.

2. Explanation of Operation

The following is the flow of operation.

Note that the numbers in the figure correspond to those in this explanation.

① The CPU reads the image data from memory 1 and writes that data in the input register memory in the encoded image data transmission controller (SORAMAME-CHIP). The capacity of the memory is 7 words.

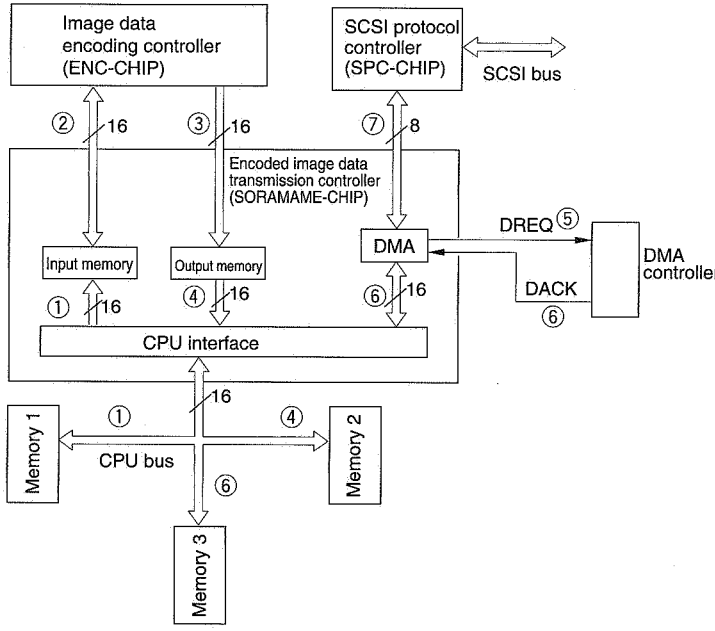


Figure 3-39

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② The data written in the input memory is transmitted to the image data encoding controller (ENC-CHIP) via a 16-bit bus specially provided for that purpose.

③ The image data encoded by the image data encoding controller (ENC-CHIP) is transmitted to the output memory in the encoded image data transmission controller (SORAMAME-CHIP) via a 16-bit bus specially provided for that purpose.
The capacity of this memory is 7 words.
When the memory becomes full, the encoded data transmission controller (SORAMAME-CHIP) stops transmitting.

④ The CPU reads the encoded data from the output memory register and writes that data in memory 2.
The foregoing ① - ④ is the interface function between the CPU and the image data encoding controller (ENC-CHIP).

⑤ When on DMA transmission, first DREQ (DMA transmission request) signals are sent from the encoded image data transmission controller (SORAMAME-CHIP) to the DMA (DMA controller).

⑥ DACK (DMA request acknowledgment) signals are returned from DMA, and image data is then transmitted by the DMA controller from memory 3, via the CPU bus, to the encoded image data transmission controller (SORAMAME-CHIP).

⑦ Image data is transmitted from the encoded image data transmission controller (SORAMAME-CHIP) to the SCSI protocol controller (SPC-CHIP) via an 8-bit bus specially provided for that purpose.

The foregoing ⑤ - ⑦ is the interface function between the CPU and the SCSI protocol controller (SPC-CHIP).

H. Main Motor Driver Circuit

1. Outline

Figure 3-40 shows an outline of the motor driver circuit.

The main motor is a DC motor.

The main motor is rotated at three different speeds, or high speed, medium speed, and low speed by combining two signals, SPEED A and SPEED B.

If the motor should stop because of abnormality, M. LOCK signal becomes "H," transmitting an abnormal signal to the CPU to stop the motor automatically.

Rotation	SPEED A	SPEED B	Rotating speed	Feed speed
Low speed	H	H	144rpm	121.0 mm/sec.
Medium speed	L	L	216rpm	181.4 mm/sec.
High speed	H	L	288rpm	241.9 mm/sec.

Table 3-6

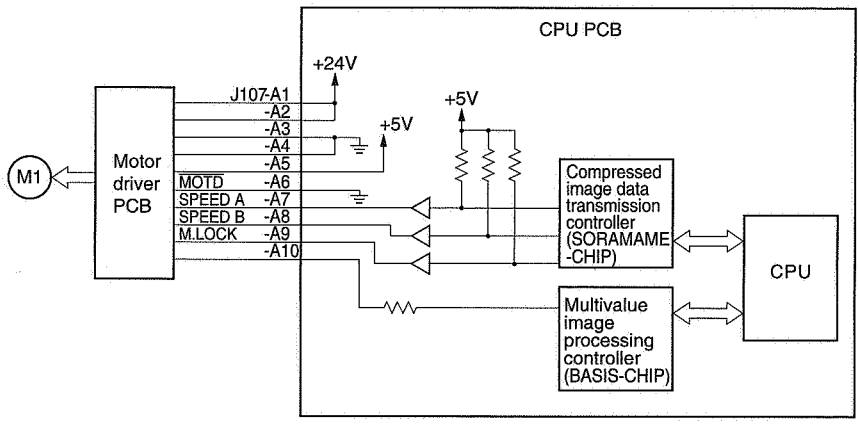
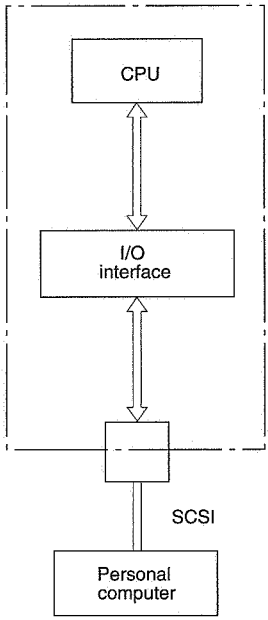


Figure 3-40

X. INTERFACE

A. Outline

This machine has a kind of interface shown in Figure 3-41.



The SCSI interface communicates with personal computers.

Figure 3-41

1. Outline of Interfaces

When data is transmitted from the this machine to an external device, it passes through an interface. The cable used then is called an interface cable, and the cable connector between this machine and the external device is called an interface connector.

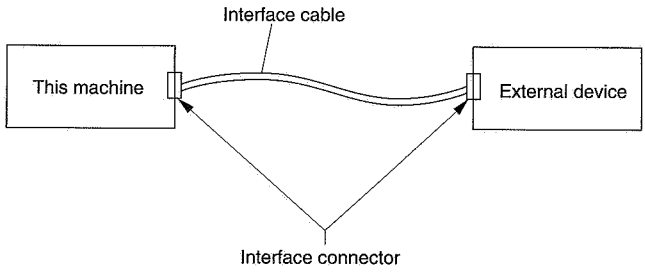


Figure 3-42

Data is transmitted between this machine and an external device via this interface cable. A set of rules is necessary to transmit data between these two different kinds of hardware.

This set of rules comprises a standard which covers the meaning and transmission procedure of the signals to be transmitted (data and control signals) (protocol: communications rules), and also the hardware. It is necessary for both sides to conform to the same standard.

Interfaces can be broadly divided into parallel interfaces and serial interfaces.

A commonly used parallel interface is the Centronics interface. Other parallel interfaces include GPIB and SCSI.

While, serial interfaces include RS232C, RS422, RS499 and the TTY interface.

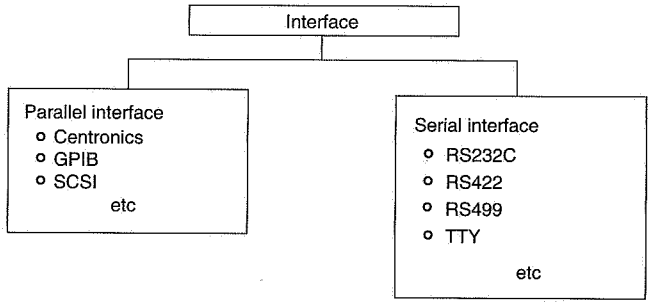


Figure 3-43

2. Parallel interfaces

When sending parallel data, one byte (1 character) of data can be sent at one time.

A dedicated line is assigned to each bit, and the bits are sent in parallel with each other.

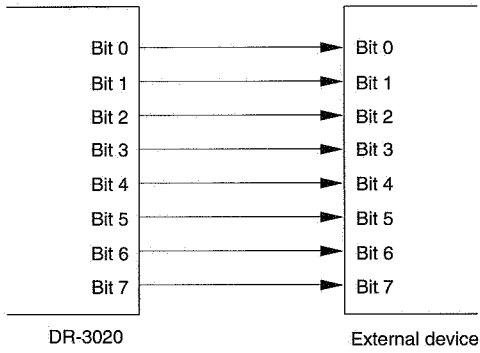


Figure 3-44

This parallel data is not suitable for transmission over long distances. Generally, the shorter the line, the faster the data can be transmitted.

Note: When parallel data is sent over a long distance, radio frequency interference (RFI) causes a problem, and the data signals themselves become very weak during transmission.

Parallel interfaces include the Centronics interface, GPIB(Note), and SCSI. Of these, GPIB and SCSI have too many functions to make them suitable as a printer interface, hence they are not commonly used. This section describes the Centronics interface.

Note: GPIB (General Purpose Interface Bus) is an interface bus specification standardized as IEEE-488-1975 by IEEE (The Institute of Electrical and Electronics Engineerings).

Because of this standard number, GPIB is sometimes referred to as IEEE488. Table 3-7 shows the maximum ratings of GPIB.

Item	Maximum Value
Total length of cable	20 m
Cable length between devices	5 m
Transmission speed	1 Mbyte/sec
Number of units connected	15 sets

Table 3-7

3. Serial Interfaces

In serial data transmission, one byte of data is transmitted using one signal line per one bit at a time. Figure 3-45 shows an example of transmitting two bytes of data.

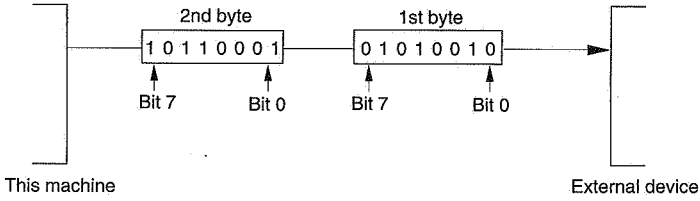


Figure 3-45

Serial data transmission is not affected by distance, and is most generally used.

Serial interfaces include RS232C, RS422, RS499, TTY interface, etc. High speed features, RS422 and RS499. The TTY interface was formerly used for printer connection using the relay circuit but is no longer in common use.

B. SCSI Interface

1. Outline

SCSI is an abbreviation for Small Computer System Interface. It is a standard interface between a computer and a peripheral device.

An SCSI can be connected almost regardless of the kind of devices connected to the SCSI bus.

An SCSI permits a plurality of peripheral devices of as many as seven sets to be connected to the logical bus.

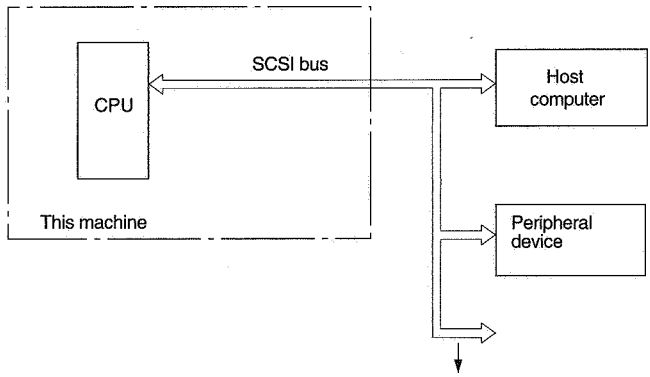


Figure 3-46

Main signals used for data transmission

The main signals on the SCSI bus are shown in Table 3-8.

The SCSI bus consists of a total of 18 signal lines which consist of data signals (one byte + parity bits = nine signals) and control signals (nine signals).

Pin No.	Signal name	Input/output at CPU side	Meaning
26-34	DB7 - 0, DBP (Data Bus)	Input/output	This is a bidirectional data bus consisting of one byte of data and an odd parity bit. This data bus is used to transmit commands, data, statuses and messages in the data transmission phase. In the arbitration phase, it is also used to output an SCSI ID for judging the priority sequence of the right to use a bus. In addition, in the selection or re-selection phase, the SCSI ID for identifying the initiator and target is sent out.
43	BSY (BuSY)	Input/output	This signal indicates that the SCSI bus is being used. Also, in the arbitration phase, it indicates a request for the right to use the bus.
47	SEL (SELect)	Input/output	This signal indicates that the initiator selected the target (selection phase) or that the target re-selected the initiator (re-selection phase). Also, in the arbitration phase, it indicates that the right to use the bus has been successfully obtained.
48 50 46	C/D (Control/Data) I/O (Input/Output) MSG (MeSsaGe)	Input	The target specifies the kind of data to be transmitted on the data bus according to the particular combination of these three signals. The I/O signal is also used to identify the selection phase and the re-selection phase.
49	REQ (REQuest)	Input	This signal is sent from the target requesting the initiator to transmit data, in the data transmission phase.
44	ACK (ACKnowledge)	Output	This signal is sent from the initiator to the target in response to the REQ signal.

Table 3-8

Pin No.	Signal name	Input/output at CPU side	Meaning
41	ATN (ATeNtion)	Output	This signal indicates that the initiator has a message to be sent to the target.
45	RST (ReSeT)	Input/output	This signal instructs all SCSI devices on the bus to be reset.

Table 3-8

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

2. Data Transmission

The data input and output, and the signal name of the connector are shown below.

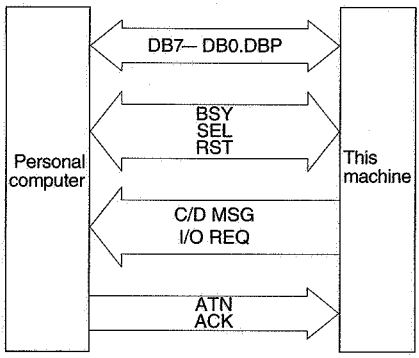


Figure 3-47

Pin NO.	Signal Name	Remarks
1-12	GND	(Ground)
13	Open	(Non-connection)
14-25	GND	(Ground)
26	-DBO	(Data Bit O)
27	-DB1	(Data Bit 1)
28	-DB2	(Data Bit 2)
29	-DB3	(Data Bit 3)
30	-DB4	(Data Bit 4)
31	-DB5	(Data Bit 5)
32	-DB6	(Data Bit 6)
33	-DB7	(Data Bit 7)
34	-DBP	(Odd Parity Data Bit)
35-37	GND	(Ground)
38	TERMPWR	(Termination Power)
39-40	GND	(Ground)
41	-ATN	(Attention)
42	GND	(Ground)
43	-BSY	(Busy)
44	-ACK	(Acknowledge)
45	-RST	(Reset)
46	-MSG	(Message)
47	-SEL	(Select)
48	-C/D	(Control/Data)
49	-REQ	(Request)
50	-I/O	(Input/Output)

The hyphen "—" in the signal name means a low active signal.

Table 3-9

3. Control Method

The basic procedure for drive control via the SCSI interface is as shown in Figure 3-48.

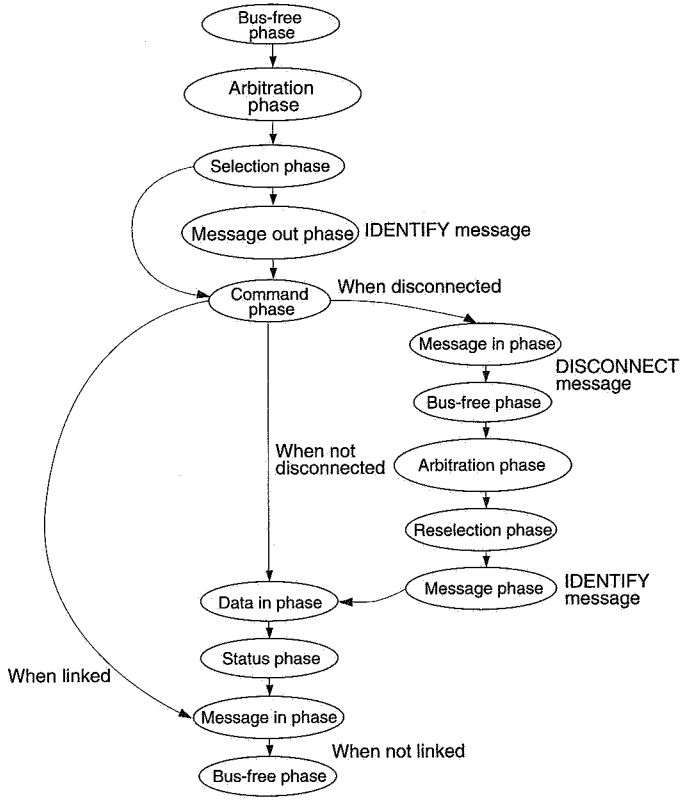


Figure 3-48

The function of each phase is as shown below.

The state of the SCSI bus during an operation between the initiator and the controller is divided into the following nine phases. The transition of these bus phases ensure that the SCSI bus cannot enter two or more phases at any one time. In a system which has a single initiator and does not use a disconnect/reconnect function, the arbitration phase and re-selection phase can be omitted.

Name	Function
Bus free phase	The state in which the SCSI bus is not used by any initiator or target. All signals on the bus are OFF.
Arbitration phase	The arbitration phase is used before the device which is to become the initiator selects the target, and also before the target device that is disconnected from the initiator selects the initiator (re-selection), in order to obtain the right to use the SCSI bus. This phase requires a multi-host environment in which a plurality of initiators exists. The initiator turns ON the BSY signal and simultaneously outputs its own ID bits to the SCSI bus, in order to obtain the right to use the bus. This phase can be omitted in a single initiator environment because no dispute over the bus arises.
Selection phase/re-selection phase	Each of the selection and re-selection phases is used to connect the initiator and the target by software. In the selection phase, when the initiator turns the SEL signal ON, the selection code which specifies the target number to be selected is output to the SCSI bus. Conversely, in the re-selection phase, the target device selects the initiator.
Command phase	In this phase, the initiator sends commands to the target device. The commands are sent as continuous bytes in a fixed form. When a link is specified in the command phase, the system will not return to the Bus-free phase after the status phase and the message input phase that follow, but will enter the command phase instead.

Table 3-10

Name	Function
Data phase	This phase is used when data returns after a command that requires the return of data was executed in the command phase, or when data is being read from the disk or written to it. This phase can be either the DATA IN phase or the DATA OUT phase depending on whether the initiator receives data or sends it.
Status phase	In this phase, a status command which indicates the status in which execution of a command was completed is returned. The system sometimes enters the status phase during the actual execution of a command as well.
Message phase	This phase is either the MESSAGE OUT phase when a message is being sent from the initiator to the target device, or the MESSAGE IN phase when a message is being sent from the target device to the initiator. A message is generally used for providing notification of the state accompanying a transition phase between the target and the initiator. Messages consist of those that are always sent in a standard sequence, such as an identification, and those that are sent for processing purposes in the event of an error.

Table 3-10

4. SCSI Bus Conditions

The SCSI bus is provided with two kinds of asynchronous operations (bus conditions), an attention condition and a reset condition, to control the bus phase transition sequence.

The following is a description of these conditions.

• Attention condition

An attention condition is a function used to notify a controller that the initiator has some kind of message. The initiator can generate an attention condition at any time other than during the arbitration or bus free phase. An attention exists while the initiator the maintains the ATN signal true.

A controller that detected the ATN signal moves to the message out phase at the following timing, and receives a message from the initiator.

① If the ATN signal was detected in the command phase, the controller will enter the message out phase immediately after receiving all the command description blocks. The initiator must continue REQ/ACK handshaking until the phase changes.

② If the NTN signal was detected in the data phase, the controller will enter the message out phase immediately after all data has been transmitted. The initiator must continue REQ/ACK handshaking until the phase changes.

③ If the ATN signal was detected in the status phase, the initiator will enter the message out phase immediately after receiving the status.

④ If the ATN signal was detected in the message in phase, the initiator will enter the message out phase immediately after receiving the present message.

⑤ If the ATN signal was detected in the selection phase, the system will enter the message out phase immediately after the selection phase.

⑥ If the ATN signal was detected in the re-selection phase, the system will enter the message out phase immediately after receiving the "Identify message" in the message in phase immediately after the re-selection phase.

The controller continues to implement the message out phase until the ATN signal becomes false. Consequently, the initiator will maintain the ATN signal true, even if the message out phase starts. After the REQ signal corresponding to the prepared message (the final byte message in the case of a message consisting of a plurality of bytes) has been received, the ATN signal must be made false before a reply can be made to the ACK signal. If the ATN signal remains true after the ACK signal reply, the controller will judge that there is a message, maintain the message out phase, and output the REQ signal.

If the controller detected a parity error while receiving a message, it will maintain the message out phase until the ATN signal becomes false, then output the REQ signal without changing the phase. Next, the initiator will reply to this message request, and re-transmit the immediately preceding message. If it is necessary to re-send a plurality of bytes, the initiator will make the ATN signal true before replying to the first ACK signal.

If the controller receives a message normally, it will enter a data transmission phase other than the message phase or the bus free phase in accordance with the provisions of the message.

• Reset condition

A reset condition is a function used to interrupt the operation of a device or to disconnect all SCSI devices from the bus. reset condition can be generated for any SCSI device whatever by making the RST signal true for at least 25 μsec (Reset Hold Time). All SCSI devices must stop the drive to all signals other than the RST signal and release the bus within 800 nsec (Bus Clear Delay). The SCSI bus always enters the bus free phase after a reset condition.

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XI. POWER SUPPLY

A. Outline

When the main switch are turned ON, power from the AC mains is supplied to the DC power supply PCB.

The DC power supply PCB outputs +24 VDC, ±12 VDC, and +5 VDC.

When the delivery assembly is opened to solve a document jam, the delivery assembly open/close sensor switch is turned off, cutting off 24 VDC, which in turn cuts off the power supply to the motors, DC loads (such as clutches, solenoids, etc.), LED array, and BASIS drive PCB.

B. Power Supply Circuit Protection Function

A switching regulator is employed for the DC power supply circuit.

If a load is shorted because of an abnormality, resulting in an overload, the protection function will operate, causing the output to stop.

When the output stops, remove the cause of the short, and switch the power OFF. After about 10 minutes the power supply will be automatically reset.

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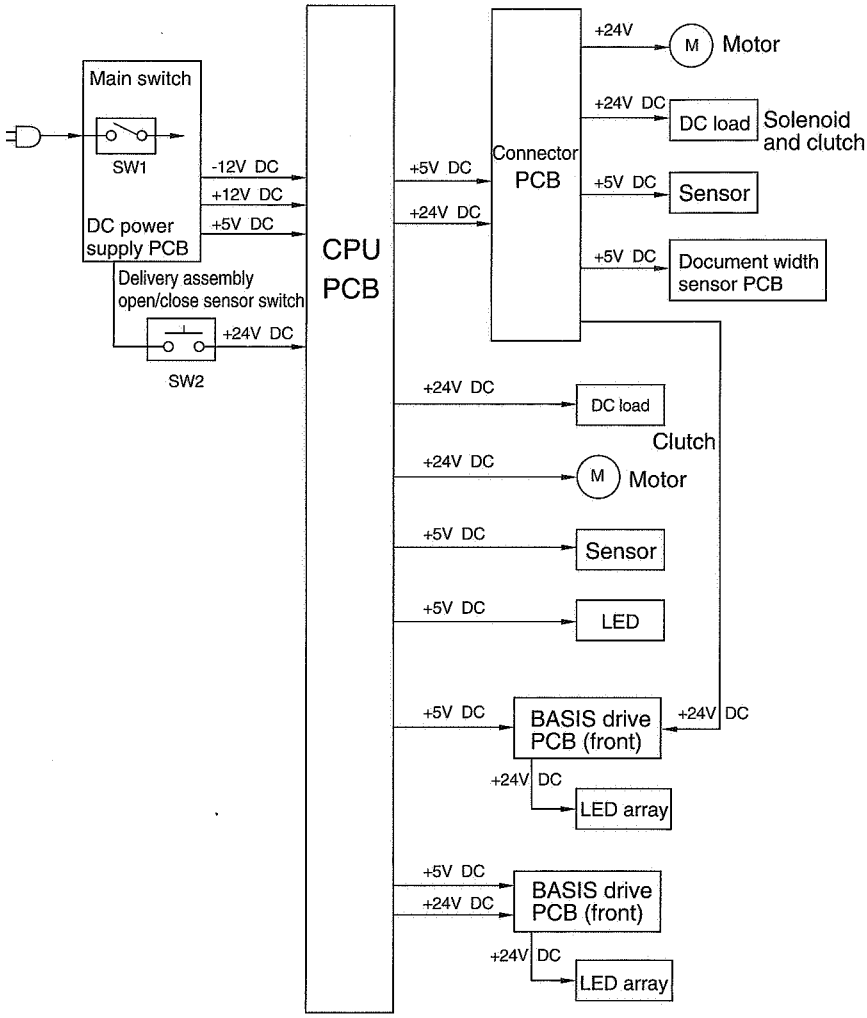

Figure 3-49

XII. LAYOUT OF ELECTRICAL COMPONENTS

A. Sensors

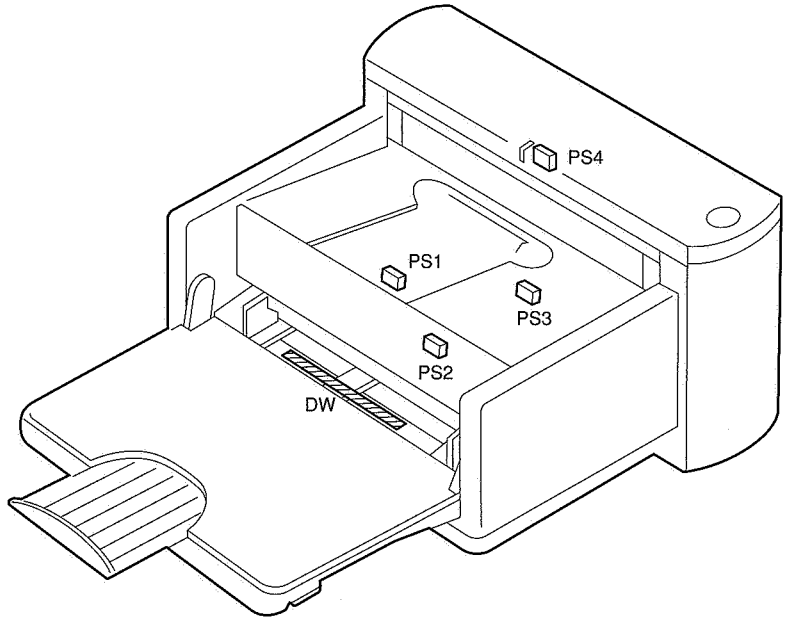

Figure 3-50

Symbol	Name	Code	Function
	Photo interrupter	PS1 PS PS3 PS4	Document detection on document board Document detection at registrator Document detection in machine (for starting of scanning) Document detection in the delivery assembly
	Sensor	DW	Document width detection

Table 3-11

B. Switches/LEDs

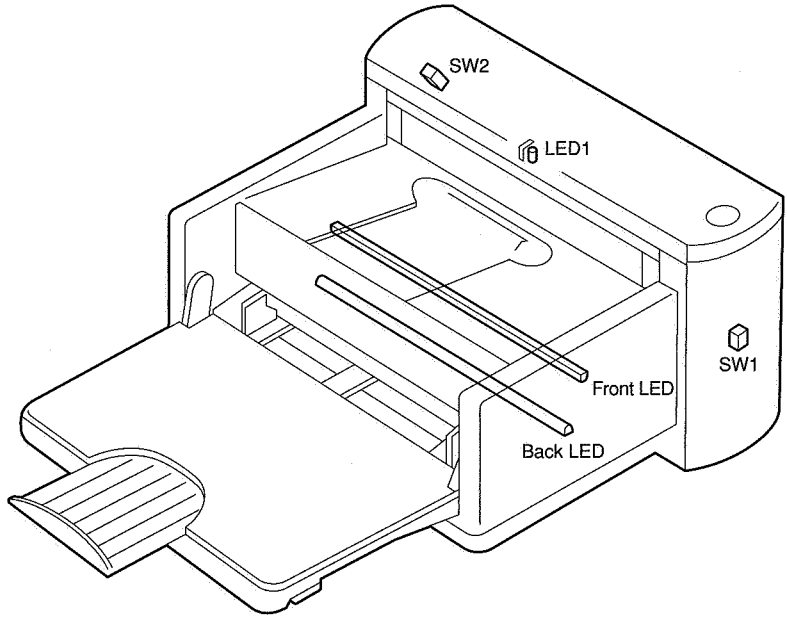

Figure 3-51

Symbol	Name	Code	Function
	Microswitch	SW1 SW2	For turning power on and off For interrupting 24 V power when the delivery assembly is open
	LED	LED1 (Front LED) (Back LED)	For DC power supply display For illuminating document (front) For illuminating document (back)

Table 3-12

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C. Clutches/Solenoids/Motors

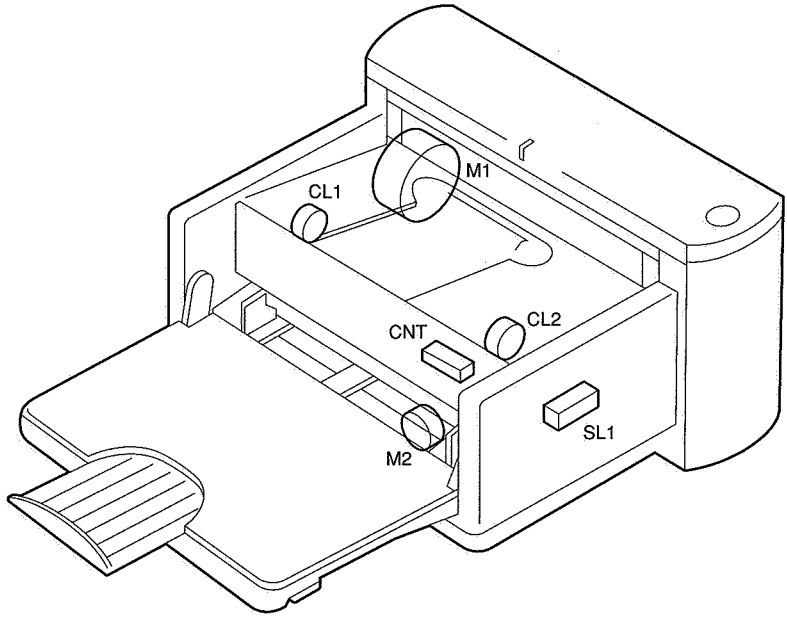

Figure 3-52

Symbol	Name	Code	Function
CL	Clutch	CL1 CL2	For document pick-up For document momentary stop
SL	Solenoid	SL1	For selecting manual feed
M	Motor	M1 M2	For feeding document For moving document board up and down
CNT	Counter	CNT	Count of paper pick-up

Table 3-13

D. PCBs

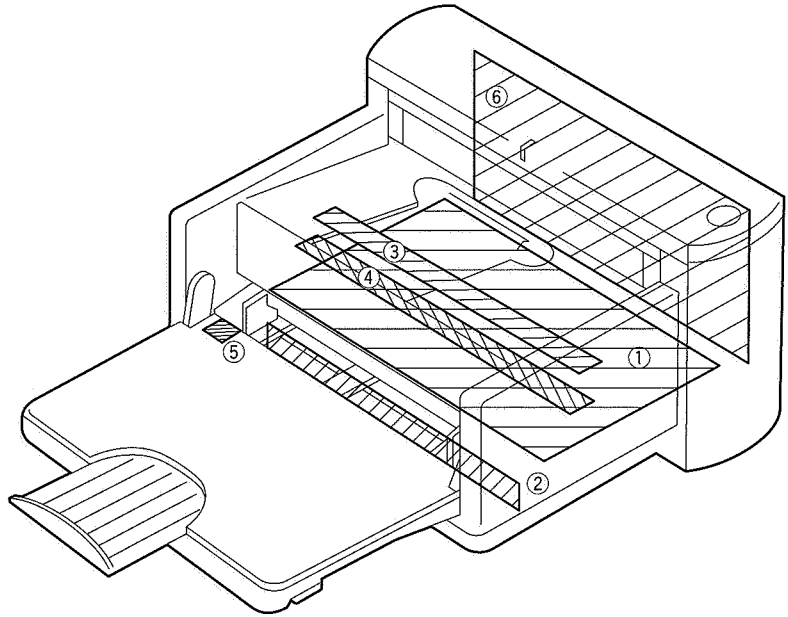

Figure 3-53

Code	Name	Function
①	CPU PCB	For sequence control and transmission with external devices
②	Connector PCB assembly	For connection between CPU PCB and DC loads and sensors
③	Front BASIS driver PCB	For driving BASIS (front)
④	Back BASIS driver PCB	For driving BASIS (back)
⑤	Document width sensor connector PCB	For connection between Connector PCB and document width sensor
⑥	DC power supply PCB	DC power supply, stabilization

Table 3-14

XIII. REFERENCE LIST OF VARIABLE RESISTORS (VR), LEDS, AND CHECK PINS FOR EACH PCB

The variable resistors (VRs), LEDs and check pins that are necessary for servicing the machine at the customer's premises are described in Figure 3-54.

VRs and check pins not listed in the table are for factory adjustment only. Special tools and measuring instruments are required to perform adjustments and checks using these VRs and check pins, and often a high degree of accuracy is demanded. Do not, therefore, touch these VRs and check pins.

Note:

1. Some LEDs pass a very small amount of current even in the normal (unlit) state, causing them to glow weakly even when they are supposed to be out.
2. VRs that may be adjusted at the customer's premises ..... ●
   VRs that must not be adjusted at the customer's premises ..... ⊘

A. CPU PCB Assembly

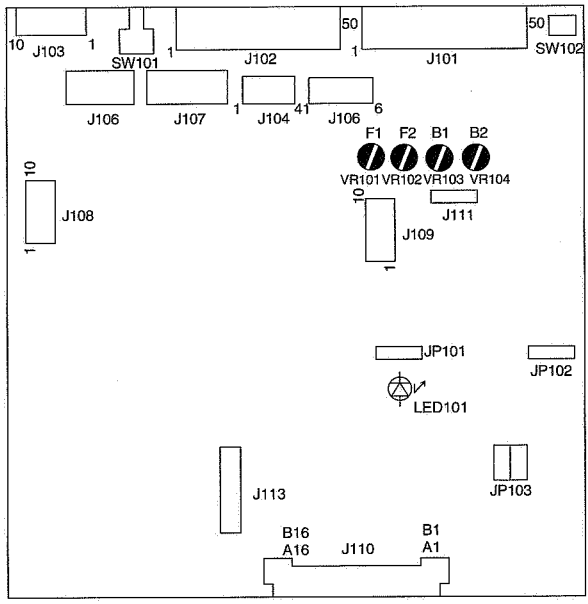

Figure 3-54

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LED No.	Description
LED101	• DRAM check error when power switch is turned ON → Lights up • Address error → Lights up

Table 3-15

Dip Switch /JP No.	Setting
SW101	ID setting of SCSI
SW102	Setting of feed test mode
JP101-103	For factory check

Table 3-16

VR No.	Adjustment
VR101 VR102 VR103 VR104	BASIS output adjustment VR101 : For former half BASIS (front) VR102 : For latter half BASIS (front) VR103 : For former half BASIS (back) VR104 : For latter half BASIS (back) For adjustment, refer to page 7-13.

Table 3-17

Check Pin No.	Check
J111	For confirming voltage at time of shading correction J111-1: For former half front BASIS J111-2: For latter half front BASIS J111-3: For former half back BASIS J111-4: For latter half back BASIS Note: When checking, use an oscilloscope.

Table 3-18

· Setting of feed test mode

With the SCSI cable disconnected, set the SCIS ID to "7." Turn the power on and press SW102, and then the machine enters to the feed test mode.

Changing the SCSI ID to "6," "5," "4," and "3" under this state enables continuous feed at low speed, continuous feed at high speed, manual feed at low speed, and manual feed at high speed, respectively.

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B. Connector PCB Assembly

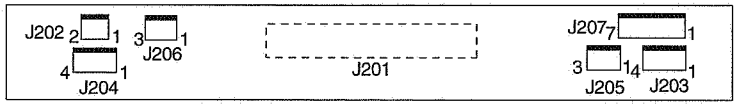

Figure 3-55

C. Pick-up Sensor PCB Assembly

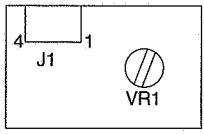

Figure 3-56

VR No.	Adjustment
VR1	Paper detection sensitivity adjustment Rotating VR clockwise increases sensitivity.

Table 3-19

D. BASIS Drive PCB Assembly

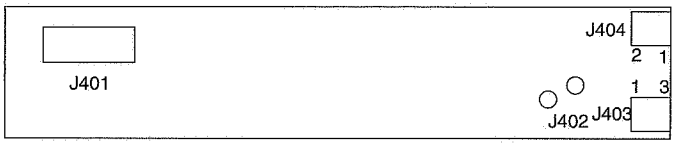

Figure 3-57

XV. LAYOUT OF MAJOR PCB DEVICES

The layout of the PCB elements that play particularly major roles on this machine and their functions are shown in Figure 3-58.

A. CPU PCB Assembly

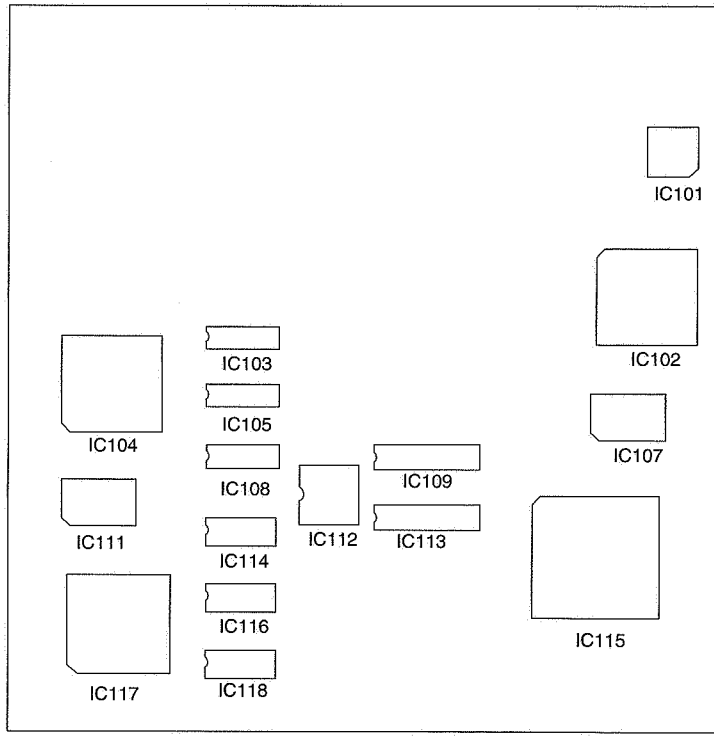

Figure 3-58

IC No.	Function
IC101 (SPC-CHIP)	Control gate array for SCSI interface
IC102 (SORAMAME-CHIP)	Control gate array for interface between IC107 (ENC-CHIP) and IC101 (SPC-CHIP)
IC103	Memory (64 Kbit) for composing image data from front BASIS and the back BASIS
IC104 (BASIS-CHIP)	BASIS drive and gate array for performing shading compensation and γ compensation
IC105	Memory (64 Kbit) for index table when performing shading compensation
IC107 (ENC-CHIP)	Gate array for compressing image data
IC108	Memory (64 Kbit) for conversion table when performing shading compensation
IC109	Buffer memory (16 Mbit) for image data transmission
IC111 (NOAH-CHIP)	Gate array for performing edge emphasizing and error diffusion
IC112	Flash ROM for working this machine and for writing all sorts of data
IC113	Buffer memory (16 Mbit) for image data transmission
IC114	Memory for processing error diffusion
IC115 (CPU)	Microprocessor for controlling this machine
IC116	Memory for processing edge emphasizing
IC117 (IFIII-CHIP)	Gate array for processing image of dust picture element erasing
IC118	Memory for processing edge emphasizing

Table 3-19

CHAPTER 4

MECHANICAL SYSTEM

This chapter describes the mechanical characteristics, operation, and disassembly and reassembly procedure.

Note that when disassembling and reassembling the machine, observe the following:

1. Before starting the disassembly and reassembly operations be sure to disconnect the power to the machine for safety sake.
2. Reassembly can be performed in the opposite way to disassembly unless otherwise mentioned.
3. In re-assembly, do not confuse the type of screws (length and diameter) and their location.
4. To ensure positive continuity of electricity, a toothed washer is used as a grounding wire retaining screw. Be sure to use this washer when reassembling the machine.
5. As a rule, do not operate the machine with any part removed.

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I. EXTERNAL CONTROL

A. Outside Cover

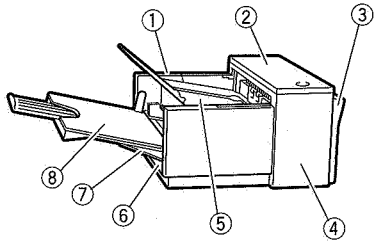


Figure 4-1

① Left cover	(1)	[2]
② Top cover	(0)	[4]
③ Rear cover	(2)	[0]
④ Right cover	(1)	[2]
⑤ Deliver tray cover	(0)	[0]
⑥ Lower front cover	(2)	[0]
⑦ Front cover	(0)	[0]
⑧ Pick-up tray	(2)	[0]

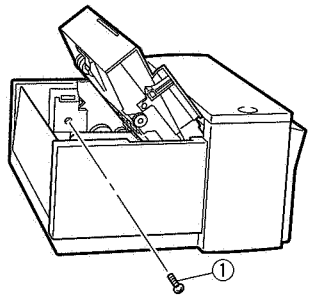
Note: The figures in ( ) and [ ] mean the numbers of fixing screws and mounting hooks, respectively.

When attempting to clean, check and repair the inside of the machine, remove the pertinent covers in the following procedure.

The procedure for removing the covers that can be removed simply and individually only by removing the mounting screws are omitted.

1. Left cover

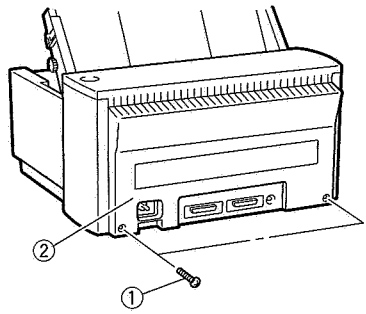
① Remove the pick-up tray.
② Open the delivery assembly.
③ Remove the screw ①.



① Screw

Figure 4-2

④ Remove two screws ①, and then remove the rear cover ②.



① Screws ② Rear cover

Figure 4-3

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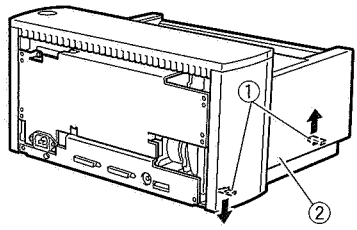
⑤ Detach two hooks ① and remove the left cover ②.

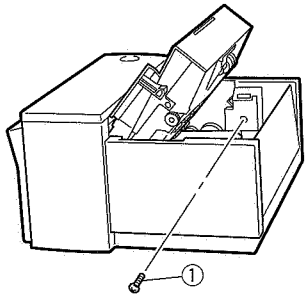


①Hooks ② Left cover

Figure 4-4

2. Right cover

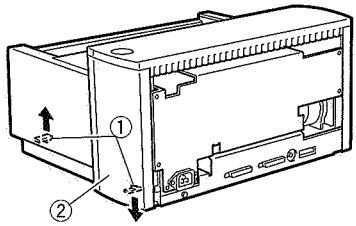
① Remove the pick-up tray.
② Open the deliver assembly
③ Remove the screw ①.



① Screw

Figure 4-5

④ Remove the rear cover. (2 screws)
Note: Be careful not to lose the knob for setting the SCSI ID.
⑤ Detach two hooks ①, and remove the right cover ②.

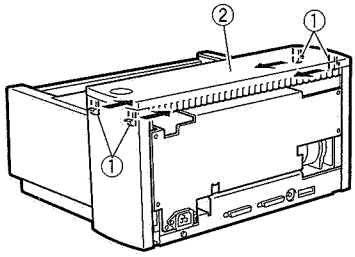


① Hooks ② Right cover

Figure 4-6

3. Top cover

① Remove the pick-up tray.
② Remove the rear cover (2 screws)
③ Detach four hooks ② (2 hooks each on both right and left sides), and lift up the top cover ② slightly.



① Hooks ② Top cover

Figure 4-7

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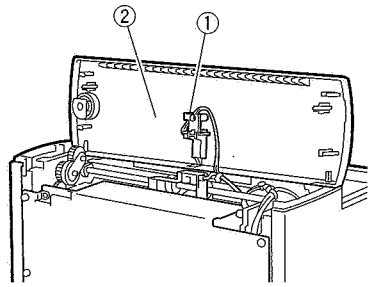
④ Disconnect connector J701 at the rear side of the top cover.

Note: When installing the top cover, be sure to hook the harness detached in step 4 to the rib of the top cover ②. If the harness is not fixed by the rib, it may be caught by the delivery roller to be broken.

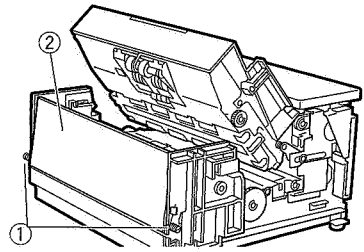


① LED mount ② Top cover

Figure 4-8

4. Front cover

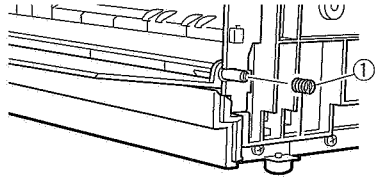
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Detach two springs ①, and then remove the front cover ②.



① Springs ② Front cover

Figure 4-9

Note: When installing the front cover, be careful not to confuse the springs detached in step 5.

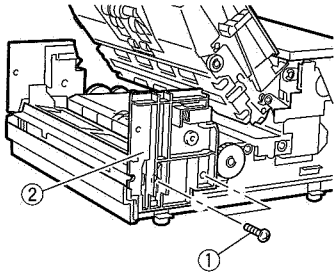


① Springs

Figure 4-10

5. Lower front cover

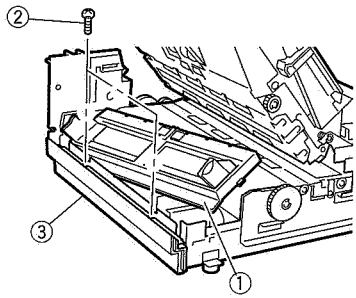
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Remove the front cover.
⑥ Remove two screws ①, and then remove the right side plate ②.



① Screws ② Right side plate

Figure 4-11

⑦ Shift the pick-up guide ① slightly, loosen two screws ②, and then remove the lower front cover ③.

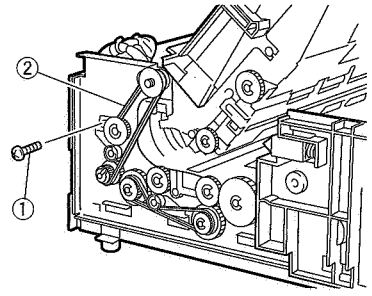


① Pick-up guide ③ Lower front cover
② Screws

Figure 4-12

6. Delivery tray cover

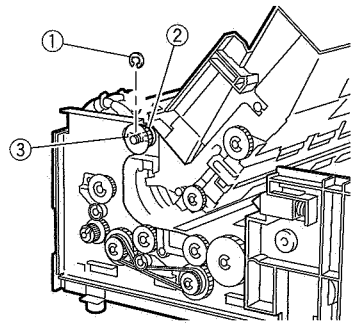
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the top cover.
④ Remove the right cover. (1 screw)
⑤ Remove the left cover. (1 screw)
⑥ Loosen the screw ①, release the tension of the belt ②, and then remove the belt ③.



① Screw ② Belt

Figure 4-13

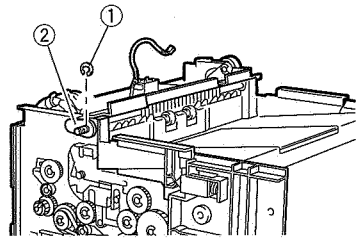
⑦ Remove the E-ring ①, and then the gear ② and pin ③.
Note: Be careful not to lose the pin.



① E-ring ③ Pin
② Gear

Figure 4-14

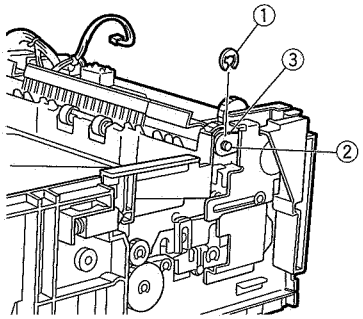
⑧ Remove the E-ring ①, and then remove the bushing ②.



① E-ring ② Bushing

Figure 4-15

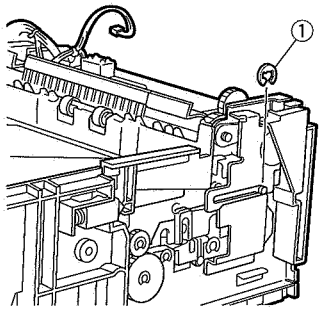
⑨ Remove the E-ring ①, shift the delivery roller shaft ② slightly, and then remove the bushing ③.



① E-ring ③ Bushing
② Delivery roller shaft

Figure 4-16

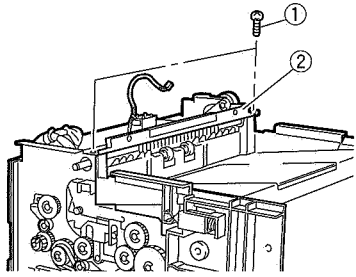
⑩ Remove the E-ring ①.



① E-ring

Figure 4-17

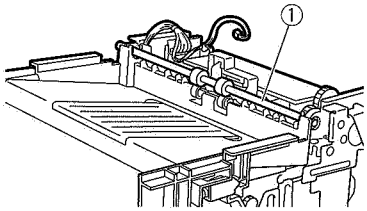
⑪ Remove two screws ①, and then remove the static eliminator brush mousnting plate ②.



① Screws
② Static eliminator brush mounting plate

Figure 4-18

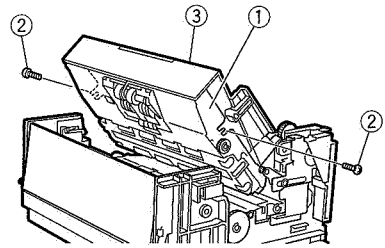
⑫ Remove the delivery roller shaft ①.



① Delivery roller shaft

Figure 4-19

⑬ Remove two screws ② paying attention to the harness while holding the delivery assembly ① by hand, and remove the delivery tray cover ③.



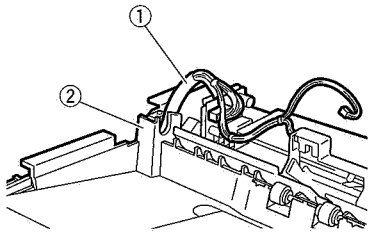
① Delivery assembly ③ Delivery tray cover
② Screws

Figure 4-20

7. Precaution when installing the delivery tray cover:

The delivery tray cover can basically be installed in the reverse procedure to the removal of the delivery tray cover; however attention must be paid to the following points.

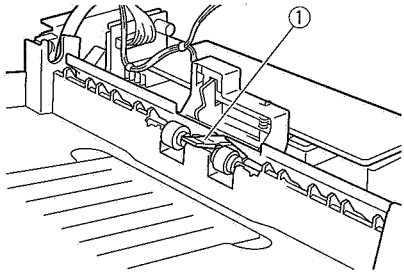
① The harness ① of the front scanner unit should run through the inside of the delivery tray cover.



① Harness ② Delivery tray cover

Figure 4-21

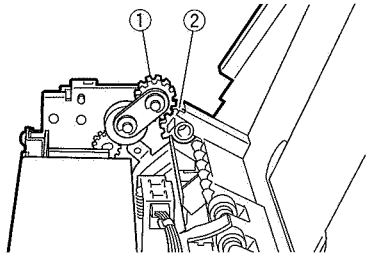
② When installing the delivery tray unit, be careful not to damage the delivery paper sensing lever ①.



① Delivery paper sensing lever

Figure 4-22

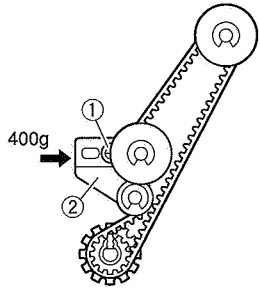
③ When installing the delivery tray unit, make sure that the gear ① for open/close damper is engaged with the gear ② with the delivery tray unit open.



① Gear for open/close damper ② Gear

Figure 4-23

④ Adjusting the belt tension
While pressing the tension plate ② with a force of 400g in the arrow direction, tighten the screw ①.



① Screw ② Tension plate

Figure 4-24

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

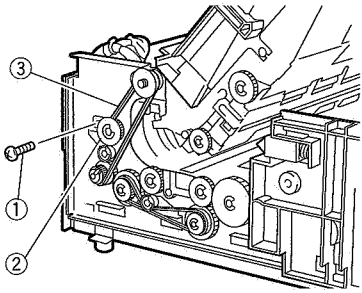
B. Delivery Assembly Open/ Close Sensor Switch

1. General Description

For safety sake, the 24 VDC power to the machine (primarily, the power for the main motor and solenoids) is cut off by this micro switch to prevent the machine from operating while the display assembly is open.

2. Removing the Delivery Assembly Open/Close Sensor Switch

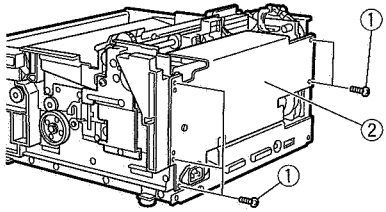
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the top cover.
④ Remove the left cover. (1 screw)
⑤ Remove the screw ①, and then remove the tension plate ② and the belt ③.



① Screw ③ Belt
② Tension plate

Figure 4-25

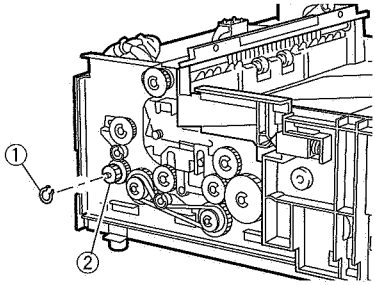
⑥ Remove five screws ①, and remove the DC power supply unit ②.



① Screws ② DC power supply unit

Figure 4-26

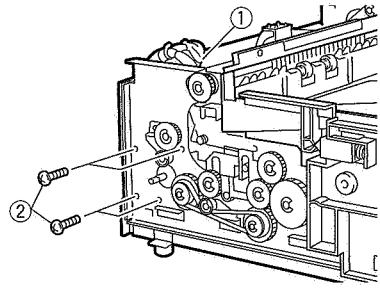
⑦ Remove the G-ring ① and the gear ②.



① G-ring ② Gear

Figure 4-27

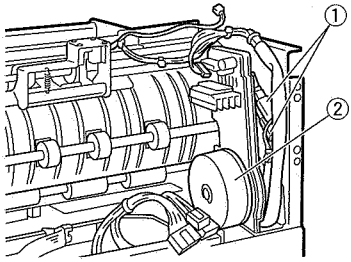
⑧ Disconnect connector CN1 ①, and remove the four screws ②.



① Connector ② Screws

Figure 4-28

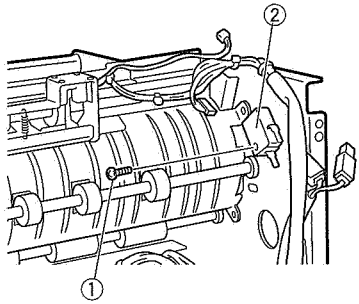
⑨ Pull out the two fastons ①, and then remove the main motor unit ②.



① Fastons ② Main motor unit

Figure 4-29

⑩ Remove one screw ①, and remove the delivery assembly release switch ②.



① Screw
② Delivery assembly release switch

Figure 4-30

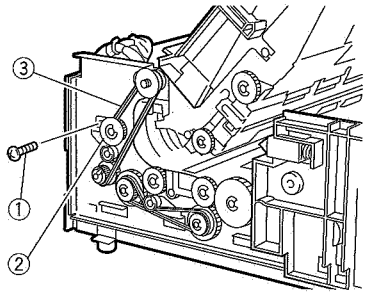
 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

II. DRIVE

A. Main Motor

1. Removing the Main Motor

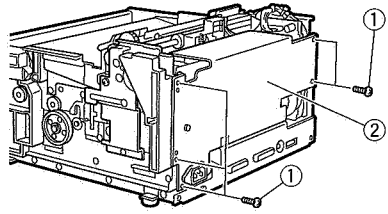
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the top cover.
④ Remove the left cover. (1 screw)
⑤ Remove the screw ①, and then remove the tension plate ② and the belt ③.



① Screw ③ Belt
② Tension plate

Figure 4-31

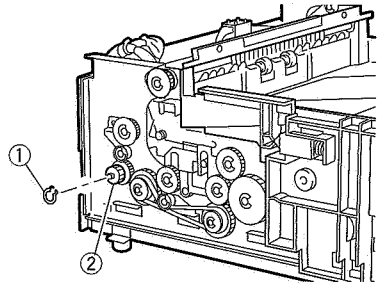
⑥ Remove five screws ①, and remove the DC power supply unit ②.



① Screws
② DC power supply unit

Figure 4-32

⑦ Remove the G-ring ① and the gear ②.

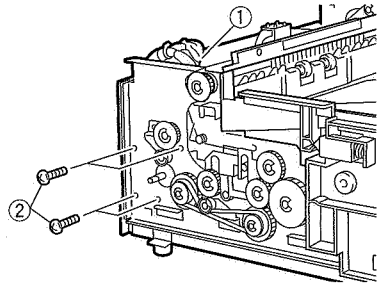


① G-ring ② Gear

Figure 4-33

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

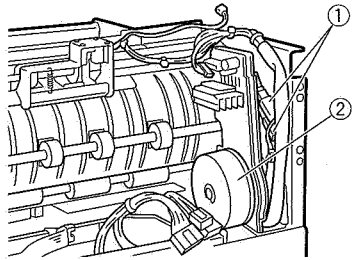
⑧ Disconnect connector CN1 ①, and remove the four screws ②.



① Connector ② Screws

Figure 4-34

⑨ Pull out the two fastons ①, and then remove the main motor unit ②.



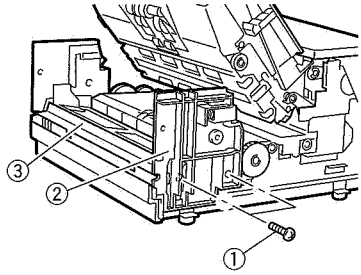
① Fastons
② Main motor unit

Figure 4-35

B. Document Board Drive Motor

1. Removing the Document Board Drive Motor

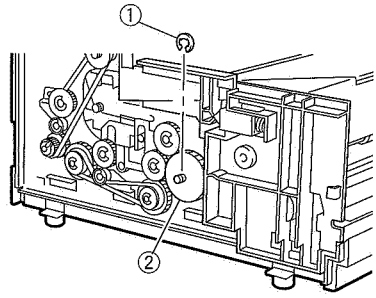
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Remove the front cover.
⑥ Remove two screws ①, and remove the right side plate ② and the pick-up guide ③.



① Screws ③ Pick-up guide
② Right side plate

Figure 4-36

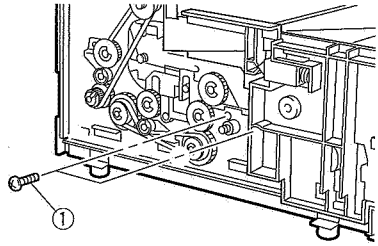
⑦ Remove the E-ring ① and the gear ②.



① E-ring ② Gear

Figure 4-37

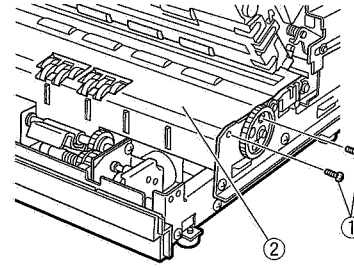
⑧ Remove two screws ①.



① Screws

Figure 4-38

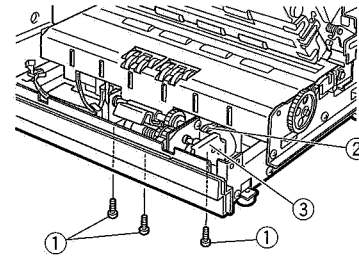
⑨ Remove two screws ①, and then shift the separation guide unit ②.



① Screws ② Separation guide unit

Figure 4-39

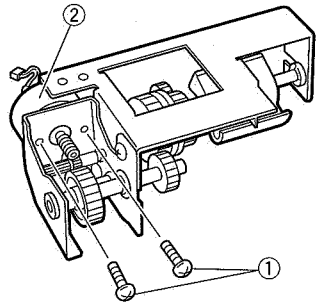
⑩ Remove three screws ①, disconnect connector J202 ②, and then remove the document board drive motor unit ③.



① Screws
② Connector
③ Document board drive motor unit

Figure 4-40

⑪ Remove two screws ①, and remove the document board drive motor ②.

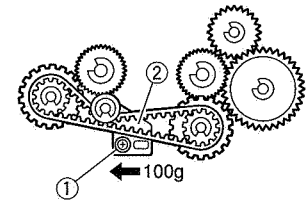


① Screws
② Document board drive motor

Figure 4-41

C. Adjusting the Belt Tension

While pressing the tension plate ② with a force of 100 g in the arrow direction, tighten the screw ①.



① Screws ② Tension plate

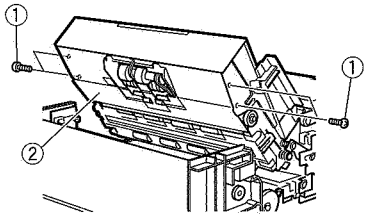
Figure 4-42

III. DELIVERY

A. Pick-up Control Assembly

1. Feeder Roller

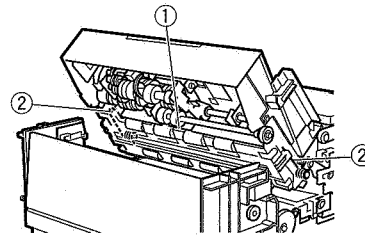
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the left cover. (1 screw)
④ Remove the right cover. (1 screw)
⑤ Open the delivery assembly.
⑥ Remove four screws ①, and remove the pick-up guide plate ②.



① Screws ② Pick-up guide plate

Figure 4-43

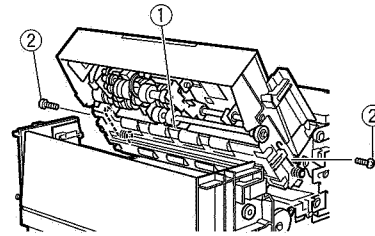
⑦ Release the two springs ② of the front scanner unit ①.



① Front scanner unit

Figure 4-44

⑧ While holding it by hand, remove two screws ②, and put the front scanner unit ① down.

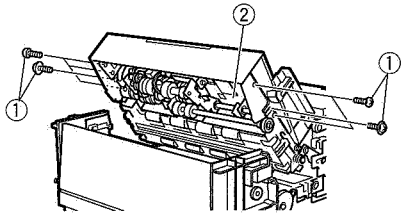


① Front scanner unit ② Screws

Figure 4-45

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

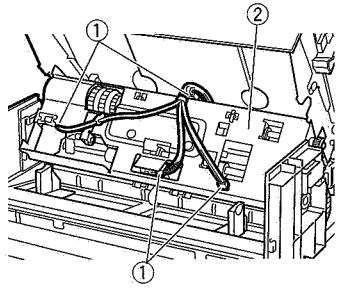
⑨ Remove seven screws ②, and put the pick-up control assembly ① down.



① Screws ② Pick-up control assembly

Figure 4-46

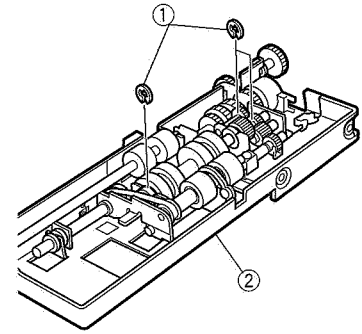
⑩ Disconnect four connectors ①, and remove the pick-up control assembly ②.



① Connectors ② Pick-up control assembly

Figure 4-47

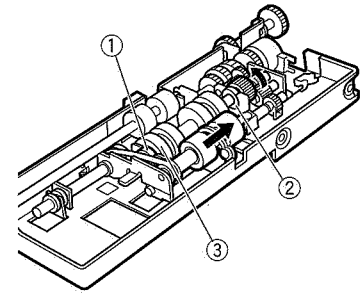
⑪ Remove three E-rings ① and one washer ②.



① E-rings ② Washer

Figure 4-48

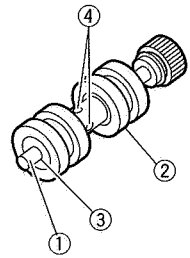
⑫ Remove the left side ball bearing ①, and then remove the feeder roller assembly ③ while pressing the right side ball bearing ② to the right, paying attention not to exert any load to the gears.



① Ball bearing ③ Feeder roller assembly
② Ball bearing

Figure 4-49

⑬ Put a mark ③ showing the position of the feeder roller ② on the feeder roller shaft ① with a marker, loosen two hex screws ④, and then remove the feeder roller ②.

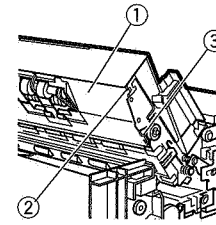


① Feeder roller shaft ③ Mark
② Feeder roller ④ Hex screws

Figure 4-50

2. Installation of Pick-up Guide Plate

Fix the pick-up guide plate ① with screws, pressing the projection ② upward and the projection ③ backward.



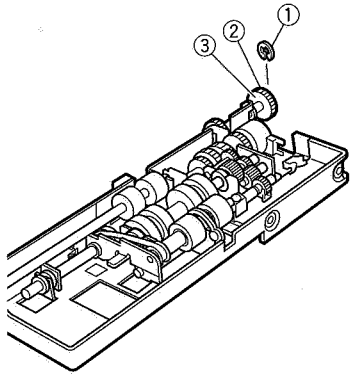
① Pick-up guide plate ③ Projection
② Projection

Figure 4-51

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

3. Pick-up Clutch

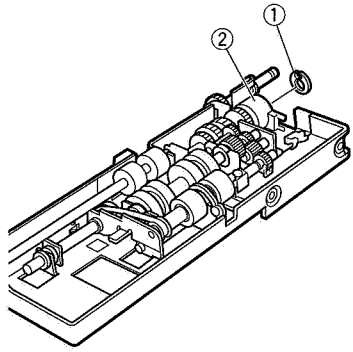
① Remove the pick-up control assembly in the same procedure as that for removing the feeder roller (Refer to page 4-15).
② Remove the E-ring ①, and remove the gear ② and pin ③.



① E-ring ③ Pin
② Gear

Figure 4-52

③ Remove the G-ring ①, and remove the pick-up clutch ②.

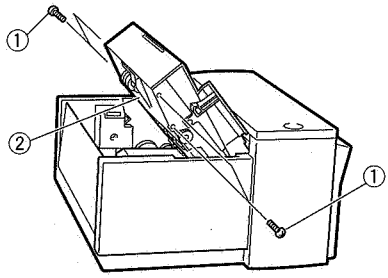


① G-ring ② Pick-up clutch

Figure 4-53

4. Pick-up Roller

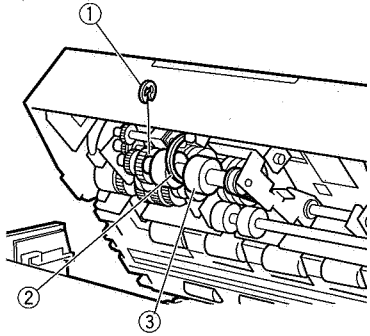
① Remove the pick-up tray.
② Remove the delivery assembly.
③ Remove four screws ①, and remove the pick-up guide plate ②.



① Screws ② Pick-up guide plate

Figure 4-54

④ Remove the E-ring ①, and remove the pick-up roller ③ paying attention to the sensor lever ②.

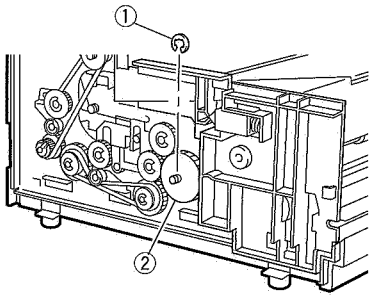


① E-ring ③ Pick-up roller
② Sensor lever

Figure 4-55

5. Separation Roller

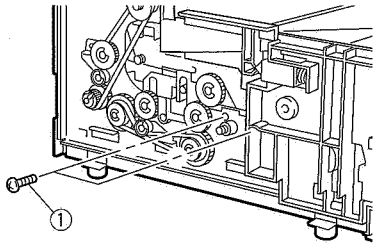
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Remove the front cover.
⑥ Remove E-ring ①, and remove the gear ②.



① E-ring ② Gear

Figure 4-56

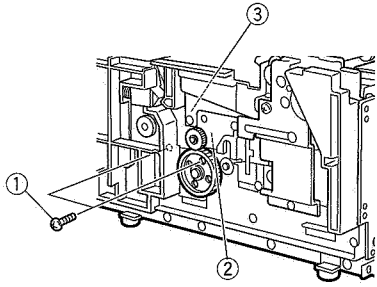
⑦ Remove two screws ①.



① Screws

Figure 4-57

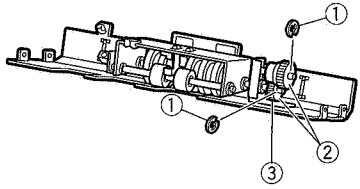
⑧ Remove two screws ①, slightly shift the separation guide unit ② toward you, disconnect the connector ③, and then remove the separation guide unit ②.



① Screws ③ Separation guide unit
② Connector

Figure 4-58

⑨ Remove two E-rings ①, and then remove two gears ② and pin ③.

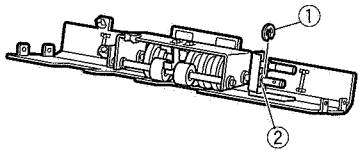


① E-rings ③ Pin
② Gears

Figure 4-59

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

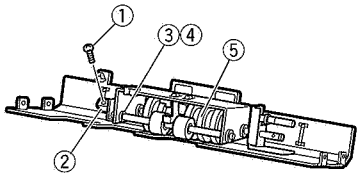
⑩ Remove the E-ring ①, and then remove the bushing ②.



① E-ring ② Bushing

Figure 4-60

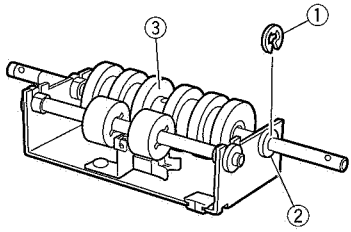
⑪ Remove the screw ①, retainer ②, washer ③, and bushing ④, and then remove the separation roller unit ⑤.



① Screw ④ Bushing
② Retainer ⑤ Separation roller unit
③ Washer

Figure 4-61

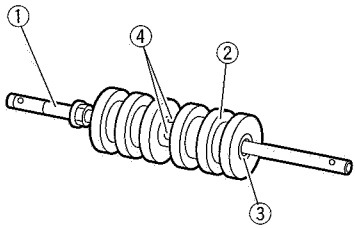
⑫ Remove the E-ring ① and bushing ②, and then remove the separation roller shaft ③.



① E-ring ③ Separation roller shaft
② Bushing

Figure 4-62

⑬ Put a mark ③ showing the position of the separation roller ② on the separation roller shaft ① with a marker, loosen two hex screws ④, and then remove the separation roller ②.

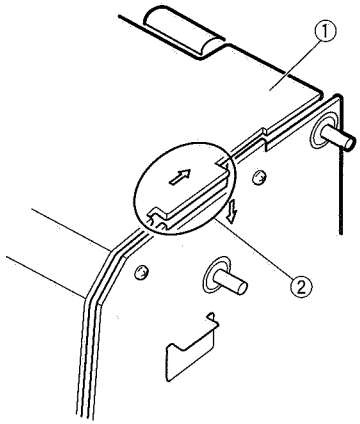


① Separation roller shaft ③ Mark
② Separation roller ④ Hex screws

Figure 4-63

6. Mounting the Separation Guide Plate

When mounting the separation guide plate, fasten the screw while pressing the projection ② on the separation guide plate ① in the lower rear direction.

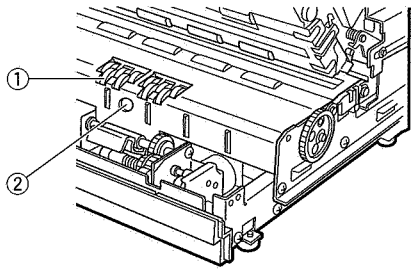


① Separation guide plate ② Projection

Figure 4-64

7. Mounting the Separation Roller

Insert the hex key through the hole on the separation guide plate paying attention so that the feed roller does not interfere with the separation roller ①, and fix the separation roller ② with the hex key.

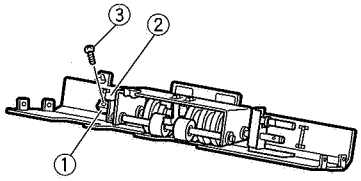


① Separation roller ② Separation roller

Figure 4-65

8. Separation Adjustment

① Disconnect the SCSI cable, set the ID of the SCSI to "7", and turn power on.
② Press push switch SW102 on the CPU PCB assembly, and the machine will enter the feed mode.
③ Place the standard white paper (FY9-3004) on the document board.
④ Set the ID of the SCSI to "6", and the machine will enter continuous feed mode at low speed.
⑤ After the third paper has been delivered, immediately turn the power off.
⑥ Open the delivery unit, and remove the separation guide plate.
⑦ Loosen the screw ③, and fix the screw ③ while pressing the stopper ① to the shaft support plate ②.
⑧ At this point, if the stopper ① has already been pressed to the shaft support plate ②, shift the stopper ① leftward to part it from the shaft support plate ②, and then repeat the same procedure from step 1.



① Stopper ③ Screw
② Shaft support plate

Figure 4-66

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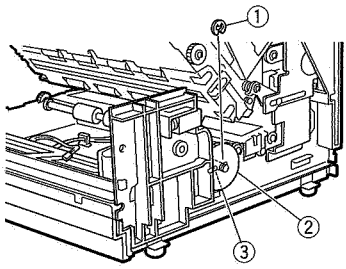
9. Momentary Stop Clutch

① Remove the separation guide unit in the same procedure as that for removing the separation roller (refer to page 4-19).

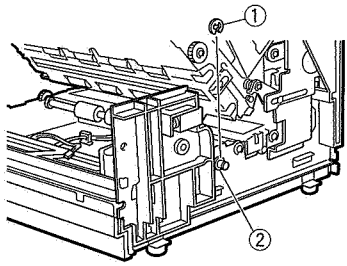
② Remove the E-ring ① and gear ②. Here, be careful not to lose the pin ③.



① E-ring ③ Pin
② Gear

Figure 4-67

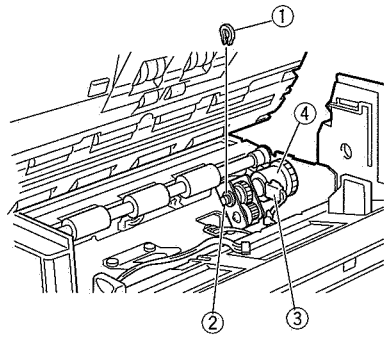
③ Remove the E-ring ①, and remove the bushing ②.



① E-ring ② Bushing

Figure 4-68

④ Remove the G-ring ①, pull out the shaft ②, disconnect the connector ③, and then remove the momentary stop clutch ④.



① G-ring ③ Connector
② Shaft ④ Momentary stop clutch

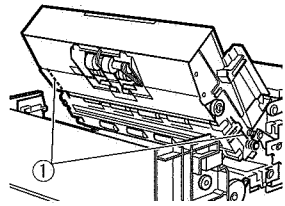
Figure 4-69

IV. EXPOSURE

A. Scanner Unit

1. Removing the Front Scanner Unit

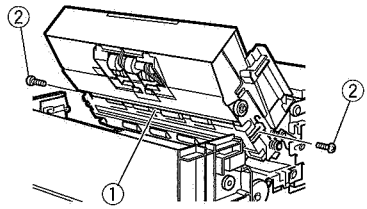
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the left cover. (1 screw)
④ Remove the right cover. (1 screw)
⑤ Release the spring ①.



① Spring

Figure 4-70

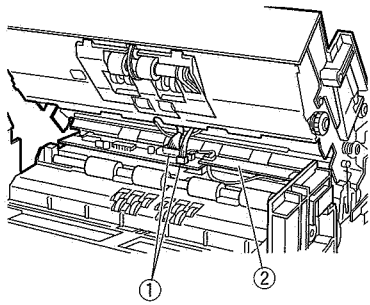
⑥ Remove two screws ② while holding the front scanner unit by hand, and then put the front scanner unit ① down.



① Front scanner unit ② Screw

Figure 4-71

⑦ Disconnect two connectors ①, and remove the front scanner unit ②.



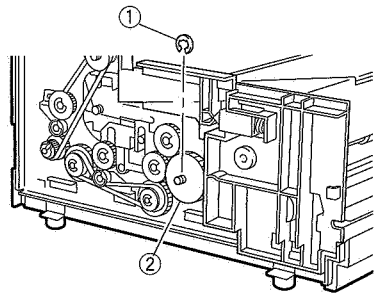
① Connectors ② Front scanner unit

Figure 4-72

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

2. Removing the Back Scanner Unit

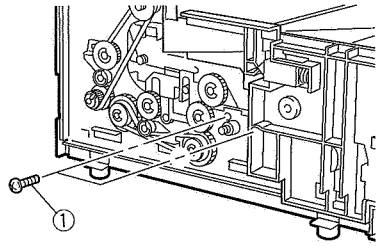
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Remove the front cover.
⑥ Remove the E-ring ① and gear ②.



① E-ring ② Gear

Figure 4-73

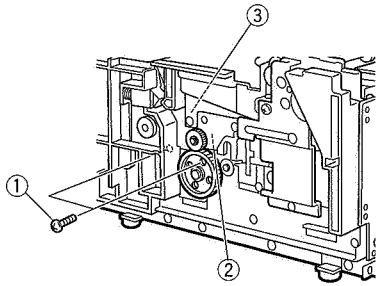
⑦ Remove two screws ①.



① Screws

Figure 4-74

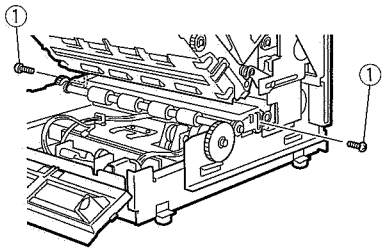
⑧ Remove two screws ①, shift the separation guide unit ② slightly, remove the connector ③, and remove the unit ②.



① Screws ③ Connector
② Separation guide unit

Figure 4-75

⑨ Remove two screws ①.



① Screws

Figure 4-76

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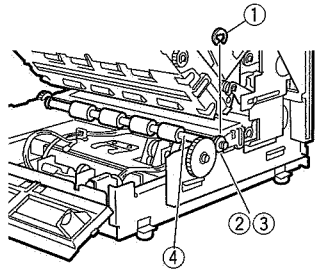
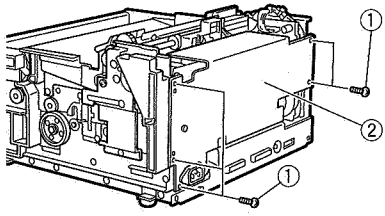
⑩ Remove the E-ring ①, washer ②, and bearing ③, and then remove the roller shaft ④.



① E-ring ③ Bearing
② Washer ④ Roller shaft

Figure 4-77

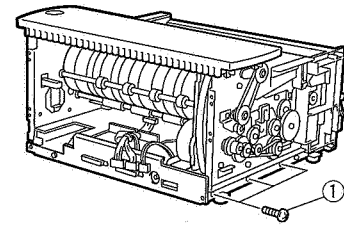
⑪ Remove five screws ①, and remove the DC power supply unit ②.



① Screws ② DC power supply unit

Figure 4-78

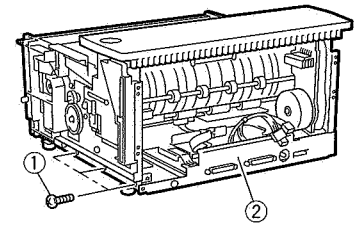
⑫ Remove the three screws ①.



① Screws

Figure 4-79

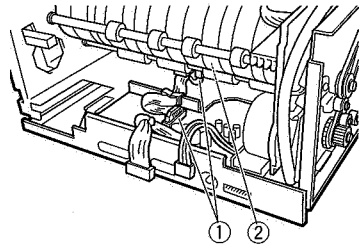
⑬ Remove three screws ①, and then slightly draw out the CPU PCB assembly ②.



① Screws ② CPU PCB assembly

Figure 4-80

⑭ Disconnect two connectors ①, and then remove the back scanner unit ②.



① Connectors ② Back scanner unit

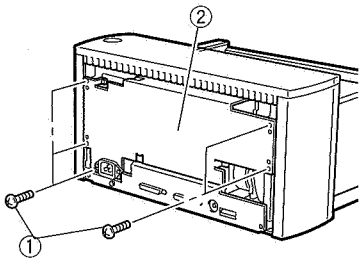
Figure 4-81

V. ELECTRICAL

A. PCBs

1. DC power supply unit

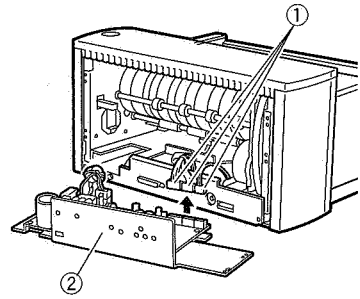
① Remove the rear cover. (2 screws)
② Remove five screws ①, and tilt the DC power supply unit ②.



① Screws ② DC power supply unit

Figure 4-82

③ Disconnect three connectors (CN2, CN3, and CN4) ①, and remove the DC power supply unit ②.



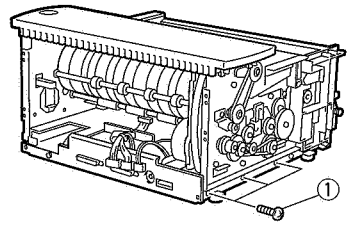
① Connectors ② DC power supply unit

Figure 4-83

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

2. CPU PCB Assembly

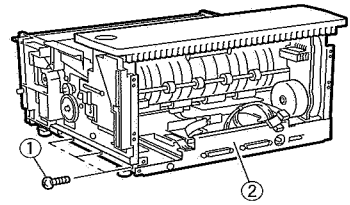
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the left cover. (1 screw)
④ Remove the right cover. (1 screw)
⑤ Remove the DC power supply unit. (5 screws)
⑥ Remove three screws ①.



① Screws

Figure 4-84

⑦ Remove three screws ①.

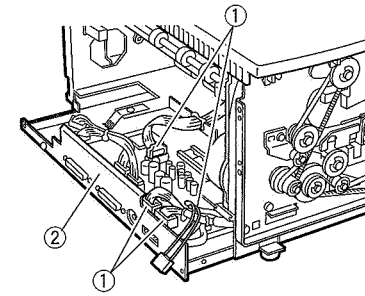


① Screws

Figure 4-85

⑧ Disconnect four connectors J109, J106, J107, and J108 ①, and pull out the CPU PCB unit ②.

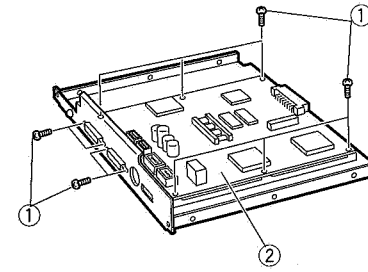
Note: When pulling out the CPU PCB assembly ②, pay attention to the harness.



① Connectors ② CPU PCB assembly

Figure 4-86

⑨ Remove ten screws ①, and remove the CPU PCB assembly ②.



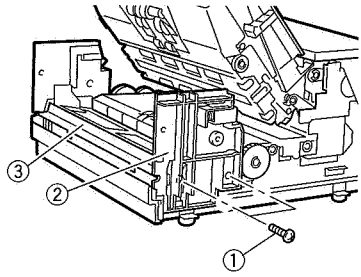
① Screws ② CPU PCB assembly

Figure 4-87

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

3. Connector PCB Assembly

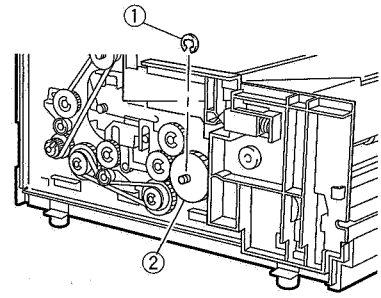
① Remove the pick-up tray.
② Remove the rear cover. (2 screws)
③ Remove the right cover. (1 screw)
④ Remove the left cover. (1 screw)
⑤ Remove the front cover.
⑥ Remove the front lower cover. (2 screws)
⑦ Remove two screws ①, and remove the right side plate ② and then pick-up guide ③.



① Screws ② Right side plate

Figure 4-88

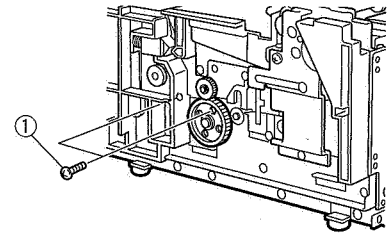
⑧ Remove the E-ring ① and gear ②.



① E-ring ② Gear

Figure 4-89

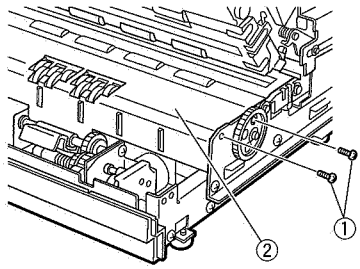
⑨ Remove two screws ①.



① Screws

Figure 4-90

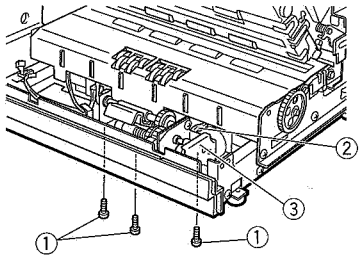
⑩ Remove two screws ①, and shift the separation guide unit ②.



① Screws ② Separation guide unit

Figure 4-91

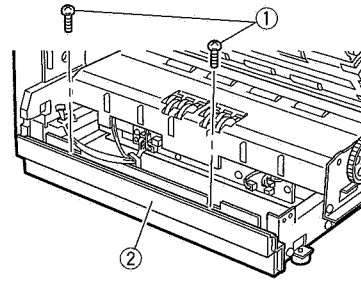
⑪ Remove three screws ①, disconnect connector J202 ②, and then remove the document board drive motor assembly ③.



① Screws
② Connector
③ Document board drive motor assembly

Figure 4-92

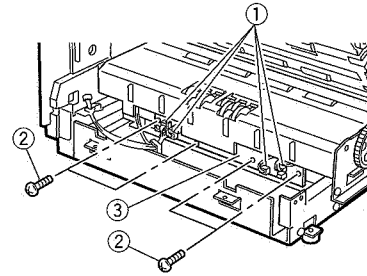
⑫ Loosen two screws ①, and remove the lower front cover ②.



① Screws ② Lower front cover

Figure 4-93

⑬ Disconnect four connectors J203, J204, J206, and J207 ①, remove four screws ②, and then remove the connector PCB assembly ③.



① Connectors
② Screws
③ Connector PCB assembly

Figure 4-94

CHAPTER 5

INSTALLATION

Each machine is carefully adjusted and strictly inspected before it leaves the factory. It is important to install and set it up properly in order to maintain its performance at the same high level.

The service technician should fully understand the function of the machine, install it properly in a suitable location, and carry out the necessary checks before it is used by the customer.

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

I. INSTALLATION SUGGESTIONS

It is recommended that the serviceman personally inspect the customer's premises before installing any machine. The location should meet the following requirements:

- The power supply should be connected to an outlet able to supply the voltage shown on the rating plate plus or minus 10%. A grounding plug must be used.
- The temperature should be between 10 and 32.5°C (50-90.5 F), and relative humidity between 20 and 85% RH. In particular, do not install the machine near water taps, hot-water heaters, and refrigerators.
- The machine should not be exposed to open flame, dust, direct sunlight, or intensive vibration.
  * In application where installation of the machine in a sunny location is unavoidable, a heavy curtain should be installed on the windows to protect the machine.

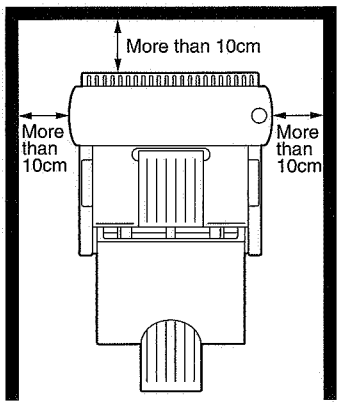
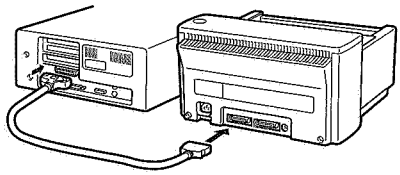


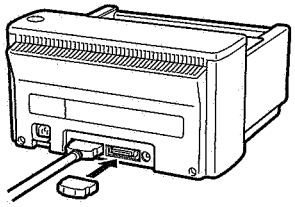
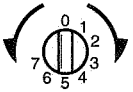
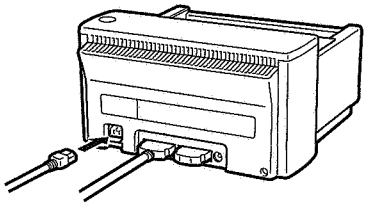
Figure 5-1

II. UNPACKING AND INSTALLATION

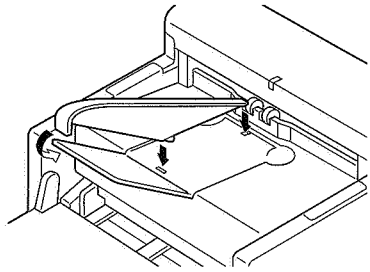
If the machine (in its shipping container) has been stored in a cold location, it should not be unpacked in a warm room until it has had time to warm up, otherwise moisture can condense on the metal and glass parts, resulting in a trouble. At least one hour should be allowed for the machine to warm up to room temperature before the shipping container is opened.

No.	Procedure	Inspection/Remarks
1	Open the shipping container of the main body of the machine.	
2	Take out the parts and other materials in the shipping container.	Check that the following items are there: • Main body • Power supply cord • Grounding wire (on 100 V machines only) • Guarantee sheet (100, 120 V machine only) • Delivery auxiliary guide • Operation manual • Device driver (floppy disk) • Device driver manual • User registration card • Function sheet (A4/LTR) • Terminator
3	Move the machine to where it is be installed.	
4	Peel off all the filament tape securing the various units.	Check all covers for possible damage incurred during transportation.
5	Open the delivery unit and peel off the protective sheet on the glass guide.	
6	Install a personal computer.	• Install SCSI interface board. • Install the peripheral devices. (For installation of the SCSI interface board and peripheral devices, refer to each operation manual.)
7	Connect the personal computer to the main body using SCSI cable.	

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

No.	Procedure	Inspection/Remarks
8	Connect SCSI terminator to SCSI connector of the main body which is not in use. **Note:** In applications where the same SCSI line is connected with peripheral devices such as a printer, connect the SCSI terminator to the last peripheral device on the SCSI line.	
9	Set the ID of SCSI using the SCSI ID switch. **Note:** Be careful not to set the same ID number as those of devices connected to other SCSI devices.	
10	Connect the power cord.	

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

No.	Procedure	Inspection/Remarks
11	Install the delivery auxiliary tray.	
12	Turn on the power to the peripheral devices first, and then the power to the personal computer.	
13	Install the device driver. Refer to the manual on the device driver.	
14	Install the application software. Refer to the operation manual on the application software.	

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

CHAPTER 6

MAINTENANCE AND SERVICING

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

I. PARTS TO BE REPLACED PERIODICALLY

No parts to be replaced periodically

II. CONSUMABLE PARTS

No consumable parts

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

CHAPTER 7

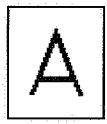
TROUBLESHOOTING

I. IMAGE ARE NOT OUTPUT

1	Images are not output (white blank, black blank, spotted)

Cause/Location	Step	Check Item	Result	Countermeasure
	1	Does image trouble occur on both sides?	YES	Carry out step 4 and subsequent steps.
			NO	Trouble on one side: Carry out steps 2 and 3.
LED for illuminating document	2	Does the LED on trouble side light up?	NO	Carry out steps listed in "LED does not light up on the faulty side."
Scanner unit	3	When the defective scanner unit is replaced, is the trouble resolved?	YES	End
CPU PCB ass'y			NO	Replace the CPU PCB ass'y.
Poor connection of interface cable	4	Is the interface cable between the main body and the external device securely connected to the interface connector of the printer?	NO	Securely insert the connector.
LED for illuminating document	5	Does the LED light up?	NO	Carry out steps in "LED does not light up."
Insufficient DC power	6	Is the DC power supplied?	NO	Carry out steps in "DC power does not come on."
CPU PCB ass'y	7	When the CPU PCB ass'y is replaced, is the trouble resolved?	YES	End
External devices			NO	Explain to the customer that this is not a problem with the machine, and ask to check the external devices.

2 Poor resolution



Cause/Location	Step	Check Item	Result	Countermeasure
Guide glass	1	Is the guide glass of the scanner unit contaminated?	YES	Clean the glass.
Scanner unit	2	Is the scanner unit is properly mounted?	NO	Remount the scanner unit properly.
CPU PCB			YES	Replace the CPU PCB ass'y.

3 Uneven image density, lines (horizontal direction)

Cause/Location	Step	Check Item	Result	Countermeasure
Guide glass	1	Is the guide glass of the scanner unit contaminated?	YES	Clean the glass.
Poor contact of connector	2	Are connectors J108 and J109 on the CPU PCB ass'y securely connected?	NO	Re-connect.
CPU PCB ass'y			YES	Replace the CPU PCB ass'y.

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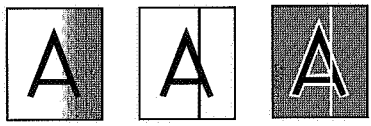
4 Uneven image density, lines (vertical direction)



Cause/Location	Step	Check Item	Result	Countermeasure
Guide glass	1	Is the guide glass of the scanner unit contaminated?	YES	Clean the glass.
Poor shading correction	2	When the shading correction is repeated, is the trouble resolved?	YES	End
CPU PCB ass'y	3	When the CPU PCB ass'y is replaced, is the trouble resolved?	YES	End
Faulty scanner unit			NO	Replace the scanner unit on the faulty side.

II. TROUBLESHOOTING

1 AC power does not come on

Cause/Location	Step	Check Item	Result	Countermeasure
Power plug	1	Is the power cord plugged into the outlet?	NO	Insert the plug into the outlet
Power voltage	2	Is the specified voltage being supplied to the outlet?	NO	Explain to the customer that this is not a problem with the machine.
Power switch (SW1)	3	Is there continuity between the two terminals of the power switch?	NO	Replace the power switch (SW1).
			YES	Check a continuity of the power cord.

2 DC power does not come on

Cause/Location	Step	Check Item	Result	Countermeasure
Faulty AC power supply	1	Is the AC power supply being supplied to the AC inlet?	NO	Carry out the check items of "AC power does not come on."
Delivery assembly	2	Is the delivery assembly properly closed?	NO	Close the delivery assembly.
Delivery assembly open/close detection switch (SW2)	3	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J303-3 and J303-1 on the DC power supply PCB, and the power is turned on with the delivery unit open?	YES	Check the switch and the wiring from J303 to the delivery assembly open/close detection switch (SW2)
CPU PCB assembly	4	Are the specified voltages being output when the probes of a multimeter set at 50 VDC range are connected to the following connectors on the DC power supply PCB?	YES	Check the wiring from the DC power supply PCB to the CPU circuit. If there is no problem, replace the CPU PCB assembly.
DC power supply PCB assembly			NO	Replace the DC power supply PCB.

Connector	Terminal	Voltage
J301	2 ⊕ 1 ⊖	+24V
	4 ⊕ 3 ⊖	+5V
J302	1 ⊕ 2 ⊖	+12V
	3 ⊕ 4 ⊖	–12V

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

3 Feeder clutch (CL1) does not operate

Cause/Location	Step	Check Item	Result	Countermeasure
Pick-up clutch (CL1)	1	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to the connectors J105-A1 and J105-A2 on the CPU PCB, and the document board motor turns off?	YES	Check the wiring from the CPU PCB to the feeder clutch (CL1). If there is no problem, replace the clutch.
CPU PCB assembly			NO	Replace the CPU PCB

4 Main motor (M1) does not rotate

Cause/Location	Step	Check Item	Result	Countermeasure
Defective DC power supply	1	Is the DC power supply being supplied to the main motor?	NO	Take corrective action referring to "2 DC power does not come on."
Main motor (M1)	2	Does the multimeter read approximately 5 V at the time of start of scanning when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected to connectors J107-A5 and J107-A7 on the CPU PCB, respectively?	YES	Check the wiring from the CPU PCB to the main motor. If there is no problem, replace the main motor.
CPU PCB assembly			NO	Replace the CPU PCB.

5 Document board motor (M2) does not rotate

Cause/Location	Step	Check Item	Result	Countermeasure
Document board load	1	Is there any load in the drive system from the document board motor (M2) to the document board?	YES	Remove the load.
Document board motor (M2)	2	Does the multimeter read approximately 24 V at the time of start of scanning when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J202-1 and J202-2 on the connector PCB?	YES	Check the wiring from the connector PCB to the document board motor (M2). If there is no problem, replace the clutch.
Connector PCB assembly	3	Does the multimeter read approximately 24 V at the time of start of scanning when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J110-A2 and J110-A4 on the CPU PCB?	YES	Check the wiring from the CPU PCB to the connector PCB. If there is no problem, replace the connector PCB.
CPU PCB			NO	Replace the CPU PCB.

6 Manual selector solenoid (SL1) does not operate

Cause/Location	Step	Check Item	Result	Countermeasure
Manual selector solenoid (SL1)	1	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J206-1 and J206-3 on the connector PCB, and the document is picked up manually?	YES	Check the wiring from the connector PCB to the manual selector solenoid (SL1). If there is no problem, replace the solenoid.
Connector PCB	2	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J110-A11 and J110-A9 on the CPU PCB, and the document is picked up manually?	YES	Check the wiring from the CPU PCB to the connector PCB. If there is no problem, replace the connector PCB.
CPU PCB			NO	Replace the CPU PCB

7 Front LED does not light up

Cause/Location	Step	Check Item	Result	Countermeasure
Front LED	1	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J404-1 and J404-2 on the front BASIS driver PCB, and the document is scanned?	YES	Check the wiring from the front BASIS driver PCB to the front LED. If there is no problem, replace the front scanner unit.
Front scanner unit	2	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J106-A7 and J106-A5 on the CPU PCB, and the document is scanned?	YES	Check the wiring from the CPU PCB to the front BASIS driver PCB. If there is no problem, replace the front scanner unit.
CPU PCB			NO	Replace the CPU PCB.

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

8 Back LED does not light up

Cause/Location	Step	Check Item	Result	Countermeasure
Back LED	1	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J404-1 and J404-2 on the front BASIS driver PCB, and the document is scanned?	YES	Check the wiring from the back BASIS driver PCB to back LED. If there is no problem, replace the back scanner unit.
Back scanner unit	2	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J207-7 and J207-5 on the connector PCB, and the document is scanned?	YES	Check the wiring from the connector PCB to back BASIS driver PCB. If there is no problem, replace the back scanner unit.
Connector PCB	3	Does the multimeter read approximately 24 V when the ⊕ probe and ⊖ probe of the multimeter set at 50 VDC range are connected respectively to connectors J110-A11 and J110-A7 on the CPU PCB, and the document is picked up manually?	YES	Check the wiring from the CPU PCB to the connector PCB. If there is no problem, replace the connector PCB.
CPU PCB			NO	Replace the CPU PCB

III. SERVICE MODE

A. Outline

The following comprise the service mode of this machine.

- Mode for displaying light intensity data for shading correction
  Displays the data detected by each sensor of BASIS when correcting shading.
- Shading correction executing mode
  Carries out shading correction and automatically writes the data in DR-3020.
- Document detecting sensor position adjusting mode
  Adjusts the position of the document width detecting sensor and automatically writes the data in DR-3020.
- Registration adjusting mode
  Adjusts registration and automatically writes the data in DR-3020.
- Input port indicating mode
  Indicates the state of input of each sensor.
- Port access mode
  Checks the operation of each DC load.
- Image display mode
  Scans the document and displays the image on the personal computer screen.

B. Use of Service Mode

DR-3020 itself does not have any service mode functions. Therefore, when starting up service mode, the following items are required.

1. Service Mode Program
   Tool No.: MG1-2625-000
   (3.5 type floppy disk)
2. Personal Computer
   IBM PC/AT compatible machine
   - SCSI driver I/F : WINASPI
   - OS : Windows 3.1®
   - CPU : 386, 33 MHz or more
   - Memory size : 8 MB or more
   - Available HD capacity : 10 MB or more

Note: Do not start up service mode with the user's personal computer. Always, use a personal computer exclusive with service mode.

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

C. Tool Installation

1. Turn on the personal computer.
2. Display the DOS prompt.
3. Insert the tool floppy disk into the floppy disk drive.
4. Copy the floppy disk file on to the hard disk.
   COPY A:3020TOOL.EXE ↵
5. Check installation.
6. Start WINDOWS.
   WIN ↵
7. Open File Manager and check that [3020TOOL] is in there.

D. Service Mode

1. Starting up Service Mode

a. Turn on DR-3020.
b. Start up WINDOWS.
   WIN ↵
c. Open File Manager, and open [3020TOOL].
d. The Service Mode screen displays as in Figure 6-1.

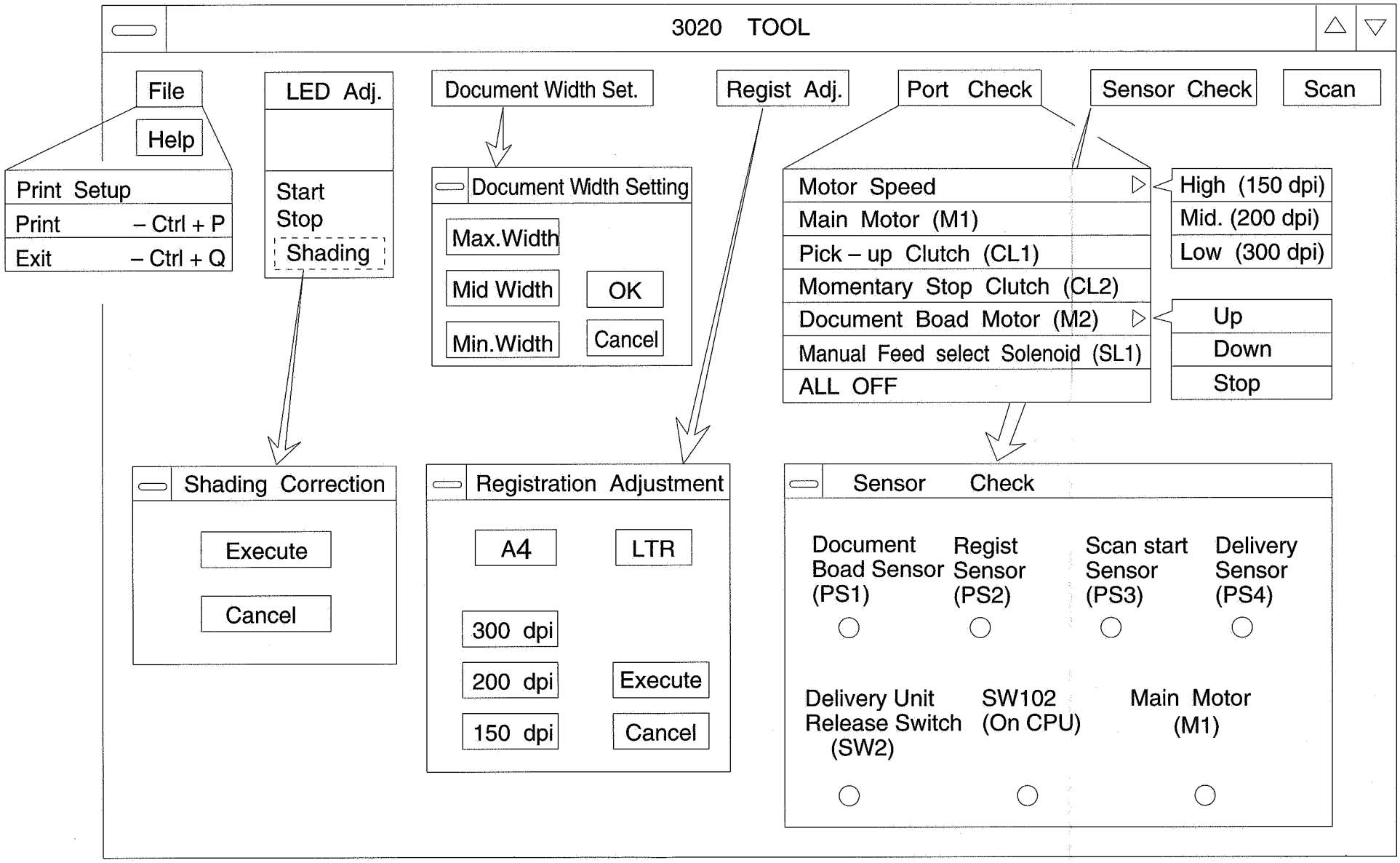


Figure 7-1

2. Shading Correction

a. Cover the entire glass surface of the upper and lower scanner unit of DR-3020 with one sheet of standard white paper (FY9-3004-020), and close the delivery assembly.
b. Select [Start] from [Shading Adj.] of the menu screen.
c. Scanning starts and the density (data) of the standard white paper will be displayed on the personal computer screen.
d. Turn VR101 through VR104 on the CPU PCB assembly to adjust so that the waveform coincides with the reference line. (Do not excessively shift the waveform upwards; this will cause the waveform to saturate.)
   VR101: For adjusting former half of front side BASIS (left side of upper waveform)
   VR102: For adjusting latter half of front side BASIS (right side of upper waveform)
   VR103: For adjusting former half of back side BASIS (left side of lower waveform)
   VR104: For adjusting latter half of back side BASIS (right side of lower waveform)
   Data waveform can be printed out by selecting [Print] from [File] of the menu screen.
e. Cover the entire glass surface of the scanner unit with three sheets of standard white paper (FY9-3004-020) placed on top of each other, and close the delivery assembly.
f. Select [Shading] from [Shading Adj.] of the menu screen.
g. When carrying out shading correction, press [Execute].

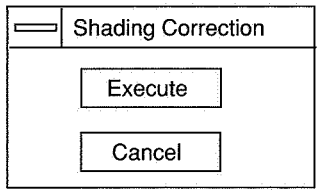


Figure 7-3

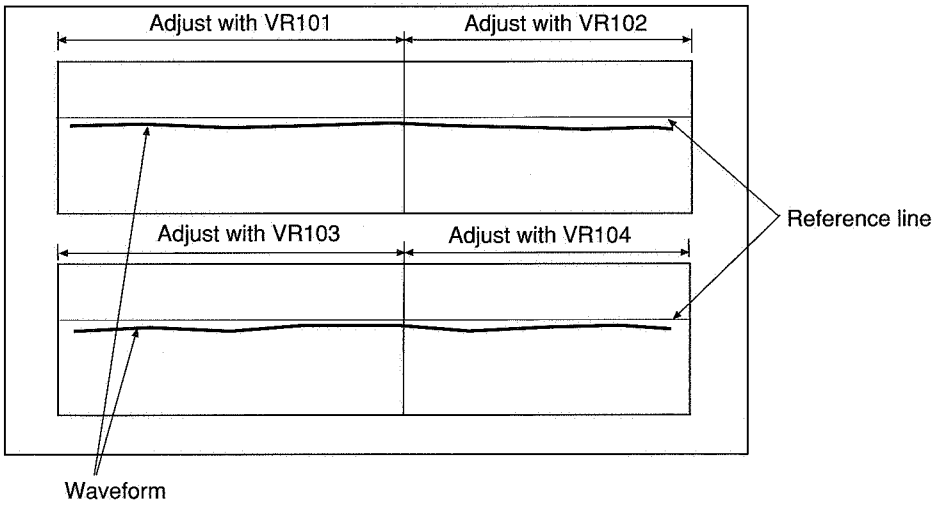


Figure 7-2

h. Shading correction will be carried out for about one minute and the shading correction data will be written into the CPU PCB memory.

Reference: When adjusting with synchroscope:

a. Cut standard white paper (FY9-3004-020) to a width of about 150 mm and place it in the center of the glass surface of the upper and lower scanner unit.
b. Connect the synchroscope probes to check pins J111-1 - J111-4 on the CPU PCB, and adjust so that the white paper (standard white paper) part becomes 1.6V.
Connect GND to J111-6.

VR No.	Check Pin No.
VR101	J111-1
VR102	J111-2
VR103	J111-3
VR104	J111-4

Table 7-1

c. After adjusting is finished, cover the entire glass surface of the upper and lower scanner unit with three sheets of standard white paper, and close the delivery assembly.
d. The subsequent steps are the same as when the work is being done via a personal computer.

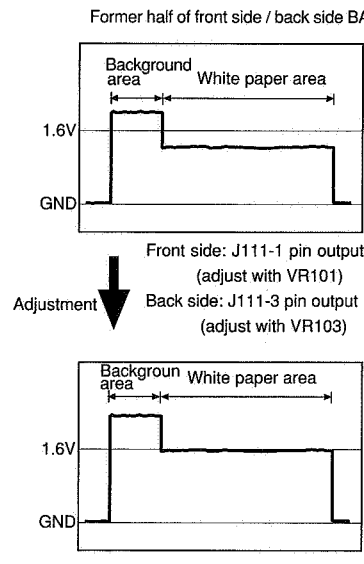


Figure 7-4

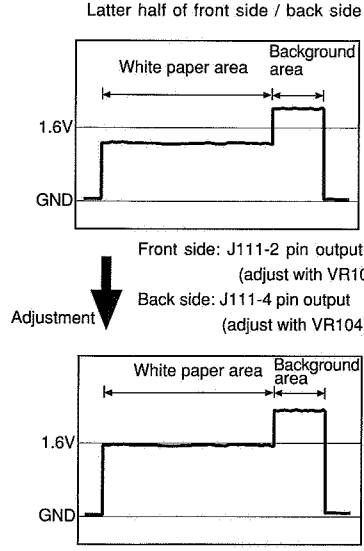


Figure 7-5

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3. Adjusting Document Width Detecting Sensors

When doing this adjustment, prepare a sheet of thick paper 160 mm wide.

a. Select [Document Width Set.] from the menu screen.

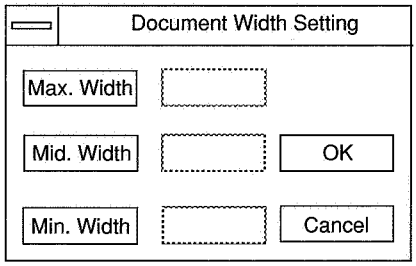

Figure 7-6

b. Widen the document guide plate fully and select [Max. Width].
   The width value will be displayed on the right.
c. Set the 160 mm wide thick paper on the document board, match the document guide plate to it, and select [Mid. Width]
   The value will be displayed on the right.
d. Narrow the document guide plate fully and select [Min. Width].
   the value will be displayed on the right.
e. If OK, select [OK]. The value of the sensed document width will be written in the memory of the CPU PCB. It will be over in a few seconds.

Reference: The figures indicated to the right of [Max. Width], [Mid. Width], and [Min. Width] are values output from the sensor of the document guide plate.

These values have to be [Max. Width] > [Mid. Width] > [Min. Width] and moreover the value of [Mid. Width] has to be approximately midway between the values of [Max. Width] and [Min. Width]. If these figures do not meet the above conditions, then it is possible that there is something wrong with the sensor.

4. Adjusting Registration

a. Place an A4 size or letter size copy paper on the document board.
b. Select [Registration Adjustment] from the menu screen.

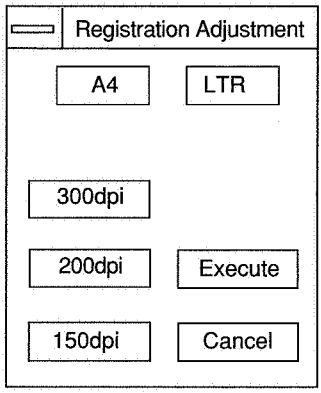

Figure 7-7

c. Select [A4] when A series documents are being used, and [LTR] when Letter series documents are being used.
d. Press [300 dpi]. The copy paper is fed and the registration data will be calculated.
e. Place the copy paper again on the document board and select [200 dpi]. The copy paper is fed and the registration data will be calculated.
f. Place the copy paper again on the document board and select [150 dpi]. The copy paper is fed and the registration data will be calculated.
g. When the work is finished, select [Execute]. The registration adjusting value will be written into the memory of the CPU PCB. It is over in a few seconds.

CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

5. Port Check

a. Select [Port Check] from the menu screen.
The following DC loads can be checked.
- [Motor Speed]
The speed of the motor can be switched in three stages.
High speed : [High] (150)
Medium speed : [Mid.] (200)
Low speed : [Low] (300)
- [Main Motor (M1)]
ON/OFF of main motor (M1)
- [Pick-up Clutch (CL1)]
ON/OFF of paper pick-up clutch (CL1)
- [Momentary Stop Clutch (CL2)]
ON/OFF of momentary stop clutch (CL2)
- [Document Board Motor (M2)]
Drives the document board motor (M2) and moves the document board up and down.
Ascend : [Up]
Descend : [Down]
Stop : [Stop]
- [Manual Feed Select Solenoid (SL1)]
ON/OFF of manual feed select solenoid
- [All OFF]
Stops all DC loads.

6. Sensor check

a. Select [Sensor Check] from the menu screen.

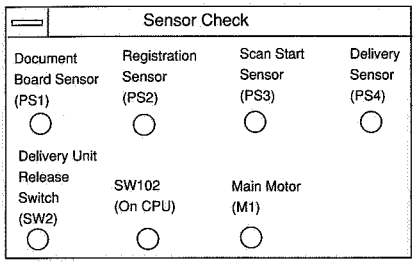

Figure 7-8

b. ON/OFF state of each sensor can be checked.
- [Document Board Sensor (PS1)]
Document board sensor
- [Registration Sensor (PS2)]
Registration sensor
- [Scan Start Sensor (PS3)]
Scan start sensor
- [Delivery Sensor (PS4)]
Paper delivery sensor
- [Delivery Unit Release Switch (SW2)]
Delivery unit release switch
- [SW102 (On CPU PCB)]
Push switch SW102 on CPU PCB
- [Main Motor (M1)]
State of drive of main motor

c. When a sensor goes ON, the corresponding ○ in the display changes to ●.
This check can be done jointly with 5. Port Check.

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7. Feed/Image Display Check

a. Place a double-sided document on the document board.
b. Select [Scan] from the menu screen.
c. The document will be fed at 300 lpi and the image will be displayed on the personal computer.

8. Tool Version Display

a. Select [Help] on menu screen.
b. Version screen will be displayed.
c. If [OK] is selected, screen will return to the menu screen.

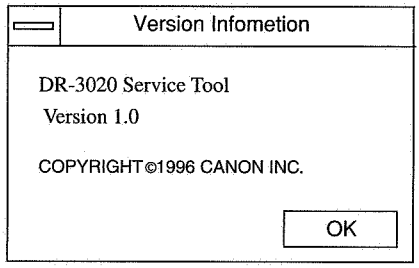

Figure 7-9

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VI. PROCESS FOR REPLACING ELECTRICAL PARTS

A. Outline

In the electrical parts used in this machine, there are some that will not properly exhibit the functions of this machine merely by replacing the parts.

- CPU PCB.
- Scanner unit (front side and back side)
- Document width detecting sensor

Caution: Always turn off the power before replacing electrical parts.

B. CPU PCB

a. Before replacing, make a note of the SCSI ID number.
b. After replacing the CPU PCB, set the SCSI ID.
c. Carry out registration adjustment (refer to Page 7-16)
d. Carry out shading correction (refer to Page 7-13)
e. Adjust the document width position sensor (refer to Page 7-15).

C. Scanner Unit

a. Carry out shading correction (refer to Page 7-13)

D. Document Width Detecting Sensor

a. Adjust the document width position sensor (refer to Page 7-15).

APPENDIX

 CANON DR-3020 REV.0 FEB. 1996 PRINTED IN JAPAN (IMPRIME AU JAPON)

I. LIST OF SIGNALS AND COMMANDS

This section lists the abbreviations of signals and commands used in this manual and circuit diagrams, and explains their meanings.

PPUD	Paper Pick-Up Drive command
LED_A	front side LED drive command
PDP1	Paper Detection signal 1
PDP3	Paper Detection signal 3
Vout1	BASIS analog Voltage out put signal 1
Vout2	BASIS analog Voltage out put signal 2
Vref	BASIS drive reference Voltage
SP	Sift Pulse signal
CLK	CLocK
DCBD1	DoCument Board Drive motor command 1
DCBD2	DoCument Board Drive motor commend 2
PDP2	Paper Detection signal 2
PAUD	Paper pAUse Drive command
LED_B	back side LED drive command
RES	REServe
MFSD	Manual Feed Solenoid Drive command
DWID	Document WIDth detection signal
PDP4	Paper Detection signal 4
MOTD	MOTor Drive command
SPEED-A	SPEED select signal A
SPEED-B	SPEED select signal B
M_LOCK	Motor LOCK signal

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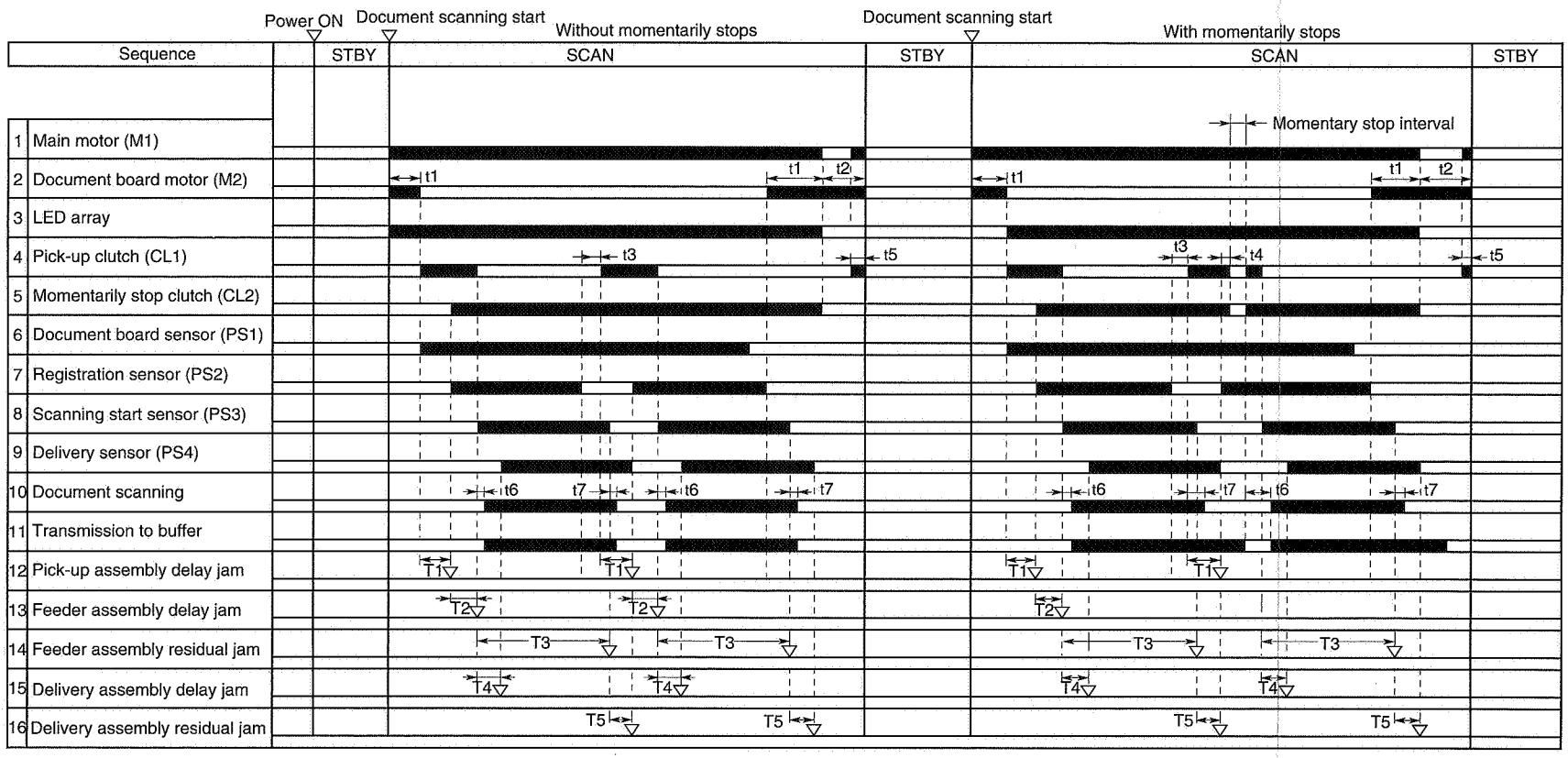
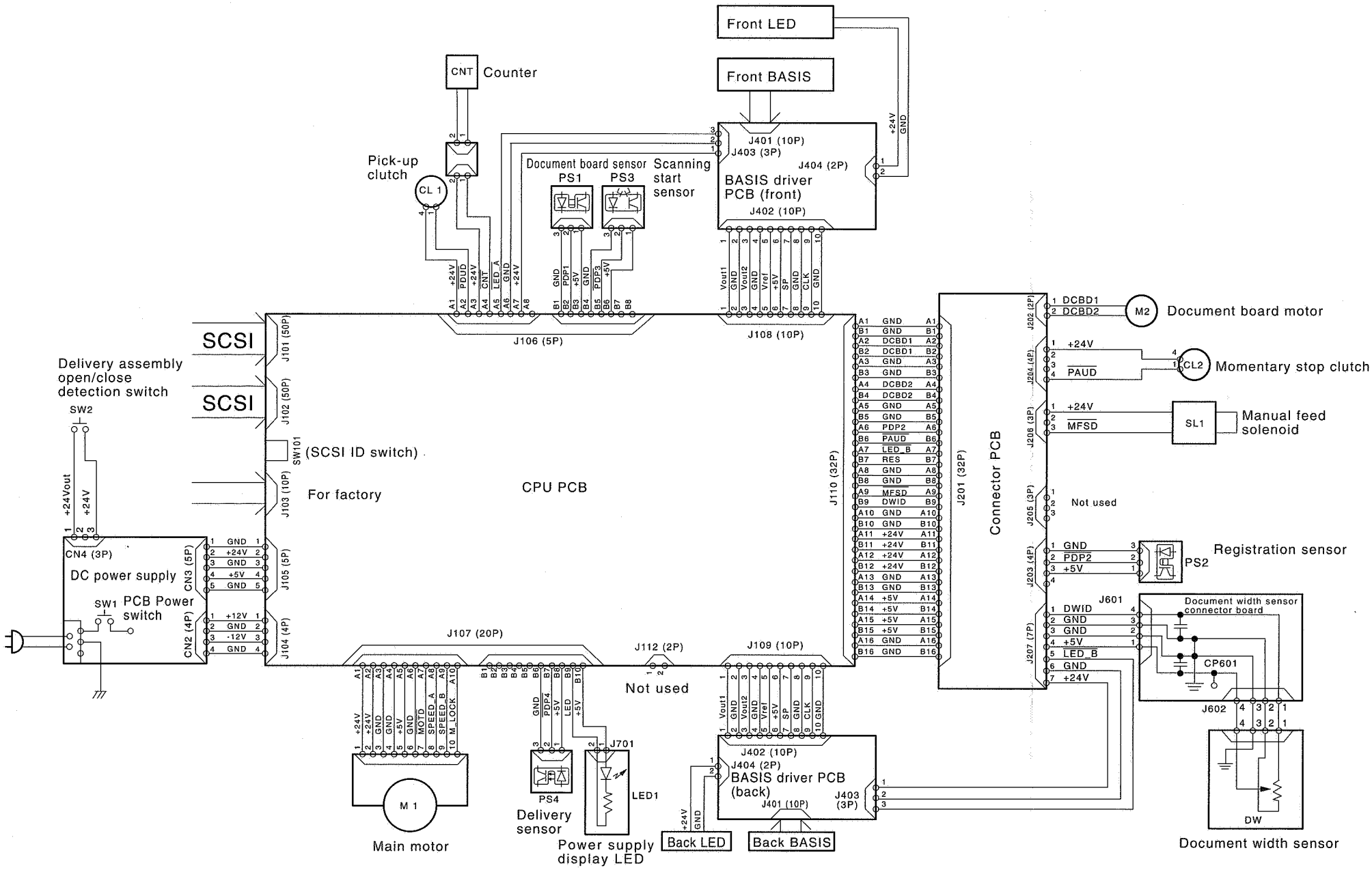
II. GENERAL TIMING CHART

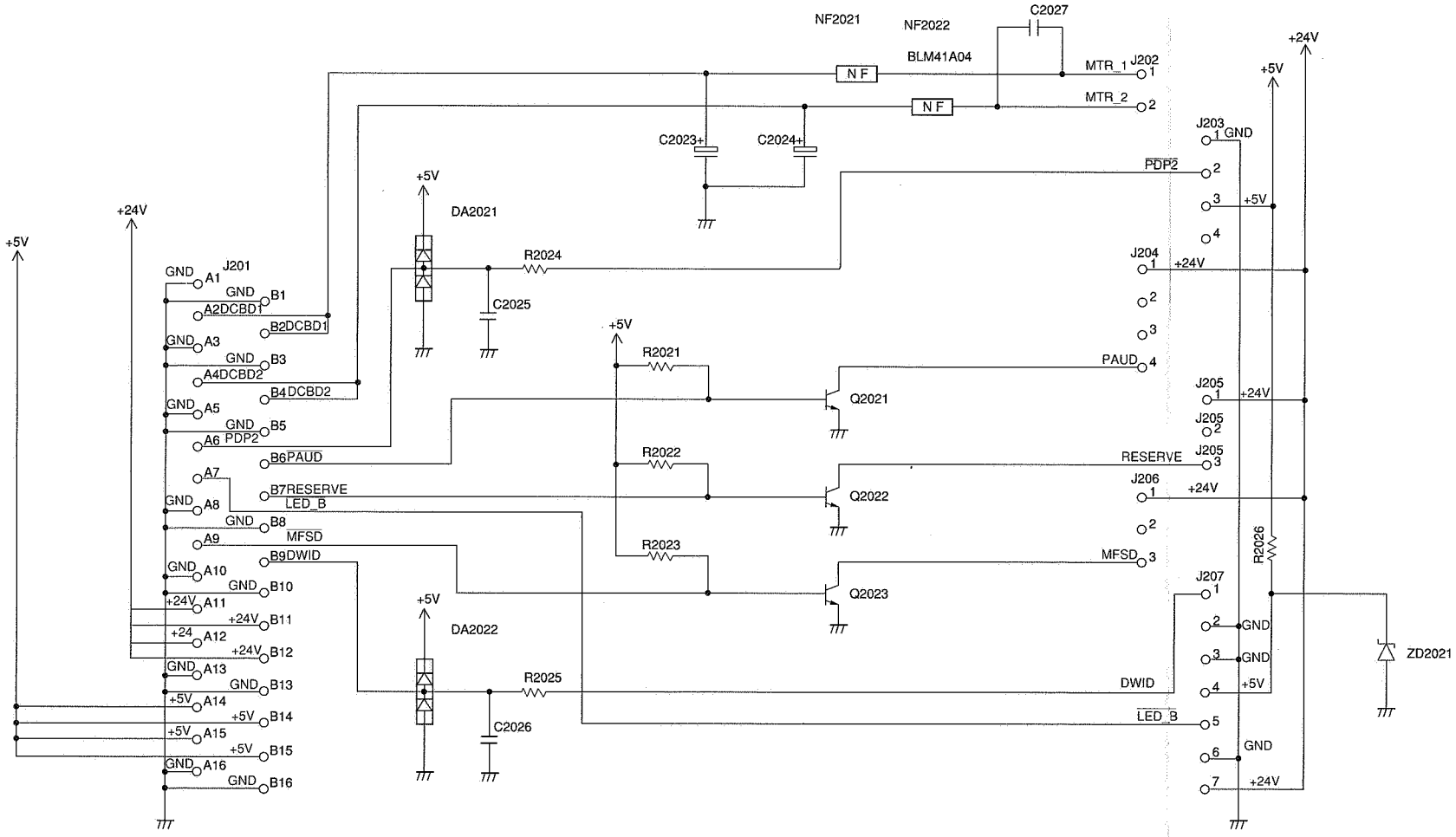
When two sheets are fed



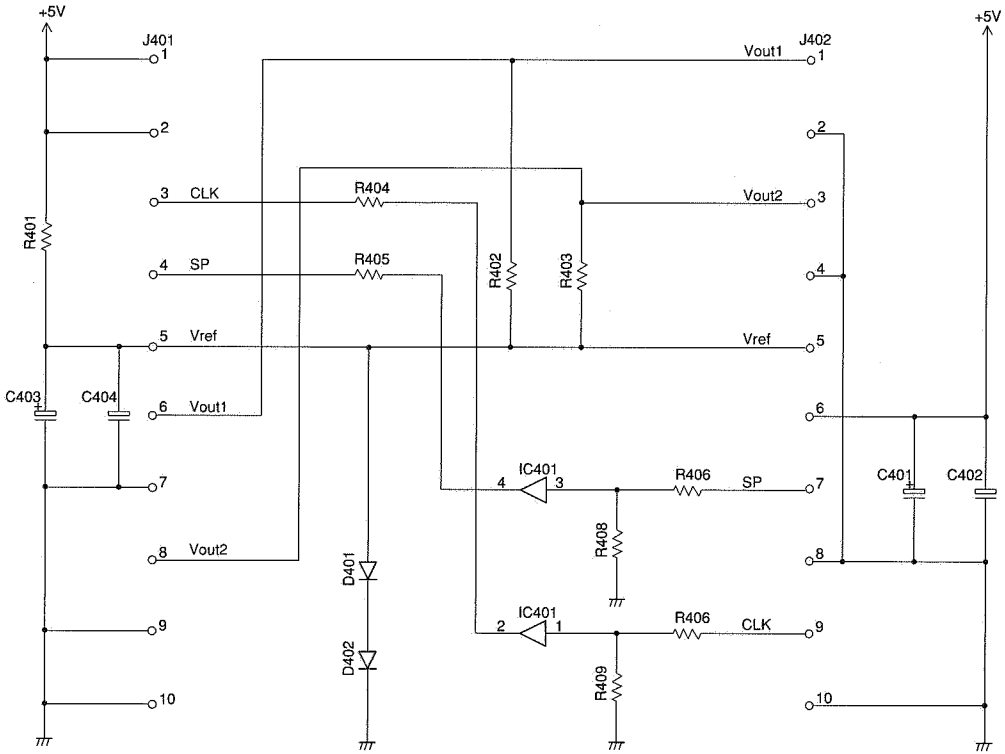
III. GENERAL CIRCUIT DIAGRAM

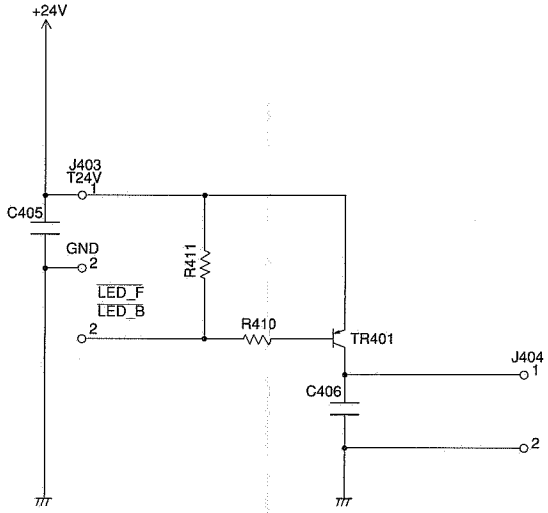


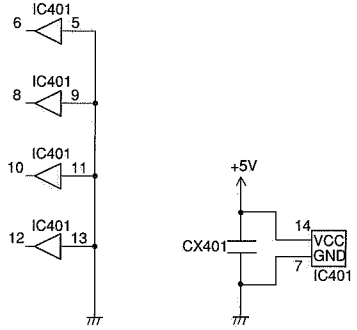
IV. CONNECTOR CIRCUIT DIAGRAM



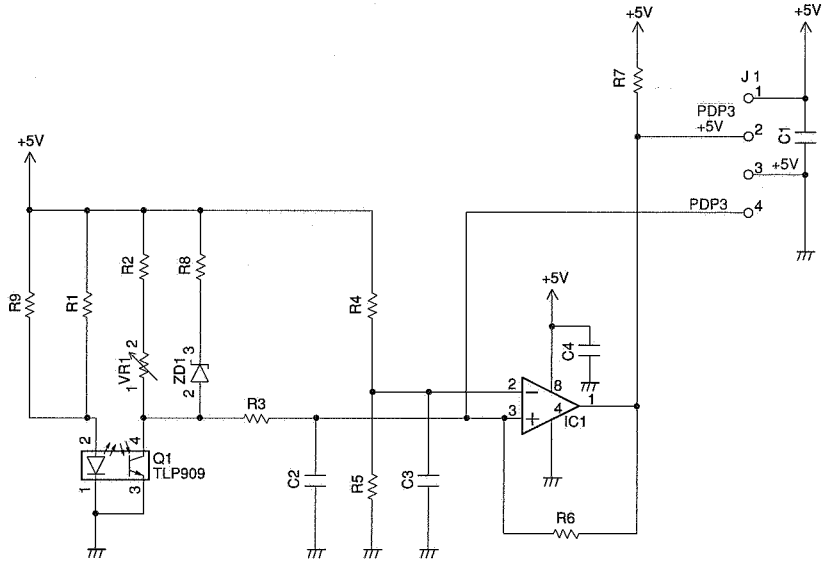
V. BASIS DRIVE CIRCUIT DIAGRAM





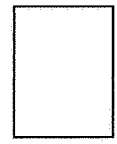
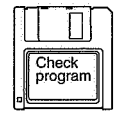
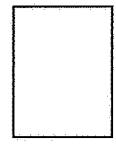


VI. SCANNING START SENSOR CIRCUIT DIAGRAM



VII. LIST OF SPECIAL TOOLS

Special tools which are required for servicing this machine in addition to the standard tool set are listed below.

No.	Tool name	Tool No.	Shape	Rank	Purpose/Remarks
1	Test sheet set	TKM-0271		A	10 sheets/(1) set
2	Check program	MG1-2625		B	• Service mode execution program • 3.5 floppy disk
3	PC/AT compatible personal computer	—		B	To be prepared by each service engineer In addition, SCSI driver I/F of WIN ASPI is needed.
4	Standard white paper	FY9-3004		B	• For shading correction • 20 sheets/(1) set

Note: Rank

A: Each service technician should carry one with him.
B: A group of five service technicians should share one.
C: Each workshop should keep one.

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VIII. SOLVENT/OIL TABLE

No.	Name	Application	Composition	Remarks
1	Ethylalcohol (Ethanol) Isopropyl alcohol (Isopropanol)	Cleaning: Glass, plastic, rubber, external covers	C_2H_5OH $(CH_3)_2$ CHOH	• Do not bring near fire. • Procure locally. • Substitutes: C1, IPA (isopropyl alcohol)
2	MEK	Cleaning: Metal portions, oil smudges, toner smudges	Mineral oil-based hydrocarbons, chlorine-based hydrocarbon, alcohol	• Do not bring near fire. • Procure locally • Substitutes: MEK
3	Heat resistant grease	Drive portion	Mineral oil-based lithium soap Molybdenum disulfide	• Vitasol MO-138S (manufactured by Hitachi Powdered Mill) • Tool No. CK-0427 (5500 g/can)
4			Mineral oil (paraffin-based)	• Uniway 68 (manufactured by Nikon Sekiyu) • Substitutes: Suwaway S68 (manufactured by Maruzen Sekiyu) Mobil Vactra Oil No. 2 (manufactured by Mobil Oil)
5	Lubricating oil		Mineral oil (paraffin-based)	• Uniway 220 (manufactured by Nihon Sekiyu) • Tool No. CK-0524 (100 cc) • Substitutes: Suwaway S180 (manufactured by Maruzen Sekiyu)

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