brother®

FACSIMILE EQUIPMENT
SERVICE MANUAL

MODEL: MFC5100C/MFC590

PREFACE

This publication is a Service Manual covering the specifications, construction, theory of operation, and maintenance of the Brother facsimile equipment. It includes information required for field troubleshooting and repair--disassembly, reassembly, and lubrication--so that service personnel will be able to understand equipment function, to rapidly repair the equipment and order any necessary spare parts.

To perform appropriate maintenance so that the facsimile equipment is always in best condition for the customer, the service personnel must adequately understand and apply this manual.

This manual is made up of six chapters and appendices.

This manual describes the models and their versions to be destined for major countries. The specifications and functions are subject to change depending upon each destination.

CHAPTER 1

GENERAL DESCRIPTION

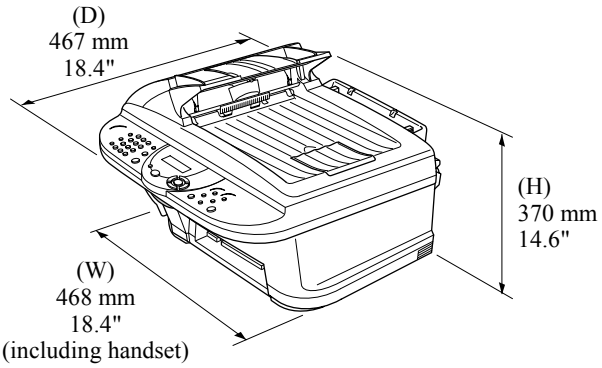
CHAPTER 1 GENERAL DESCRIPTION

CONTENTS

1.1 EQUIPMENT OUTLINE

1.1.1 External Appearance and Weight

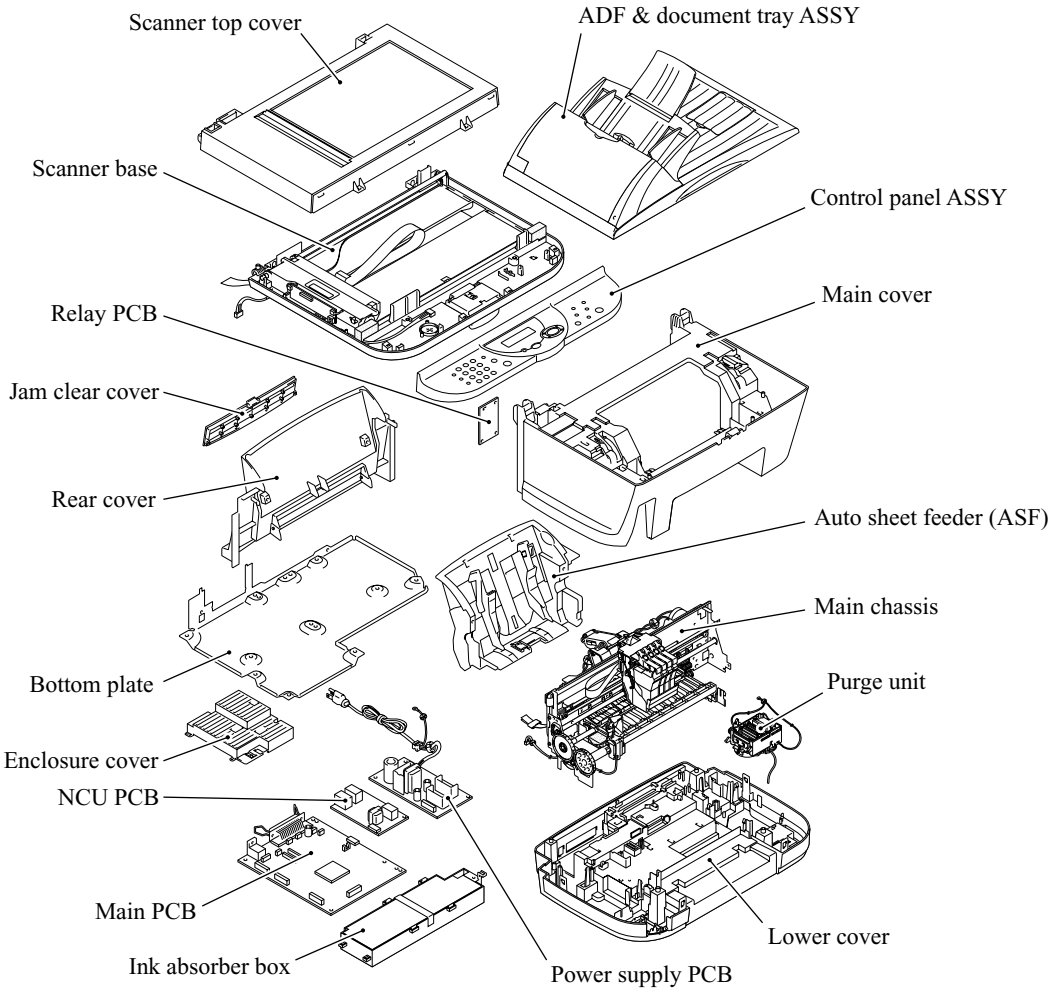
The figure below shows the equipment appearance and approximate dimensions.



Weight:	Machine proper	Approx. 15 kg (33.1 lbs.)
	In package	Approx. 11 kg (24.2 lbs.)

1.1.2 Components

The equipment consists of the following major components:



1.2 SPECIFICATIONS

(1/2)

Model Name	MFC-5100C
GENERAL	
Print Engine	Ink Jet (BH 2-head)
Modem Speed (bps)	14,400 (Fax)
Transmission Speed (sec.)	6 (Brother#1, MMR)
ITU-T Group	G3
Coding System	MH/MR/MMR/JPEG
Print Paper Size (W x L)	3.5"-8.5" x 5.0"-14"
Document Size for ADF (W x L)	5.8"-8.5" x 5.7"-14"
Max. Document Size for Flat-bed Scan (W x L)	8.5" x 11.7"
Print Paper Margin (upper, lower, left, right)	0.12, 0.43, 0.12, 0.12 inch (3, 11, 3, 3 mm)
ADF (pages)	Up to 30
LCD Columns	16 characters
LCD Lines	1 line
LCD Backlight	No
Backup Clock	Yes (1 hour)
Memory Backup	N/A
Memory Capacity (physical)	8MB (RAM)
Optional Memory	No
Dimensions w/ Carton (WxDxH)	23.3"x22.3"x18.1" (592x566x460 mm)
Dimensions w/o Carton (WxDxH)	18.4"x18.4"x14.5" (468x467x368 mm)
Weight w/ Carton	34.1 lbs/15.5 kg
Weight w/o Carton	24.2 lbs/ 11 kg
Color	Gray 1495
Standby Mode	No
PC-Fax Protocol Compliance	N/A
Simultaneous Operation	Yes (Print/Fax, Print/Scan)
Energy Star Compliant	Yes
Operating Environment Temperature Humidity	10 - 35 degrees Centigrade 20% to 80%
Power Source	120 VAC, 50/60 Hz
Power Consumption (Standby/Peak)	Under 13.5W/40W
On/Off Switch	No
TELEPHONE	
Handset	No
One-Touch Dial	No
Speed Dial	Max. 40
Speaker Phone	No
Chain Dialing	Yes
Caller ID	No
Call Waiting Caller ID	No
Distinctive Ringing	Yes
Hold/Mute Key	No
Hook Key	No
Power Failure Dialing	No
Speaker Volume	No
Ring Volume	Yes (2 steps + OFF)
Handset Volume	No
FAX	
Scan Speed (A4:Standard)	Approx. 3 sec./page (A4: standard)
Memory Transmission (Brother#1 Chart)	Yes (200:MMR)
Memory Transmission (ITU-T Chart)	Yes (170:MMR)
Out-of-Paper Reception (Brother #1 Chart)	Yes (200:MMR)
Out-of-Paper Reception (ITU-T Chart)	Yes (170:MMR)
Color FAX (Document Send/Receive)	Yes/Yes
Color FAX (Memory Send/Receive)	No/Yes

Model Name	MFC-5100C
INTERFACE	
External TAD Interface	Yes
Host Interface (IEEE1284)	Yes
Host Interface (USB)	Yes
LAN Interface	No
PRINTER	
Color/Mono	Color/Mono
Engine Type	Piezo Ink Jet (2-head BH: 75 nozzles/color)
Resolution (dpi)	1200x1200 /2400x1200 (Mono/Color)
Speed (ppm)	10/8 (Mono/Color: 600*150) 4/3.5 (Mono/Color: 600*300) 2/1.5 (Mono/Color: 600*600) 0.2/0.2 (Mono/Color: 1200*1200/2400*1200)
Paper Capacity (sheets)	100
Output Paper Capacity (sheets)	50
Standard Print Language	Windows GDI
Emulation	No
Resident Fonts	Yes
Fonts Disk Based	Yes
Paper Handling Size	LTR, LGL, A4, B5, A5, EXE, Post card, Photo, Index card
Manual Feed Slot	N/A
Other Paper Type	OHP, Envelopes
Sheet Weight (Paper Cassette) (Manual Slot)	64-120 g/m2 (17 - 32 lb) N/A
Printer Driver	Win95/98/98SE/Me/2000Professinal/NT4.0/ MacOS 8.5-9.1
COPY	
Color/Mono	Color/Mono
Speed (ppm)	7/5 (Mono/Color)
Multi Copy (Stack)	Yes (Color) or Via PC
Multi Copy (Sort)	Yes (Color) or Via PC
Resolution (dpi)	Max. 1200x1200 (color)
SCANNER	
Color/Mono	Color/Mono
Resolution (dpi) (Physical)	CCD: 600x2400 (Opt.)
Resolution (dpi) (Logical)	9600 (Int.)
Speed (ppm)	Max. 3 sec
Gray Scale	256
TWAIN Compliant&Operating System	Win95/98/98SE/2000Professinal/NT4.0/Me MacOS 8.6-/9.1
PCI Scanner (Parallel/Serial)	Parallel/ USB
Color Depth	36-bit color processing (24-bit external)
ACCESSORIES	
Cartridge	4 colors (each separate tank)
Life / Yield (Draft, 5% Coverage)	BK: 950, CL: 450

Model Name	MFC-590
GENERAL	
Print Engine	Ink Jet (BH 2-head)
Modem Speed (bps)	14,400 (Fax)
Transmission Speed (sec.)	6 (Brother#1, MMR)
ITU-T Group	G3
Coding System	MH/MR/MMR/JPEG
Print Paper Size (W x L)	90-216 x 127-216 mm
Document Size for ADF (W x L)	147-216 x 145-356 mm
Max. Document Size for Flat-bed Scan (W x L)	216 x 297 mm
Print Paper Margin (upper, lower, left, right)	0.12, 0.43, 0.12, 0.12 inch (3, 11, 3, 3 mm)
ADF (pages)	Up to 30
LCD Columns	16 characters
LCD Lines	1 line
LCD Backlight	Yes
Backup Clock	Yes (1 hour)
Memory Backup	N/A
Memory Capacity (physical)	4 MB
Optional Memory	No
Dimensions w/o Carton (WxDxH)	23.3"x22.3"x18.1" (592x566x460 mm)
Dimensions w/ Carton (WxDxH)	18.4"x18.4"x14.6" (468x467x370 mm)
Weight w/o Carton	24.2 lbs/ 11 kg
Weight w/ Carton	33.1 lbs/15 kg
Color	Gray 1495
Operating Environment Temperature Humidity	10 - 35 degrees Centigrade 20% to 80%
Power Source	240 VAC, 50/60 Hz
Power Consumption (Standby/Peak)	Under 13W/50W
On/Off Switch	No
TELEPHONE	
Handset	N/A
One-Touch Dial	N/A
Speed Dial	Max. 100
Speaker Phone	No
Chain Dialing	Yes
Caller ID	No
Call Waiting Caller ID	No
Distinctive Ringing	Yes (Only UK, Denmark)
Hold/Mute Key	No
Hook Key (Tel Key)	Tel (for F/T switch)
Power Failure Dialing	No
Speaker Volume	No
Ring Volume	Yes (2 steps + OFF)
Handset Volume	No
FAX	
Scan Speed (A4:Standard)	Approx. 3 sec./page (A4: standard)
Memory Transmission (Brother#1 Chart)	Yes (200:MMR)
Memory Transmission (ITU-T Chart)	Yes (170:MMR)
Out-of-Paper Reception (Brother #1 Chart)	Yes (200:MMR)
Out-of-Paper Reception (ITU-T Chart)	Yes (170:MMR)
Color FAX (Document Send/Receive)	Yes/Yes
Color FAX (Memory Send/Receive)	No/Yes
INTERFACE	
External TAD Interface	Yes
Host Interface (IEEE1284)	Yes
Host Interface (USB)	Yes
LAN Interface	No

Model Name	MFC-590
PRINTER	
Color/Mono	Color/Mono
Engine Type	Piezo Ink Jet (2-head BH: 75 nozzles/color)
Resolution (dpi)	1200x1200 /2400x1200 (Mono/Color)
Speed (ppm)	10/8 (Mono/Color: 600*150) 4/3.5 (Mono/Color: 600*300) 2/1.5 (Mono/Color: 600*600) 0.2/0.2 (Mono/Color: 1200*1200/2400*1200)
Paper Capacity (sheets)	100
Output Paper Capacity (sheets)	50
Standard Print Language	Windows GDI
Emulation	N/A
Resident Fonts	Yes
Fonts Disk Based	Yes
Paper Handling Size	LTR, LGL, A4, B5, A5, EXE, Post card, Index card
Manual Feed Slot	N/A
Other Paper Type	OHP, Envelopes
Sheet Weight (Paper Cassette) (Manual Slot)	64-120 g/m2 (17 - 32 lb) N/A
Printer Driver	Win95/98/98SE/Me/2000Professinal/NT4.0/ MacOS 8.5/8.5.1/8.6/9.0/9.04/9.1
COPY	
Color/Mono	Color/Mono
Speed (ppm)	7/4
Multi Copy (Stack)	Yes (Color) or Via PC
Multi Copy (Sort)	Yes (Color) or Via PC
Resolution (dpi)	Max. 1200x1200
SCANNER	
Color/Mono	Color/Mono
Resolution (dpi) (Physical)	CCD 600x2400 (Opt.)
Resolution (dpi) (Logical)	9600 (Int.)
Speed (ppm)	Max. 3 sec.
Gray Scale	256
TWAIN Compliant&Operating System	Win95/98/98SE/2000Professinal/NT4.0/Me MacOS 8.6/9.0/9.04/9.1
PCI Scanner (Parallel/Serial)	Parallel/ USB
Color Depth	36-bit color processing (24-bit external)
ACCESSORIES	
Cartridge	4 colors (each separate tank)
Life / Yield (Draft, 5% Coverage)	BK: 950, CL: 450

CHAPTER 2

INSTALLATION

CHAPTER 2 INSTALLATION

CONTENTS

2.1 INSTALLING THE UPDATE DATA TO THE FACSIMILE MACHINE

If you want to update the current program stored in the flash ROM of the main PCB to the newer version or after you replace the main PCB, install the update program onto the flash ROM.

The program installation requires a PC/AT-compatible computer (which is capable of running MS-DOS or its compatible OS).

Connecting the facsimile machine to your PC

(1) Make sure that your PC is turned off.

(2) Make sure that the power cord of the facsimile machine is unplugged from a wall socket or other power source.

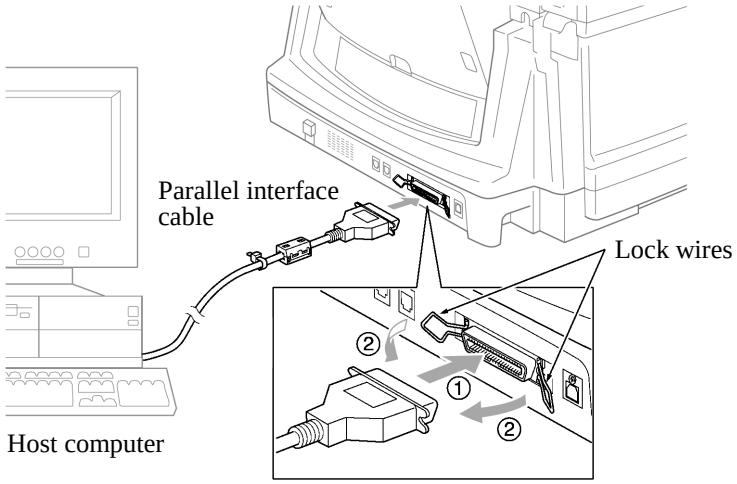
(3) Connect the parallel interface cable to the parallel port on the back of the machine and secure it with the lock wires.

(4) Connect the other end of the interface cable to the printer port of your PC and secure it with two screws.

(5) While pressing the **5** key on the machine's control panel, plug the machine's power cord into a wall socket.

(6) Check to see that the following pattern displays on the LCD. If it does not display, go back to step (2) above.

(7) Turn on your PC.



Installing the update data onto the flash ROM of the facsimile machine

NOTE: The following is an installation procedure example on a PC that is running Windows 95/98.

(1) Copy the update data and transfer utility onto the desired directory of the hard disk.
e.g., C:\UPDATE

(2) Click the Start button, point to Programs, and then click MS-DOS Prompt to open an MS-DOS window.

(3) Type the drive letter where the update data and transfer utility are located. In the above example, type C:\ from the command line and press the **ENTER** key.

Then type CD UPDATE and press the **ENTER** key.

(4) Check that your PC is connected with the facsimile machine correctly.

(5) To start the transfer utility transmitting the update data to the flash ROM of the facsimile machine, type the following:

`ICEN` *`filename`* `/b`

Where *`filename`* is an update data file, e.g., 5100x.upd and 590xxxx.upd.

Then press the **ENTER** key.

During downloading, the machine beeps *intermittently*.

Upon completion of the downloading, the machine beeps *continuously*.

NOTE: If the facsimile machine cannot return to the standby state after completion of downloading, turn the power off and on.

2.2 SETTING ID CODES TO FACSIMILE MACHINES

Brother facsimile machines are assigned unique ID codes (character strings) at the factory. If you replace the main PCB of the machine, the machine will lose its assigned ID code so that it will not be identified by the connected PC*.

You need to assign a unique ID code (character string) to the machine according to the procedure given here. For models covered by this manual, set serial numbers given to individual machines as ID codes.

(*ID codes are essential when more than one machine is connected to a single PC via USB.)

Connecting the facsimile machine to your PC (See the illustration on page 2-1.)

(1) Make sure that your PC is turned off.

(2) Make sure that the power cord of the facsimile machine is unplugged from a wall socket or other power source.

(3) Connect the interface cable to the parallel interface port on the back of the facsimile machine and secure it with the lock wires.

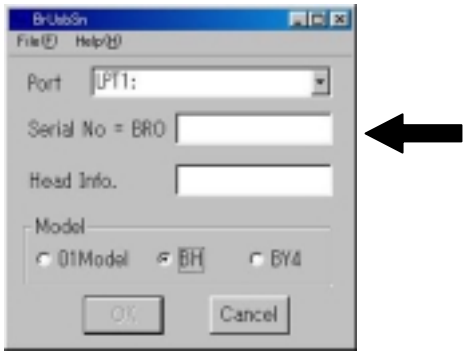
(4) Connect the other end of the interface cable to the printer port of your PC and secure it with the two screws.

(5) While holding down the **Menu** key, plug the machine's power cord into a wall socket or other power source.

(6) Turn on your PC.

Running the setup utility

(1) On your PC, run the ID/head property setup utility (BRUSBSN.EXE). The following window will appear.



(2) On the **Model** menu, click **BH**.

In **Port**, make sure that the LPT1 is selected.

In the **Serial No = BRO** box, type the 9-digit serial number (e.g., G01012345) printed on the nameplate labeled to the back of the facsimile machine as an ID code. Then press the **Enter** key.

The setup utility will transmit the ID code data from your PC to the facsimile machine and then it will terminate.

The facsimile machine will automatically return to the standby mode.

(3) To check whether the entered character string (ID code) is correct, make the machine enter the maintenance mode (refer to CHAPTER 5, Section 5.1) and then press the **1** key twice (Subsection 5.3.6).

The facsimile machine will print out a Configuration List. At the right top of the list, "SER.#: BROXXXXXXXXX" is printed.

(4) Check that the character string entered in step (2) is printed in "XXXXXXXXX."

If it is OK, press the **9** key twice to exit from the maintenance mode.

If something other than that is printed in XXXXXXXXX, check the connection between the PC and facsimile machine and go back to step (1).

2.3 UPDATING HEAD PROPERTY INFO STORED IN THE FACSIMILE MACHINE

To keep the print quality, the controller optimizes the head drive strength, ink jet-out timing, and other drive conditions according to the electromechanical properties unique to individual print heads and ambient temperature. The head property information is stored in the EEPROM of the main PCB.

If you replace the print head unit and/or main PCB of the machine, then you need to update head property information according to the procedure given here.

TIP: The updating procedure given here uses a PC. For the updating procedure in the maintenance mode without using a PC, refer to CHAPTER 5, Subsection 5.3.14.

Connecting the facsimile machine to your PC (See the illustration on page 2-1.)

(1) Make sure that your PC is turned off.

(2) Make sure that the power cord of the facsimile machine is unplugged from a wall socket or other power source.

(3) Connect the interface cable to the parallel interface port on the back of the facsimile machine and secure it with the lock wires.

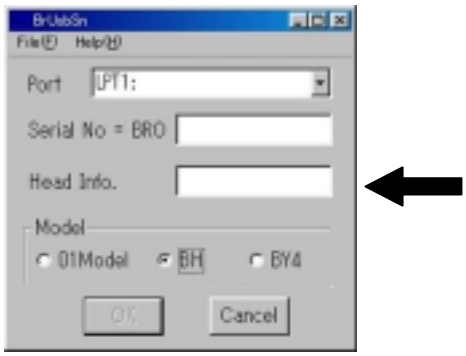
(4) Connect the other end of the interface cable to the printer port of your PC and secure it with two screws.

(5) While holding down the **Menu** key, plug the machine's power cord into a wall socket or other power source.

(6) Turn on your PC.

Running the setup utility

(1) On your PC, run the ID/head property setup utility (BRUSBSN.EXE). The following window will appear.



(2) On the **Model** menu, click **BH**.

In **Port**, make sure that the LPT1 is selected.

In the **Head Info.** box, type upper 12 digits (e.g., 66667F657031) out of the 13-digit property code (enclosed with asterisks, e.g., *66667F657031H*) which is printed on the bar code label attached to the print head unit. Then press the **Enter** key.

The setup utility will transmit the entered data from your PC to the facsimile machine and then it will terminate.

The facsimile machine will automatically return to the standby mode.

(3) To check whether the entered head property is correct, make the machine enter the maintenance mode (refer to CHAPTER 5, Section 5.1) and then press the **7** key twice.

The facsimile machine will print out the Equipment's Log. On the line about 1/3 of full length of the log sheet below from the top, the 12-digit code will be printed.

(4) Check that the character string entered in step (2) is printed in "XXXXXXXXXXXX."

If it is OK, press the **9** key twice to exit from the maintenance mode.

If something other than that is printed in XXXXXXXXXXXX, check the connection between the PC and facsimile machine and go back to step (1).

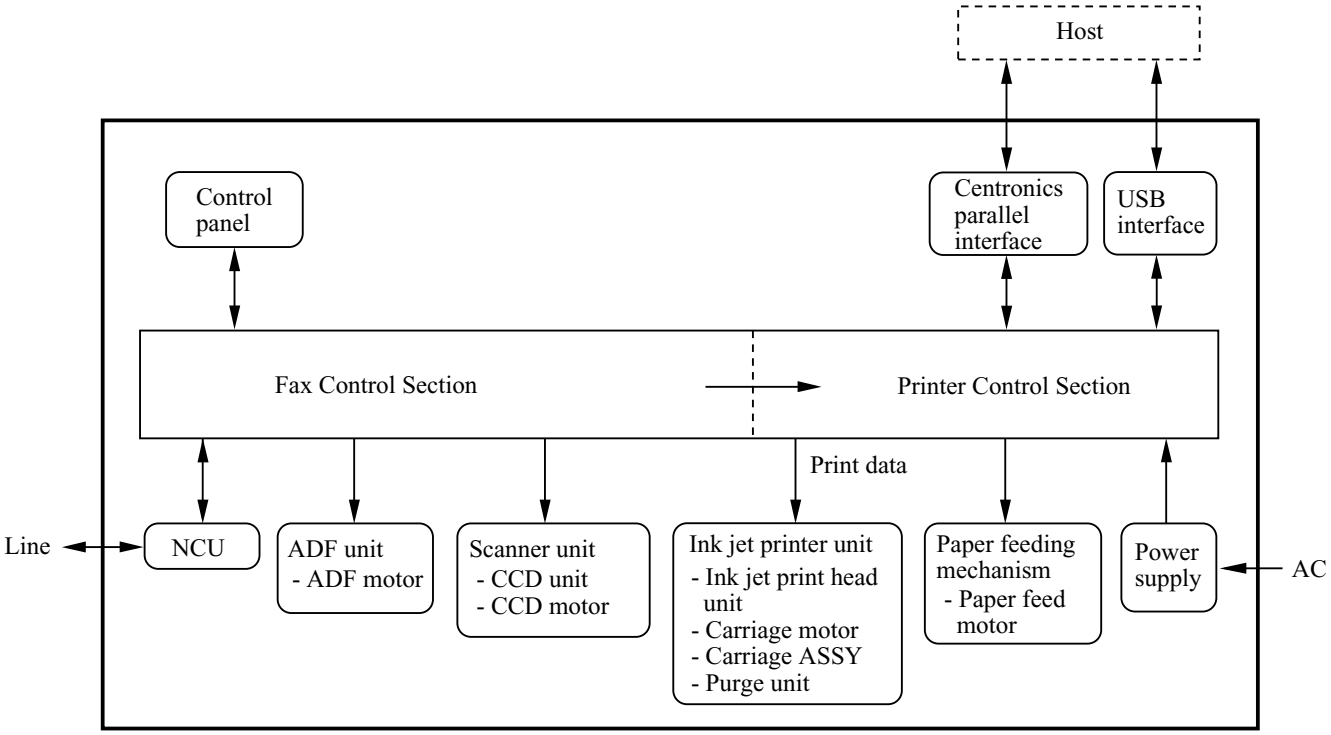
CHAPTER 3

THEORY OF OPERATION

CHAPTER 3 THEORY OF OPERATION

CONTENTS

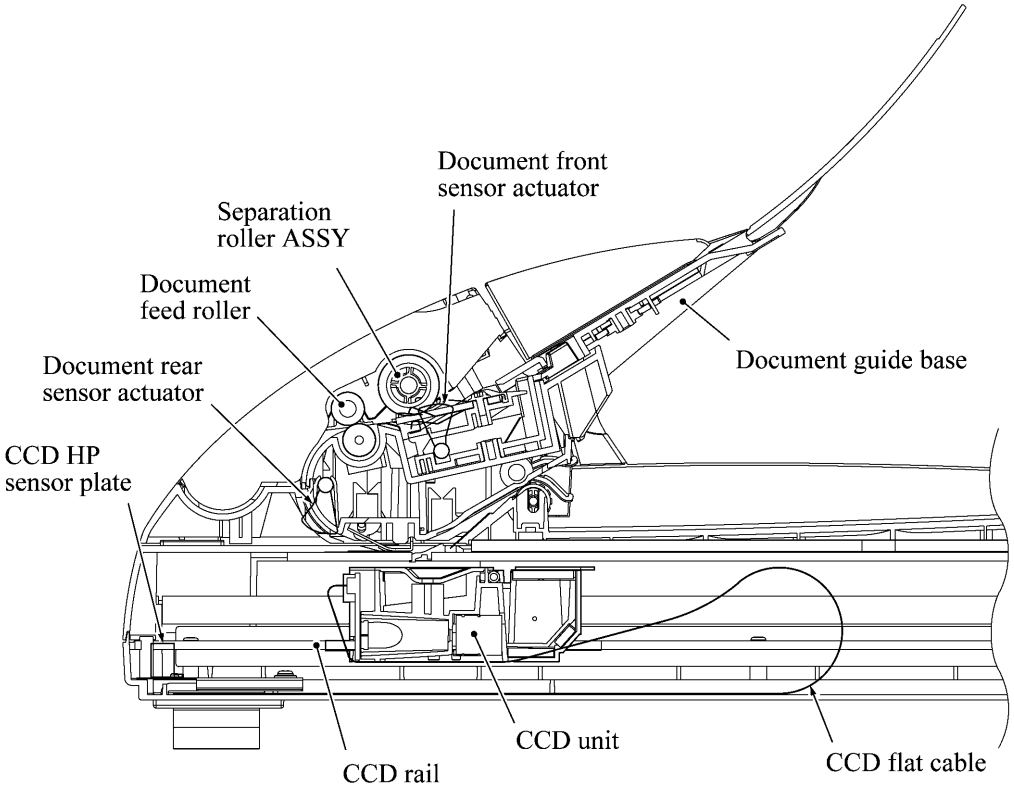
3.1 OVERVIEW


Host
Control panel
Centronics parallel interface
USB interface
Fax Control Section
Printer Control Section
Print data
Line
NCU
ADF unit
- ADF motor
Scanner unit
- CCD unit
- CCD motor
Ink jet printer unit
- Ink jet print head unit
- Carriage motor
- Carriage ASSY
- Purge unit
Paper feeding mechanism
- Paper feed motor
Power supply
AC

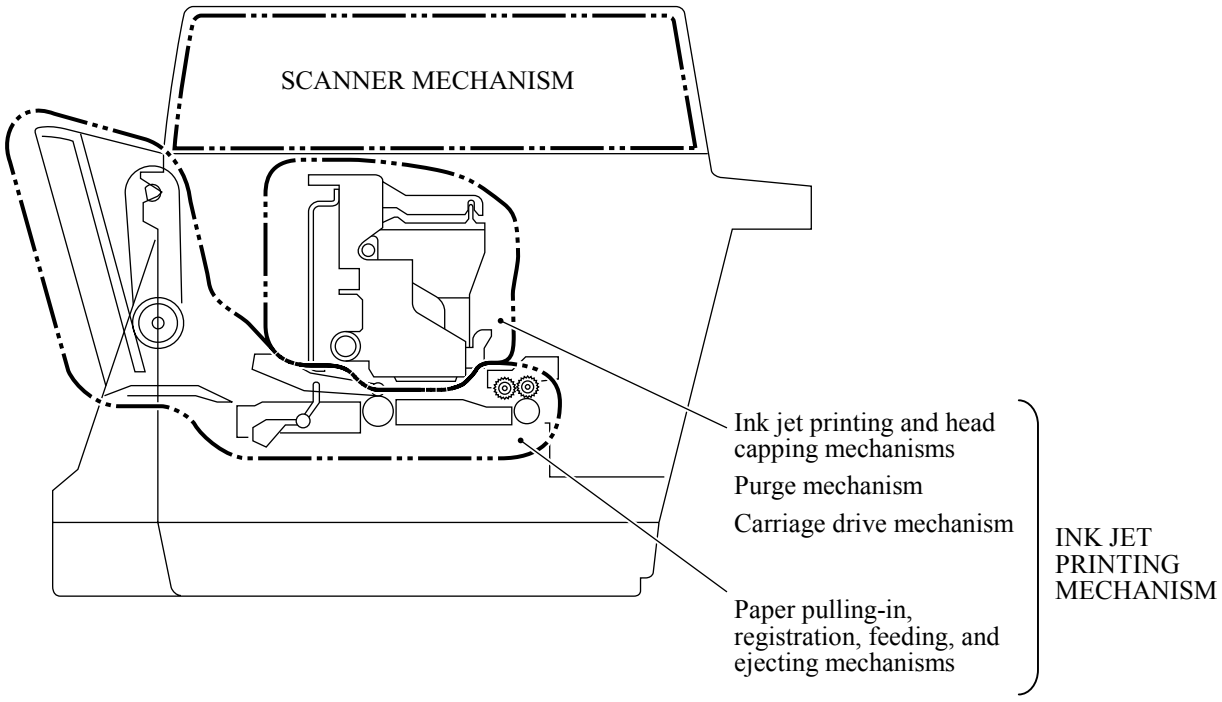
3.2 MECHANISMS

The facsimile machine is classified into the following mechanisms:

- SCANNER MECHANISM
  - ADF mechanism
  - Document scanning mechanism
- INK JET PRINTING MECHANISM
  - Paper pulling-in, registration, feeding, and ejecting mechanisms
  - Ink jet printing and head capping mechanisms
  - Purging mechanism
  - Carriage drive mechanism
- SENSORS AND ACTUATORS



SCANNER MECHANISM (Viewed from the front)



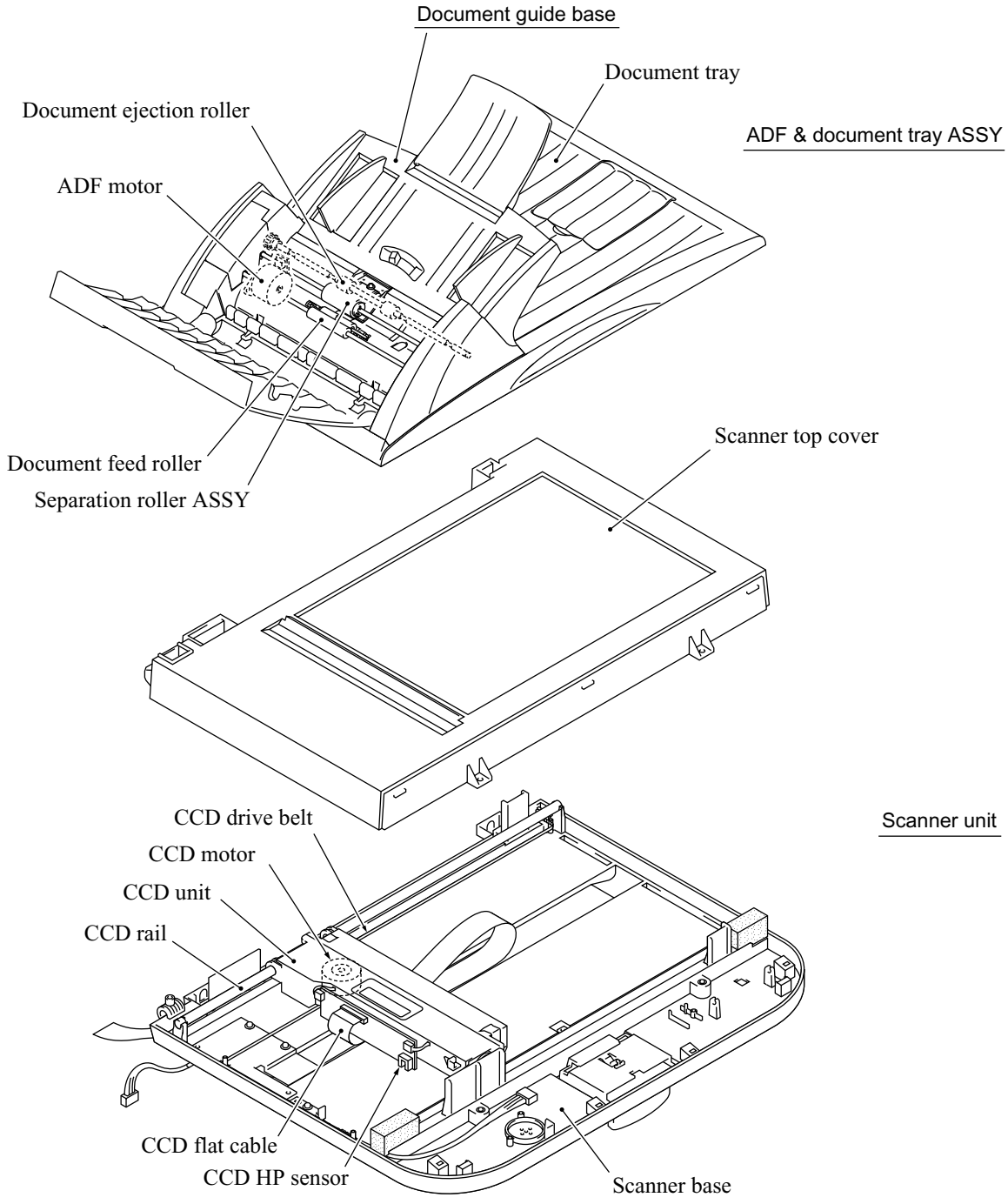
3.2.1 Scanner Mechanism

This mechanism consists of the document guide base, ADF & document tray ASSY and scanner unit.

The ADF (automatic document feeder) unit contains a separation roller ASSY, document feed roller ASSY, document ejection roller, ADF motor, and document front and rear sensors.

The scanner unit consists of a scanner top cover, CCD unit, CCD drive mechanism, CCD HP sensor, and scanner base.

For details about the sensors, refer to Subsection 3.2.3.



This scanner mechanism supports a dual scanning system.

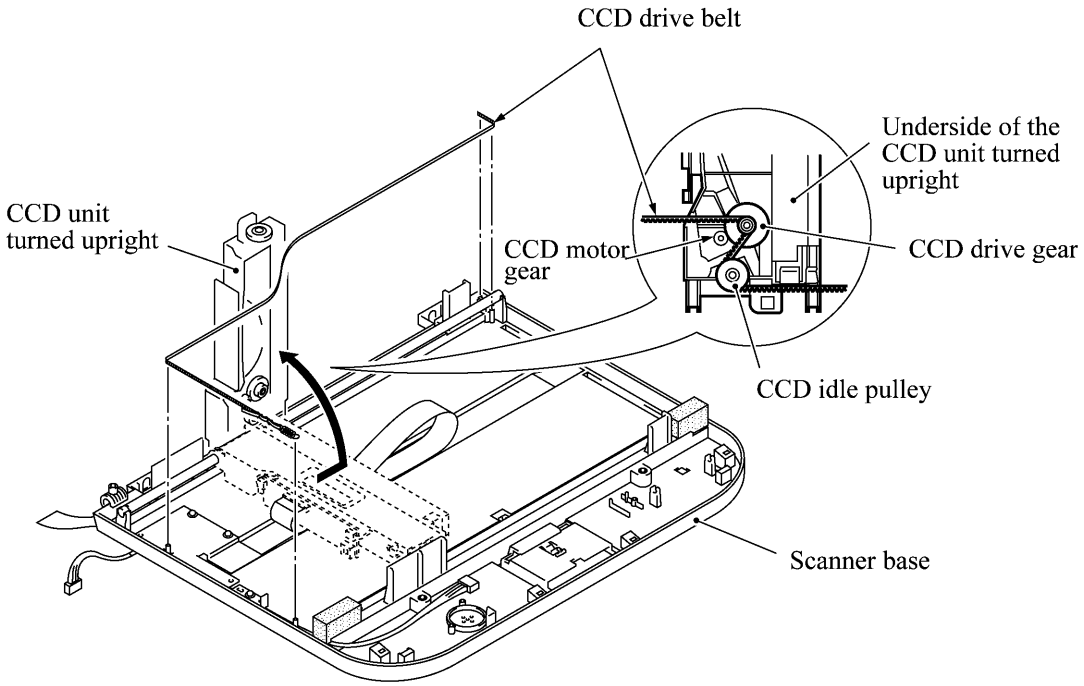
(1) If you set documents on the document guide base with their faces up and start the scanning operation, then the ADF motor rotates to pull in those documents into the ADF unit, starting from the top sheet to the bottom, page by page. Each document curves downwards and turns to the right with the document feed roller so as to advance above the CCD unit, and then it is fed out to the document tray with the document ejection roller ASSY.

    This way, documents move above the CCD unit being kept in a stationary position.

(2) If you open the ADF & document tray ASSY, put a sheet of document (or put a bound book opened) on the glass of the scanner top cover, close the ADF & document tray ASSY, and start the scanning operation, then the CCD drive mechanism will be driven.

    The CCD motor built in the CCD unit rotates. As illustrated below, the CCD drive gear and idle pulley carry the CCD drive belt on the underside of the CCD unit, so clockwise and counterclockwise rotations of the CCD motor move the CCD unit to the right and left, respectively.

    In this scanning system, the CCD unit moves horizontally beneath a document being kept in stationary position.



The CCD unit contains a charge coupled device (CCD) image sensor. The cold-cathode fluorescent lamp illuminates a document and the reflected light of the scanned image data is transmitted via the mirrors into the lens which reduces the scanned data so as to form the image on the CCD.

3.2.2 Ink Jet Printing Mechanism

3.2.2.1 Paper pulling-in, registration, feeding, and ejecting mechanisms

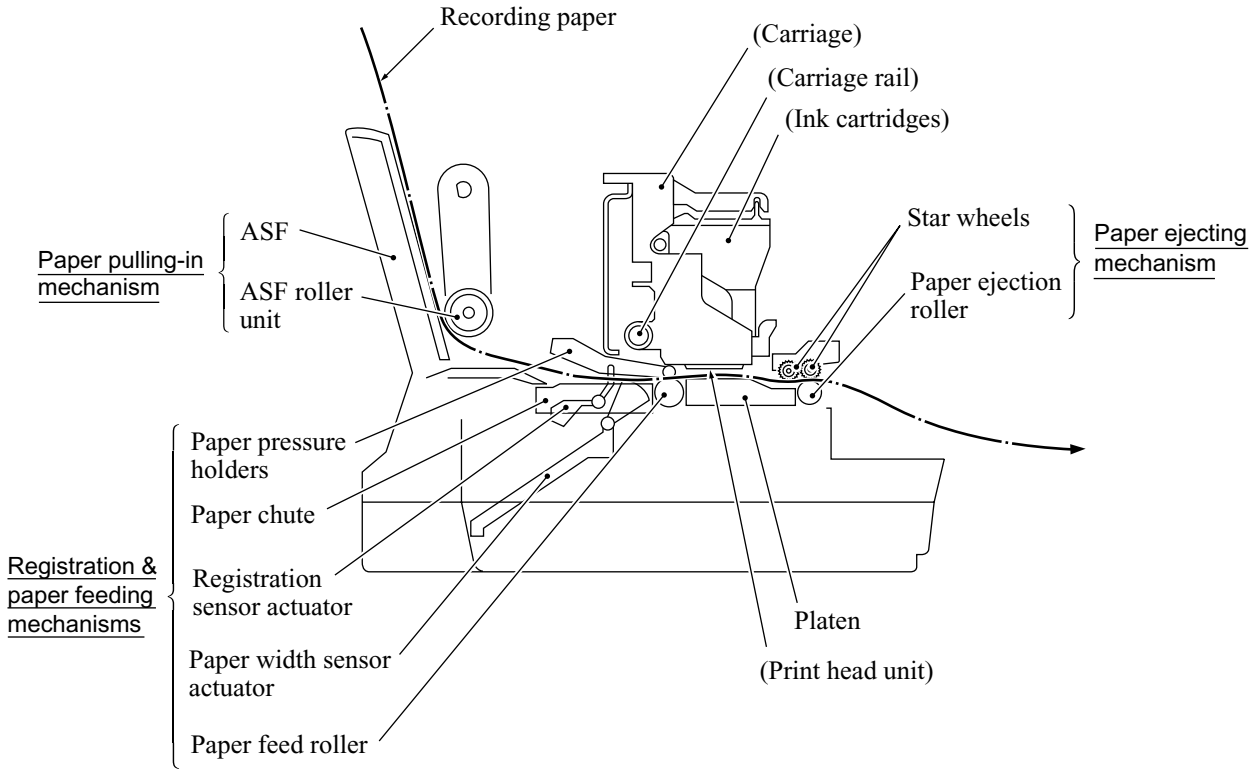
The paper pulling-in, registration, feeding, and ejecting mechanisms are driven by a single paper feed motor located at the left side of the main chassis via the gear train. (See the illustration given on the next page.)

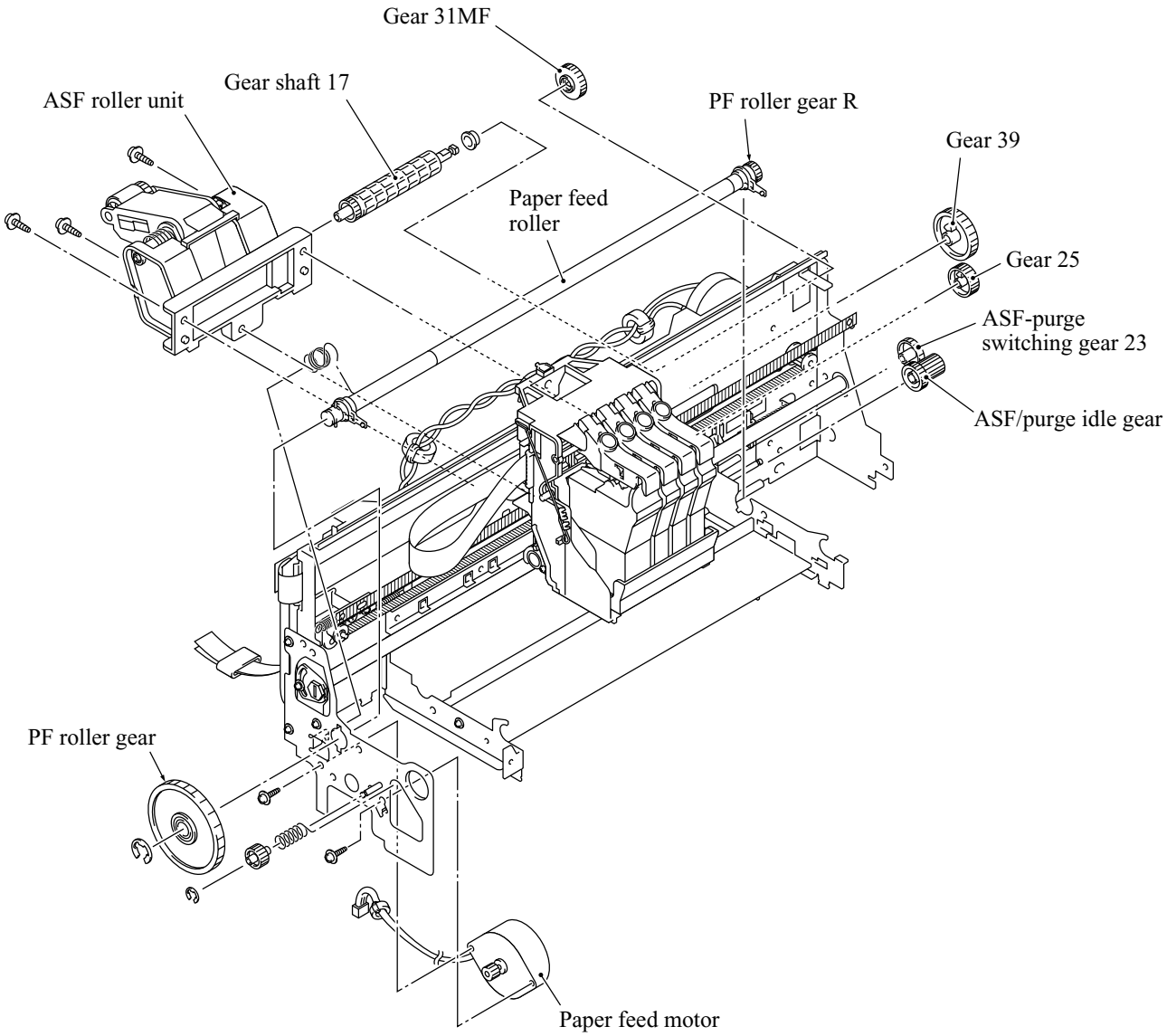
First, the paper feed motor rotates clockwise (when viewed from the output gear). The rotation is transmitted to the PF roller gear that rotates paper feed roller. At the right end of the paper feed roller is the PF roller gear R which is always engaged with the ASF/purge idle gear. Engaged with the ASF/purge idle gear, the ASF-purge switching gear 23 transmits the rotation via gear 25 and the ASF gear train to the ASF roller unit. This way, the ASF roller will pull in paper.

When the ASF roller is pulling in paper, the paper feed roller rotates in the backward direction to register the leading edge of the pulled-in paper.

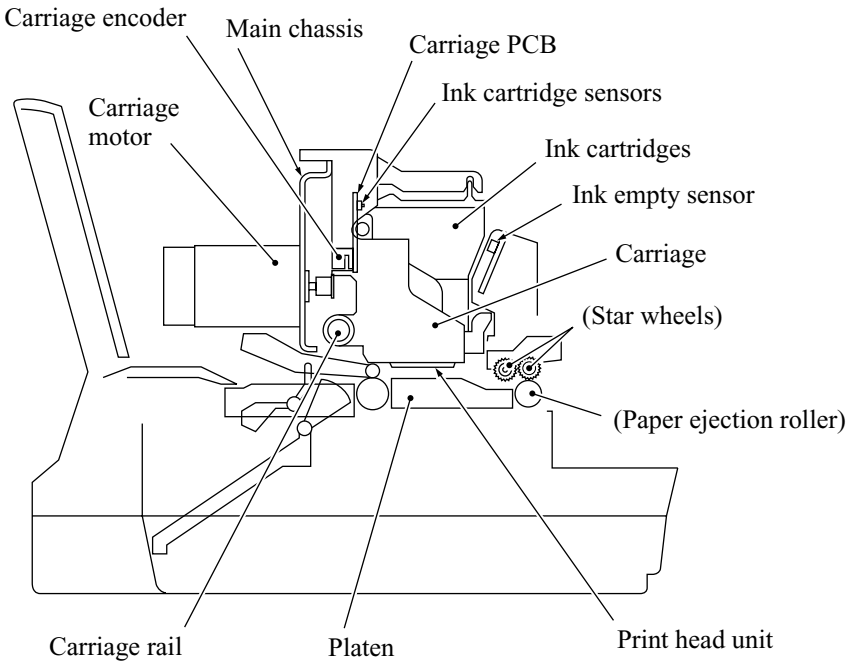
Next, the paper feed motor rotates counterclockwise to rotate the paper feed roller in the forward direction. The paper will advance through the paper path. During the paper feeding operation, no rotation is transmitted to the ASF roller because of the planetary gear system built in the ASF roller unit.

The above paper pulling-in and feeding operations take place when the carriage is in printing operation. If the carriage reaches the purge position, the ASF-purge switching gear 23 will be disengaged from the gear 25 and engaged with purge bevel gear A. For the purging mechanism, refer to Subsection 3.2.2.3.



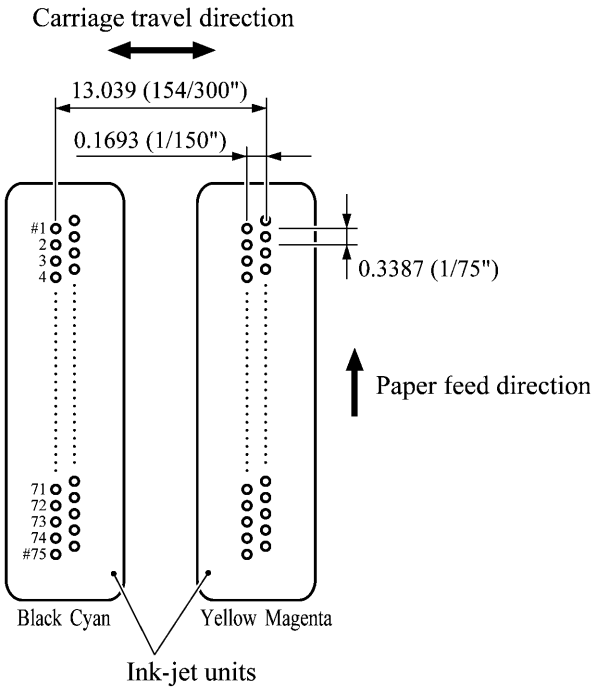

Gear 31MF
Gear shaft 17
ASF roller unit
PF roller gear R
Gear 39
Paper feed
roller
Gear 25
ASF-purge
switching gear 23
ASF/purge idle gear
PF roller gear
Paper feed motor

3.2.2.2 Ink jet printing and capping mechanisms



(1) Print head unit

This machine uses drop-on-demand ink jet printing. Each of the right and left print heads has an ink-jet unit that has a pair of nozzle columns for two color inks. A nozzle column consists of 75 nozzles, 75 channels covered with piezoelectric ceramic (PZT), a manifold, and filter. As illustrated below, the pair of nozzle columns is staggered.

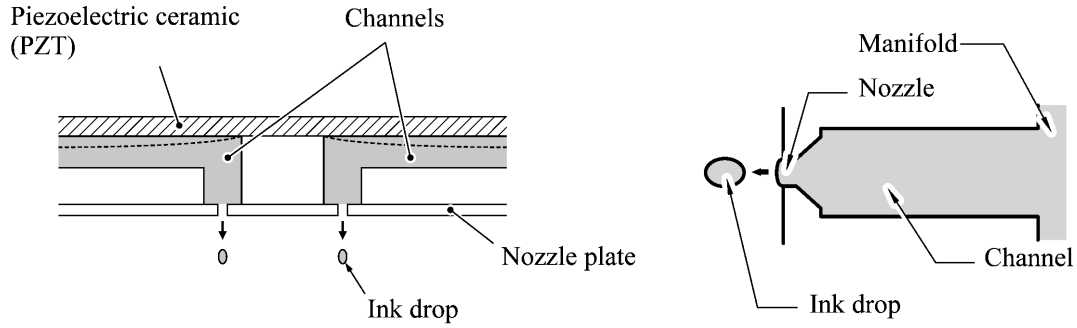


Nozzle Layout (viewed from the bottom)

If the controller issues a print command, a biased voltage will be applied to all electrodes formed on the surface of the piezoelectric ceramic so that each actuator will be distorted as shown with broken lines.

If the electrodes on a target channel are deenergized according to drive signals, then the associated piezoelectric ceramic actuator returns to the previous form so that the ink in the manifold will be vacuumed out to the channel.

If the voltage is applied again, the piezoelectric ceramic actuator will be distorted again to apply pressure to the ink in the channel, causing the ink to jet out through the nozzle. The jetted-out ink drop will be splashed and produce a dot on paper held by the platen.

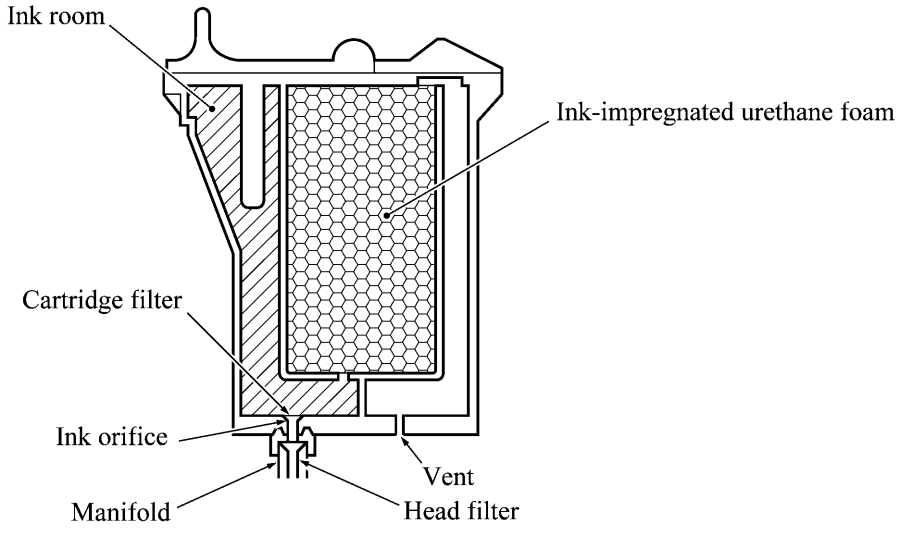


As the carriage holding the print head unit travels at the printing speed, the controller sends print command pulses to the piezoelectric actuator driver circuit embedded in the print head unit.

(2) Ink cartridges

The machine uses four ink cartridges (black, cyan, yellow, and magenta) of disposable type to supply ink to the print head unit. As shown below, an ink cartridge contains an ink-impregnated urethane foam. If ink-jet print operation or purging operation takes place, ink comes out of the urethane foam and is supplied to the print head unit through the ink room, filters, and manifold.

For the ink cartridge sensors on the carriage PCB, refer to Subsection 3.2.3.



(3) Head caps

Shown below is a head cap mechanism that prevents the nozzles of the print heads from drying up when they are not in use.

Upon completion of printing, the carriage travels to the right and moves the head cap holder provided on the purge unit to the right together. In the head cap holder is a head cap unit which is supported with a lift lever. The rightward movement of the head cap holder turns the lift lever and pushes up the head cap unit to the position where the head caps come into tight contact with the print heads. This way, the nozzles will be capped.