EPSON

EPSON TERMINAL PRINTER

FX-870/1170
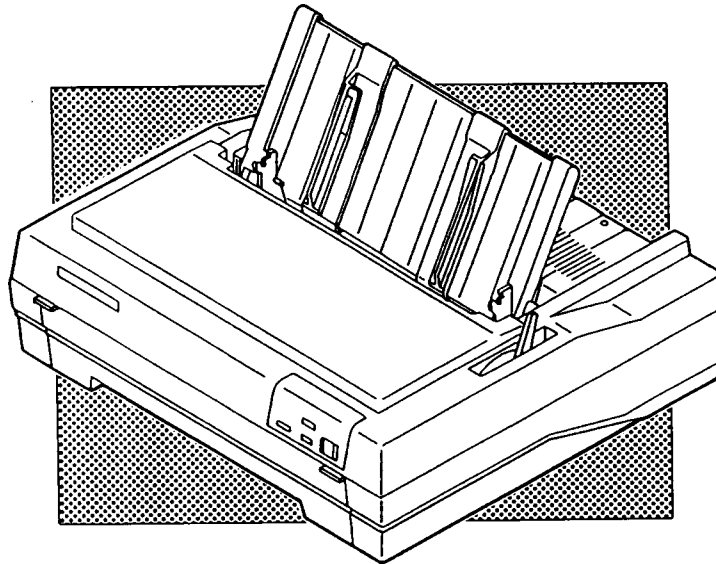
SERVICE MANUAL

NOTICE

PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

DANGER   Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by a DANGER headings.

WARNING   Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/maintenance procedures.

DANGER

1. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.

2. NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.

3. WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.

WARNING

1. REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY AN EPSON CERTIFIED REPAIR TECHNICIAN.

2. MAKE CERTAIN THAT THE SOURCE VOLTAGE IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF THE EPSON PRODUCT HAS A PRIMARY-AC RATING DIFFERENT FROM THE AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.

3. ALWAYS VERIFY THAT THE EPSON PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.

4. IN ORDER TO PROTECT SENSITIVE μP CHIPS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.

5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS RECOMMENDED BY THE MANUFACTURER; INTRODUCTION OF SECOND-SOURCE ICS OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE EPSON WARRANTY.

PREFACE

This manual describes functions, theory of electrical and mechanical operations, maintenance, and repair of the FX-870/1170.
The instructions and procedures included herein are intended for the experienced repair technician, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

Chapter 1 -   Provides a general product overview, lists specifications, and illustrates the main components of the printer.

Chapter 2 -   Describes the theory of printer operation.

Chapter 3 -   Includes a step-by-step guide for product disassembly and assembly.

Chapter 4 -   Includes a step-by-step guide for adjustment.

Chapter 5 -   Provides Epson-approved techniques for troubleshooting.

Chapter 6 -   Describes preventive maintenance techniques.

.The contents of this manual are subject to change without notice.

REVISION SHEET

REVISON	DATE ISSUED	CHANGE DOCUMENT
A	June 15, 1992	1st issue

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CHAPTER 1

GENERAL DESCRIPTION

LIST OF FIGURES

LIST OF TABLES

1.1 Scope

These specifications apply to the **EPSON** FX-870/1170 dot matrix printer.

1.1.1 Features

•**Upward compatibility with the FX-850(+)/1050(+), FX-800/1000, FX-86e/286e**
•**380 cps (high-speed draft for both 80 and 136-column models)**
•**285 cps (draft pica), 342 cps (draft elite)**
•**Advanced paper handling**
    Continuous paper
   -3 paths for insertion (front/bottom/rear)
   - Dual paper park and auto load (front/rear)
   - The standard tractor unit can be set to 3 positions (2 push and 1 pull)
   - Continuous paper can be used without removing the cut-sheet feeder (CSF)
    Cut sheets
   -2 paths for insertion (top/optional front)
   - Auto loading
•**24K byte input buffer**
•**16 character tables are supported for European model.**
  (Italic, PC437, 850,860,863,865, 437 Greek, 851,869,852,853,857, 855,866, GOST, 861)
•**6 character tables are supported for Non-European model.**
  (Italic, PC437, 850,860,863, 865)
•**Default setting mode replaces DIP switches.**
•**Type B optional I/F boards can be installed.**

Figure 1-1 shows an exterior view of the FX-870/1170.
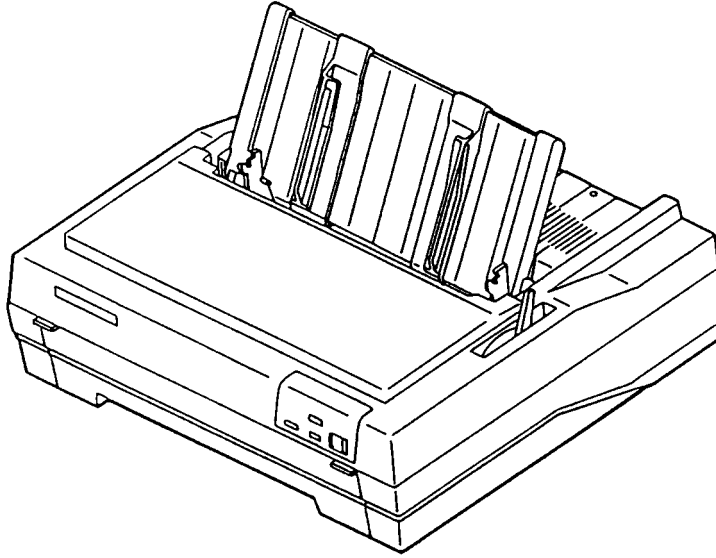
80-column model
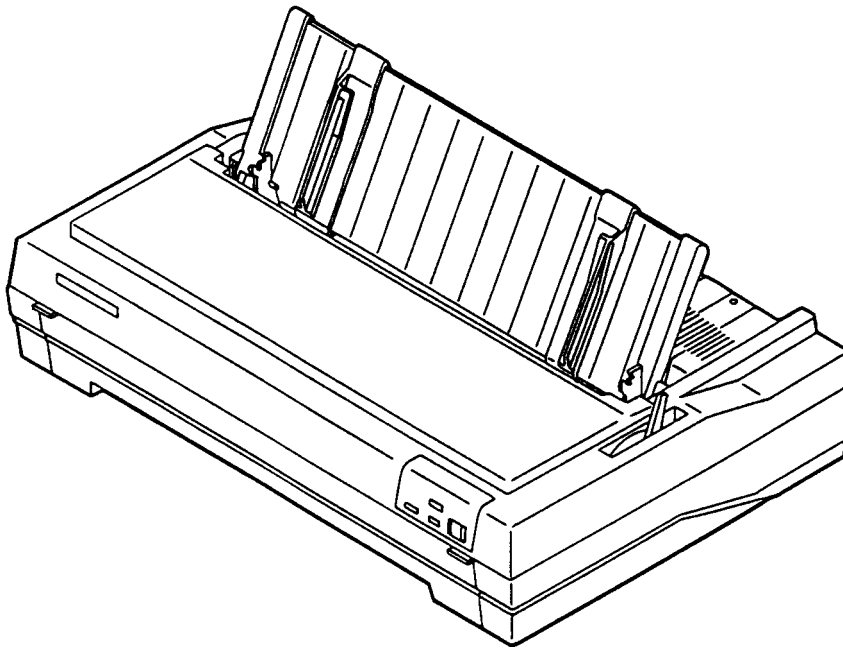
136-column model

Figure 1-1. External View of the FX-870/1170

1.1.2 Options

C806371 (U.S. version)	**Plain cut sheet feeder (80-column)**
C806372 (other)	**Plain cut sheet feeder (80-column)**
C806391 (U.S. version)	**Plain cut sheet feeder (136-column)**
C806392 (other)	**Plain cut sheet feeder (136-column)**
C806381 (U.S. version)	**Cut sheet feeder (80-column)**
C806382 (other)	**Cut sheet feeder (80-column)**
C806401 (U.S. version)	**Cut sheet feeder (136-column)**
C806402 (other)	**Cut sheet feeder (136-column)**
C800201 (U.S. version)	**Tractor unit (80-column)**
C800202 (other)	**Tractor unit (80-column)**
C800211 (U.S. version)	**Tractor unit (136-column)**
C800212 (other)	**Tractor unit (136-column)**
C814001	**Front sheet guide (80-column)**
C814011	**Front sheet guide (136-column)**
C82305 (inch screw)	**Serial I/F card**
C82306 (mm screw)	**Serial I/F card**
C82307 (inch screw)	**32KB intelligent serial I/F card**
C82308 (mm screw)	**32KB intelligent serial I/F card**
C82310 (inch screw)	**32KB intelligent parallel I/F card**
C82311 (mm screw)	**32KB intelligent parallel I/F card**
C82313	**32KB IEEE-488 I/F card**
#8750	**Fabric ribbon cartridge (80-column)**
#8755(M)	**Fabric ribbon cartridge (136-column)**
#8758	**Fabric ribbon sub cartridge**
#8310	**Roll paper holder (only for 80-column model)**

1.2 Specifications

1.2.1 Hardware Specifications

1.2.1.1 Printing Method

Printing method: **Impact dot matrix**

Pin configuration: 9 wires
                      (diameter 0.29 mm)

wire

#1 ●

2 ● - - - ⊼ - -
            ⇕ **0.35mm (1/72")**
3 ● - - - ⊻ - - -

4 ●

5 ●

6 ●

7 ● - - - - ⊽ - - - **0.29mm**
            ⊼

8 ●

9&
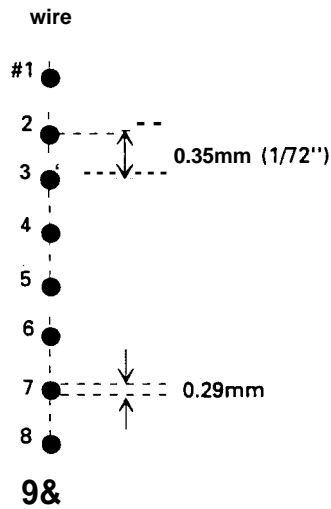
Figure 1-2. Pin Configuration

Dot matrix: **9 x 7 matrix (high-speed draft)**
                       9 x 9 matrix (draft)
                       18x 23 matrix (NLQ)

1.2.1.2 Paper Handling

Feeding method: **Friction feed (front/top)**
                           Push tractor feed (front/rear)
                           Pull tractor feed (front./rear/bottom)
                           Push-pull tractor feed (front/rear)

      Fanfold: **Tractor feed**
      Cut sheet: **Friction feed**
      Envelope: **Friction feed**
      Label: **Tractor feed**
      Roll: **Friction feed**

Line spacing: **1/6", 1/8", or programmable (min.1/216")**

Table 1-1. Line Feed Speed (1 line = 1/6")

Type of paper	Intermittent feed		Continuous feed	
	Thin ms	Thick ms	Thin ms (ips)	Thick ms (ips)
Fanfold paper	77	85	55 (3.0)	66 (2.5)
Cut sheet (manual)	69	77	45 (3.7)	55 (3.0)
Cut sheet (CSF)	71	77	48 (3.5)	55 (3.0)

* Thin: Thickness is less than or equal to 0.18 mm.
  Thick: Thickness is more than 0.18 mm.

***** precautions for Handling Paper *****

1) Friction feed
•Set the release lever to the FRICTION position.
•Load the paper from the front or top entrance.
•Do not use continuous paper.
•Do not perform any reverse paper feeds within the top 8.5 m m area and bottom 22 mm area.
•Do not perform reverse feeds greater than 1/6" after the paper end has been detected.
•Use the paper-tension unit.
•Insert the multi-part cut sheet forms only from the front.

2) Push tractor feed
•Set the release lever to the REAR PUSH/FRONT PUSH position.
•Load the paper from the rear or front entrance.
•Release the friction feed mechanism.
•M u lti-part paper must be carbonless.
•Use the paper-tension unit.
•Do not perform reverse feeds greater than 1/6".
•Do not perform reverse feeding after the paper end has been detected, because accuracy of paper feed cannot be assured.

3) Pull tractor feed

●Set the release lever to the PULL position.

●Load the paper from the front, rear, or bottom entrance.
   (The front or bottom entrance is recommended for thick paper or labels.)

●Release the friction feed mechanism.

●Remove the paper-tension unit and attach the pull tractor unit.

●Insert the paper from either front or bottom.

●Multi-part paper must be carbonless.

●Do not perform reverse feeds.

4) Push-pull tractor feed

●Set the release lever to the REAR PUSH/FRONT PUSH position.

●Load the paper from the front or rear entrance.

●Release the friction feed mechanism.

●Remove the paper-tension unit and attach the pull tractor unit.

• Remove any slack in the paper between the platen and the pull tractor.

• Precisely adjust the horizontal position of the pull tractor and push tractor.

●Multi-part paper must be carbonless.

●Do not perform reverse feeds greater than 1/6".

●Do not perform reverse feeds after the paper end has been detected.

1.2.1.3 Paper Specifications

See Tables 1-2, 1-3, 1-4, 1-5, 1-6, and 1-7.
Recycled paper, envelopes, and labels require the following environmental conditions.

Normal environment
Temperature: 15-25 deg. C (59-68 deg. F)
Humidity: 30-60 % RH

Table 1-2. Specifications for Cut Sheets (Plain Paper)

Width		
top insertion	148-257 mm (5.8-10.1")	80-column
	148-420 mm (5.8-16.5")	136-column
front insertion	182-257 mm (7.2-10.1")	80-column
	182-364 mm (7.2-14.3")	136-column
Length	Up to 364 mm (14.3")	
Thickness	0.065-0.14 mm (0.0025-0.0055")	
Weight	14-24 lb (45-78 Kg) (52.3-90 g/m^2)	
Quality	Plain paper	
	Recycled paper (in normal environment)	

Table 1-3. Specifications for Cut Sheets (Carbonless Duplicating Paper)

Width		
front insertion	182-257 mm (7.2-10.1")	80-column
	182-364 mm (7.2-14.3″)	136-column
Length	Up to 297 mm (1 1.7")	80-column
	Up to 364 mm (14.3")	136-column
Quality	Carbonless duplicating paper	
Thickness	0.12-0.22 mm (0.0047-0.0086")	
Weight	12-15 lb (34-50 kg) (40-58 g/m^2) - each	
Copies	4 sheets (1 original + 3 copies) maximum	

Table 1-4. Specifications for Continuous Paper

Width	101-254 mm (4-10")	80-column
	101-406 mm (4-16")	136-column
Thickness	0.065-0.32 mm (0.0025-0.012")	
Weight	14-22 lb (45-70 kg) (52.3-82 g/m^2) - single sheet	
	12-15 lb (34-50 kg) (40-58.2 g/m^2) - each	
Quality	Plain or carbonless duplicating paper	
	Recycled paper (in normal environment)	
	(with push tractor and optional pull tractor)	
Copies	4 sheets (1 original + 3 copies) maximum	

Table 1-5. Specifications for Envelopes

Size	No. 6	166 mm x 92 mm
	No. 10	240 mm x 104 mm
Thickness	0.16-0.52 mm (0.0063-0.0197")	
	* Differences in thickness within the printing area must be less than 0.25 mm (0.0098").	
Weight	12-24 lb (39-78 kg) (45-91 g/m^2)	
Quality	Bond paper, plain paper, airmail	

Notes: 1) Envelopes must be inserted from the top.

2) Keep the longer side of the envelope horizontal during insertion.

3) Set the left edge of a No. 6 envelope at the sheet guide setting mark.

4) Do not feed envelopes with the cut sheet feeder.

Table 1-6. Specifications for Labels

Size	2 1/2″ x 15/16" 4" x 15/16" 4" x 17/16"
Thickness	0.07-0.09 mm (0.0028-0.0031") - base paper 0.16-0.19 mm (0.0063-0.0075″) - total
Quality	Plain paper

Notes: 1) Labels must be fanfold.

      2) Example of labels   AVERY CONTINUOUS FORM LABELS

                                   AVERY MINI-LINE LABELS

      3) Labels should be used with the pull tractor (front, bottom), or with the front push tractor.

      4) Do not perform reverse feed at any time. (including by hand).

      5) Remove labels from the paper path when not in use.

Table 1-7. Specifications for Roll Paper

Size	216 +/- 3 mm (8.5 +/- 0.12")
Thickness	0.07-0.09 mm (0.0028-0.0035″)
Weight	14-22 lb (45-70 Kg) (52.3-82 g/m^2)
Quality	Plain paper

Note: Roll paper isavailable only forthe 80-column model optionally, and itsdiameter must notexceed 127 mm (5").

1.2.1.4 Printable Area

1) Cut sheets

top insertion	**148-257 mm (5.8-10.1")**:	80 columns
	148-420 mm (5.8-16.5") :	136 columns
front insertion	**182-257 mm (7.2-10.1")**:	80 columns
	182-364 mm (7.2-14.3"):	136 columns
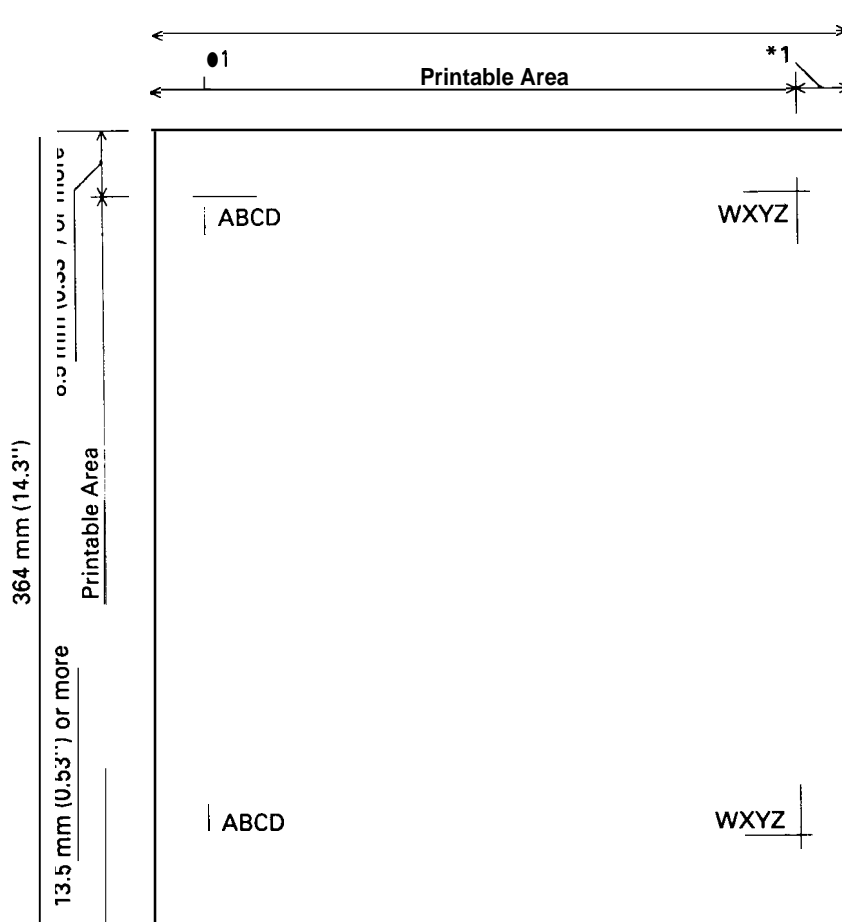
Figure 1-3. Printable Area for Cut Sheets

* 1 3.0 mm (0.1 2") or more when the paper width is less than 364 mm (14.3"). 25 mm (0.9") or more when the paper width is 420 mm (16.5"). **(136-column)**
3.0 mm (0.12") or more. **(80-column)**

Note: **Paper feed accuracy cannot be assured within 24 mm (0.94") from the bottom edge of the paper.**
(top insertion)

Paper feed accuracy cannot be assured within 48.5 mm (1.9") from the bottom edge of the paper. **(front insertion)**

2) Continuous paper
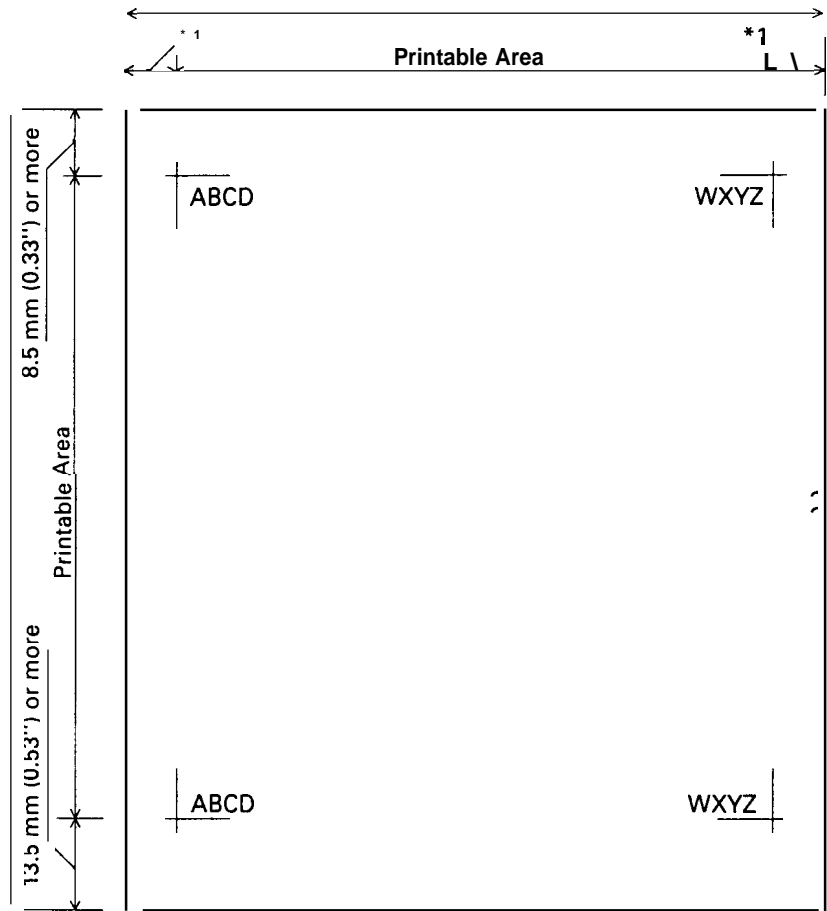
Figure 1-4. Printable Area for Continuous Paper

*1 13 mm (0.51") or more when the paper width is 101 mm to 241 mm (4" to 9.5"). 25 mm (1.0") or more when the paper width is 254 mm (10"). (80 columns)

13 mm (0.51") or more when the paper width is 101 mm to 377.8 mm (4" to 14.87"). 25 mm or more when the paper width is 381 mm to 406 mm (15" to 16"). (136 columns)

3) Roll paper (80-column model only)

top insertion   **216 +/- 3 mm (8.5 +/- 0.12")**
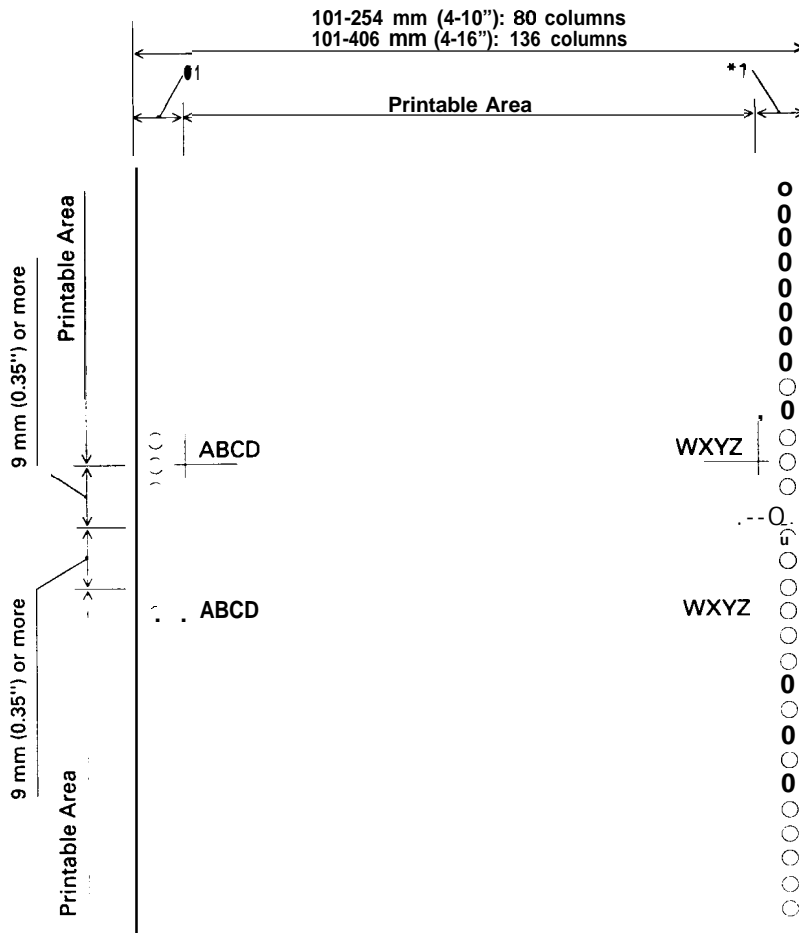
Figure 1-5. Printable Area for Roll Paper

*1   3.0 mm (0.1 2") or more

Note: Paper feed accuracy cannot be assured within 24 mm (0.94") from the bottom edge of the paper.
(top insertion only)

1.2.1.5   Ribbon Cartridge

Ribbon	**Cartridge type (same as FX series)**
	# 8750 - **80-column model**
	# 8755(M) **- 136-column model**
	# 8758- Subcartridge

Color   **Black**

Life of ribbon   **3 x 106 characters (at 14 dots/character)**

1.2.1.6 Electrical Specifications

See Table 1-8 and 1-9.

Table 1-8. Electrical Specifications for 120V Model

Rated voltage	120 VAC
Input voltage range	103.5-132 V AC
Rated frequency range	50-60 Hz
Input frequency range	49.5-60.5 Hz
Rated current	1.8 A
Power consumption	Approx. 45 W (80 columns)
	Approx. 45 W (136 columns)
	(Self test in draft mode, 10 cpi)
Dielectric strength	1.0 kVAC, 1 second
	(Between AC line and chassis)

Table 1-9. Electrical Specifications for 220/240V Model

Rated voltage	220-240 VAC
Input voltage range	198-264 VAC
Rated frequency range	50-60 Hz
Input frequency range	49.5-60.5 Hz
Rated current	0.9 A
Power consumption	Approx. 45 W (80 columns)
	Approx. 45 W (136 columns)
	(Self test in draft mode, 10 cpi)
Dielectric strength	1.5 kVAC, 1 second
	(Between AC line and chassis)

1.2.1.7 Environmental Conditions

Table 1-10. Environmental Conditions

Temperature	5 to 35 deg.C (41 to 95 deg. F) — operating
	-30 to 60 deg.C (-22 to 140 deg. F) — in shipment container
Humidity	10 to 80 ·Y. RH — operating
	5 to 85 % RH — non-operating
Resistance to shock	IG, within 1 ms — operating
	2G, within 1 ms — non-operating
Resistance to vibration	0.25G, 55 Hz max. — operating
	0.50G, 55 Hz max. — non-operating

1.2.1.8 Reliability

MCBF	5 million lines (excluding a printhead) (MCBF: Mean Cycles Between Failures)
MTBF (expected value)	4000 power on hours (duty cycle 25%) — 80-column model 6000 power on hours (duty cycle 25%) —136-column model (MTBF : Mean Time Between Failures)
Printhead Life	100 million characters (14 dots/character)

1.2.1.9 Safety Approvals

Safety standards	UL1950 with D3 CSA22.2#220	(U.S.A model)
	EN 60950 (TUV)	(EUR model)
R.F.I	FCC class B	(U.S.A model)
	VDE0871 (Self certification)	(EUR model)

1.2.2 Firmware Specifications

1.2.2.1 Print Control

Printing direction

Text mode	Bidirectional printing with logic seeking. (Unidirectional printing can be specified by software.)
Bit image mode	Unidirectional printing
Character sets	ASCII characters

— ESC/P mode —

International characters (13 countries) and their italics
PC 437,850,860,863,865, 437 Greek, 851,869,852,853,857, 855,866, GOST, 861 (European model)
PC 437,850,860,863,865 (Non-European model)

— IBM mode —

PC 473,865
(PC = Personal Computer character table)
Fonts: Draft, NLQ Roman, NLQ Saris serif

Table 1-11. Character Size and Pitch

Type of letters	Width [mm]	Height [mm]	Character pitch [mm]
Pica	2.1	3.1	2.54 (10 cpi)
Condensed	1.05	3.1	1.48 (17 cpi)
Elite	1.7	3.1	2.11 (12 cpi)
Condensed elite	0.85	3.1	1.27 (20 cpi)

Table 1-12. Printable Columns

Type of letters	Printable columns [cpl]	
	80-column model	136-column model
Pica	80	136
Condensed	137	233
Elite	96	163
Condensed elite	160	272

Table 1-13. Print Speed

Type of letters	Print speed [cps]	
High-speed draft	380	(320) [1421
Draft pica	285	[142]
Draft elite	342	[170]
Condensed draft pica	243	[122]
Emphasized draft pica	142	[711
NLQ normal pica	57	

Notes: 1) The printing speed for high speed draft is reduced to the value in "( )" with thick paper (over 0.18 mm).

2) The printing speed for high speed draft is reduced to the value of "draft pica" when any graphic character is in the line.

3) The printing speed for draft is reduced to the value in "[ ]" when any italic character is in the line.

4) The speed for high duty printing is reduced to approximately half of each speed, except for the printing speed in "[I".

1.2.2.2 Input Data Buffer

24K or OK bytes (selectable with power on default settings; see Section 1.5.2.)

, 1.3 Interface

This printer has a built-in, 8-bit centronics parallel interface.

1.3.1 Parallel Interface

Data transmission mode	8-bit parallel
Synchronization	Controlled by external STROBE pulse.
Handshaking	Controlled by ACKNLG and BUSY signals.
Logic level	TTL- compatible
Connector plug	57-30360 (Amphenol) or equivalent

It is recommended that the interface cable be as short as possible (10 feet maximum).

t_1: 0.5 us (min.)
t2: 7 us (approx.)
t3: 5 us (approx.)

Figure 1-6. Data Transmission Timing

Table 1-14. Connector Pin Assignments and Signal Functions

Signal Pin No.	Return Pin No.	Signal Name	Dir.	Description
1	19	STROBE	In	STROBE pulse to read data in. Pulse width must be more than 0.5 μs at receiving terminal.
2	20	DATA 1	In	These signals represent the 1st to 8th bits of parallel data, respectively. Each signal is HIGH when data is a logical 1 and LOW when a logical O.
3	21	DATA 2	In	
4	22	DATA 3	In	
5	23	DATA 4	In	
6	24	DATA 5	In	
7	25	DATA 6	In	
8	26	DATA 7	In	
9	27	DATA 8	In	

Signal Pin No.	Return Pin No.	Signal Name	Dir.	Description
10	28	$\overline{\text{ACKNLG}}$	out	Approx.12 μs pulse. LOW indicates that data has been received and that the printer is ready to accept more data.
11	29	BUSY	out	A HIGH signal indicates that the printer cannot receive more data. The signal becomes HIGH in the following cases: 1. During data entry 2. During input buffer full 3. During printer error status
12	30	PE	out	A HIGH signal indicates that the printer is out of paper.
13	—	—	—	Pulled up to +5V through a 3.3 K-ohm resistor.
14	—	AUTO FEED XT	In	When this signal is LOW, paper is automatically fed one line upon receipt of a CR code. (The signal level can be set LOW by default.)
15	—	NC	—	Not used.
16	—	Ov	—	Logic GND level.
17	—	CHASSIS GND	—	Printer chassis GND. In the printer, the chassis GND and the logic GND are short-circuited.
18	—	NC	—	Not used.
9 to 30	—	GND	—	TWISTED-PAIR RETURN signal GND level.
31	—	INIT	In	When the level of this signal becomes LOW, the printer controller is reset to its initial state and the print buffer is cleared. This signal is normally atthe HIGH level, and its pulse width must be more than 50 μs at the receiving terminal.
32	—	$\overline{\text{ERROR}}$	out	The level of this signal becomes LOW when the printer is in — 1. Paper-out status 2. Error status
33	—	GND	—	TWISTED-PAIR RETURN signal GND level.
34	—	NC	—	Not used.
35	—	—	—	Pulled up to +5V through a 3.3 K-ohm resistor.
36	—	$\overline{\text{SLCT IN}}$	In	The data between DC3 and DC1 is invalid when this signal is HIGH. (The level of this signal is factory set to LOW.)

Notes: 1) Direction of signal flow is as viewed from the printer.

2) Return means TWISTED PAIR RETURN and is to be connected at signal ground level.

3) Be sure to use a twisted-pair cable for each signal and always complete connection on the return side. To prevent noise effectively, these cables should be shielded and connected to the chassis of the host computer and the printer, respectively.

4) All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less than 0.2 μs.

5) Data transfer must not be carried out by ignoring the $\overline{\text{ACKNLG}}$ or BUSY signal.
(Data transfer to this printer can be carried out only after confirming the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is LOW.)

, **1.3.2 Optional Interface**

The following interface cards can be used for this printer.

Table 1-15. Optional Interface

Catalog #	Type
C82305* (inch screw)	Serial I/F card
C82306* (inch screw)	Serial I/F card
C82307* (inch screw)	32KB intelligent serial I/F card
C82308* (inch screw)	32KB intelligent serial I/F card
C82310* (inch screw)	32KB intelligent parallel I/F card
C82312* (inch screw)	32KB intelligent parallel I/F card
C82313* (inch screw)	Local Talk I/F card card
C82314* (inch screw)	Coax I/F card
C82315* (inch screw)	Twinax I/F card

Note: The last digit of catalog # "*" varies depending on the country.

1.4 Control Panel

1.4.1 Components

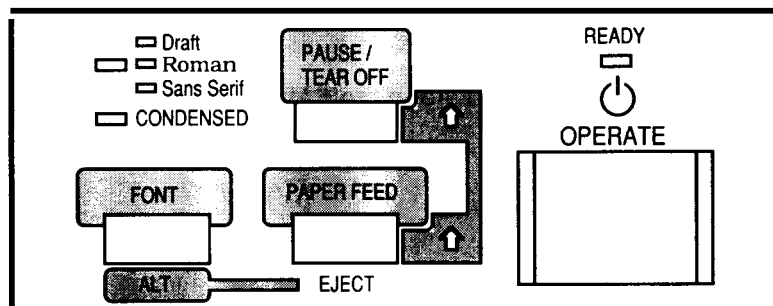Figure 1-7. Control Panel

Buttons

  OPERATE   1 lock type button

  PAUSE/TEAR OFF

  PAPER FEED   (non-lock Push type buttons)

  FONT

Indicators   3 LEDs

  READY — (green)

  FONT (Draft, Roman, Saris serif) — (green)

  CONDENSED — (green)

1.4.2 Buttons

[PAUSEI

Selects printing or pause alternately when there is some data to print in the input buffer.

Advances continuous paper to tear-off position when the printer has printed all received data and is ready to receive more print data.

[PAPER FEED]

Advances the paper line by line using the current line spacing setting while the printer is ready to print or paused by PAUSE button.
Holding down the button for about 1 second, it advances the paper to the next top-of-form (TOF) position.

Loads continuous paper inserted in the push tractor or cut sheets in the CSF when the printer has detected a paper out.

[FONT]

Selects NLQ Roman, NLQ Saris serif, Draft, and condensed of those 3 fonts in rotation:
(Draft──►Draft cond.──►Roman──►Roman cond.──►Sans.──►Saris. cond.──►Draft──►Draft cond. ....)
(The factory setting is the Draft, uncondensed font)
The selection is executed when the button is released.
The selection is stored in non-volatile memory.

Enables the micro feed function when pressed along the PAUSE or PAPER FEED button. The micro feed function is described below.

[FONT]+[PAUSE] or [FONT]+[PAPER FEED]

Activates the function. The PAUSE and PAPER FEED buttons micro-adjust the paper position up or down, as described below:

[FONT]+ [PAUSE]

Advances the paper forward by 1/108 inch per step.

[FONT]+[PAPER FEED]

Moves the paper backward by 1/108 inch per step.

Pressing FONT along with PAUSE or PAPER FEED lets you micro-adjust the following positions:
- the loading position, immediately after paper is loaded in the printer.
- the tear-off position, when paper has been advanced for tear off.
- the current print position.

The adjusted loading and tear-off positions will be stored in non-volatile memory (except for the loading position of cut sheets by manual insertion).

You can end micro feed (or micro adjust) mode by pressing the FONT button again. The printer exits this mode automatically in several seconds if no operation is performed.

Pressing FONT+ PAUSE or FONT+ PAPER FEED switches bins when a double-bin CSF is installed, there is no paper in the paper path, and friction feed is selected.

[FONT]+[PAPER FEED]
Ejects a cut sheet forward or feeds continuous paper backward to the paper park position.

1.4.3 Indicators

<READY>

Ready to print :	ON
Tear-off :	Blinking (75% duty)
Pause :	Blinking (50% duty)
Paper error :	Blinking (25% duty)
Head hot :	Blinking (25% duty)

<FONT>

Draft :	OFF
NLQ Roman :	ON
NLQ Saris serif:	Blinking

<CONDENSED>

Normal pitch :	OFF
Condensed pitch :	ON

When an error occurs, the READY, FONT, and CONDENSED LEDs will be used in combination to identify the error.

All indicators blink simultaneously: Fatal error
All indicators blink sequentially in the clockwise direction: Voltage error

1.5 Functions

1.5.1 Default Settings

Users can set certain default parameters, which will be used at printer initialization.

To change the parameters shown in Table 1-16, Group 1 Features, follow the steps below.

1. Turn on the printer while pressing the FONT button. Then, the current default settings will be printed on the paper loaded in the paper path.

2. Press the FONT button to select a parameter. The FONT and CONDENSED LEDs turn on, off, or blink to show the current parameter selected. Press the FONT button as many times as necessary to make the LEDs indicate the setting you want. (See Table 1-16.)

3. Press the PAUSE button to change the setting. The READY LED shows your selection.

4. Repeat this procedure for any Group 1 feature you want to change. (After you have set the feature at the bottom of Table 1-16, the printer returns to the first feature in Table 1-16.)

5. When all the settings are as you want them, turn off the printer. The settings will be stored in non-volatile memory.

To change the settings shown in Table 1-17, Group 2 Features (ESC/P mode), or in Table 1-18, Group 2 Features (IBM mode), follow the steps below.

1. Turn on the printer while pressing the FONT and PAUSE buttons. Then, the current CG table for either ESC/P or IBM mode will be printed on the paper loaded in the paper path.

2. Press the FONT button to select the character table. The FONT, CONDENSED, and READY LEDs turn on, off, or blink to show your selection. Press the FONT button as many times as necessary until the FONT, CONDENSED, and READY LEDs indicate the character set you want.

3. Turn off the printer. The settings will be stored in non-volatile memory.

Table 1-10. Group 1 Features

FONT LED	COND. LED	Feature	Setting	READY LED
OFF	ON	Emulation	ESC/P	OFF
			IBM Proprinter	ON
OFF	BLINKS	Character pitch	Pica	OFF
			Elite	ON
ON	OFF	Page length	11 inch	OFF
			12 inch	ON
ON	ON		8.5 inch	OFF
			70/6 inch (A4)	ON
ON	BLINKS	Skip over perforation	No skip	OFF
			Skip 1 inch	ON
BLINKS	OFF	Zero face	o	OFF
			0	ON
BLINKS	ON	Auto tear-off	Valid	OFF
			Invalid	ON
BLINKS	BLINKS	Auto LF with CR	Depends on I/F	OFF
			Valid	ON

Note: The factory setting is that the READY LED is OFF for all features.

Table 1 7. Group 2 Features (ESC/P Mode)

FONT LED	COND. LED	READY LED	CG table	
OFF	OFF	ON	Italic	U. S. A.(std. setting)
OFF	OFF	BLINKS	France	
OFF	ON	OFF	Germany	
OFF	ON	ON	U.K.	
OFF	ON	BLINKS	Denmark	
OFF	BLINKS	OFF	Sweden	
OFF	BLINKS	ON	Italy	
OFF	BLINKS	BLINKS	Spain	
ON	OFF	OFF	Character table PC437	
ON	OFF	ON	PC850	
ON	OFF	BLINKS	PC860	
ON	ON	OFF	PC863	
ON	ON	ON	PC865	
ON	ON	BLINKS	PC437 Greek	
ON	BLINKS	OFF	PC851	
ON	BLINKS	ON	PC869	
ON	BLINKS	BLINKS	PC852	
BLINKS	OFF	OFF	PC853	
BLINKS	OFF	ON	PC857	
BLINKS	OFF	BLINKS	PC855	
BLINKS	ON	OFF	PC866	
BLINKS	ON	ON	GOST	
BLINKS	ON	BLINKS	PC861	

Note: The CG tables between 'PC437 Greek' and 'PC861' are available only for European models. When the CG table of PCxxx is selected, the table is assigned as the table selected by the ESC tl command. Then ESC t1 and ESC 6 are set as defaults. (Codes 80-9FH are printable characters.)

Table 1-18. Group 2 Features (IBM Mode)

FONT LED	COND. LED	READY LED	CG table
OFF	OFF	ON	Character table PC437 (table 1) (std.)
OFF	OFF	BLINKS	PC437 (table 2)
OFF	ON	OFF	PC865 (table 1)
OFF	ON	ON	PC865 (table 2)

Notes: 1) For table 1, codes 80-9FH are control codes. (ESC 7 is set.)
For table 2, codes 80-9FH are printable characters. (ESC 6 is set.)

2) The CG tables for ESC/P mode and IBM mode are saved independently in non-volatile memory.

1.5.2 Power On Default Settings

The printer also lets you change some of its power on parameters. To change the settings shown in Table 1-19, Group 3 Features (Power on settings), follow the steps below.

1. Turn on the printer while pressing the PAUSE, PAPER FEED, and FONT buttons.
2. Press the button indicated in Table 1-19 for a few seconds to change parameters.

Table 1-19. Group 3 Features (Power-on Settings)

Button	Feature	Setting
[PAUSE]	Input buffer	valid (**) or invalid (*)
[PAPER FEEDI	Draft printing speed	high (**) or normal (*)
[FONT]	Auto CR	valid (**) or invalid (*)

standard setting

Notes: 1) Auto CR moves the next print position to the left margin when LF or ESC J code is sent.
2) '*' is one beep, and '**' is two beeps.
If no operation is executed within a few seconds, the printer exits the power on selection mode with five beeps (*****).
The selected value is stored in non-volatile memory.

* The printer automatically becomes ready to print after the selection.

1.5.3 Buffer-full Printing

1.5.4 Hexadecimal Dump

Press the PAUSE button while turning on the printer to put the printer in hexadecimal dump mode. In this mode, received data is printed out in hexadecimal format, along with the corresponding ASCII characters. This function is useful to check received data from the host. If a received code is not a printableASCII character, the printer prints a period (.) in the ASCII column.

```
Data Dump Mode
0000   1B 4B 1B 43 30 1B 4F 30 1B 54 31 34 0D 0A 1B 08    .K.C0.00.T14....
0001   1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08    ................
0002   1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08    ................
0003   1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08    ................
0004   1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08 1B 08    ................
```

Figure 1-8. Hexadecimal Dump Printout

REV.-A

1.5.5 Self Test

Press the PAPER FEED button while turning on the printer to put the printer in self-test mode. To stop the self test, turn off the printer. (The control panel is still operational in self-test mode for paper handling and font selection.) When pages are printed from the CSF, the first sheet is used for scaling the sheet length. Then, the maximum number of printable lines is printed in the bottom line of the sheet and saved in non-volatile memory as the default page length. Page lengths are saved individually when a dual bin CSF is in use.

The self test prints out the following:
(a) Maximum printable lines (only on cut sheets from the CSF)
(b) Firmware version
(c) Current default settings
(d) Short help messages for control panel operation
(e) A Pattern of characters, as shown below.

```
GA281AES
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefgh:
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefghi.
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefghij1
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefghijk:
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefghijkl:
          456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ;Ñ;^_`abcdefghijklmr
```

Figure 1-9. Self Test Printout

1.5.6 Paper-out Detection

When the paper-out sensor detects a paper out, the printer enters the pause condition automatically after feeding or printing several lines. When a paper-out is detected, load new paper properly and set the printer ready to print by pressing the PAUSE button.

1.5.7 Auto Tear-off

When the release lever is set to one of the tractor positions, the paper advances to the tear-off position automatically if the input data buffer is empty and the paper is at the top-of-form position (If the printer receives no additional data after it has received a form feed). If subsequent data is sent to the printer, the paper reverse feeds to the original position automatically and the printing starts. This function can be turned off in the default setting mode.

1.5.8 Thermal Protection

When the printhead temperature exceeds 82 deg. C, the printer stops printing to protect the printer from overheating.

1.5.9 High Duty Printing

The printer stops printing when the printing duty is too heavy for the printer's power supply. If it occurs, the printer continues printing the rest at half speed.

, 1.5.10 Sheet Loading and Sheet Ejection

The release lever engages or disengages the push-tractor unit drive mechanism. The lever's operation provides with improved paper-handling functions:

(a) Automatic cut sheet loading without the cut sheet feeder

Move the release lever to the FRICTION position and load a sheet using the paper guide (top or optional front). A few seconds later, the sheet is automatically loaded to the top-of-form position, and the printer becomes ready to print.

(b) Automatic cut sheet loading and ejection with the cut sheet feeder

Move the release lever to the FRICTION position and load a stack of paper into the hopper of the cut sheet feeder. Pressing the PAPER FEED button loads the sheet to the top-of-form position. If a paper-out is detected before printing starts, the sheet is automatically loaded to the top-of-form position, without the PAPER FEED button being pressed.

(c) Continuous paper loading and ejection (paper park)

Move the release lever to REAR PUSH/FRONT PUSH position and load the paper into the tractor unit. Press the PAPER FEED button to load the paper automatically to the top-of-form position. If a paper-out is detected before printing starts, the paper is automatically loaded to the top-of-form position, without the PAPER FEED button being pressed.
If the FONT+ PAPER FEED buttons are pressed when the continuous paper is loaded, the paper is ejected backward to the paper park position. To feed several pages backward, repeat this operation several times.

1.5.11 Adjust Lever Operation

The platen gap adjust lever must be set to the proper position (from the 8 step available) for the paper thickness.If this lever is set to the position 2 (4th step) or higher, printing speed and paper feeding speed will be reduced.

Table 1-20. Lever Positions

Lever position	Paper thickness
O (2nd step)	0.06-0.12 mm
1 (3rd step)	0.13-0.17 mm
2 (4th step)	0.18-0.25 mm
3 (5th step)	0.26-0.32 mm

Note: If printing density becomes lighter, move the platen gap adjust lever position one step closer.
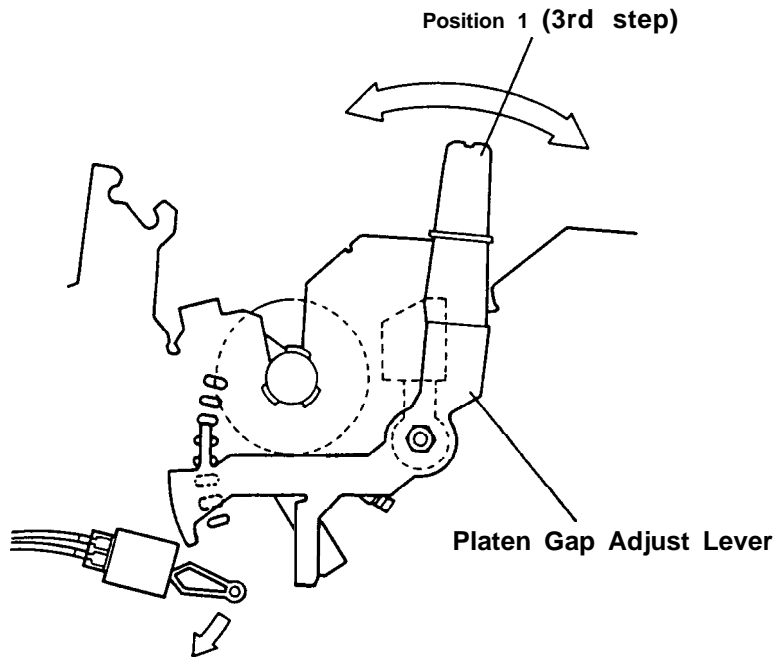
Position 1 **(3rd step)**

Platen Gap Adjust Lever

Figure 1-10. Lever Positions

1.5.12 Printer Initialization

The printer is initialized in the following cases.

(1) When the printer is turned on.
(2) When the INIT signal or CMREQ (optional I/F) is input.

When the printer is initialized, it performs the following functions:
• The printhead returns to the leftmost position (carriage home).
• The READY LED lights.
• The printer clears the print buffer and input data buffer.
• The line spacing is set to 1/6 inch.
• The page length and skip over perforation settings are returned to their default values.
• All vertical tab positions are cleared.
• The horizontal tab positions are set to every 8 columns.
• The print mode is set to the default value set from the control panel and stored in non-volatile memory.

TOF position will be reset in the following cases.
(1) Power on
(2) INIT signal or CMREQ (optional I/F)
(3) Software reSet command (ESC @)
(4) Page length command (ESC C)

NOTE: The CMREQ signal goes LOW when the command request is sent from the optional card to the main system.

1.5.13 Buzzer

The buzzer beeps for 0.1 second at a time. These beep sounds a recombined in various ways, as shown below, to indicate different meanings.

In the following table, each "*" stands for one beep.

Table 1-21. Buzzer Functions

Status	Sound and Description
BEL code	* Sounds when a BEL code has been input.
Carriage trouble	*** *** An error has occurred with the carriage position.
Voltage error	No beeps. (Shown by indicators blinking sequentially in the clockwise direction.)
Fatal error	No beeps. (Shown by indicators blinking simultaneously.)
Incorrect memory	** ** ** ** — RAM ** ** ** ** ** — E^{2}PROM

Paper error	**** **** **** **** ****
	
	Continuous paper has run out.
	Cut sheet paper from the CSF has run out.
	No paper was present at the start of a self test.
	A sheet could not be ejected from the CSF.
	* * *
	
	Other paper detection error have occurred.
	  With single sheet feed selected, no paper is present.
	  Continuous paper can't be loaded.
	  Paper runs out after the PAPER FEED button has been pressed.

Illegal paper release/u nrelease	***** ***** *****... (continuously till corrected) The release lever has been changed while there was paper in the paper path. Change the lever again or remove the paper in the path to stop the sound.
Recognition of operation	* Power-on operation (self test, hex dump, default setting, power-on selection) CSF bin-1 selected. ** CSF bin-2 selected.
Micro feed	* The adjusted value set using micro feed is the same as the factory setting value (loading position or tear-off position). ***** ***** *****... (continuously until button is released) The micro feed value has reached its upper or lower limit.

1.6 Main Components

The components of the FX-870/1170 are designed for easy removal and replacement during maintenance and repair.

The main components are:

(1) **BOARD ASSEMBLY, C094 MAIN**

(2) **BOARD ASSEMBLY, C094 PNL**

(3) **BOARD ASSEMBLY, C076 PSB/PSE**

(4) **Printer Mechanism**

(5) **Housing Assembly**

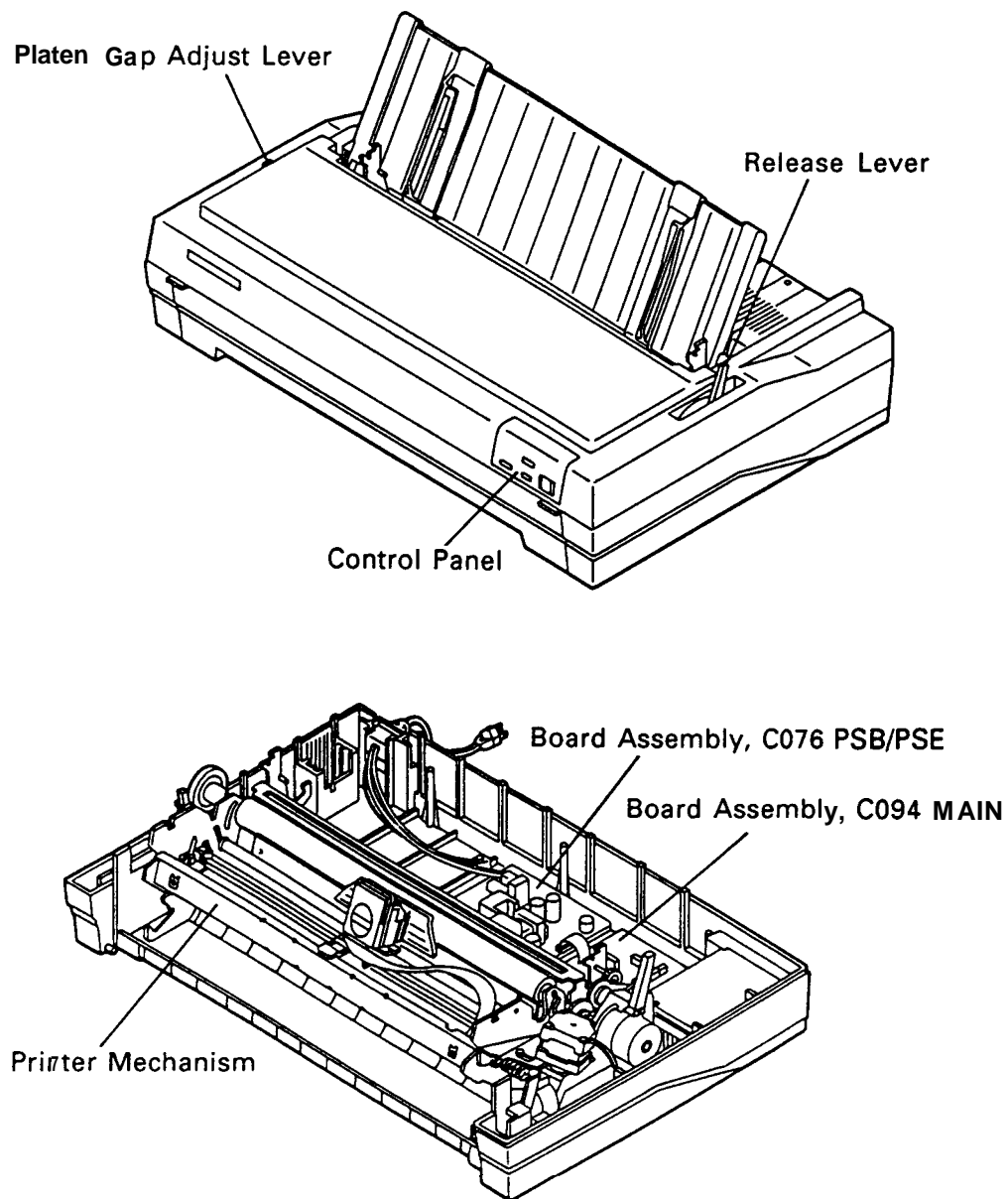The following figure shows the main components of the FX-870/1170.

Figure 1-11. Main Components

1.6.1 BOARD ASSEMBLY, C094 MAIN (Main Control Circuit Board)

Basically, the same board layout is used in both the 136-column model and the 80-column model. The CPU on this board controls all the main functions of the printer. It consists of a TMP90C041F 8-bit CPU, an E05A55YA gate array, an E²PROM, a PSRAM, a MASK ROM, motor drivers, and head drive transistors.
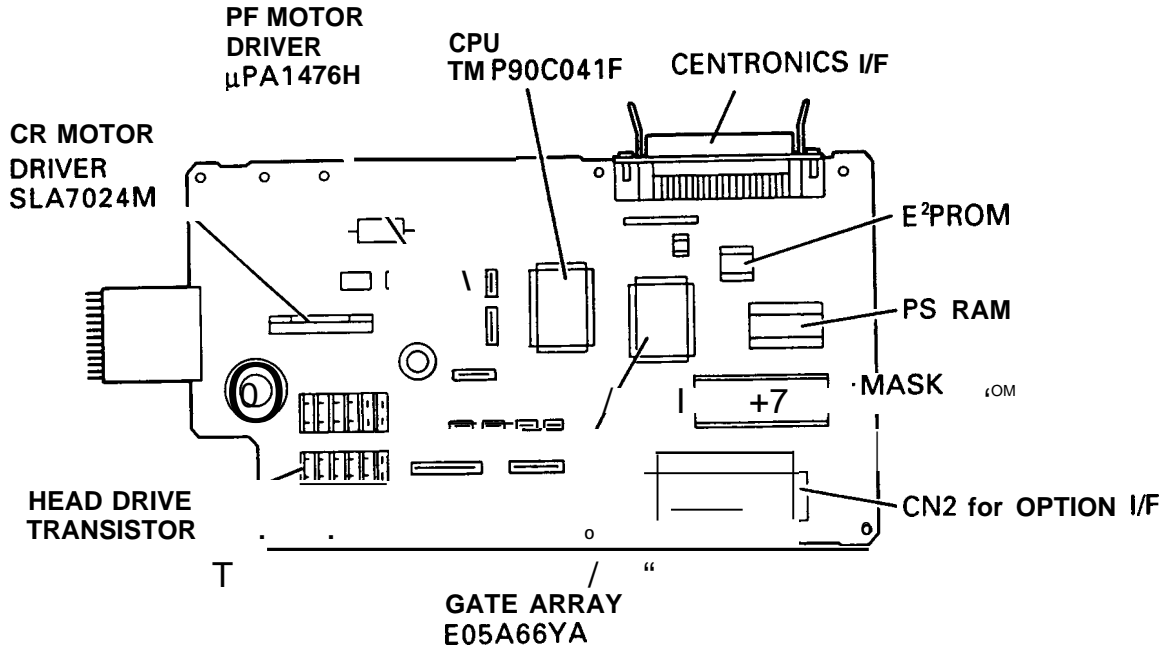
<136-column model>
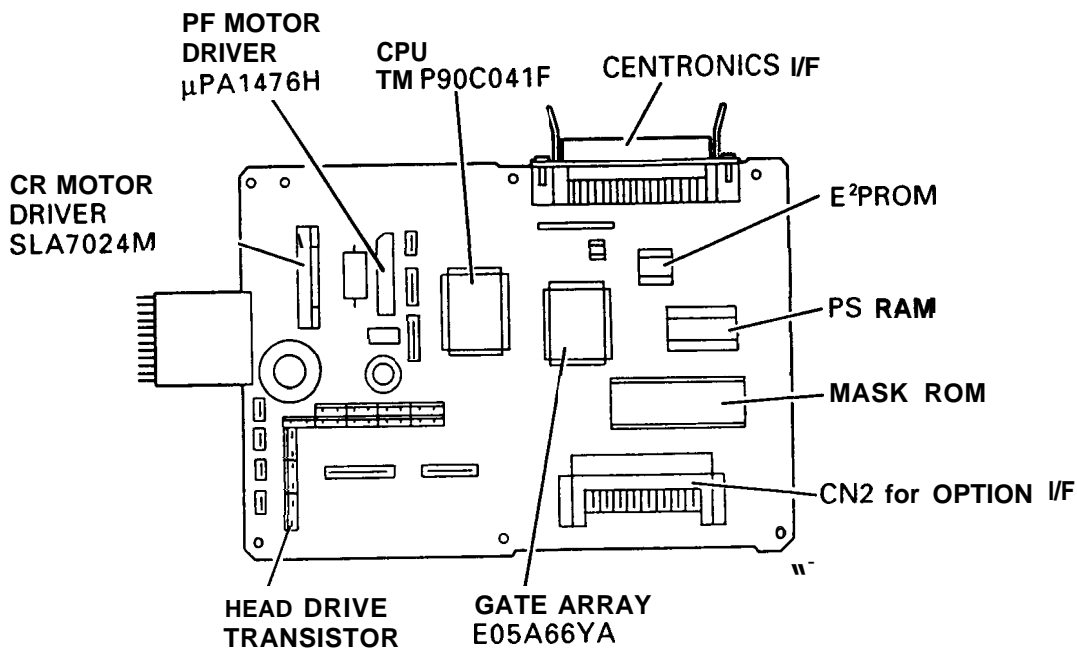
<80-column model>

Figure 1-12. BOARD ASSEMBLY, C094 MAIN (Main Control Circuit Board)

1.6.2 BOARD ASSEMBLY, C094 PNL (Control Panel Circuit Board)

This board functions as the control panel of the FX-870/1 170, and consists of a power switch, three function switches, and three indicator LEDs.
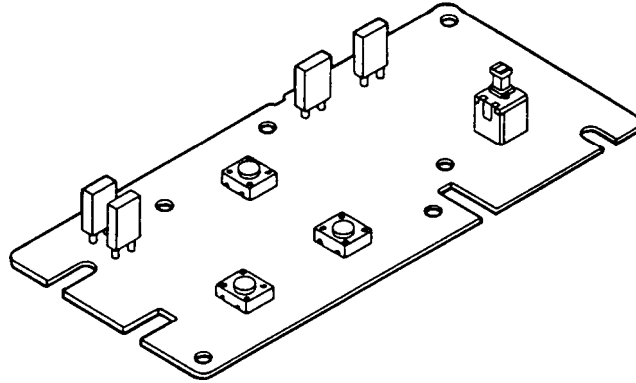

Figure 1-13. BOARD ASSEMBLY, C094 PNL (Control Panel Circuit Board)

1.6.3 BOARD ASSEMBLY, C076 PSB/PSE (Power Supply Circuit Board)

This board is composed of an input filter circuit, a transforming circuit, a switching regulator circuit, a rectifying circuit, a smoothing circuit, and various protecting circuits.
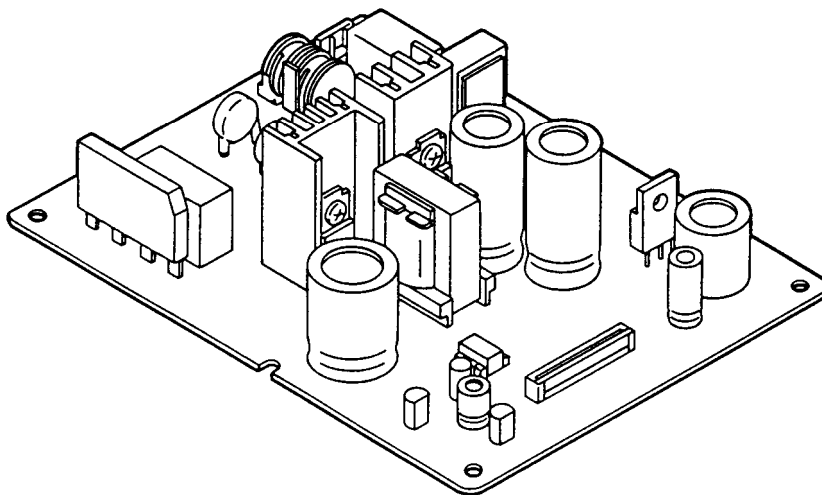

Figure 1-14. BOARD ASSEMBLY, C076 PSB/PSE (Power Supply Circuit Board)

1.6.4 Printer Mechanism

The printer mechanism consists of a 9-pin impact dot head, a carriage mechanism, a carriage motor, a paPer feed mechanism, a paper feed motor, a ribbon feed mechanism, and various sensors.
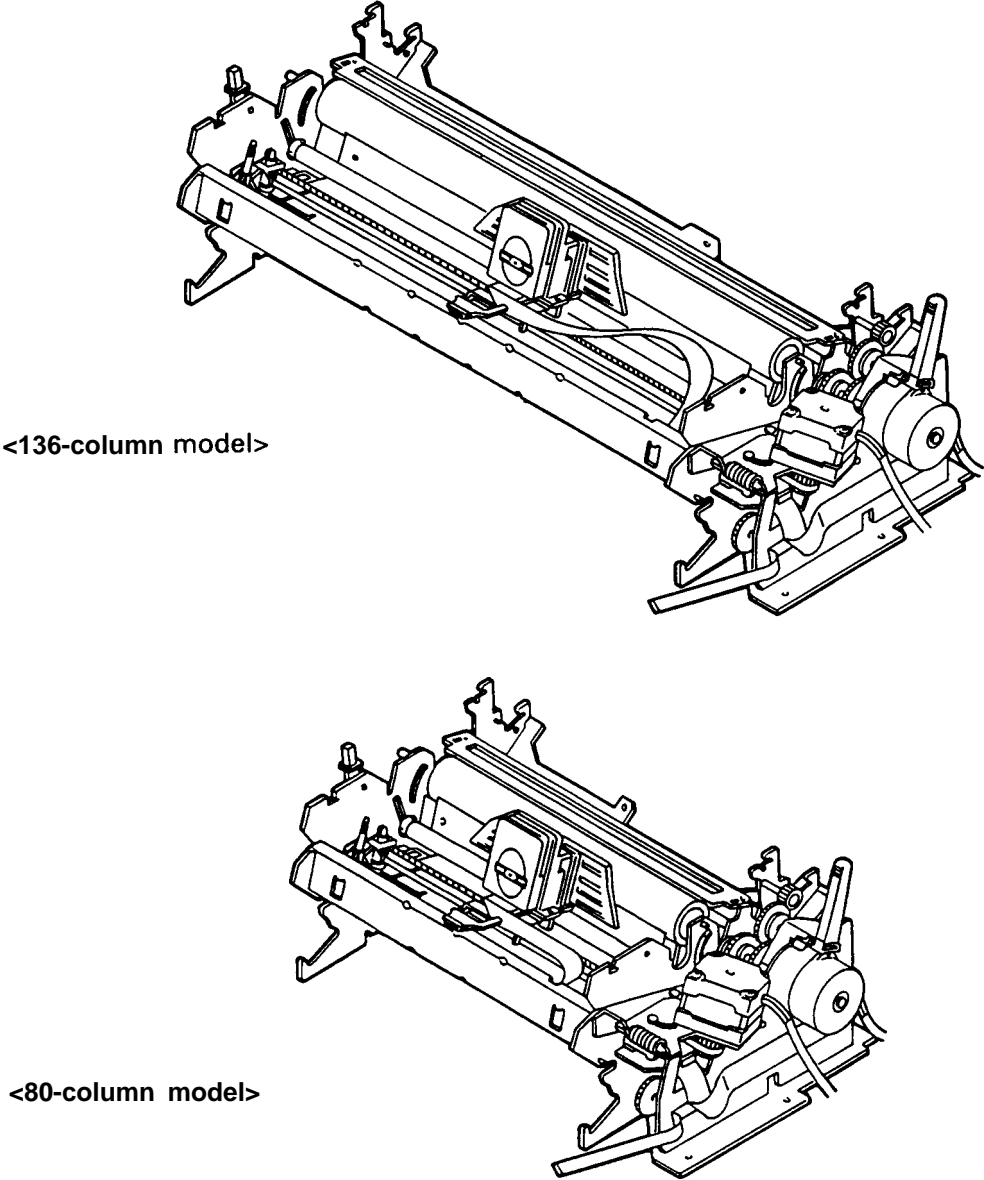
<136-column model>

<80-column model>

Figure 1-15. Printer Mechanism

1.6.5 Housing Assembly

The printer mechanism and all the boards are contained in a housing assembly that consists of the uppercase and the lower case.
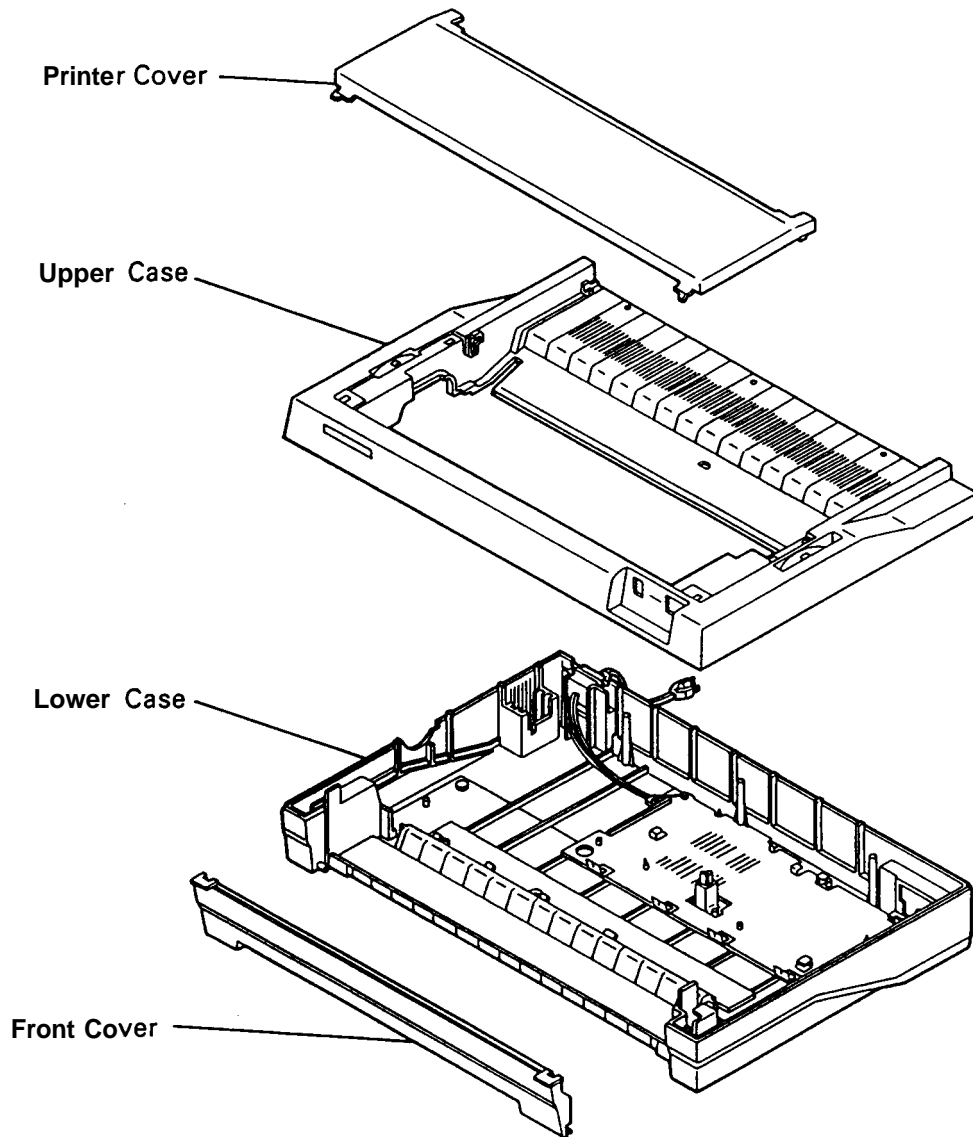
Printer Cover

Upper Case

Lower Case

Front Cover

Figure 1-16. Housing Assembly

CHAPTER 2

OPERATION PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 Printer Mechanism Operation

This section describes the printer mechanism of the FX-870/1170 printer and explains how the printer works. The FX-870/1170 printer mechanism features a 9-pin impact dot printhead for serial printing. It has four main parts: 1) the printhead mechanism, 2) the carriage movement mechanism, 3) the paper feed mechanism, and 4) the ribbon advance mechanism. Each of these is described below.

2.1.1 Printhead Mechanism

The printhead mechanism consists of the printhead itself, the ink ribbon, and the platen. The printhead contains a column of 9 wires. Each of these wires has a drive coil which causes the wire to move in and out of the printhead to print each dot. The four steps below describe how these driving wires work.

(1) The control circuit outputs drive signals to the printhead drive circuit. This changes the printhead drive voltage, and current flows through the corresponding printhead coil. The coil acts as a solenoid and generates a magnetic force.

(2) This induced force causes the plate to approach the coil rod and the associated dot wire is rapidly ejected to impact on the platen.

(3) The dot wire presses the ink ribbon up against the paper as it hits the platen and in this way prints a dot on the paper.

(4) As soon as the current through the coil is switched off, the force induced in the coil rod stops. The plate then returns to its original position (the position assumed before the coil was energized) through the action of the plate spring. After the dot wire hits the platen, the rebounding force of hitting the platen works with the wire resetting spring to pull the wire back to its original position.

Figure 2-1 shows the action of the printer mechanism when a single dot is printed.
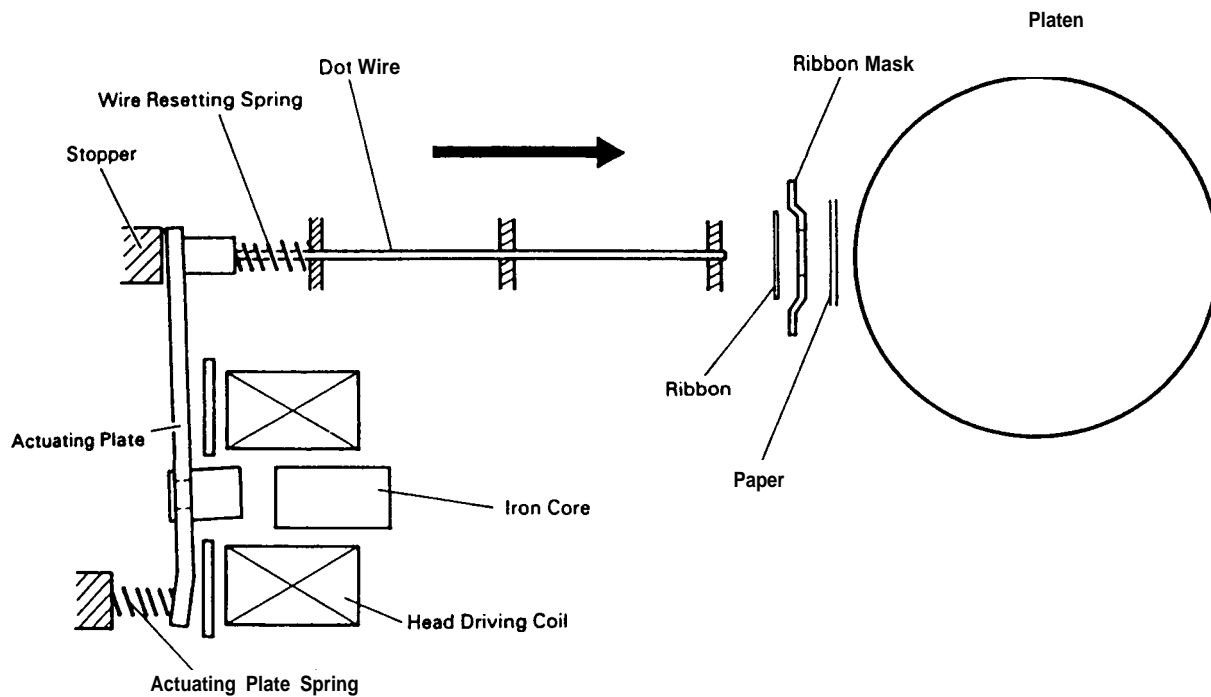
Figure 2-1. How the Printhead Works

The printhead tends to heat up after a period of continuous printing. To minimize the dot wire drive coil overheating, the head is equipped with a thermistor that can detect the head temperature. When the thermistor detects changes in the printhead temperature, the voltage signal changes. The CPU detects the voltage change and stops printing until the head temperature cools.

The printhead is also used as a buzzer. Head driving coils move all the dot wires back and forth at a frequency of 1.5 KHZ for 40 μs without impacting the platen, so that the wires vibrate. The vibrating dot wires sound like a buzzer.

2.1.2 Carriage Mechanism

The timing belt is connected to the lower side of the carriage. With the printhead installed, the carriage moves in either direction along the carriage guide shaft. The carriage (CR)motor (a stepping motor) drives the timing belt which moves the carriage. The home position (HP) sensor detects the home position of the carriage.

NOTE: Carriage initialization for the 80-column and 136-column models are different.
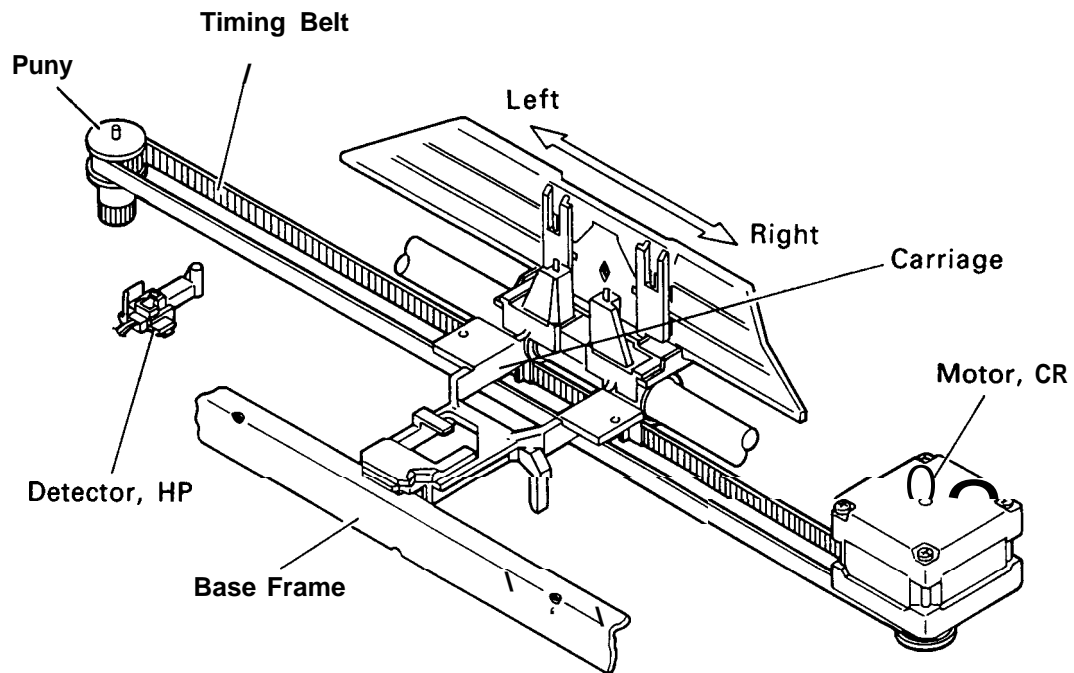
Figure 2-2. Carriage Operation

2.1.3 Platen Gap Adjustment

The platen gap (the gap between the platen and the printhead) can be adjusted to allow the printer to use paper of different weights or thicknesses. When the platen gap adjust lever is moved forward or backward, the carriage guide shaft rotates. This rotation moves the carriage either toward or away from the platen and changes the platen gap. Setting the adjust lever to position 2 (the 5th slot from the top) turns off the platen gap switch, which slows down the printing speed of the printer to protect the printhead. The PG detector detects the position of the adjust lever. The correct platen gap is 0.38mm ± 0.02mm with the adjust lever set to position O.

Platen

Printhead

Platen Gap
Adjustment Slot

Lever, G, Adjust

Detector, PG
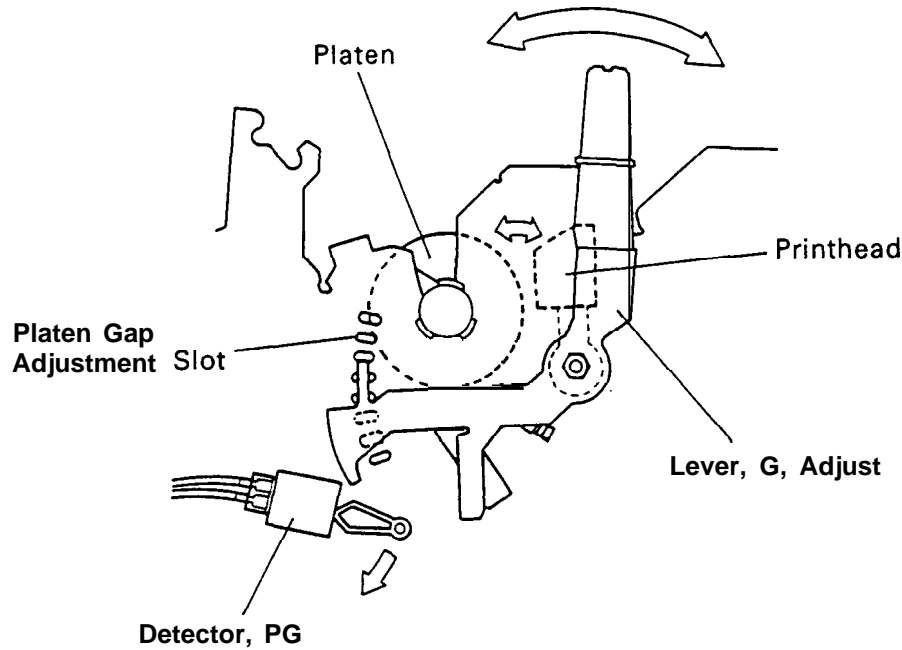
Figure 2-3. Platen Gap Adjust Lever

2.1.4 Paper Handling Mechanisms

During normal operation, the paper is fed to the printer, advanced to the specified position, and ejected from the printer. These paper handling operations are performed by various paper handling mechanisms, such as the tractors, platens, rollers, and gears. This section describes the printer's paper handling mechanisms.

2.1.4.1 Paper Feed Mechanisms

Cut sheets are fed by friction. Continuous paper is fed by a tractor. There are three ways to feed paper with tractors: the push tractor method, the pull tractor method, and the push-pull tractor method. During normal operation, the printer is set up with only one tractor, which functions as either a push or a pull tractor, depending on where it is attached on the printer. To use the push-pull tractor feed method, an optional tractor must be attached.

There are four paper entrances for feeding paper into the printer. Different paper entrances are used for different types of paper. Table 2-1 lists which paper entrances can be used with each paper feed method.

Table 2-1. Paper Feed Methods and Paper Entrances

Paper Feed Method	Paper Entrance			
	Rear	Front	Bottom	Top
Friction	No	OK	No	OK
Push Tractor	OK	OK	No	No
Pull Tractor	OK	OK	OK	No
Push-pull Tractor	OK	OK	No	No

2.1.4.2 Paper Advance Mechanisms

This section describes how the friction advance and tractor advance mechanisms work to advance the PaPer through the printer.

(1) Friction Advance Method

The paper is held between the platen and paper guide rollers and between the paper tension roller and paper tension unit cover. The PF motor pinion gear, turning in the direction of the black arrow, drives the paper advance reduction gear. The paper advance reduction gear turns the platen gear and the paper tension roller gear. The paper advances in the direction of the white arrow. Figure 2-4 illustrates the friction advance method when the paper is fed through the top paper entrance.

In the friction advance method, the paper guide roller spring holds the paper against the platen. You can release this pressure and free the paper by setting the release lever to the tractor feed position.
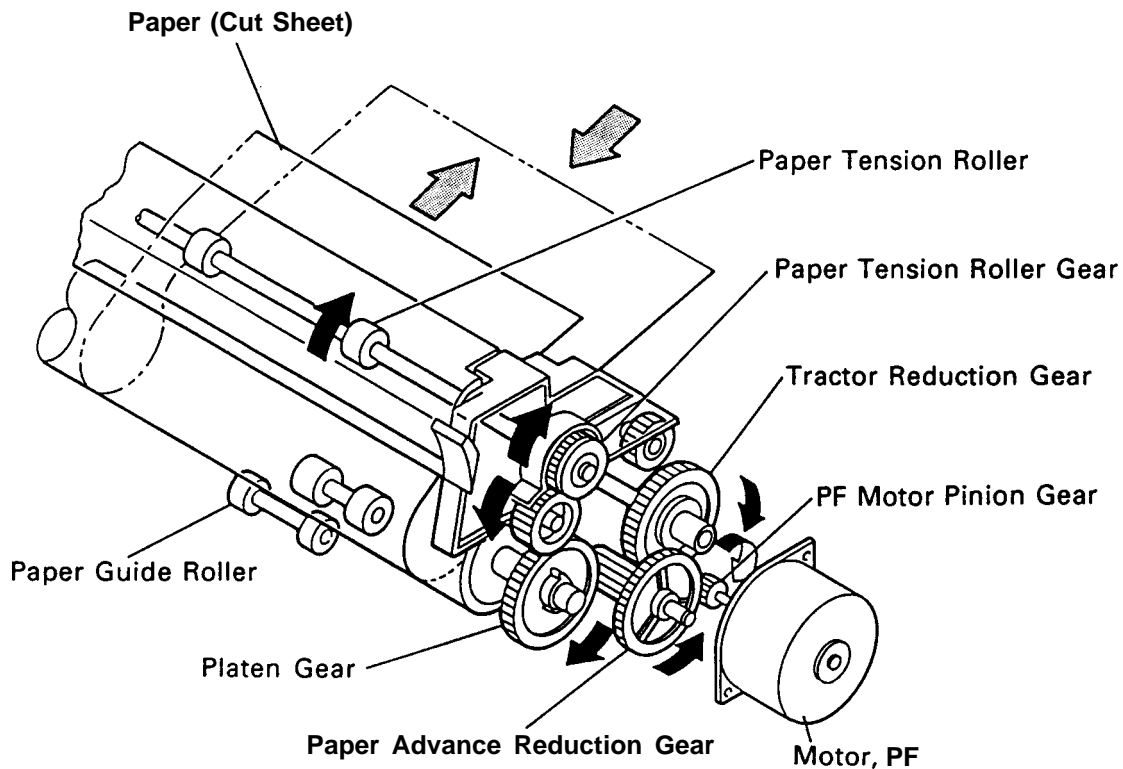
Figure 2-4. Friction Advance Operation Using the Top Paper Entrance

(2) push Tractor Method

When the push tractor method is used with the rear entrance, the torque generated by the PF motor is transmitted to the push tractor gear through the PF motor pinion gear, paper advance reduction gear, and tractor reduction gear. When the PF motor pinion gear turns in the direction of the black arrow, the tractor gear rotates in the direction of the black arrow and thus feeds the paper into the printer. The paper is advanced by the platen and the paper tension roller, which are also driven by the PF motor through the train of gears.

When the push tractor method is used with the front entrance, the torque generated by the PF motor is transmitted to the push tractor gear through the PF motor pinion gear, paper advance reduction gear, platen gear, and the train of gears in the front part of the printer. When the PF motor pinion gear turns in the direction of the black arrow, the tractor gear rotates in the direction of the black arrow and thus feeds the paper into the printer. The paper is advanced by the paper drive roller and the platen, which are also driven by the PF motor through the train of gears.

In the push tractor method, the release lever issetto one of the tractor positions to release the pressure between the paper advance roller and the platen, Figure 2-5 illustrates push tractor operation when the paper is fed through the rear paper entrance. Figure 2-6 illustrates push tractor operation when the paper is fed through the front paper entrance.
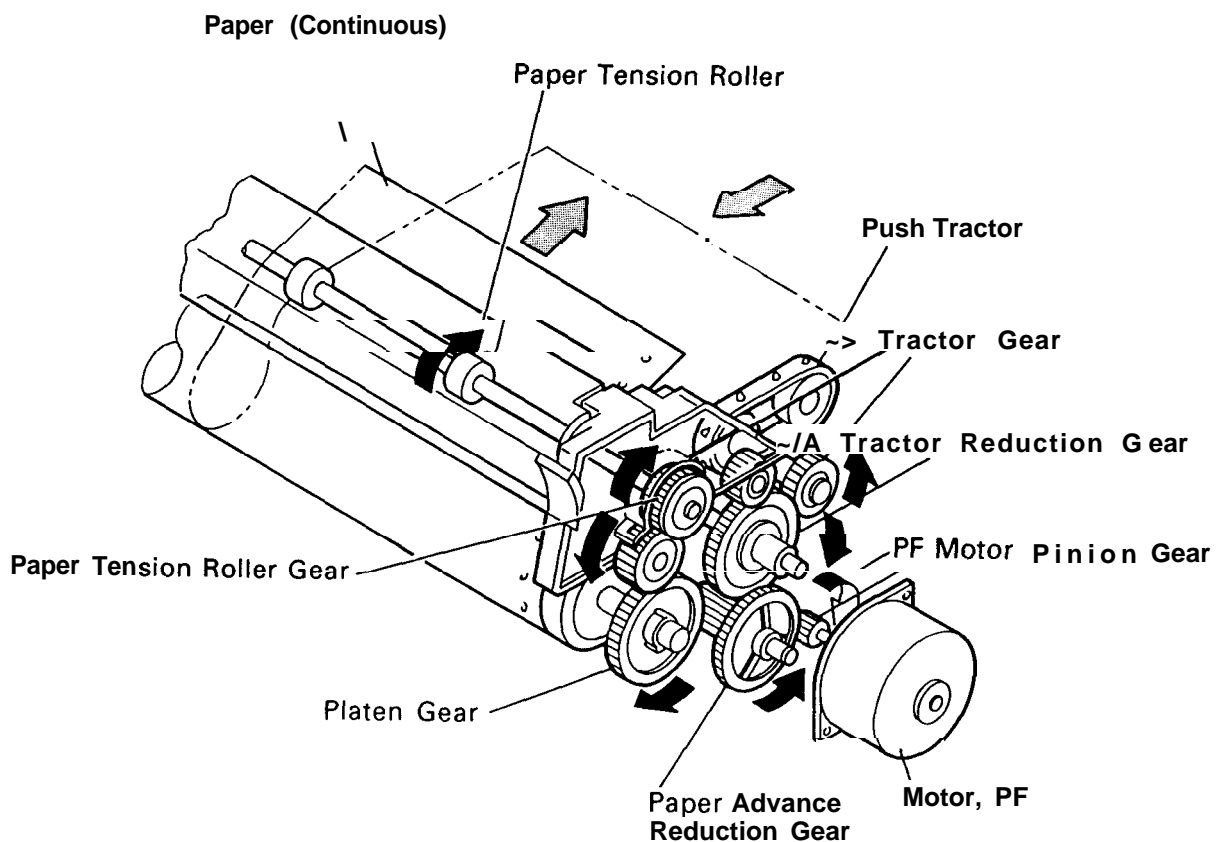
Figure 2-5. Push Tractor Operation Using the Rear Paper Entrance

Paper (Continuous)

Paper Tension Roller

Paper Tension
Roller Gear

Platen Gear

PF Motor
Pinion Gear

Paper Drive Roller

Motor, PF

Paper Advance
Reduction Gear

Paper Drive Roller Gear

Push Tractor
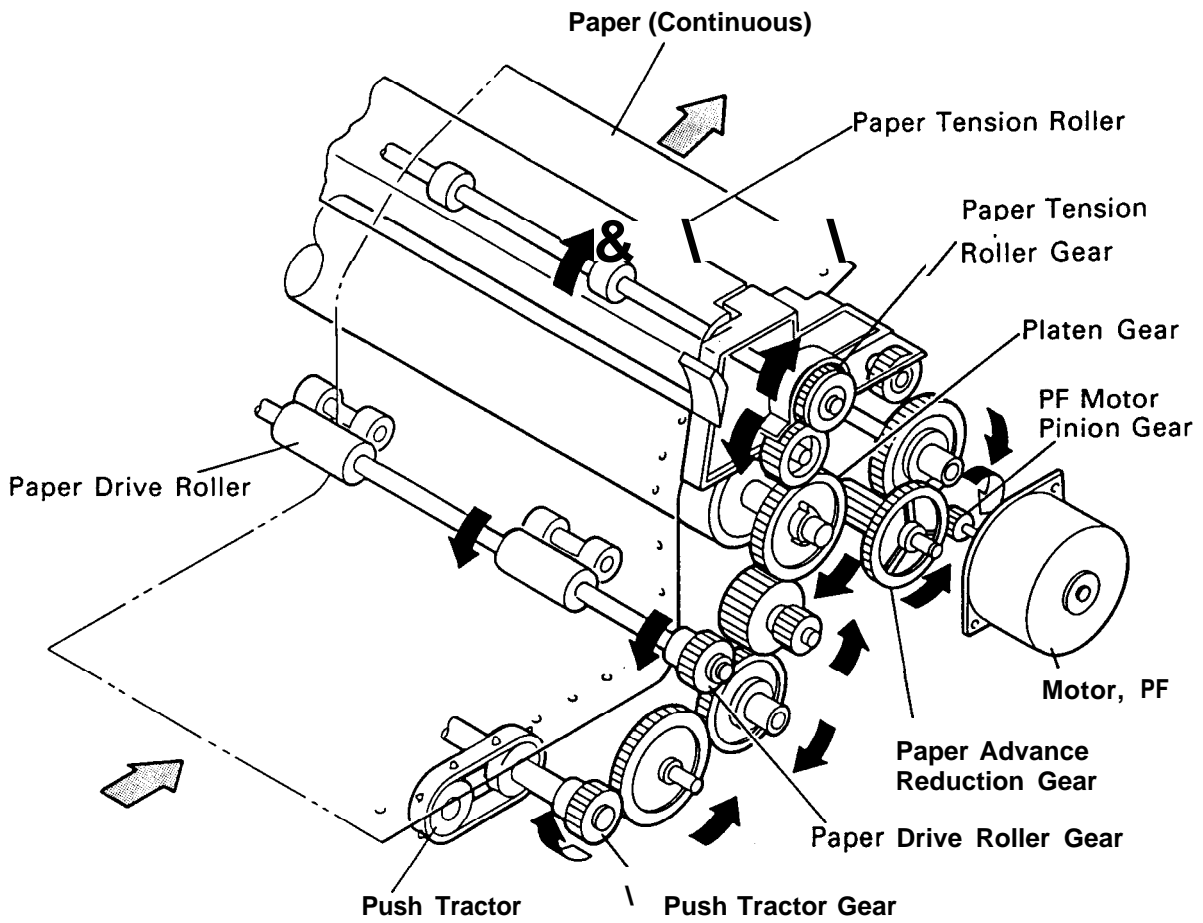
Push Tractor Gear

Figure 2-6. Push Tractor Operation Using the Front Paper Entrance

(3) Pull Tractor Method

The pull tractor advances paper in basically the same way as the push tractor. The push tractor is installed at the paper entrance and pushes the paper into the printer mechanism. The pull tractor, however, is installed at the paper exit and pulls the paper out of the printer mechanism. As the result, the paper tension unit is not required.

Figure 2-7 illustrates pull tractor operation when the paper is fed through the bottom paper entrance.
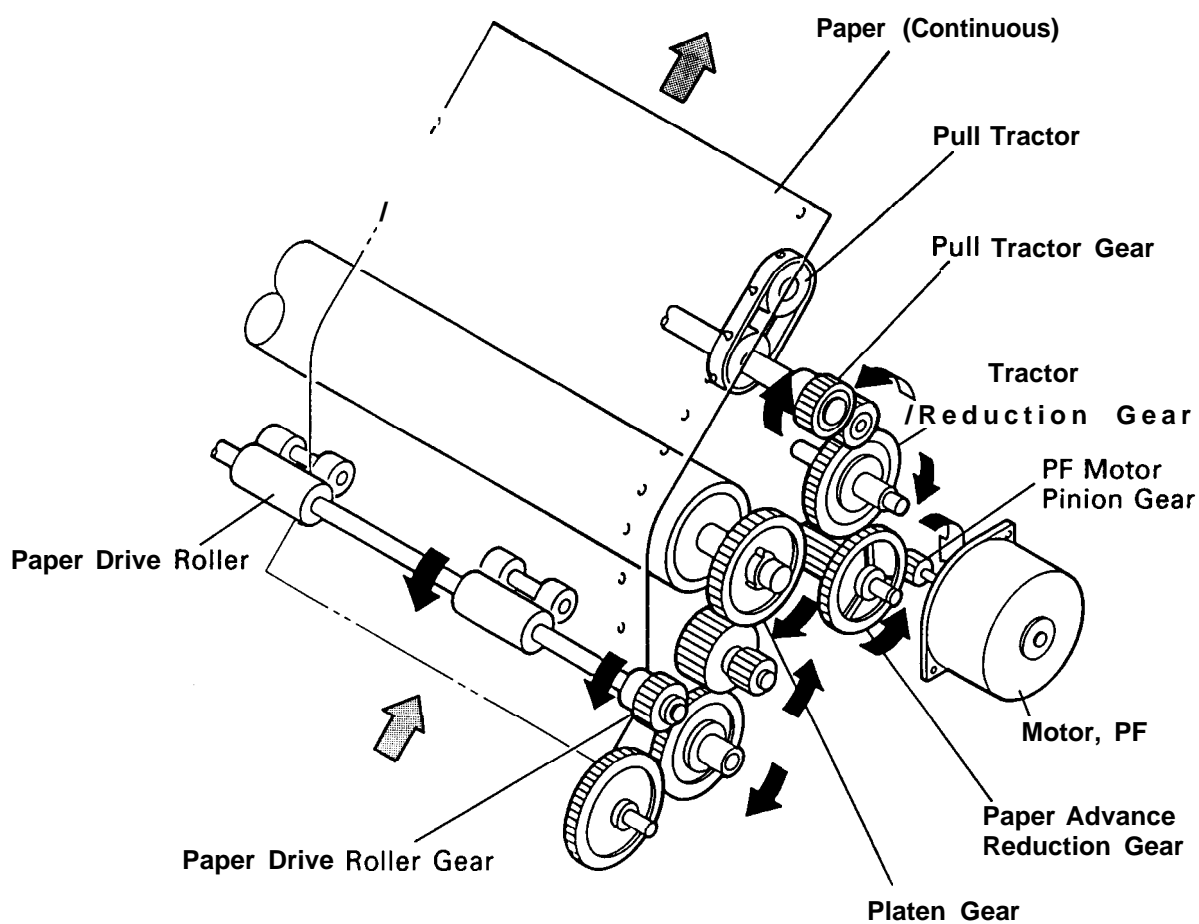
Figure 2-7. Pull Tractor Operation Using theBottom Paper Entrance

(4) Push-pull Tractor Method

The push-pull tractor method is a combination of the push and pull tractor methods. Two tractors are used to advance the paper: one at the front paper entrance and the other at the rear paper entrance. They operate simultaneously to push and pull the paper through the printer mechanism. Figure 2-8 illustrates push-pull tractor operation when the paper is fed through the rear paper entrance. Figure 2-9 illustrates push-pull tractor operation when the paper is fed through the front entrance.
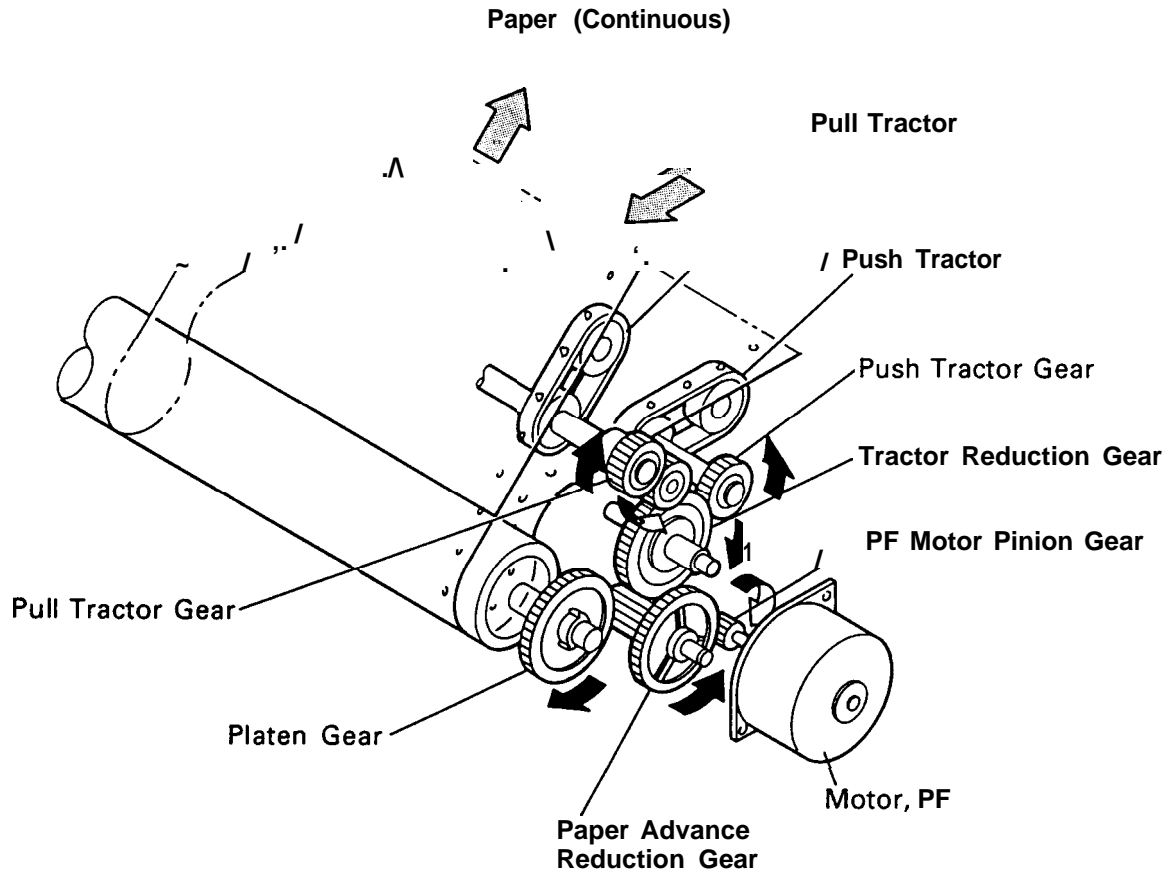
Figure 2-8. Push-Pull Tractor Operation Using the Rear Paper Entrance

Paper (Continuous)

Paper Drive Roller

Pull Tractor

Pull Tractor Gear

Tractor Reduction Gear

PF Motor Pinion Gear

Motor, PF

Paper Advance Reduction Gear

Platen Gear

Paper Drive Roller Gear

Push Tractor Gear
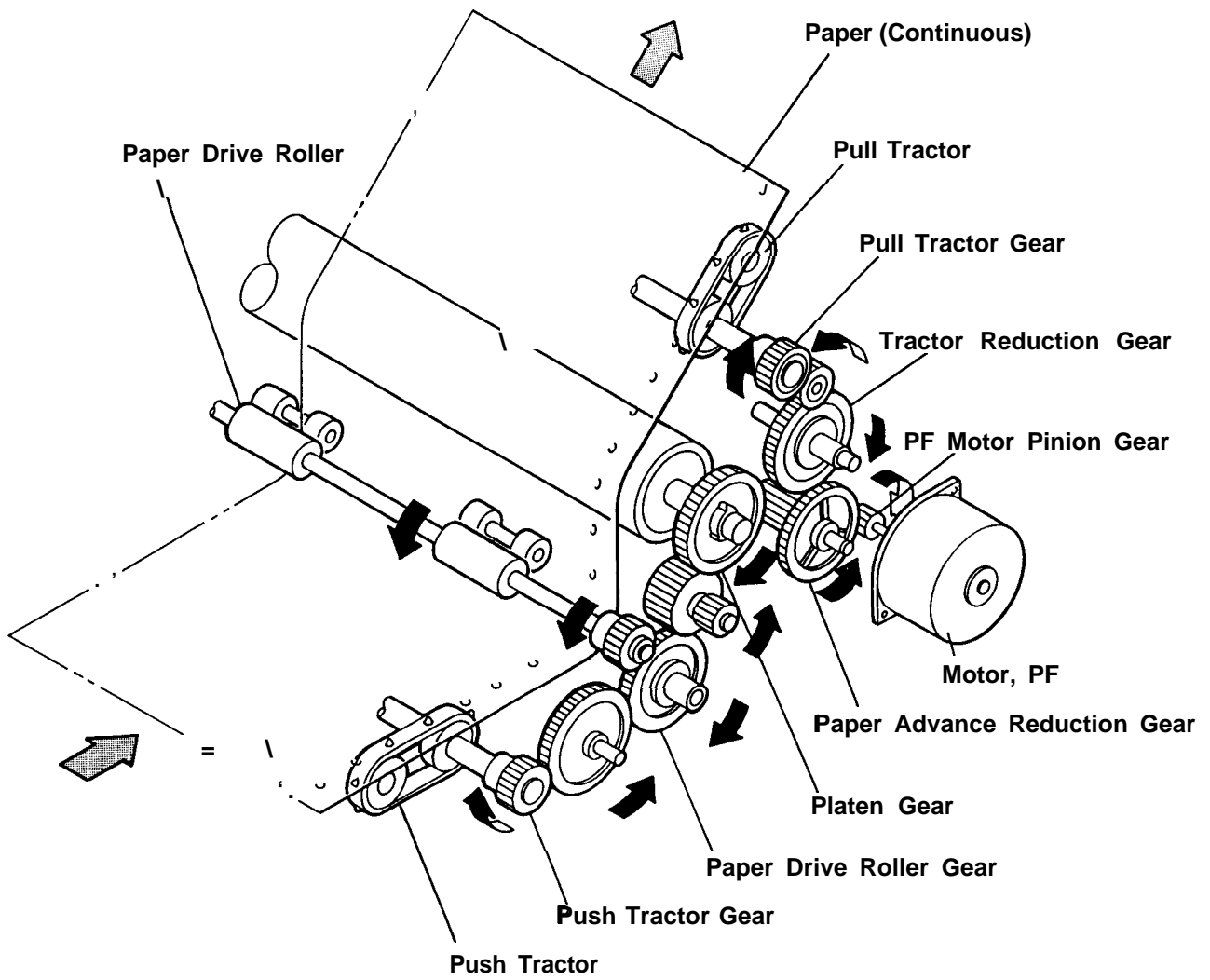
Push Tractor

Figure 2-9. Push-pull Tractor Operation Using the Front Paper Entrance

(5) Release Lever

The release lever is used to select friction or tractor feeding or release the paper. When the release lever is set to the friction feed position, the paper guide rollers are pressed against the platen. When it is set to one of the tractor feed positions, this pressure is released and the paper guide rollers are separated from the platen. When it is set to the paper free position, the paper drive roller and the lower paper guide roller at the front entrance are separated from each other. Figure 2-10 illustrates the release lever. Figure 2-11 shows the function of each release lever setting.
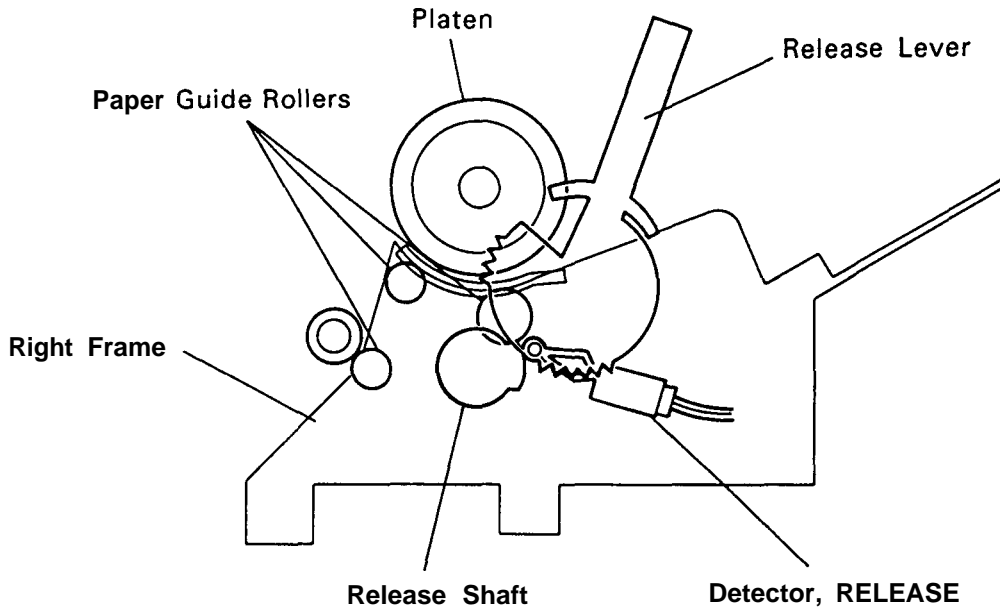
Figure 2-10. Release Lever
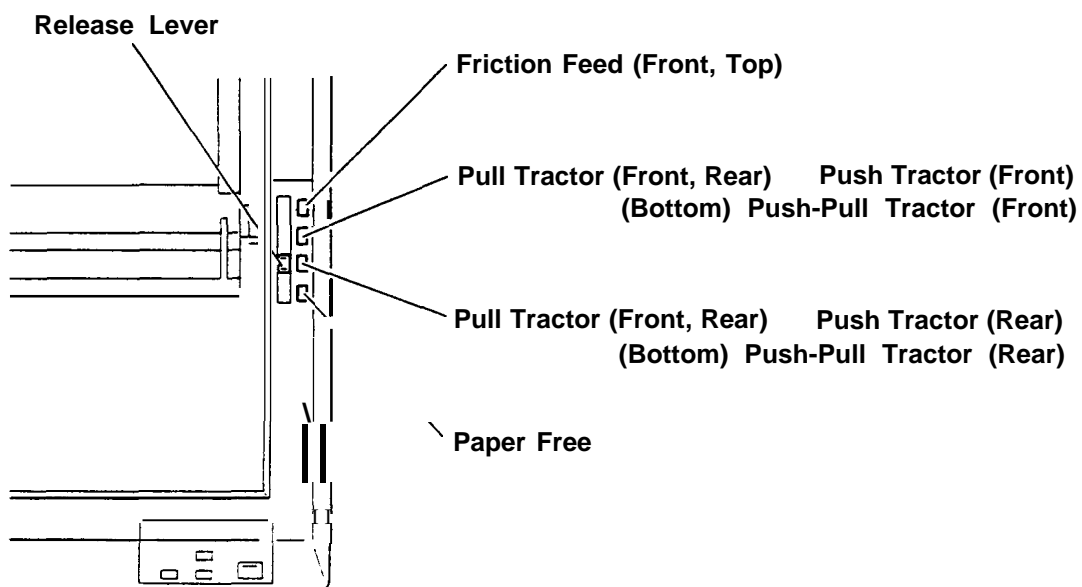
Figure 2-11. Release Lever Setting Functions

2-12

2.1.4.3 Paper Paths

This section describes the various paths the paper follows through the printer mechanism. The various paper paths are divided into four groups depending on the entrance(top, rear, bottom, or front) the PaPer is fed from.

Note: The front PE (paper-end) detector is located in front of the printer mechanism and the rear PE detector is located behind the printer mechanism.

(1) Top entrance

Figure 2-12 shows the paper path for friction feeding using the top entrance. The top entrance is used only for friction feed method. When the top entrance is used, the rear PE detector senses when the paper is out.
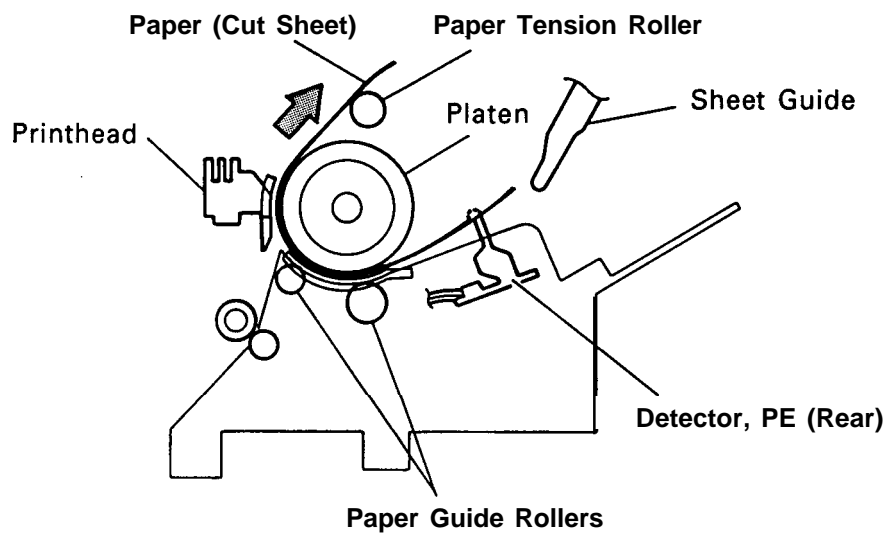
Figure 2-12. Paper Path for Friction Feeding Using the Top Entrance

(2) Rear entrance

Figures 2-13 and 2-14 show the paper paths fortractorfeeding using the rear entrance. The rear entrance can be used with any of the following paper feed methods: the push tractor feed method, the pull tractor feed method, or the push-pull tractor feed method. When the rear entrance is used, the rear PE detector senses when the paper is out.
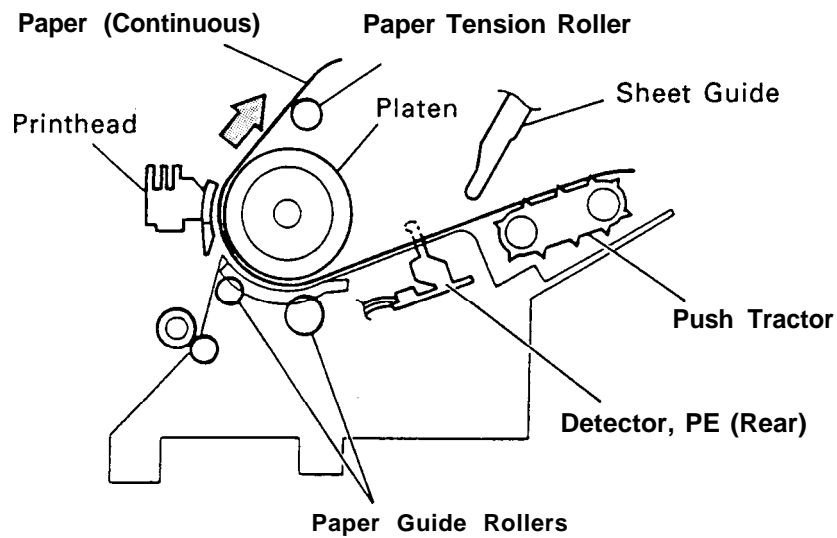
Figure 2-13. Paper Path for Push Tractor Feeding Using the Rear Entrance
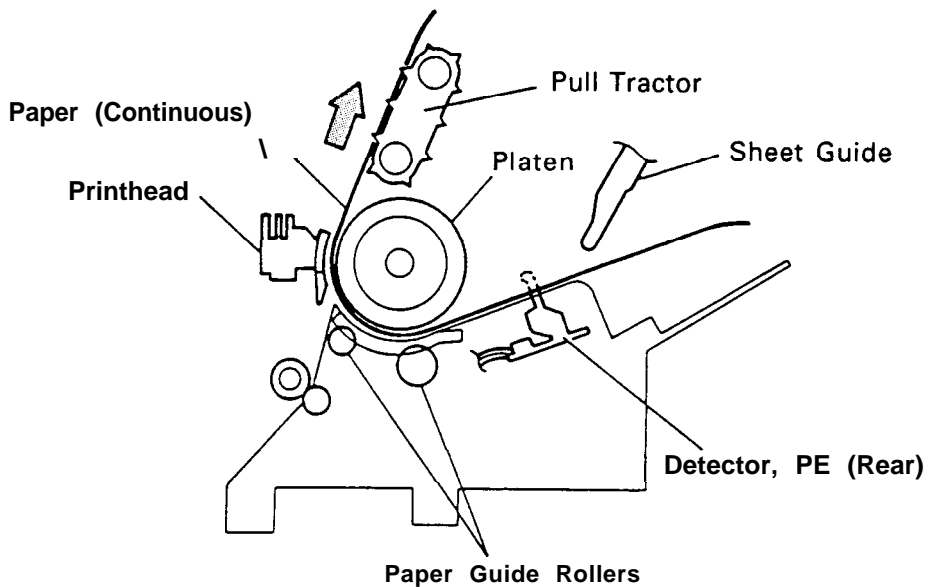
Figure 2-14. Paper Path for Pull Tractor Feeding Using the Rear Entrance
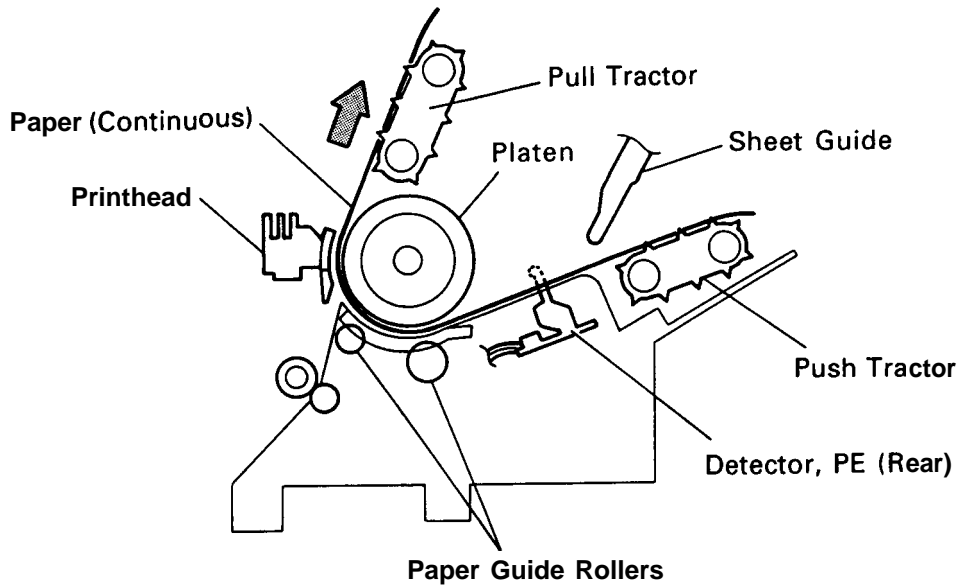
Figure 2-15. Paper Path for Push-pull Tractor Feeding Using the Rear Entrance

(3) Bottom entrance

Figure 2-16 shows the paper path for tractor feeding using the bottom entrance. The bottom entrance is used only for pull tractor feeding. When the bottom entrance is used, the front PE detector senses when the paper is out.
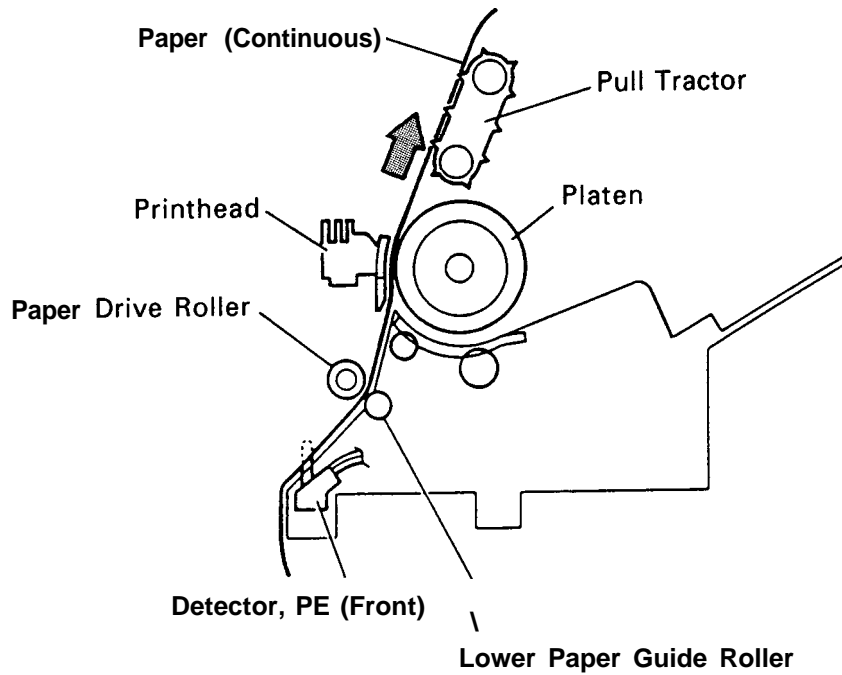
Figure 2-16. Paper Path for Pull Tractor Feeding Using the Bottom Entrance

(4) Front entrance

Figures 2-17 through 2-20 show the paper paths for the front entrance. The front entrance can be used with any of the following paper feed methods: the friction feed method, push tractor feed method, pull tractor feed method, or push-pull tractor feed method. When the front entrance is used, the front PE detector senses when the paper is out.
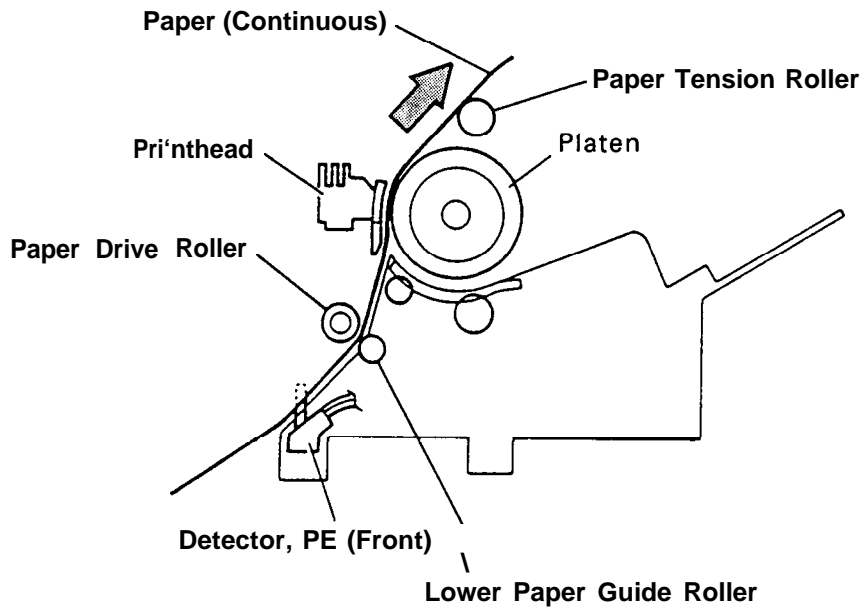
Figure 2-17. Paper Path for Friction Feeding Using the Front Entrance
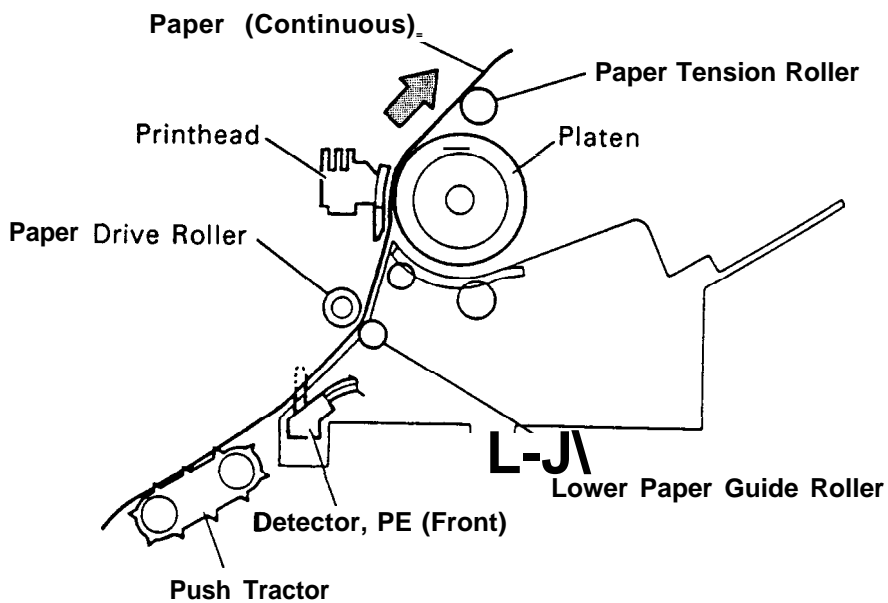
Figure 2-18. Paper Path for Push Tractor Feeding Using the Front Entrance
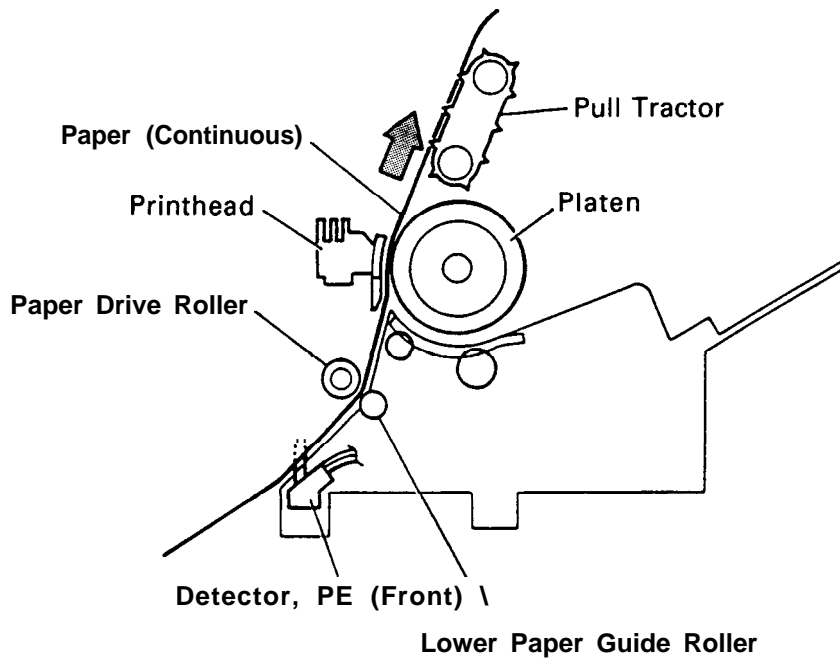
Figure 2-19. Paper Path for Pull Tractor Feeding Using the Front Entrance
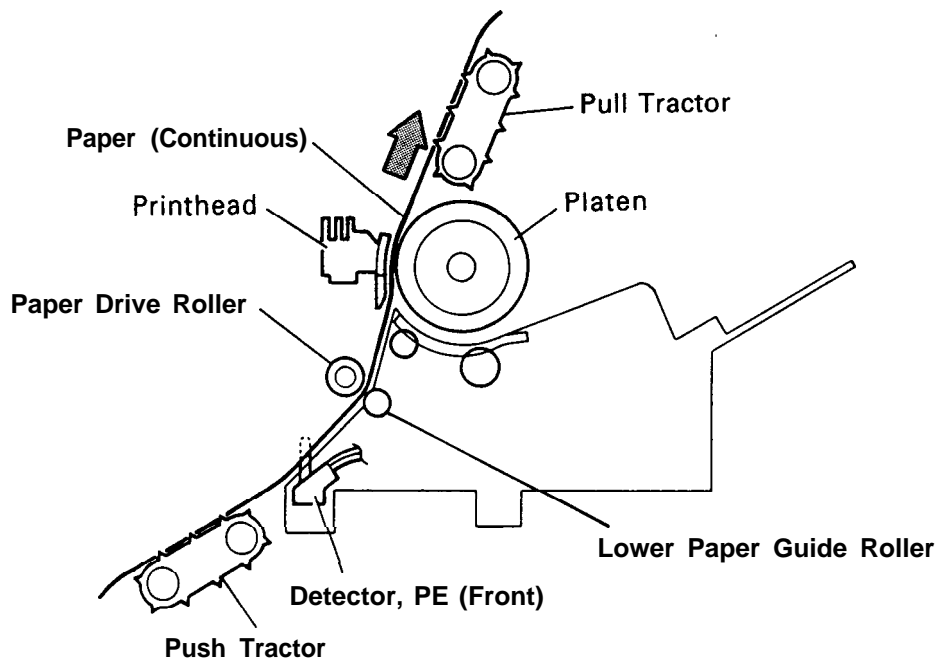
Figure 2-20. Paper Path for Push-pull Tractor Feeding Using the Front Entrance

2.1.4 Ribbon Advance Mechanism

The ribbon is held between the ribbon advance roller (ribbon driving gear) and the ribbon pressure roller. When the carriage moves ontheshaft, the timing belt turns the belt driven pulley, andthetorque is transmitted to the ribbon driving gear through the train of gears. The ribbon driving gear rotates counterclockwise no matter what direction the carriage moves, because the planetary gear is used in the gear linkage.

Table 2-2. Ribbon Advance Gear Linkage

Direction of Carriage Movement	Gear Linkage
Left to right (indicated by the black arrow)	Belt driven pulley ● Gear (1) ● Gear (2) ➡ Ribbon driving gear
Right to left (indicated by the white arrow)	Belt driven pulley ⇨ Gear (1) ⇨ Gear (3) ⇨ Gear (4) ⇨ Ribbon-driving gear

The ribbon brake spring, attached to the exit slot of the cartridge case, prevents slack in the ribbon and keeps the ribbon tension at an appropriate level. The ribbon mask prevents the ribbon from brushing against the paper.
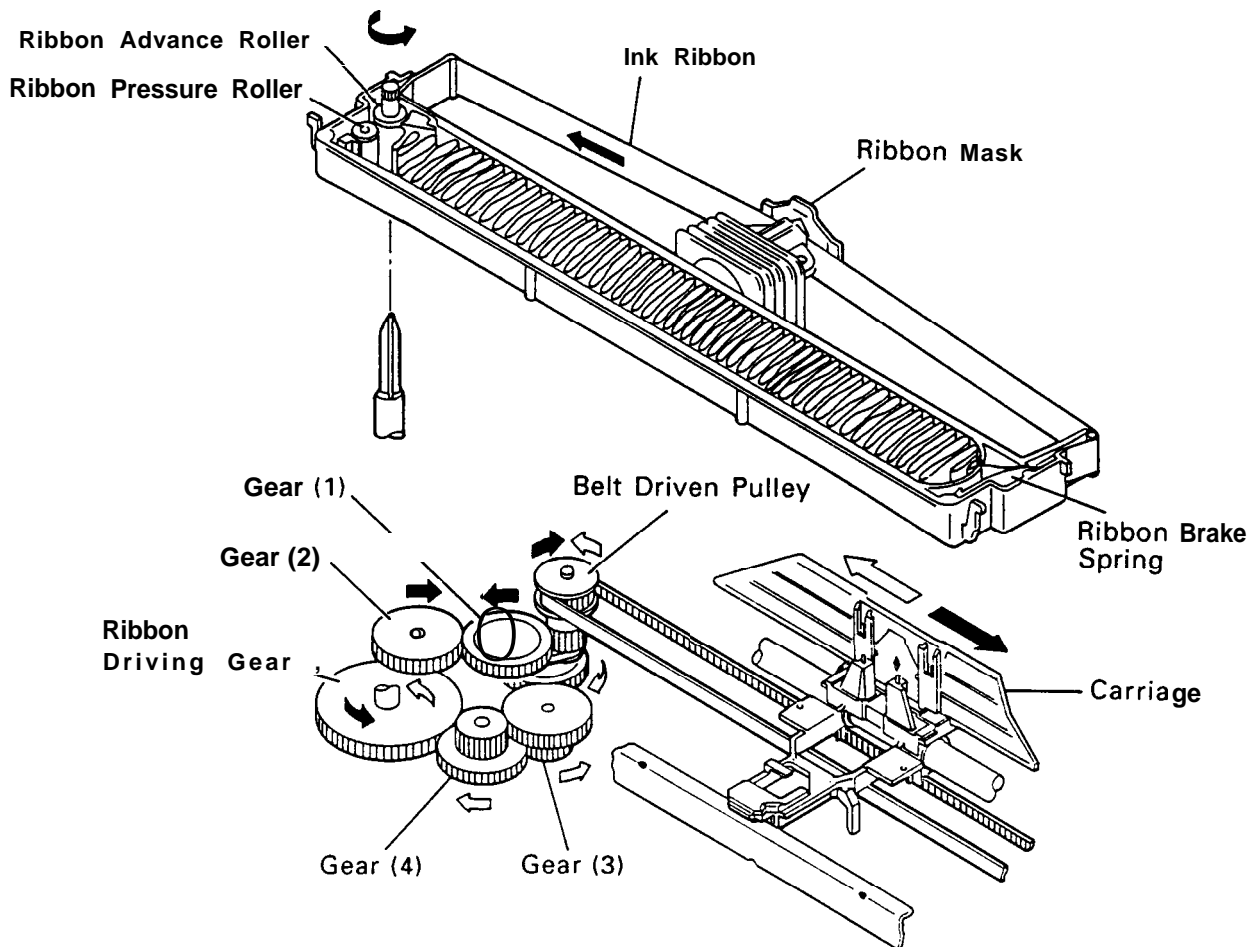
Figure 2-21. Ribbon Advance Mechanism

2.2 Power Supply Operation

The FX-870/I 170 printer is powered by either of the two power supply boards: 120 VAC power supply board (BOARD ASSEMBLY, C076 PSB) or 220/240 VAC power supply board (BOARD ASSEMBLY, C076 PSE). These boards output the DC current necessary to drive the printer control circuits and the printer drive mechanism. Fuse F1 (2.5A/125 V for C076 PSB or 1.25 A/250 V for C076 PSE) is used to Protect the Power supply circuit of each board in case of a short circuit.

Table 2-3. Power Supply Input Voltages and Fuse Ratings

Board	Input Voltage	Fuse F1 Rating
C076 PSB	103.5-132 VAC	2.5 A/125 V
C076 PSE	198-264 VAC	1.25 A/250 V

2.2.1 Power Supply Overview

The power supply board has two power output lines that supply power to the control circuits and the drive mechanisms. Table 2-3 lists the components (parts or assemblies) of the printer that are powered by these two DC voltages.

Table 2-4. Power Supply Output Voltages and Applications

Output voltage (DC)	Applications
+35 V	CR (carriage) motor drive PF (paper feed) motor drive Printhead drive
+5 v	Main control board logic circuitry Sensors Control panel LEDs PF (paper feed) motor hold

2.2.2 Power Supply Circuit Operation

Figure 2-22 shows the power supply circuitry in block diagram form. When AC power enters the printer from an external power source, the filter circuit removes the noise. The AC voltage then undergoes full wave rectification and is smoothed to produce direct current. The voltage is then fed through the switching circuit and the secondary smoothing circuit to produce a stepped down +35 VDC voltage. A +35 VDC detector circuit is connected to the switching circuit. This feedback control arrangement ensures a stable +35 VDC voltage supply.

A +5VDC voltage is generated by feeding the +35 VDC voltage through the +5 VDC power supply circuit, where the +35 VDC is stepped down to a stable +5 VDC voltage. The switching regulator IC containing the overcurrent/overvoltage control circuits performs this function. It controls the +5 VDC line output.

The +5 VDC voltage overload protection circuit cuts the +5 VDC line output if the voltage exceeds +7 VDC. It stops the operation of the switching circuit and then the output of +35 VDC voltage.

The +35 VDC line has a voltage overload protection circuit and a voltage drop protection circuit. The +35 VDC voltage overload protection circuit cuts the +35 VDC line output if the voltage exceeds +36 VDC. It stops the operation of the switching circuit and then the output of the +35 VDC voltage. The voltage drop protection circuit protects the printer against a sudden voltage drop that maybe caused by a short circuit in the secondary circuitry of the +35 VDC line. If a voltage drop is detected, it stops the operation of the switching circuit and then the output of the +35 VDC voltage.

An external switch is used to turn the printer power on or off. When the power switch is turned off, the switching circuit is de-energized and the output of the +35 VDC voltage is stopped. However, since the switch is in the secondary circuitry, the current continues to flow in the primary circuitry as long as the printer remains plugged into an external AC power source. For this reason, you must disconnect the printer from the external AC power source. Unplug the power cable from the AC power outlet before you perform any maintenance work.

Primary   Secondary

Full Wave
Rectification
Circuit — Smoothing
Circuit   Switching
Circuit   Smoothing
Circuit   +35 VDC

Filter Circuit

AC input

+5 V
Switching
Regulator   +5 VDC

+5V
Over Current
Control Circuit

+5V
Over Voltage
Control Circuit

Photo-
coupler ← +35 V Line
Detector Circuit   ZD51

Photo-
coupler ← +5 V Line Voltage
Overload
Protection Circuit   ZD53

+35 V Line
Voltage Overload
Protection Circuit   ZD52

+35 V Line
Voltage Drop
Protection Circuit

Switch

Figure 2-22. Power Supply Circuit Block Diagram

2-21

2.3 Control Circuit Operation

The control circuit consists of two circuit boards: the C094 MAIN (the main control circuit board) and the C094 PNL (the control panel circuit board). This section describes the operation of these boards.

2.3.1 Control Circuit Operation Overview

The CPU on the C094 MAIN is the 8-bit TM P90C041F microprocessor (9.83 MHz). It oversees control of all the components of the printer. The E05A66YA gate array contains various memory management functions that control the memory assignment and I/O areas. The output signals from each detector are sent to the analog input port of the CPU. The signals from the control panel are sent to the gate array, which in turn sends LED signals to the control panel. The two motors (CR and PF) are controlled by signals sent from the stepping motor control port of the CPU. Figure 2-23 shows the control circuits in block diagram form.
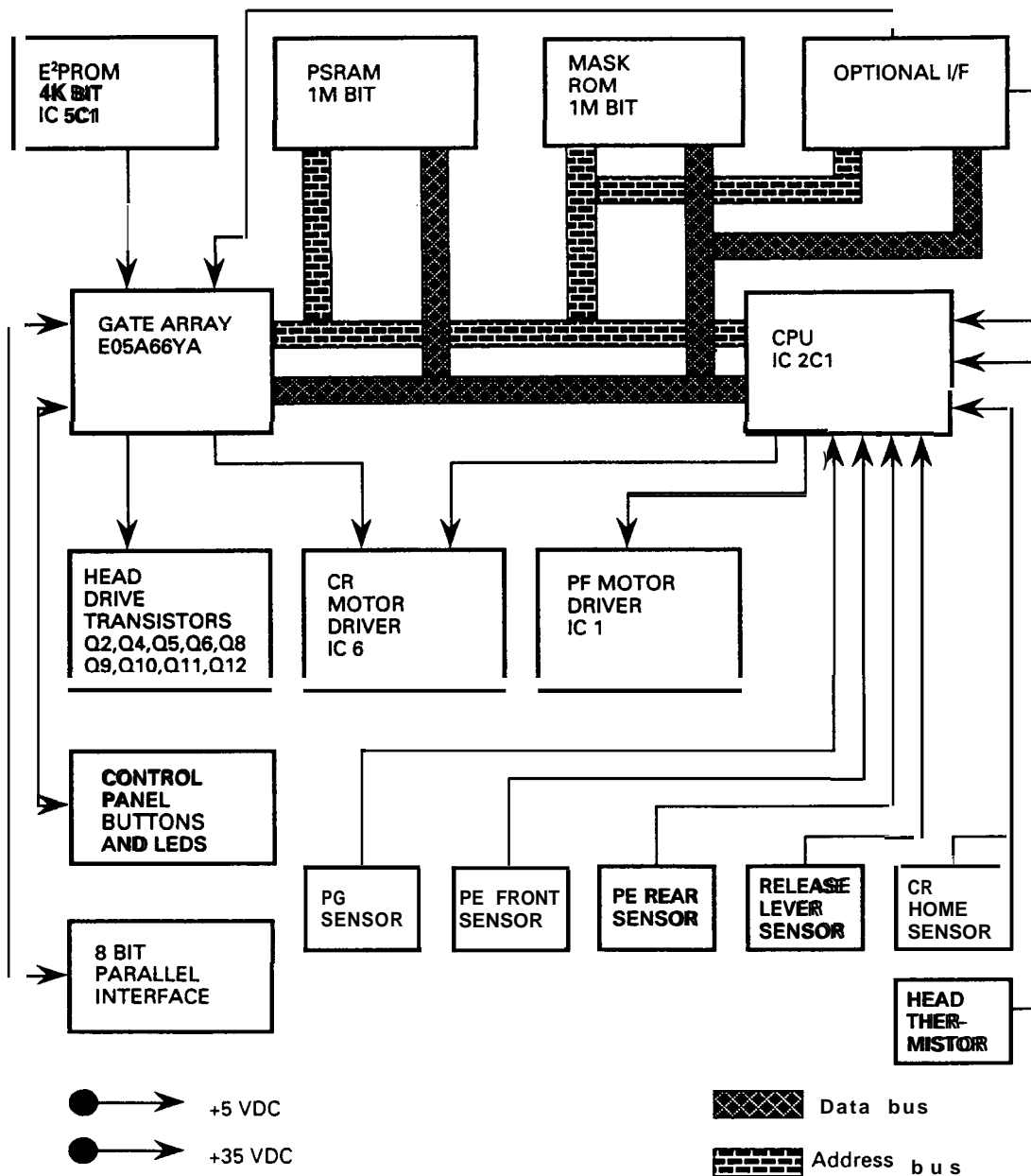
Figure 2-23. Control Circuit Block Diagram

Figure 2-24 shows the data flow from the host computer to the printhead. Data sent from the host computer is converted to image data and transmitted to the printhead through the gate array.
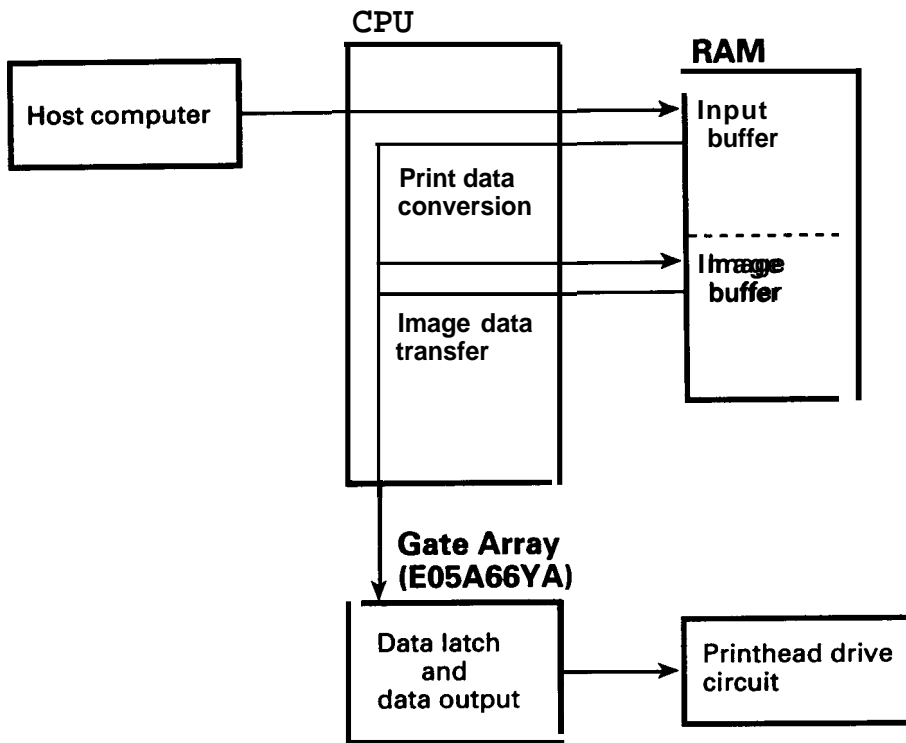
Figure 2-24. Data Flow

Table 2-4 lists the functions of the main components of the C094 MAIN.

Table 2-5. Functions of Main Components of C094 MAIN

IC or Circuit	Functions
TMP90C041F (2C1)	Receives data from the host computer and loads it to the input buffer in RAM. Expands the input data held in the buffer to create image data. Loads the image data to the image buffer in RAM. Transfers the image data to the printhead drive circuit. Also controls various printer mechanism parts, such as the motors.
E05A66YA (IC4)	This gate array mainly performs the following five functions: • Memory management • Centronics I/F control • Control panel control • E²PROM control • Printhead drive circuit control
PROM (IC3)	The PROM contains the program that runs the CPU.
RAM (IC2)	The RAM contains the CPU working area and the buffers.
E²PROM (5CI)	The E²PROM is used to store information such as the top-of-form position.
UPA1475H (ICI)	Drive circuit for PF motor
SLA7024M (IC5)	Drive circuit for CR motor

2.3.2 Reset Circuit

The control circuits are initialized when the $\overline{RESET}$ signal is issued. The reset operation occurs under these two conditions:

(1) Power on reset

   Immediately after the power is turned on, +35 VDC is rapidly generated. Because it takes a moment for the voltage at ZD2 to reach +31.5 V, the voltage at the DISC terminal on the gate array does not reach +5 VDC until capacitor C24 is fully charged. A similar integration circuit is provided in the gate array and further delays the output of the $\overline{ROUT}$ signal. This low level is used as a reset signal.

(2) INIT signal reset

   The reset signal is also issued when the INIT signal is sent from the host computer.

Figure 2-25 shows the power on reset circuit.
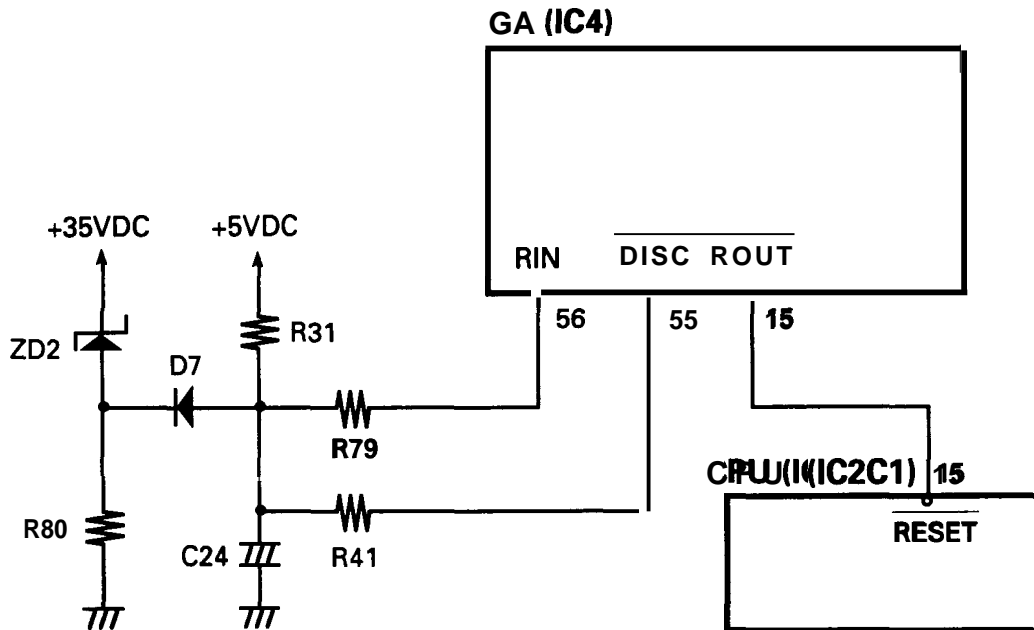
Figure 2-25. Power On Reset Circuit

2.3.3 Sensor Circuits

The FX-870/1170 printer has the following sensors: CRHOME, PE (FRONT), PE (REAR), PG (platen gap), RELEASE LEVER, and HEAD TEMPERATURE. All the sensors are momentary switches, except the PE (REAR) sensor, which is a photo diode, and the HEAD TEMPERATURE sensor, which is a thermistor.

In addition to the sensor circuits, the +35 V monitor circuit and the Vref circuit are also provided. The +35 V monitor circuit is used to set the pulse length of the head drive signal. If the voltage of the +35 V line drops below +31V (approx.), the printer stops printing fora while. As soon as the voltage recovers, the printer starts to print at a half speed. (The PF motor also slows down.) The Vref circuit is used to supply the reference voltage for the A/D convertor in the CPU.

The CPU constantly monitors the printhead temperature. If the printhead temperature exceeds the maximum level, the printer stops printing until the temperature drops to a certain level. When the printhead temperature cools down, the printer resumes printing automatically.

Figure 2-26 shows the sensor circuit block diagram.
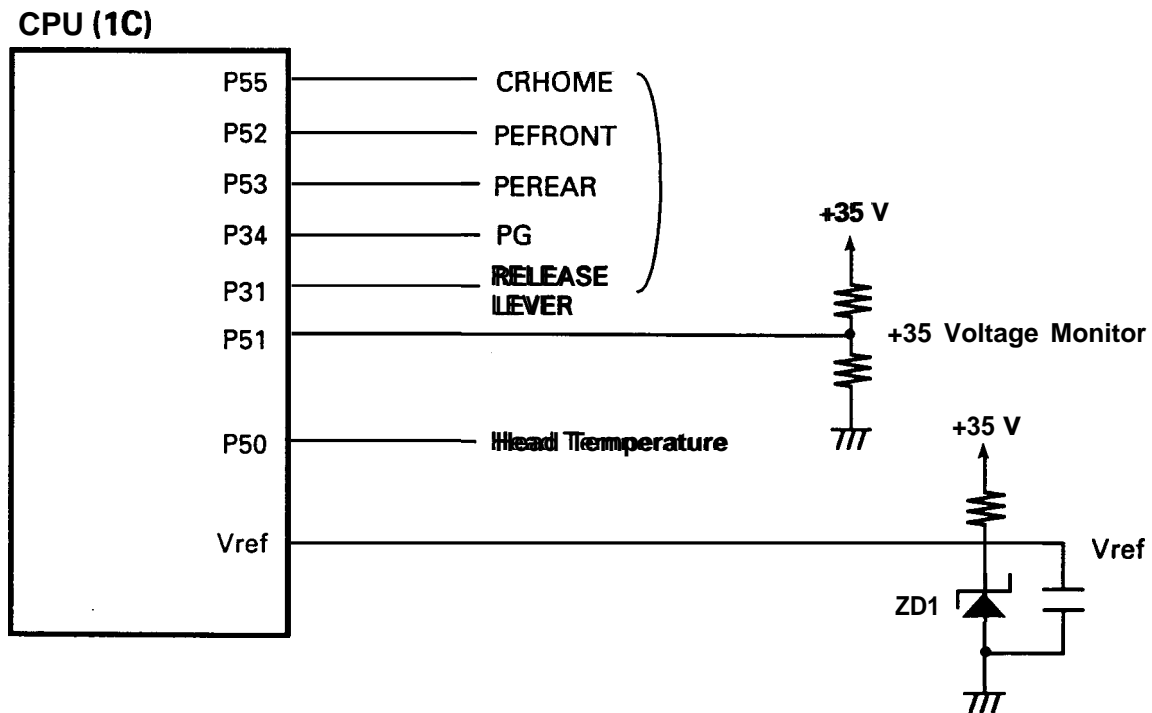
Figure 2-26. Sensor Circuit Block Diagram

2.3.4 Carriage Motor Drive Circuit

The carriage motor drive circuit controls the CR motor. An open loop, constant current drive arrangement runs the CR motor. 2-2 and 1-2 phases are used to excite the motor. A 2-2 phase step is equivalent to a 1-2 phase step doubled. Table 2-5 describes the motor drive modes.

The CR motor drive circuit of the SLA7024M(IC6) detects and regulates the amount of current flowing in the carriage motor coil. The current flowing through the coil varies depending on the speed of the CR motor. The CPU sets the amount of current via the I/O port of the gate array. Signals are sent to the ports (L, M, HOLD) on the SLA7024M. The SLA7024M sets the coil current depending on the CR motor speed.

The printer may stop printing to protect the CR motor from overheating if a continuous printing of short columns (less than 10 columns) is repeated.

The printer uses CPU ports P60 to P63 exclusively to control the CR motor.
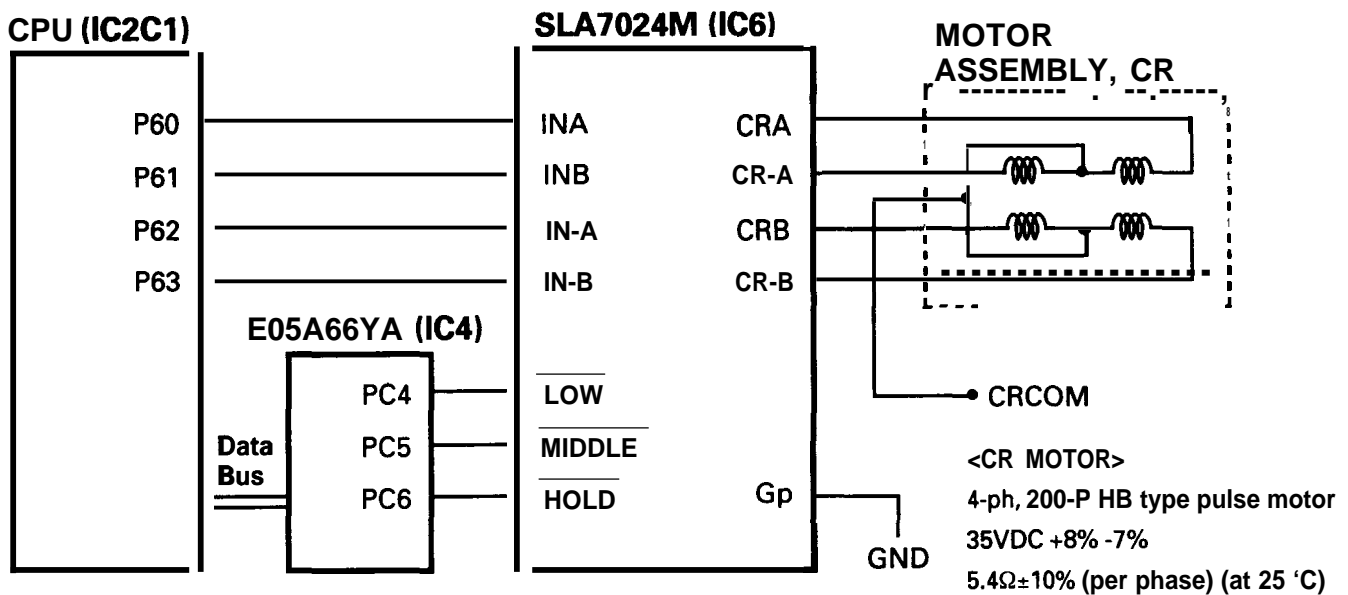
Figure 2-27. Carriage Motor Drive Circuit

Table 2-6. Carriage Motor Drive Modes

Speed mode	PPS	Excitation phase	Characters printed
4/3	4468	2-2	Superdraft
9/8	3840	2-2	Superdraft copy
1	3357	2-2	Draft 10 cpi
5/6	2800	2-2	
2/3	2240	2-2	4/3 High duty
1/2	1680	1-2	NLQ
5/12	1400	1-2	
1/4	840	1-2	
5/24	700	1-2	5/12 High duty
1/8	420	1-2	1/4 High duty

2.3.5 Paper Feed Motor Drive Circuit

The PF motor (a stepping motor) is used to advance the paper. The minimum advance rate is 1/216 inch. The motor is a 2-2 phase, constant voltage drive motor. CPU ports (P70 to P73) are used to control the PF motor. Phase data for the PF motor are outputted through these ports. PFA to PF-B are turned on or off within the uPA1476H(IC1) depending on the phase data sent from the CPU.

When there is an output at A19 of the CPU, a +35 V voltage is supplied to the PFCOM terminal of the PF motor. Otherwise, a +5 V voltage is supplied through D1 to hold the motor.
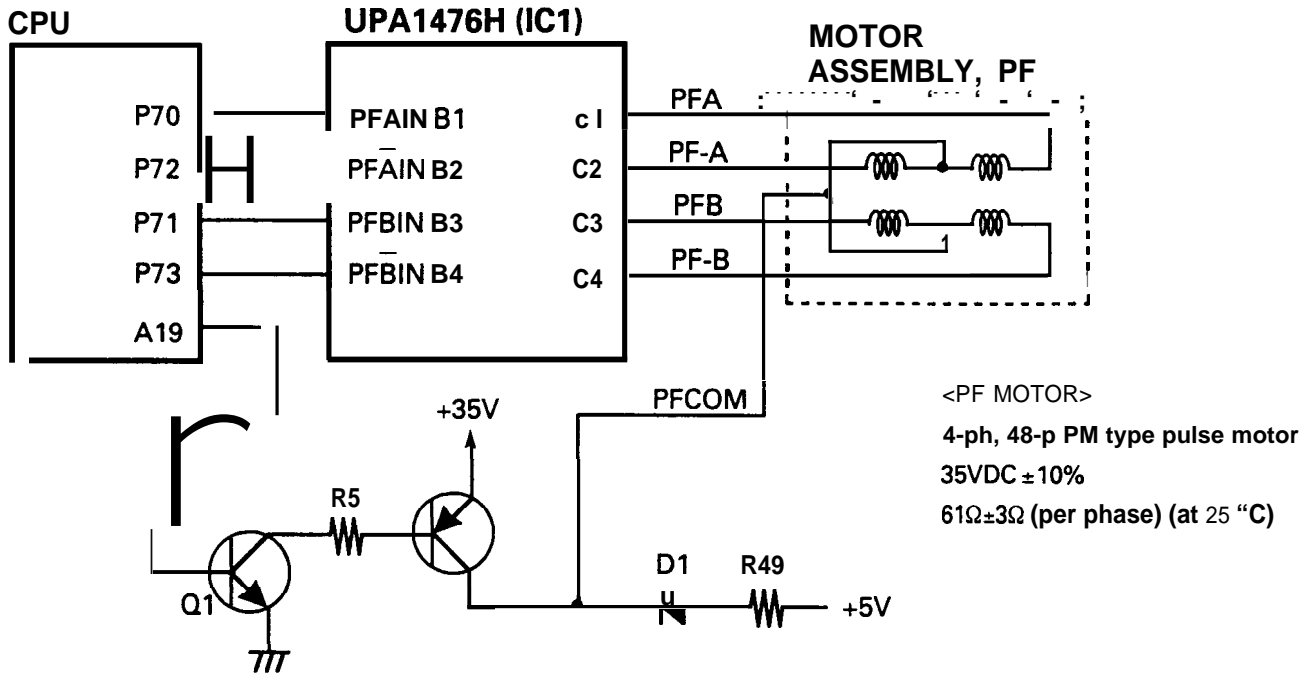
Figure 2-28. Paper Feed Motor Drive Circuit

2.3.6 Printhead Drive Circuit

The printhead drive circuit receives two types of signals; image data and the pulse length control signal. Image data is created in the CPU, transferred to the gate array, and latched to the printhead. The pulse length control signal is set by the CPU. The pulse length is adjusted referring to the voltage of the +35 V line. These two types of signals are sent to the printhead to print each dot. Figure 2-29 shows the printhead drive circuit.
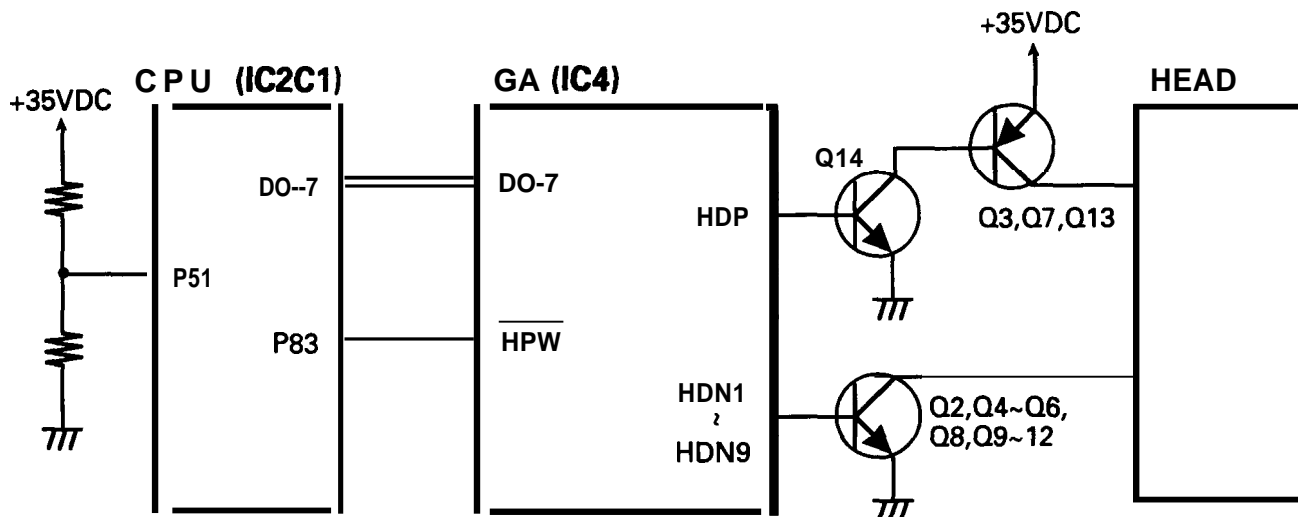
Figure 2-29. Printhead Drive Circuit

2.3.7 Parallel Interface Circuit

The parallel interface circuit controls the data flow from the host computer. When a $\overline{\text{STROBE}}$ signal is sent from the host computer, the data is latched into the gate array (E05A66YA). Data is transmitted until a BUSY signal is automatically sent back to the host computer to stop the data. Then the gate array outputs an IBF signal to P82 (the interrupt signal port) of the CPU. The CPU then reads the data latched into the gate array and, on completion of the reading, resets the BUSY signal to enable the host computer to send more data. Figure 2-30 shows the parallel interface circuit.
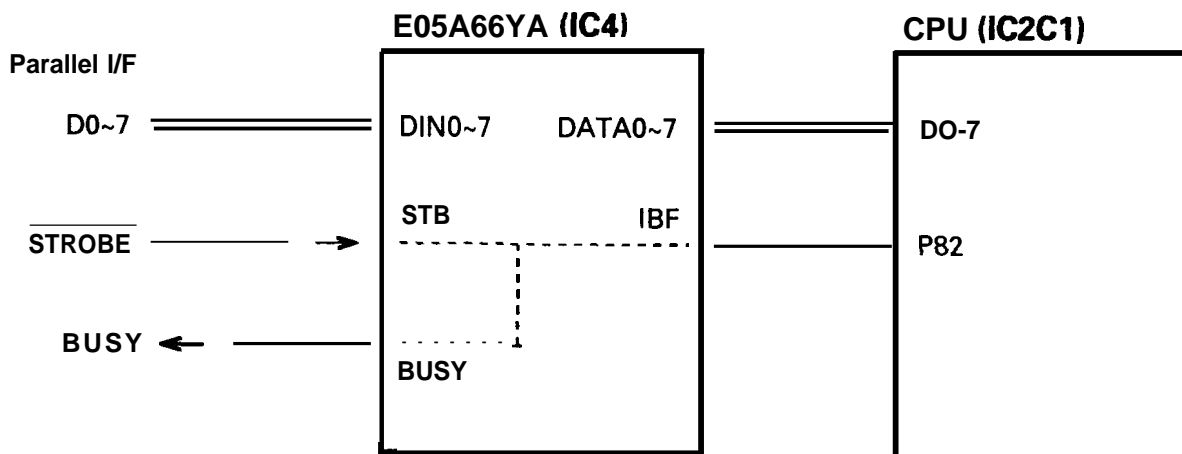
Figure 2-30. Parallel Interface Circuit

2.3.8 E²PROM Control Circuit

Figure 2-31 shows the E²PROM control circuit. The E²PROM is non-volatile memory containing information such asthetop-of-form position. Because the E²PROM is a serial I/O device, the gate array converts the parallel data (sent from the host computer) into serial data.
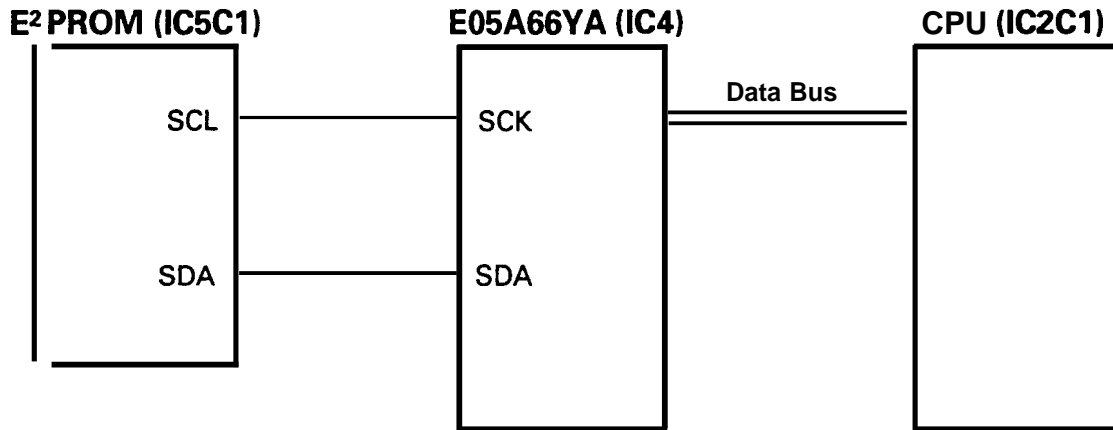
Figure 2-31. E²PROM Control Circuit

CHAPTER 3

DISASSEMBLY AND ASSEMBLY

CHAPTER 3

LIST OF FIGURES

LIST OF TABLES

3.1 Overview

This section describes the information you need to know before you disassemble or assemble the printer.

3.1.1 Precautions

Follow the precautions below before you disassemble or assemble the printer.

```
┌──────────────────────── WARNING ────────────────────────┐
│ Before disassembling, assembling, or adjusting the printer, disconnect the power supply cable from │
│ the AC power outlet. Failure to do so may cause physical injury. The power switch is wired in the │
│ secondary circuitry. Therefore, the printer's primary circuitry remains live even after the power switch │
│ is turned off. │
└──────────────────────────────────────────────────────────┘
```

```
┌──────────────────────── CAUTION ────────────────────────┐
│ To maintain optimum printer operation, use only the recommended tools for maintenance work. │
│ Also only the lubricants recommended in Chapter 6. Adjust the printer only as described in this │
│ manual. (See Chapter 4.) │
└──────────────────────────────────────────────────────────┘
```

3.1.2 Tools

Tables 3-1 and 3-2 list the recommended tools needed to disassemble, assemble, or adjust the printer. Use only tools that meet these specifications.

Table 3-1. Recommended Tools

Tool	Part No.
Round-nose pliers	B740400100
Nippers	B740500100
Tweezers	B741000100
Soldering iron	B740200100
E-ring holder #2.5	B740800400
Phillips screwdriver no.2	B743800200
Normal screwdriver	B743000100
Thickness gauge	

Note: **All the tools in the table above are commercially available.**

Table 3-2. Equipment Required for Maintenance

Description	Specification
Multimeter	
Oscilloscope	20 MHz

3.1.3 Service Checks After Repair

Before you send the printer back to the customer, fill in the checklist in Table 3-3 to note the current state of the components. This checklist facilitates servicing and shipping.

Table 3-3. Inspection Checklist for Repaired Printer

Category	Component	Items to Check	Is Check Required?
Printer features	Printhead •	Are any wires broken?	❑ Checked, ❑ Not necessary
		Are any wires worn out?	Checked, •❙ Not necessary
	Carriage mechanism	Does the carriage move smoothly? ❑ ❙Movement noisy, Mechanism dirty, (Mechanism oily	❑ Checked, ❑ Not necessary
		Is the carriage motor at the correct temperature and not overheating?	❑ Checked, Not necessary
	Paper advance mechanism	Is paper advancing smoothly? ❑ Movement noisy, ❑ Mechanism dirty, Mechanism oily	❑ Checked, Not necessary
		Is the paper advance motor running at the correct temperature and not overheating?	Checked, ❑ Not necessary
	Paper path	Is the type of paper in the printer feeding smoothly?	Checked, •❙ Not necessary
		Is the tractor feeding the paper correctly?	❑ Checked, Not necessary
		Is the paper path clear of all obstructions?	Checked, •❙ Not necessary
		Is the platen free of damage?	Checked, ❑ Not necessary
	Ribbon mask	Is ribbon mask free of distortion?	Checked, •❙ Not necessary
	Self-print test	Was the self-print successful?	❑ Checked, Not necessary
	On-1ine test	Was the on-line test successful?	❑ Checked, ❑ Not necessary
Adjustment	Printhead	Is the platen gap adjusted correctly?	Checked, •❙ Not necessary
	Printing	Is the bidirectional alignment adjusted correctly?	Checked, ❑ Not necessary
System upgrade	ROM version	The ROM version is XXX.	❑ Checked, ❑ Not necessary
	Shipment	Has the ribbon been removed?	❑ Checked, ❑ Not necessary
	•	Have all the required parts been included in the shipment?	Checked, ❑ Not necessary
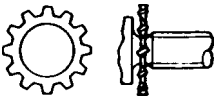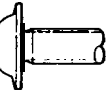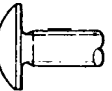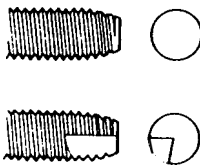
3.1.4 Screw Specifications

This chapter uses abbreviations for small parts, such as screws and washers. Tables 3-4 and 3-5 list these abbreviations.

Table 3-4. Abbreviations Used for Screws

Abbreviation	Part Name
CBB	Cross-recessed Bind head B tight screw
CBC	Cross-recessed Bind head C tight screw
CBN	Cross-recessed Bind head N tight screw
CBS	Cross-recessed Bind head S tight screw

Table 3-5. Screw Types and Abbreviations

Head		Body	Washer (assembled)
Top	Side		
1. Cross-recessed head	1. Bind	1. Normal	1. Plain washer
2. Slotted head	(with Notch)	2. S-tight	2. Outside toothed lock washer
	2. Pan	3. B-tight	
	3. Cup	4. Tapping	3. Spring washer
	4. Truss		

3.2 Disassembly and Assembly

This section describes the procedures for disassembling and assembling the main components of the printer. In general, you can install a component in the printer by simply reversing the procedure for removing the component. Therefore, this chapter does not describe assembly procedures in most cases.

If necessary, special notes on assembling or adjusting a component are given at the end of the description of each procedure. Be sure to follow the instructions in these notes.

```
──────────────── WARNING ────────────────
  Before disassembling the printer, read the warning in Section3.1.
```

```
──────────────── CAUTION ────────────────
  Before disassembling any part of the printer, remove the paper and the ink ribbon. Also disconnect
  the interface cable.
```

Note: Exploded diagrams in the appendix show how the components fit together. Refer to them as
      necessary. The flowchart below shows the order in which you need to disassemble the printer.
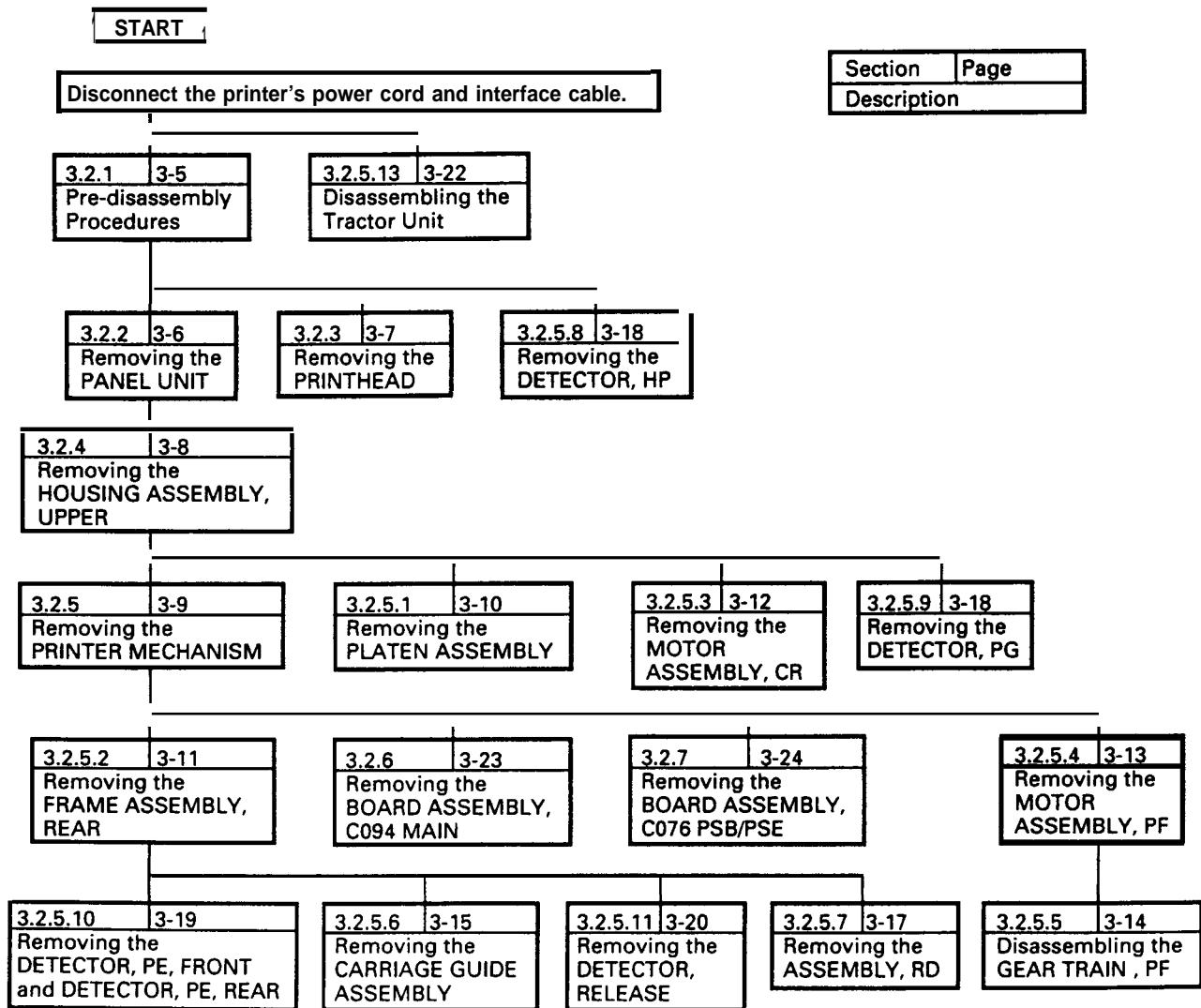
Figure 3-1. Flowchart for Disassembling the Printer

3.2.1 Pre-disassembly Procedures

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit.
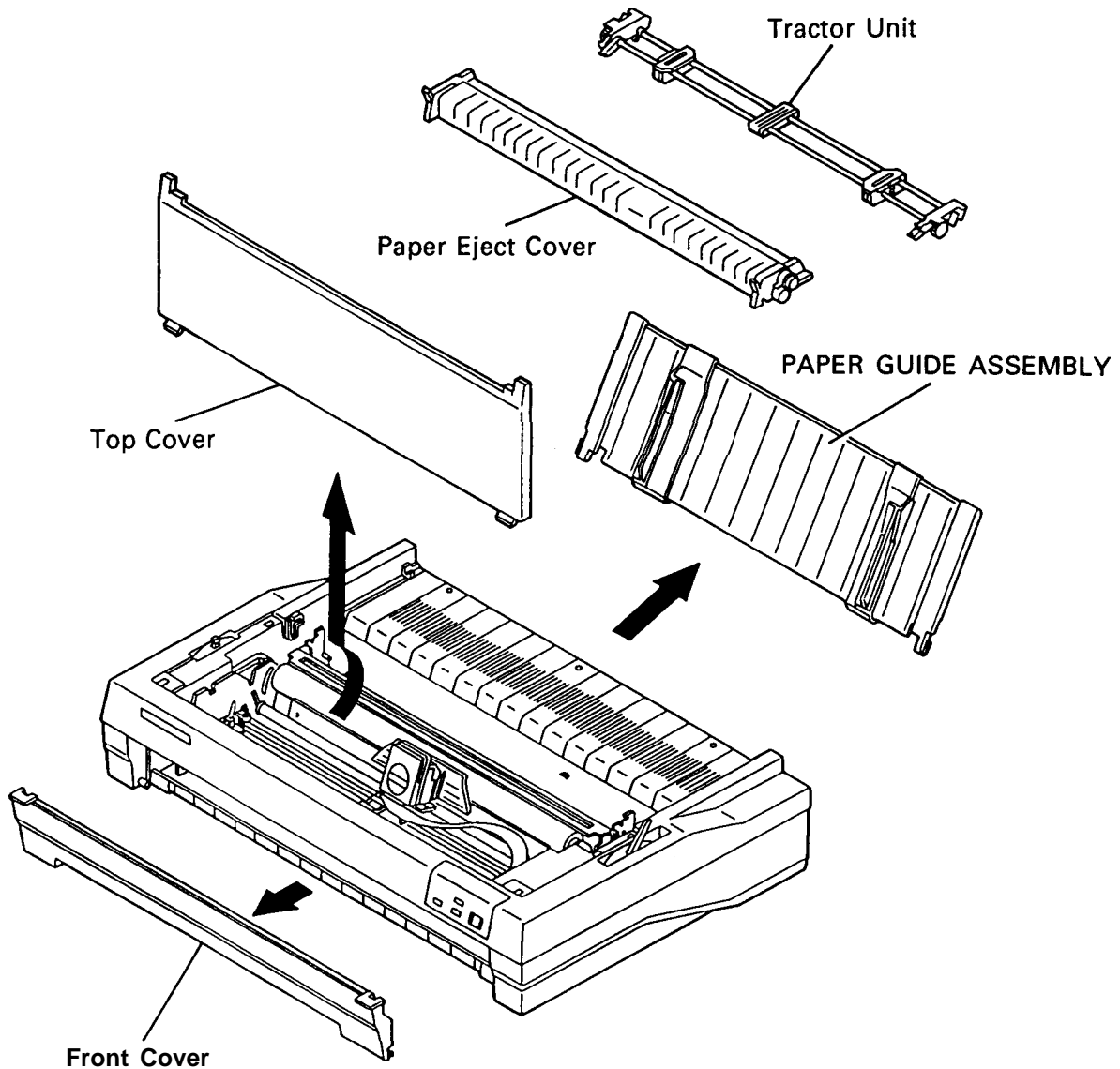
Figure 3-2. Removing the PAPER GUIDE ASSEMBLY

Note: Remove the paper eject cover and the tractor unit by pushing and releasing the hooks at both sides. When remounting them, be sure to snap these hooks on the projecting parts.

3.2.2 Removing the PANEL UNIT

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit.
(See Section 3.2.1.)

[STEP 2]   Push the two clips on the bottom of the panel unit and remove the PANEL UNIT.

[STEP 3]   Remove the flexible flat cable (FFC cable).
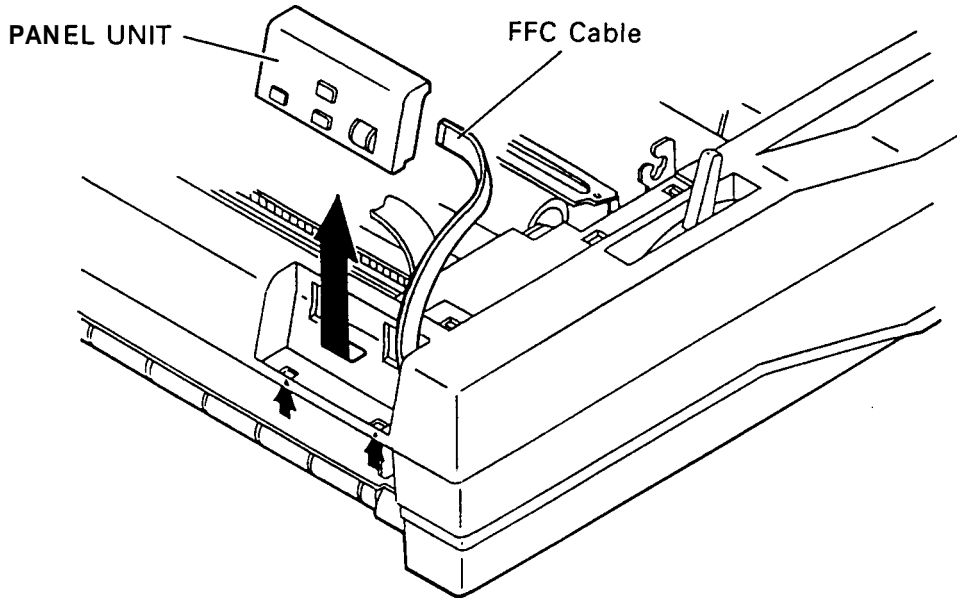
Figure 3-3. Removing the PANEL UNIT

───── Assembly Note ─────

The FFC cable must be connected properly, as shown below.

Plain Face

FFC Cable

Face with exDosed
terminals at the end
of the cable.
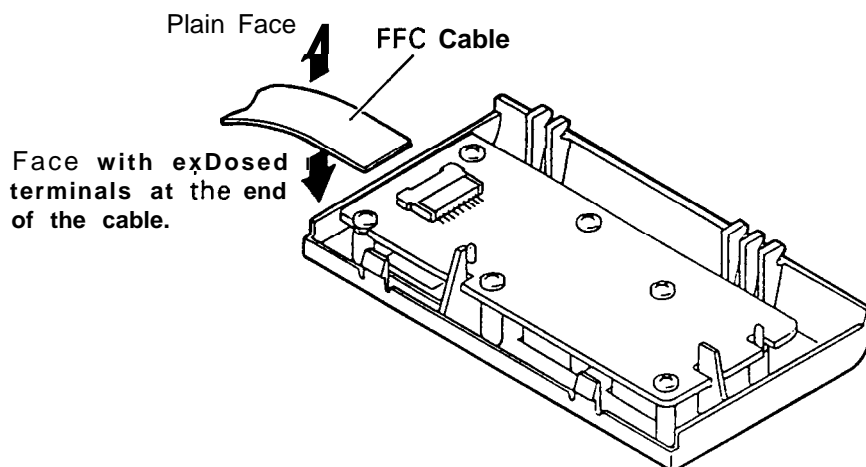
Figure 3-4. Connecting the FFC Cable to the PANEL UNIT

3.2.3 Removing the **PRINTHEAD**

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)

[STEP 21   Remove the two CBS (M3X8) screws and the FFC cable from the PRINTHEAD.

[STEP 31   Remove the PRINTHEAD.
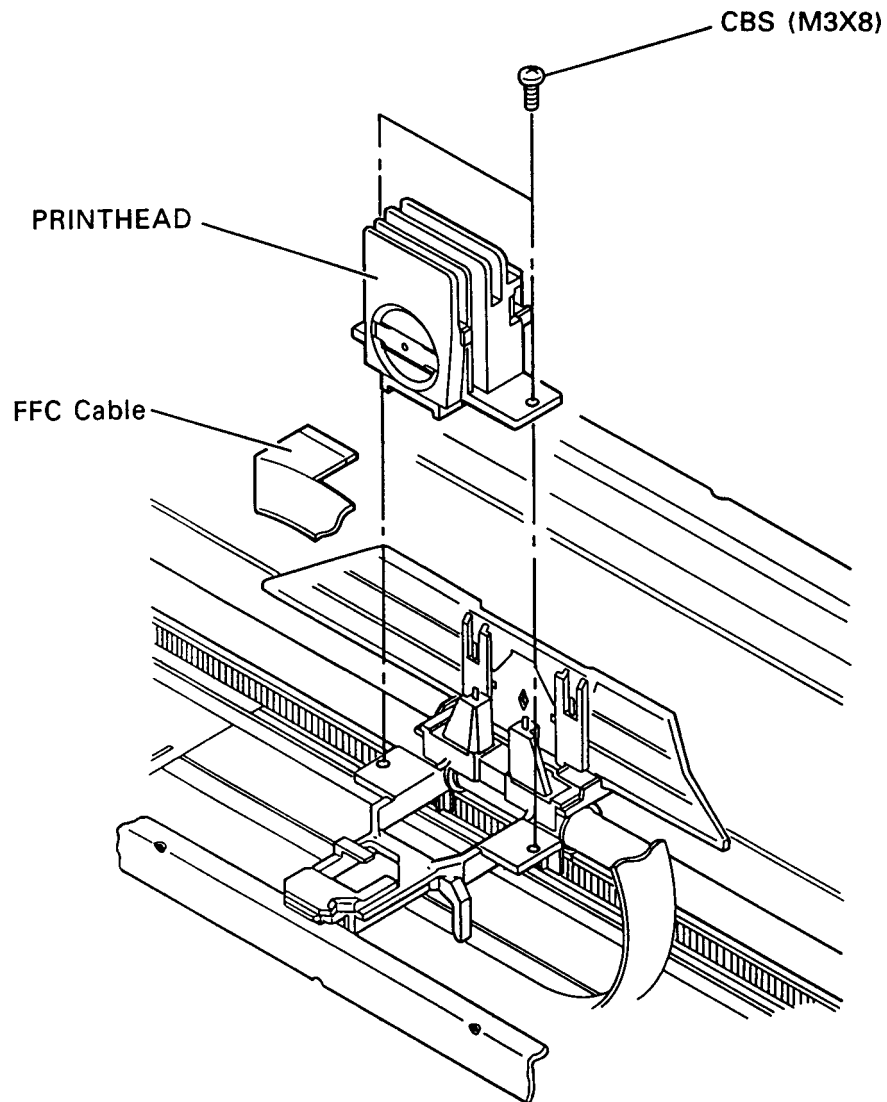
Figure 3-5. Removing the PRINTHEAD

3.2.4 Removing the HOUSING ASSEMBLY, UPPER

[STEP 1] **Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)**

[STEP 2] **Remove the PANEL UNIT. (See Section 3.2.2.)**

[STEp 3] **Remove the three CBC (M4X15) screws securing the HOUSING ASSEMBLY, UPPER. (There are only two screws in the 80-column printer.)**

[STEP 4] **Push the two hooks through the cutouts located on the front cover to disengage the hooks from the plates. Lift up the front side of the HOUSING ASSEMBLY, UPPER.**

[STEP 5] **Remove the HOUSING ASSEMBLY, UPPER.**
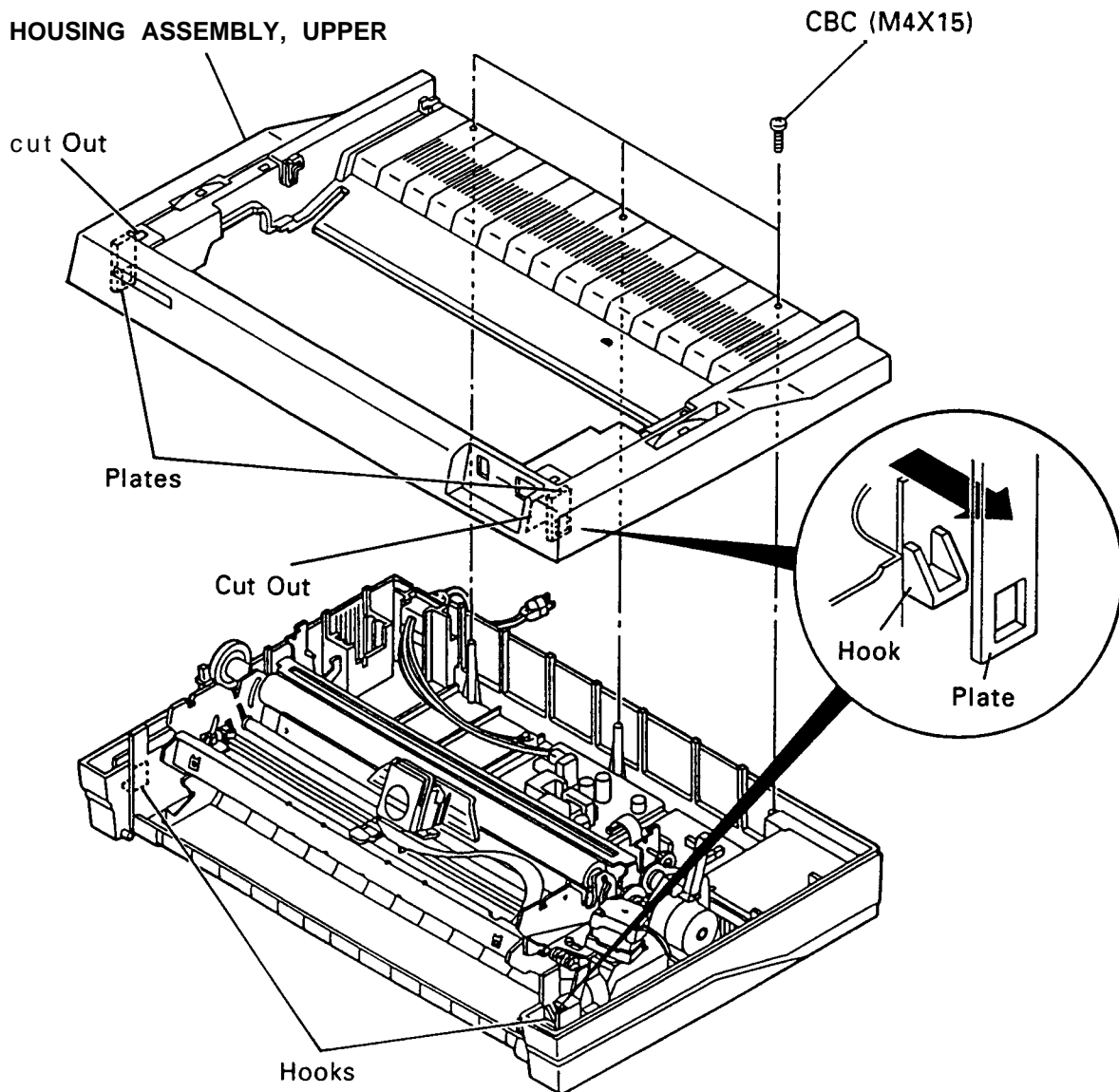
Figure 3-6. Removing the HOUSING ASSEMBLY, UPPER

Note: The figure above shows the 136-column printer.

3.2.5 Removing the PRINTER MECHANISM

[STEP 1] **Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)**

[STEP 2] **Remove the PANEL UNIT. (See Section 3.2.2.)**

[STEP 3] **Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)**

[STEP 4] **Remove the four CBB(M4X12) screws securing the PRINTER MECHANISM.**

[STEP 5] **Remove the CBS (M3X6) screw securing the INTERFACE COVER.**

[STEP 6] **Disconnect the following connectors on the BOARD ASSEMBLY, MAIN: CN3 (2-pin, Blue), CN4 (2-pin, White), CN5 (2-pin, Black), CN6 (6-pin), CN7 (2-pin, Yellow), CN8 (14-pin), CN9 (3-pin), CN12 (IO-pin), and CN13 (5-pin).**

[STEP 7] **Remove the PRINTER MECHANISM.**
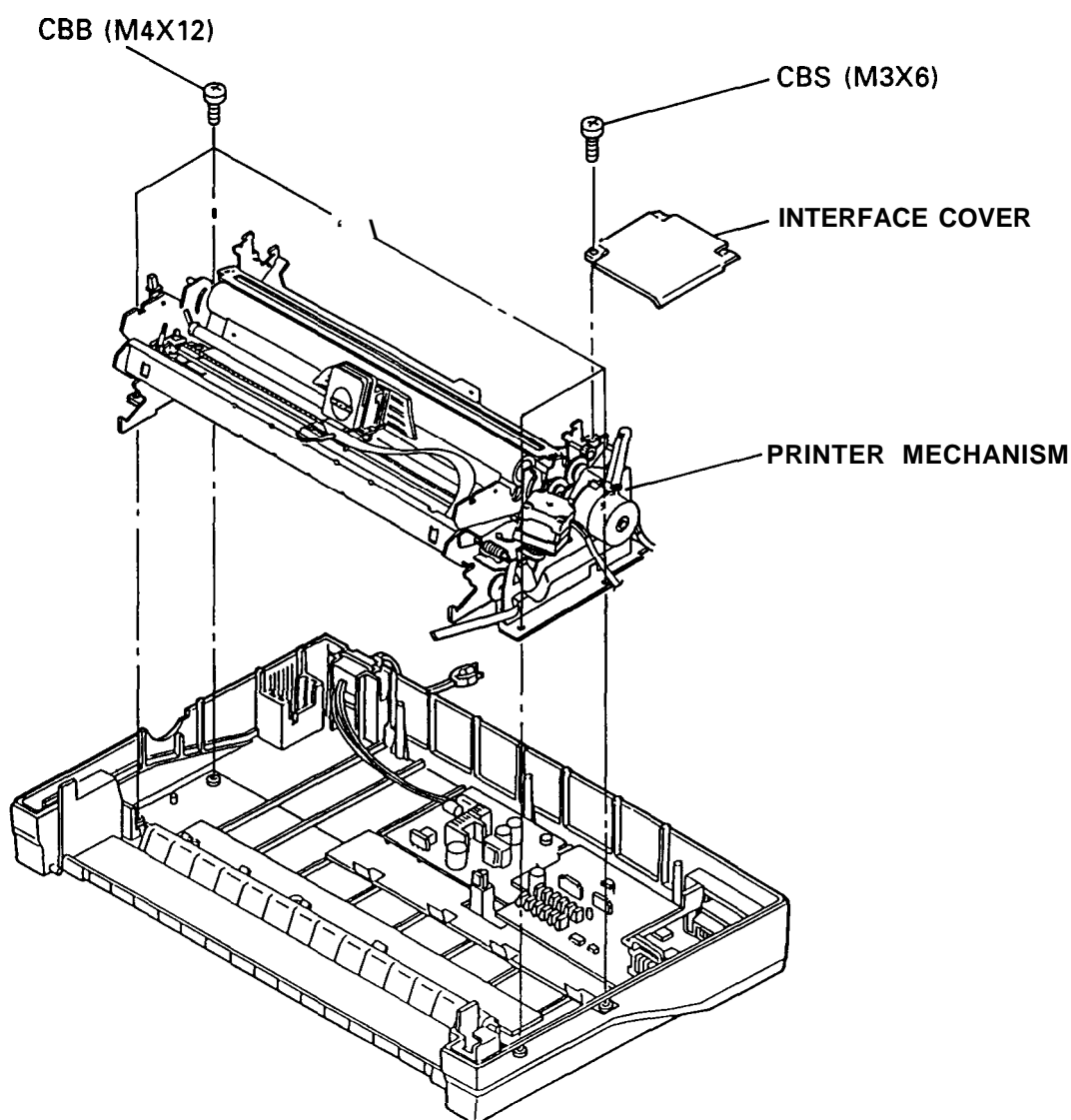
Figure 3-7. Removing the PRINTER MECHANISM

3.2.5.1 Removing the PLATEN ASSEMBLY

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)

[STEP 21   Remove the PANEL UNIT. (See Section 3.2.2.) -

[STEP 31   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4]   Remove the two CBS (M3X8) screws securing the COVER, PLATEN.

[STEP 51   Disengage the teeth of the PLATEN SHAFT HOLDERS and rotate them.

[STEP 61   Remove the PLATEN KNOB.

[STEP 7]   Slide the PLATEN ASSEMBLY and remove it.
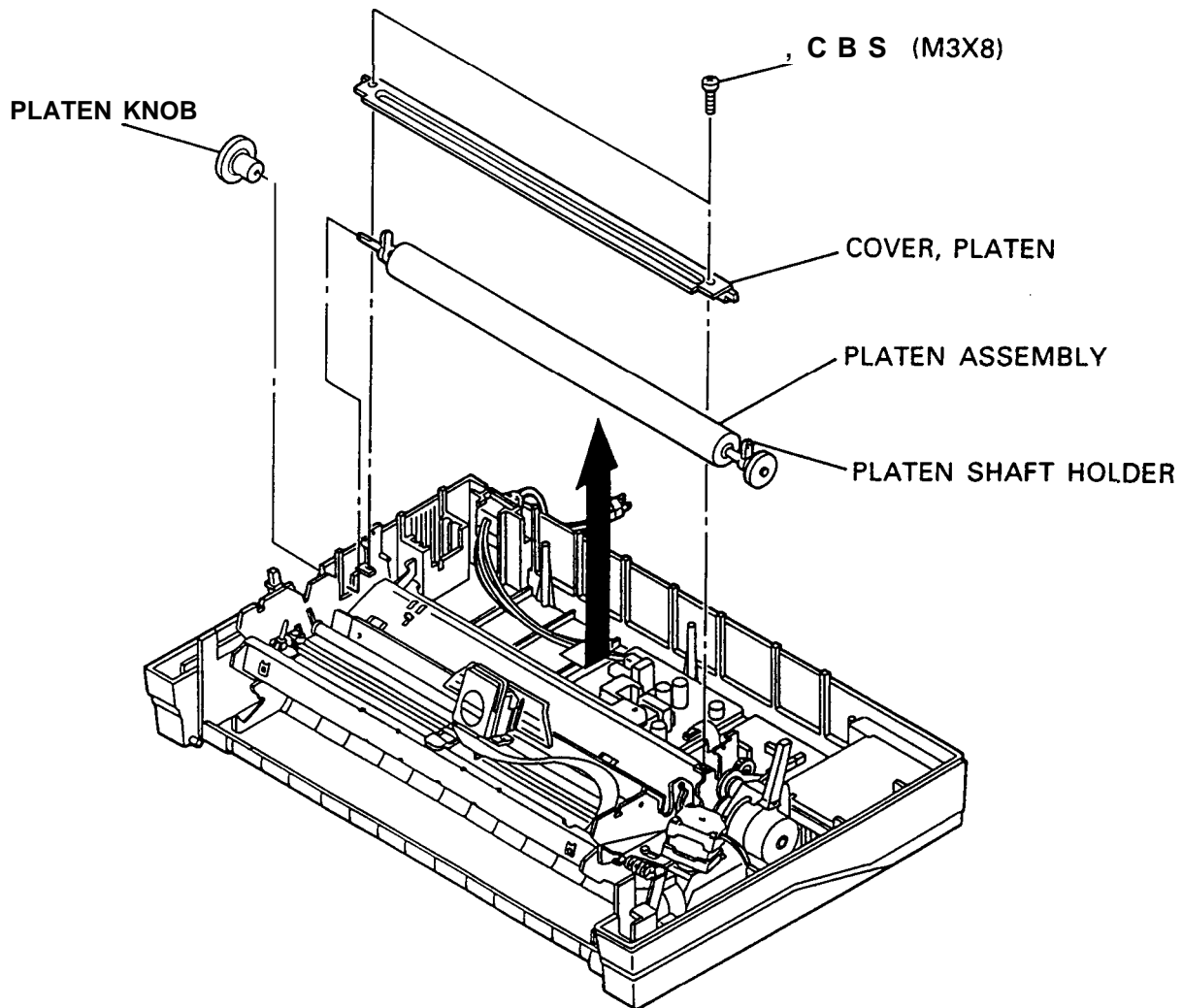
Figure 3-8. Removing the PLATEN ASSEMBLY

3.2.5.2 Removing the FRAME ASSEMBLY, REAR

[STEP 1]   **Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)**

[STEP 2]   **Remove the PANEL UNIT. (See Section 3.2.2.)**

[STEP 3]   **Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)**

[STEP 4]   **Remove the PRINTER MECHANISM. (See Section** 3.2.5.)

[STEP 5]   Remove **the PLATEN ASSEMBLY. (See Section 3.2.5.1.)**

[STEP 6]   **Remove the four CBS (M3X8) screws securing the LEFT FRAME of the PRINTER MECHANISM, and the nut and washer securing the LEVER, G, ADJUST. Remove the BUSHING, PARALLEL, ADJUST. Remove the LEFT FRAME.**

[STEP 7]   **Remove the FFC cables from the RIGHT FRAME of the PRINTER MECHANISM, and then the two CBS (M3X8) screws securing the RIGHT FRAME.**

[STEP 8]   **Remove the FRAME ASSEMBLY, REAR.**

[STEP 9]   **Push the clip on the back of the FRAME ASSEMBLY, REAR. Slide out the FRAME, REAR.**
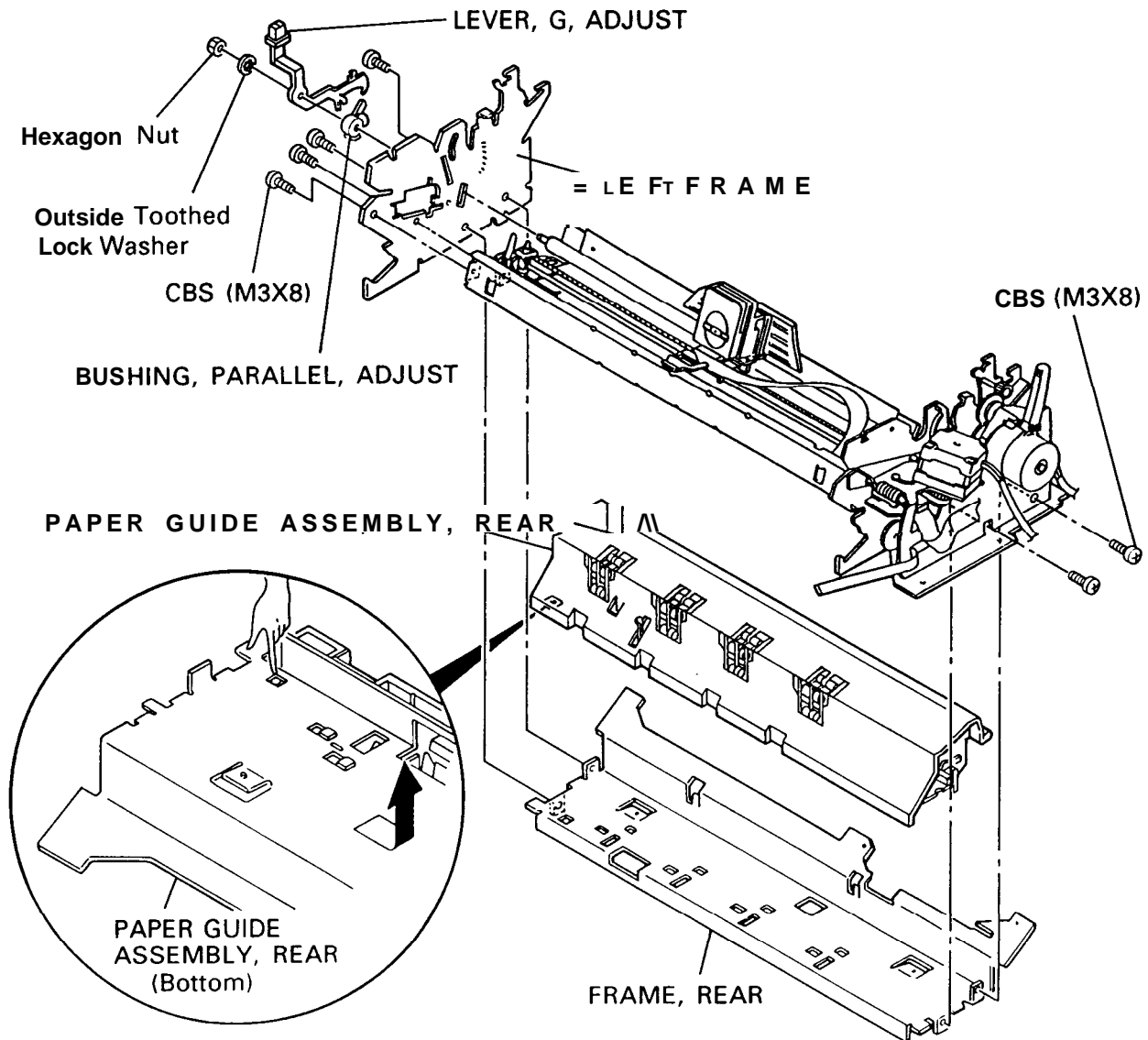
Figure 3-9. Removing the FRAME ASSEMBLY, REAR

3.2.5.3 Removing the MOTOR ASSEMBLY, CR

[STEP 1] Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)

[STEP 2] Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3] Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4] Remove the face screw (M3X7) securing the MOTOR ASSEMBLY, CR. After releasing the tension spring, disengage the TIMING BELT from the MOTOR ASSEMBLY, CR and hang it on the hook.

[STEP 5] Disconnect the connector CN13 on the BOARD ASSEMBLY, C094 MAIN. Remove the MOTOR ASSEMBLY, CR.

[STEP 6] Remove the two CBN (M3X6) screws on the back of the MOTOR ASSEMBLY, CR. Remove the MOTOR ASSEMBLY, CR.
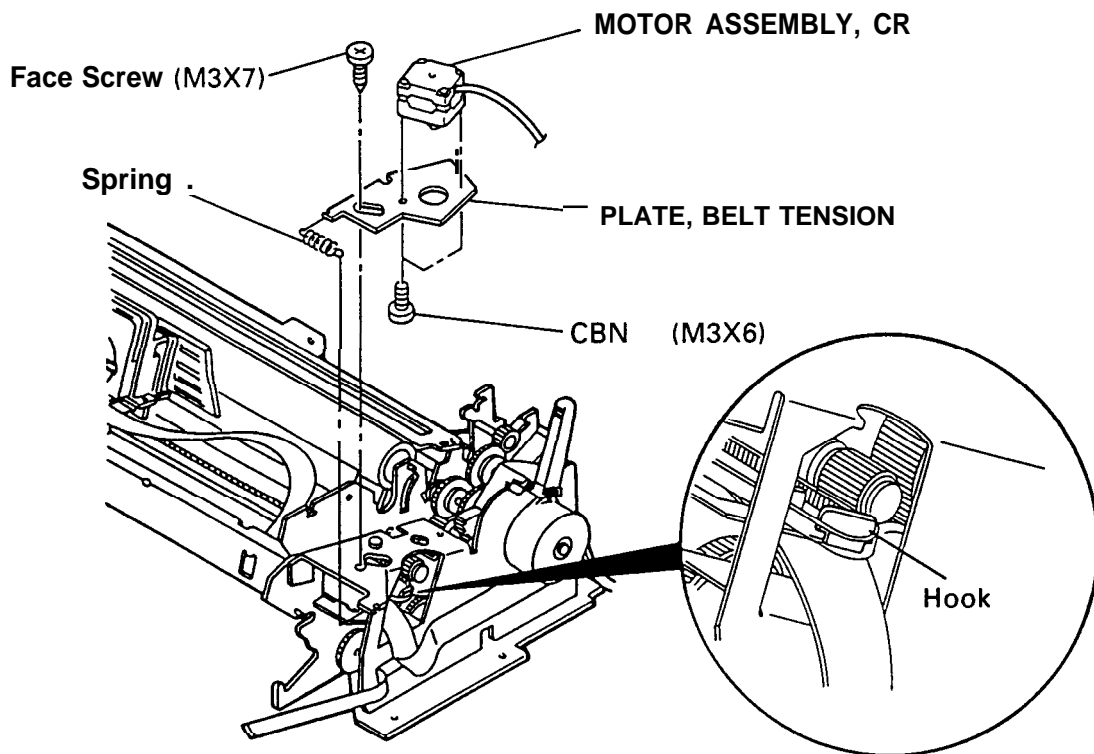
Figure 3-10. Removing the MOTOR ASSEMBLY, CR

― Assembly Note ―

Position the MOTOR ASSEMBLY, CR on the PLATE, BELT TENSION correctly as shown below.
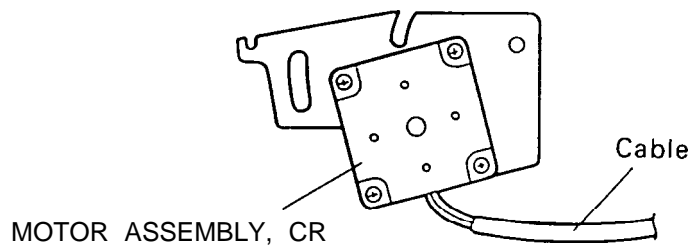
Figure 3-11. Positioning the MOTOR ASSEMBLY, CR

3.2.5.4 Removing the MOTOR ASSEMBLY, PF

[STEP 11   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit.
           (See Section 3.2.1.)
[STEP 21   Remove the PANEL UNIT. (See Section 3.2.2.)
[STEP 31   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)
[STEP 41   Remove the PRINTER MECHANISM. (See Section 3.2.5.)
[STEP 51   Set the LEVER, RELEASE to the vertical or forward position.
[STEP 61   Remove the FFC cables and then the two CBS (M3X8) screws securing the MOTOR ASSEMBLY, PF.
[STEP 71   Remove the MOTOR ASSEMBLY, PF.
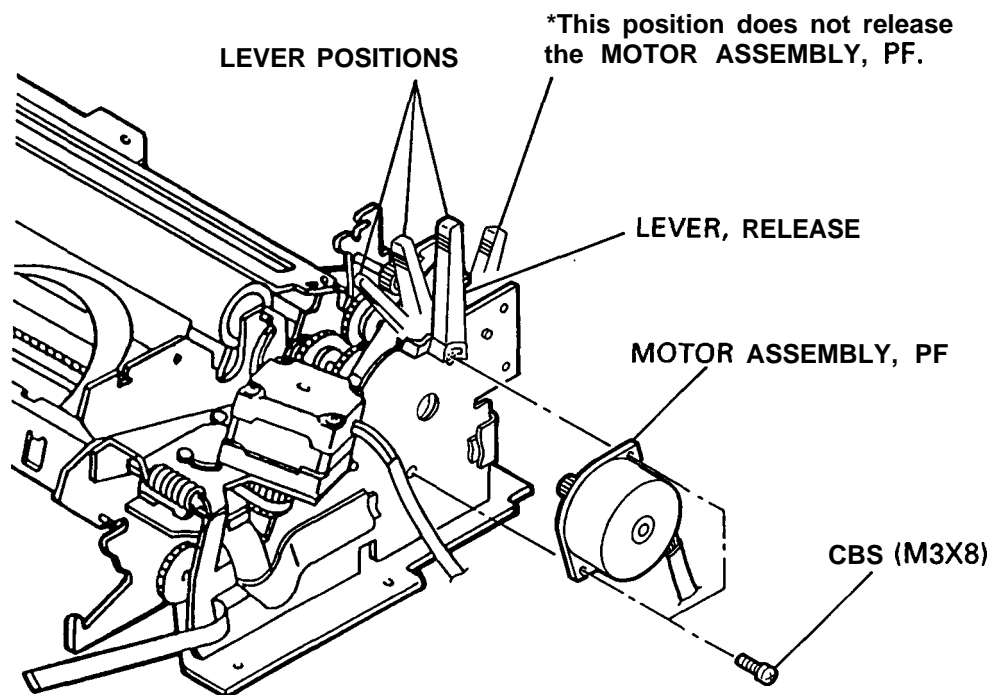
Figure 3-12. Removing the MOTOR ASSEMBLY, PF

3.2.5.5 Disassembling the GEAR TRAIN, PF

[STEP 1] Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)

[STEP 2] Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3] Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4] Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 5] Remove the MOTOR ASSEMBLY, CR. (See Section 3.2.5.3.)

[STEP 6] Remove the MOTOR ASSEMBLY, PF. (See Section 3.2.5.4.)

[STEP 7] Remove the FFC cables from the FRAME, SUB, RIGHT of the PRINTER MECHANISM, and then remove the two CBS (M3X8) screws securing the FRAME, SUB, RIGHT.

[STEP 8] Remove the FRAME, SUB, RIGHT.

LEVER, RELEASE

FRAME, SUB, RIGHT

CBS (M3X8)

FFC Cables

1
CAM, CLUTCH, TRACTOR
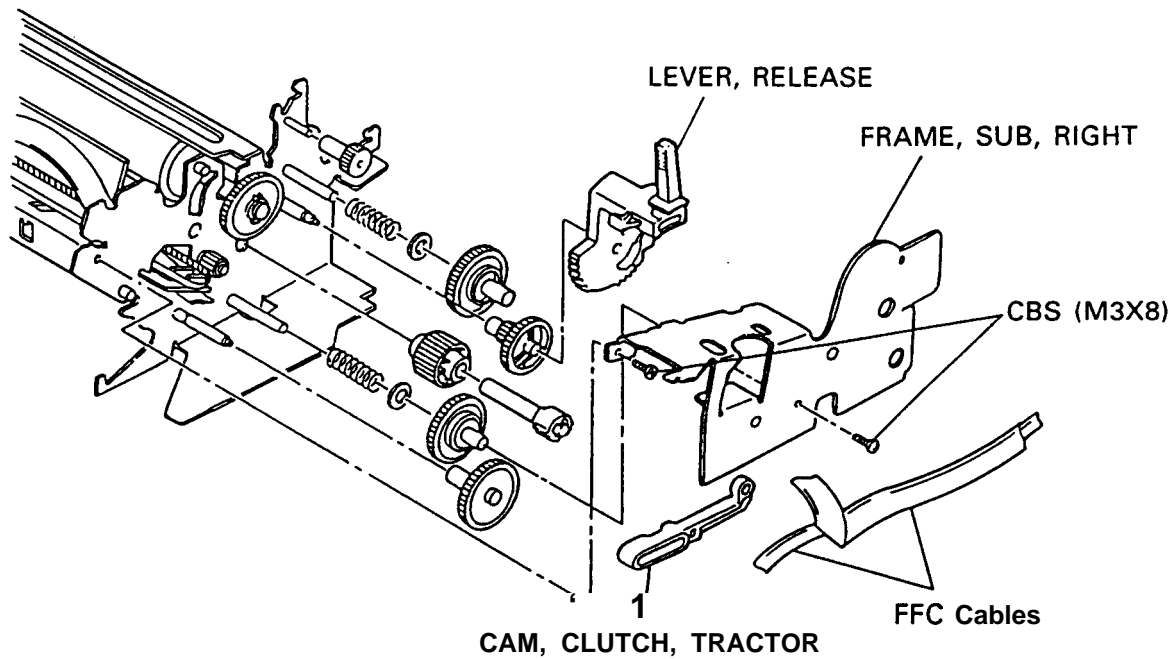
Figure 3-13. Disassembling the GEAR TRAIN, PF

Assembly Note

Be sure to properly mesh the LEVER, RELEASE with the mechanism.
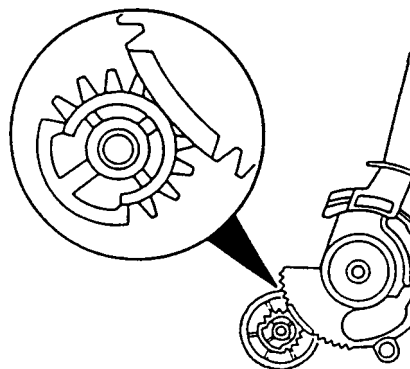
Figure 3-14. Positioning the LEVER, RELEASE for Insertion

3.2.5.6 Removing the CARRIAGE GUIDE ASSEMBLY

[STEP 1] Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)

[STEP 2] Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3] Remove the PRINTHEAD. (See Section 3.2.3.)

[STEP 4] Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 5] Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 6] Remove the PLATEN ASSEMBLY. (See Section 3.2.5.1.)

[STEP 7] Remove the LEFT FRAME of the PRINTER MECHANISM. (See Section 3.2.5.2.)

[STEP 8] Disengage the TIMING BELT from the MOTOR ASSEMBLY, CR. (See Section 3.2.5.3.)

[STEP 9] Release the TIMING BELT from the two clips at the bottom of the CARRIAGE ASSEMBLY.

[STEP 10] Move the CARRIAGE ASSEMBLY to the MOTOR ASSEMBLY, CR. Remove the CARRIAGE ASSEMBLY from the rack.
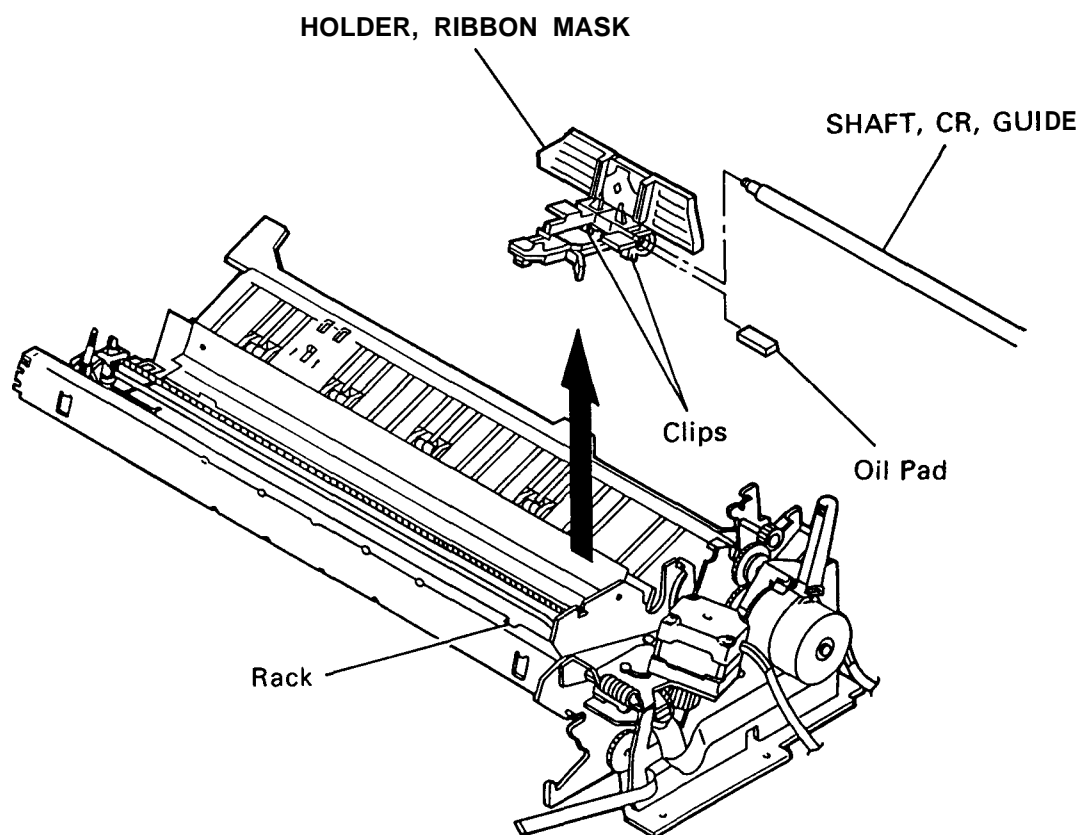
Figure 3-15. Removing the CARRIAGE GUIDE ASSEMBLY

Assembly Note

When attaching the **TIMING BELT** to the **CARRIAGE ASSEMBLY**, secure the **TIMING BELT** using the left and right clips of the **CARRIAGE ASSEMBLY** as shown below. Make sure there is no slack in the **TIMING BELT**.

Clip
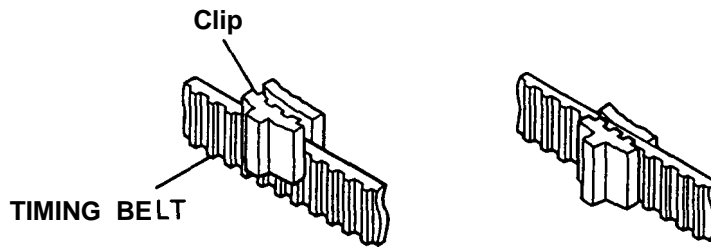
TIMING BELT

Figure 3-16. Attaching the TIMING BELT

3.2.5.7 Removing the Ribbon Drive (RD) ASSEMBLY

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)

[STEP 2]   Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3]   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4]   Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 5]   Remove the PLATEN ASSEMBLY. (See Section 3.2.5.1.)

[STEP 6]   Remove the LEFT FRAME of the PRINTER MECHANISM. (See Section 3.2.5.2.)

[STEP 7]   Disengage the TIMING BELT from the MOTOR ASSEMBLY, CR. (See Section 3.2.5.3.)

[STEP 8]   Remove the CARRIAGE GUIDE ASSEMBLY. (See Section 3.2.5.7.)

[STEP 9]   Remove the CBC (M3X8) screw and the CBB (M3X8) screw securing the RD ASSEMBLY.

[STEP 10]   Remove the RD ASSEMBLY.
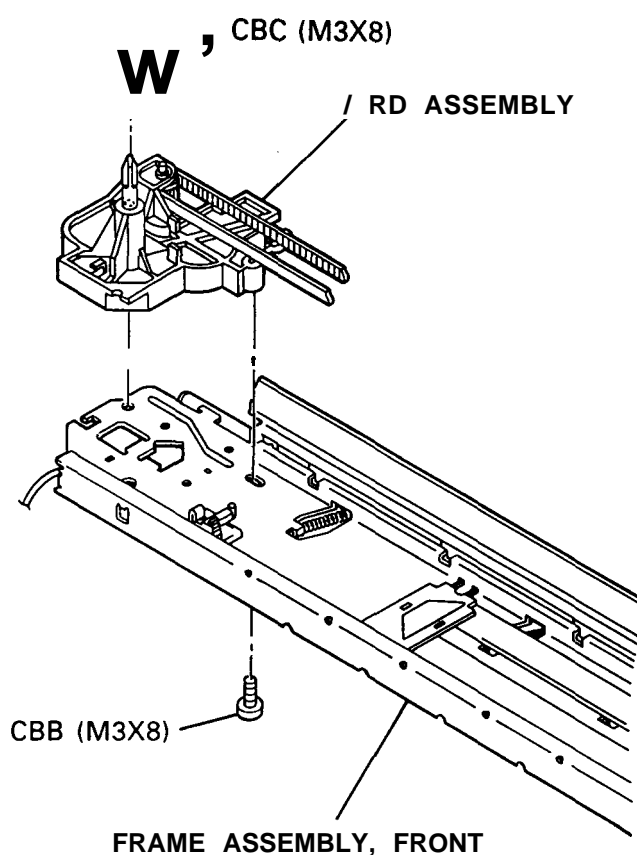
Figure 3-17. Removing the RD ASSEMBLY

3.2.5.8 Removing the Home Position (HP) DETECTOR

[STEP 1] **Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)**

[STEP 2] **Remove the clip of the DETECTOR, HP. Remove the detector.**

[STEP 3] **Disconnect the LEAD, HP** from the DETECTOR, HP.
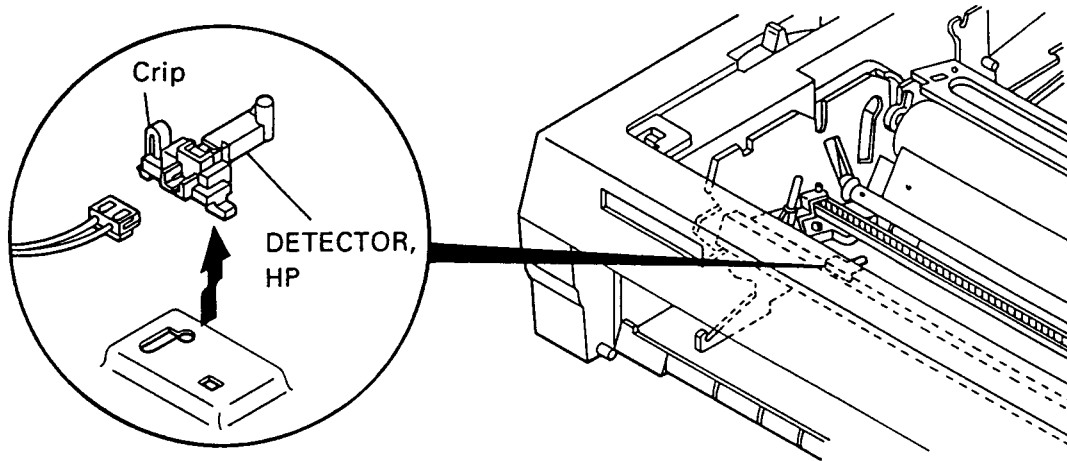
Figure 3-18. Removing the DETECTOR, HP

3.2.5.9 Removing the Platen Gap (PG) DETECTOR

[STEP 1] **Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)**

[STEP 2] **Remove the PANEL UNIT. (See Section 3.2.2.)**

[STEP 3] **Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)**

[STEP 4] **Remove the PRINTER MECHANISM. (See Section 3.2.5.)**

[STEP 5] **Remove the two clips of the DETECTOR, PG attached to the LEFT FRAME of the PRINTER MECHANISM. Remove the detector.**

[STEP 6] **Disconnect the LEAD, PG from the DETECTOR, PG.**
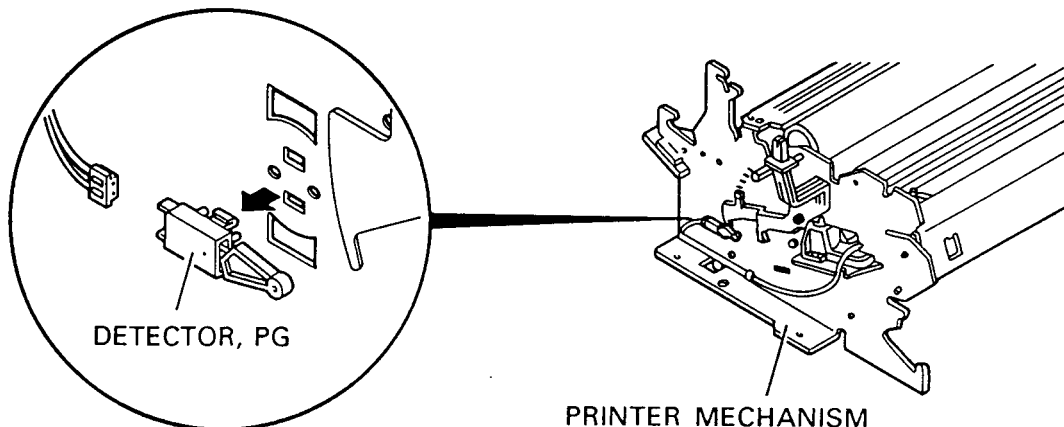
Figure 3-19. Removing the DETECTOR, PG

3-18

3.2.5.10 Removing the Front and Rear Paper End (PE) DETECTORS

[STEP 11   Remove the **PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit.**
(See Section 3.2.1.)

[STEP 2]   Remove the PANEL UNIT. (SeeSection 3.2.2.)

[STEP 3]   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4]   Remove the PRINTER MECHANISM. (See Section 3.2.5.) ,

[STEp 51   Remove the PLATEN ASSEMBLY. (See Section 3.2.5.1.)

[STEP 61   Remove the FRAME ASSEMBLY, REAR. (See Section 3.2.5.2.)

**[STEP 71   Remove the clip for each DETECTOR, PE mounted on the PAPER GUIDE ASSEMBLY, REAR.
Remove the DETECTOR, PE, FRONT and DETECTOR, PE, REAR.**

[STEP 81   **Remove the LEAD from each DETECTOR, PE.**
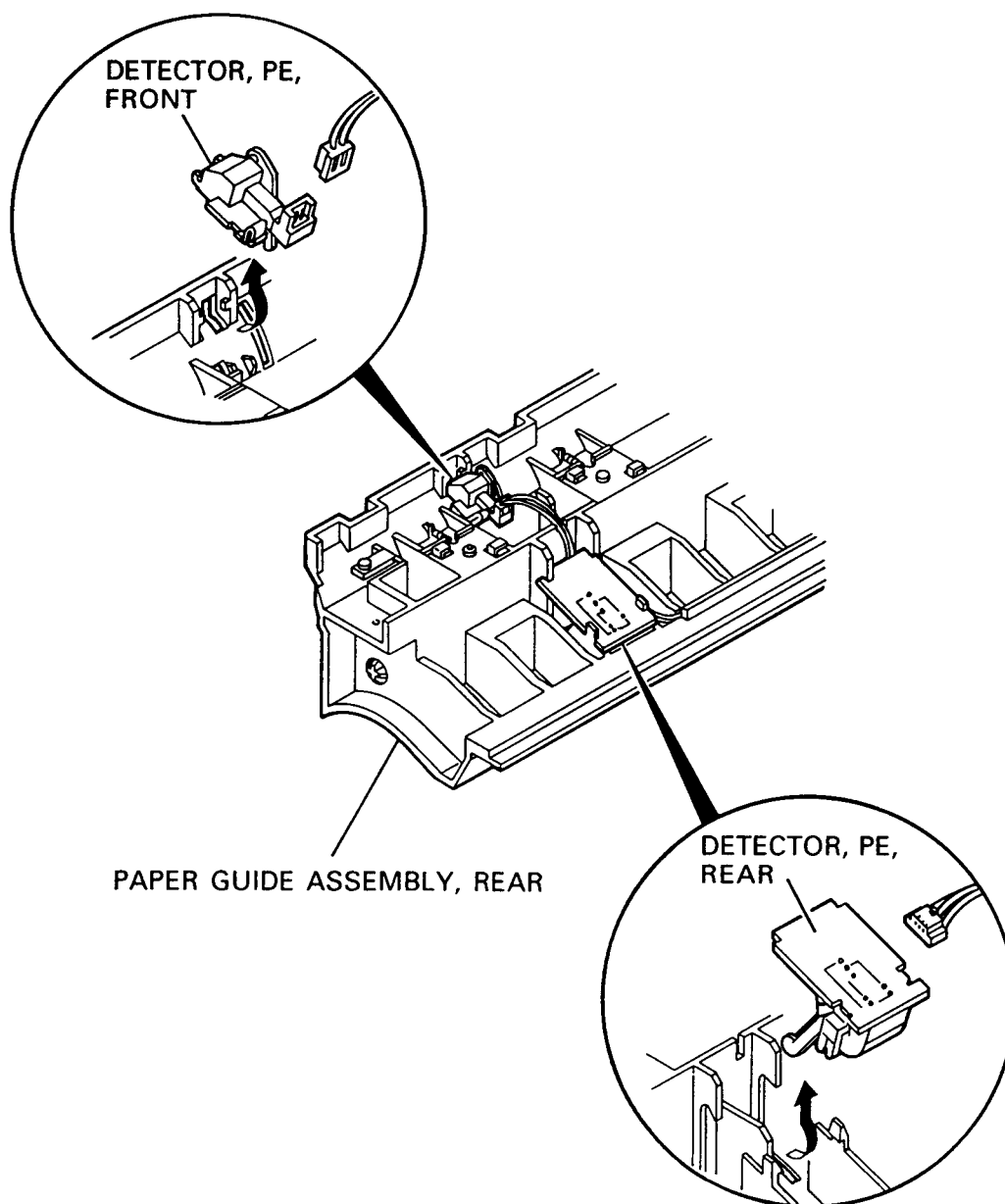
Figure 3-20. Removing tha DETECTORS, PE

3.2.5.11 Removing the DETECTOR, RELEASE

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)

[STEP 2]   Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3]   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4]   Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 5]   Remove the PLATEN ASSEMBLY. (See Section 3.2.5.1.)

[STEP 6]   Remove the FRAME ASSEMBLY, REAR. (See Section 3.2.5.2.)

[STEP 7]   Remove the two clips of the DETECTOR, RELEASE mounted on the PAPER GUIDE ASSEMBLY, REAR. Remove the DETECTOR, RELEASE.

[STEP 8]   Disconnect the LEAD, RELEASE from the detector.

DETECTOR, RELEASE

PAPER GUIDE ASSEMBLY, REAR
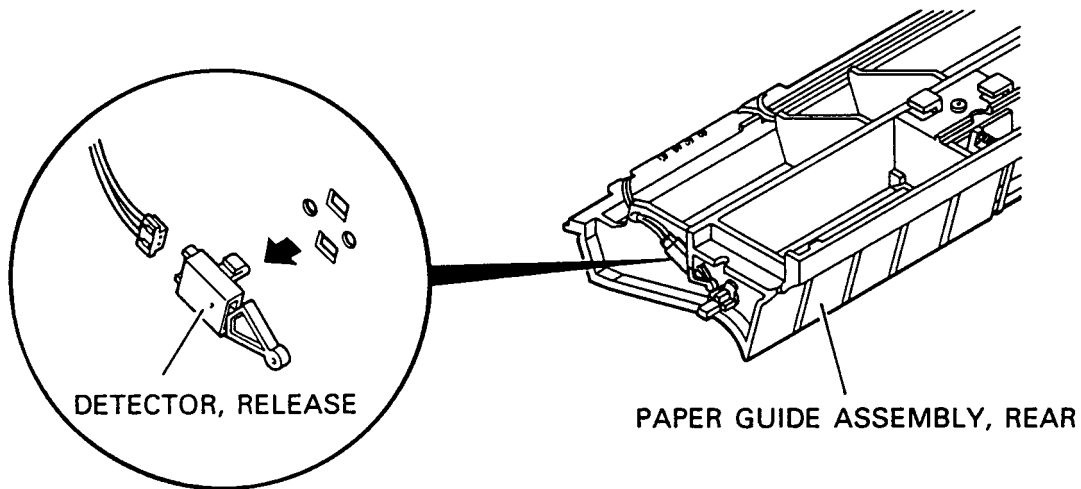
Figure 3-21. Removing the DETECTOR, RELEASE

3.2.5.12 Arranging the Cables

When you assemble the printer, arrange the cables as shown in Figure 3-22.

PRINTER MECHANISM
(Bottom)
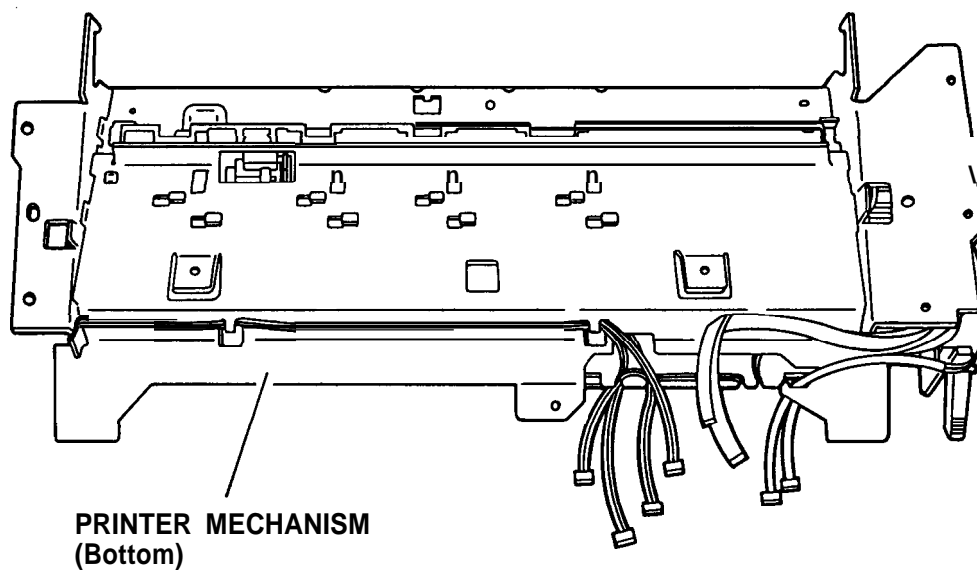
Figure 3-22. Arranging the Cables

3.2.5.13 Disassembling the Tractor Unit

[STEP 11   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)

[STEP 21   Release the two clips of the cog (17) from the tractor shaft. Remove the cog.

[STEP 31   Remove the right tractor frame from the tractor shaft and the tractor guide shaft.

[STEP 41   Remove the E-ring from the tractor shaft.

[STEp 51   Remove the right tractor, the paper support unit, and the left tractor from the tractor shaft and tractor guide shaft.
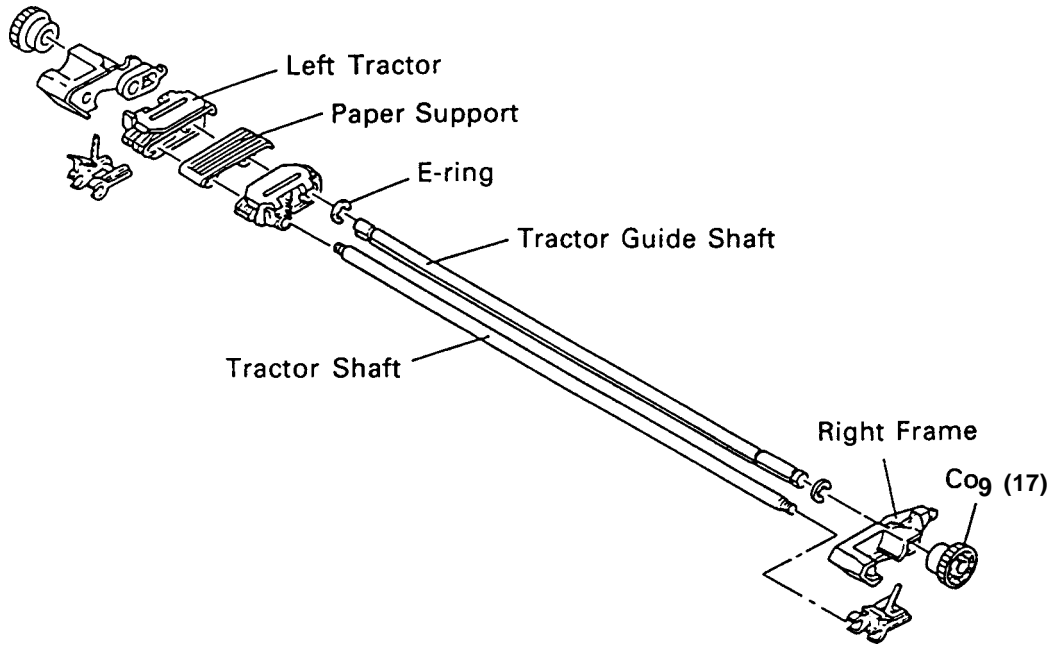
Figure 3-23. Disassembling the Tractor Unit

─────────────────── **Assembly Note** ───────────────────

When reassembling the tractor unit, be sure to snap the clips of the cog (17) onto the tractor shaft.

Clips
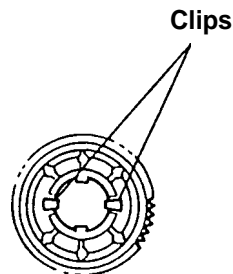
Figure 3-24. Position of the Cog

3.2.6 Removing the BOARD ASSEMBLY, C094 MAIN

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover, and tractor unit. (See Section 3.2.1.)

[STEP 21   Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 31   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 41   Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 51   Disconnect the cable from connector CN2 on the BOARD ASSEMBLY, C076 PSB/PSE.

[STEP 61   Remove SUPPORT, I/F from the BOARD ASSEMBLY, C094 MAIN.

[STEP 71   Remove the two CBS (M3X12) screws securing the cover for the optional interface card.

[STEP 81   Remove the CBC (M3X8) screw and the five CBB (M3X12) screws securing the BOARD ASSEMBLY, C094 MAIN. Remove the GROUNDING PLATE, I/F.

[STEP 9]   Remove the BOARD ASSEMBLY, C094 MAIN.
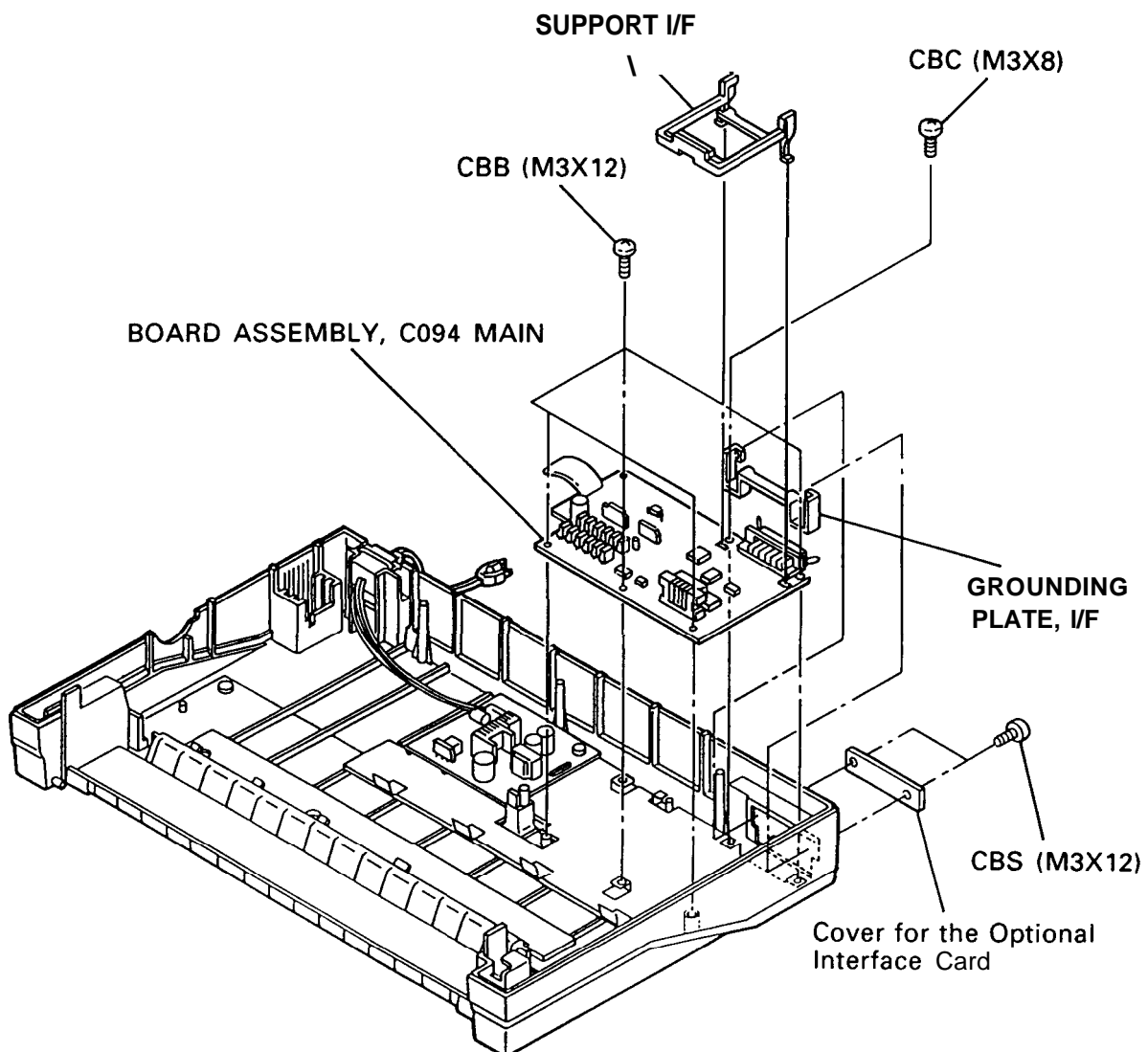
Figure 3-25. Removing the BOARD ASSEMBLY, C094 MAIN

3.2.7 Removing the BOARD ASSEMBLY, C076 PSB/PSE

───────────────────── **WARNING** ─────────────────────

Do not touch the heat sink attached to the FET (QI) when the printer is powered. If you touch the heat sink, you may suffer from electric shock.

[STEP 1]   Remove the PAPER GUIDE ASSEMBLY, top cover, front cover, paper eject cover and tractor unit. (See Section 3.2.1.)

[STEP 2]   Remove the PANEL UNIT. (See Section 3.2.2.)

[STEP 3]   Remove the HOUSING ASSEMBLY, UPPER. (See Section 3.2.4.)

[STEP 4]   Remove the PRINTER MECHANISM. (See Section 3.2.5.)

[STEP 5]   Remove the three CBB (M3X12) screws and the two CBC (M3X8) screws on the BOARD ASSEMBLY, C076 PSB/PSE. Remove the connectors CN1 (2-pin) and CN2 (1 I-pin).

[STEP 61   Remove the BOARD ASSEMBLY, C076 PSB/PSE.
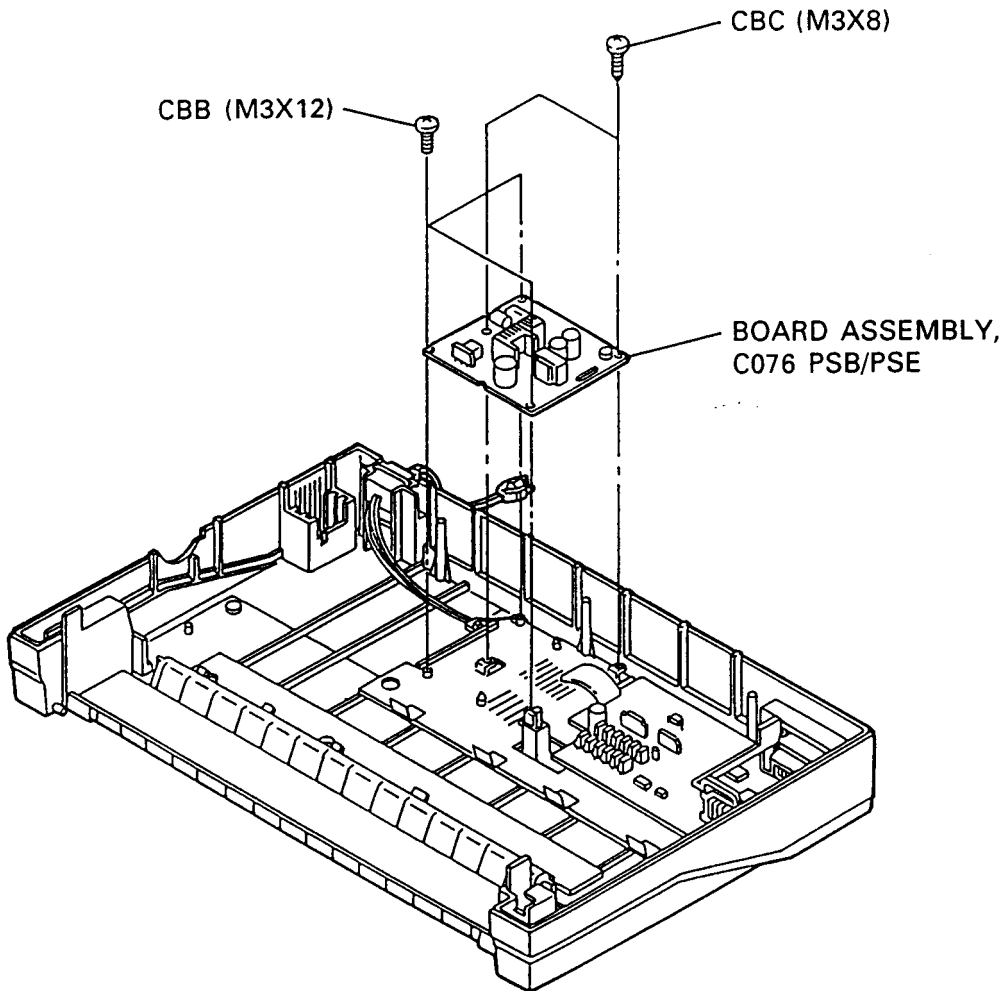
Figure 3-26. Removing the BOARD ASSEMBLY, C076 PSB/PSE

CHAPTER 4

ADJUSTMENTS

LIST OF FIGURES

CHAPTER 4

4.1 Adjusting the Printer Mechanism

This section describes the various adjustments required to keep the printer mechanism in optimum condition.

4.1.1 Platen Gap Adjustment

If you rotated or reassembled the carriage guide shaft or the PARALLELISM ADJUSTMENT BUSHING, or if printing is abnormal, you must adjust the gap between the platen and the printhead.

[STEP 11   Remove the printer's top cover.

[STEp 21   Move the LEVER, G. ADJUST to the O setting.

[STEP 31   Remove the RIBBON MASK using tweezers.

[STEP 41   Adjust the platen gap according to the following flowchart. The correct platen gap is 0.38 mm +/- 0.02 mm. Use the clearance gauge and adjust the gap so that the 0.36 mm gauge will fall into the gap and the 0.41 mm gauge will not. (Never try to force the gauge into the gap.)

To widen the gap, rotate the PARALLELISM ADJUSTMENT BUSHING downward. To narrow the gap, rotate the PARALLELISM ADJUSTMENT BUSHING upward. A rotation of one notch changes the gap by approximately O. 025 mm.

LEVER, G, ADJUST

BUSHING, PARALLEL, ADJUST
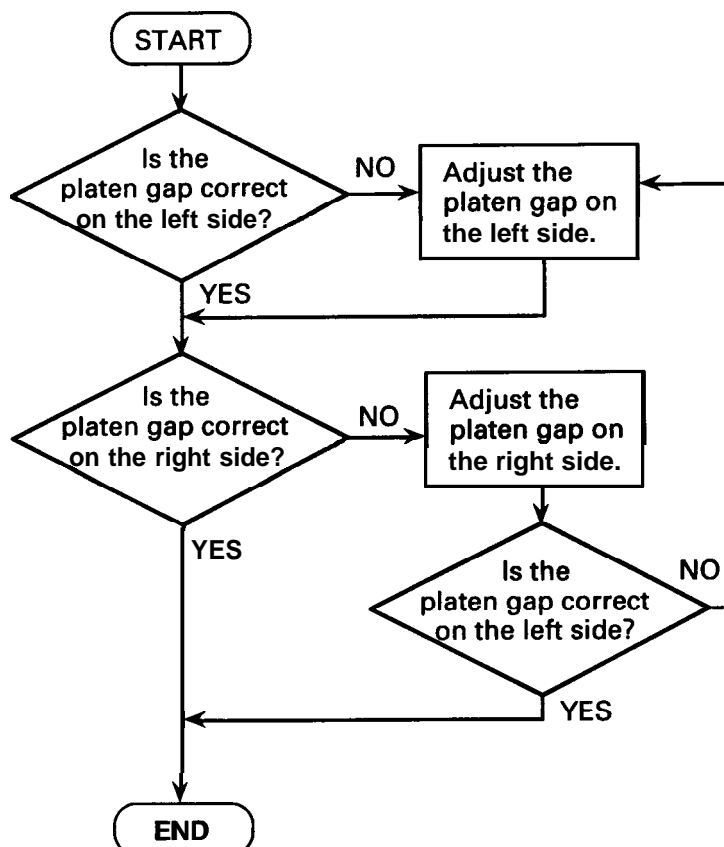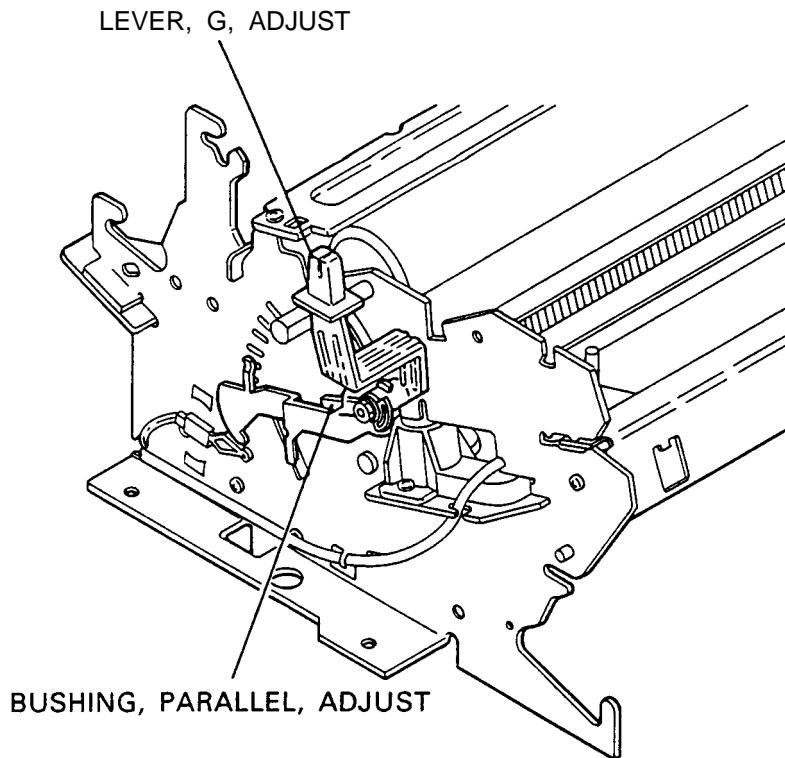
Figure 4-1. PARALLEUSM ADJUSTMENT BUSHING

4.2 Bidirectional Alignment Adjustment

This section describes how to adjust the bidirectional print position to ensure correct printing.

4.2.1 Overview of the Bidirectional Alignment Adjustment

The FX-870/1 170 prints characters when the carriage moves from both left to right and right to left. Therefore, the printing in one direction must be correctly aligned with the printing in the other direction. Otherwise, printed vertical lines may be staggered.

It is important to readjust the bidirectional alignment whenever anything has been done to the gear arrangement of the printer mechanism that might affect this alignment. The bidirectional alignment can be adjusted by altering the timing in which the carriage moves from one end to the other.

Since no two printer mechanisms are manufactured exactly the same, the bidirectional misalignment correction differs for each printer. Also, the correction value must be written in each E* PROM, and it must be rewritten after each adjustment.

4.2.2 Bidirectional Alignment Adjustment Procedure

The FX-870/l 170 provides bidirectional alignment adjustment program. When you load PaPer and run the program, the printer automatically feeds the paper and prints some patterns. You use the printout to adjust the printer's bidirectional alignment as described in the following steps.

Adjustment Operation

[STEP 1] Turn on the printer's power while pressing the PAUSE, PAPER FEED, and FONT buttons simultaneously.

[STEP 2] The printer enters Draft mode and prints an Adjust value and four lines of I characters. (See Figure 4-2.)

If the vertical lines are well aligned, go to STEP 4. Otherwise, go to STEP 3.

[STEP 3] Referring to the odd-numbered lines (1 st and 3rd), adjust the even-numbered lines (2nd and 4th).

(1) If the even-numbered lines are shifted to the right, press the FONT button to shift them to the left. The Adjust value increases by the shifted amount.

(2) If the even-numbered lines are shifted to the left, press the PAPER FEED button to shift them to the right. The Adjust value decreases by the shifted amount.

[STEP 4] Press the PAUSE/TEAR OFF button when you finish the Draft mode adjustment.

[STEP 5] The printer enters NLQ mode and prints an Adjust value and four lines of I characters. (See Figure 4-3.)

If the vertical lines are well aligned, go to STEP 7. Otherwise, go to STEP 6.

[STEP 6] Follow the instructions in STEP 3.

[STEP 7] Turn off the printer's power.

⊃ r-aft

Figure 4-2. Bidirectional Alignment Adjustment (Draft mode)

LQ

11
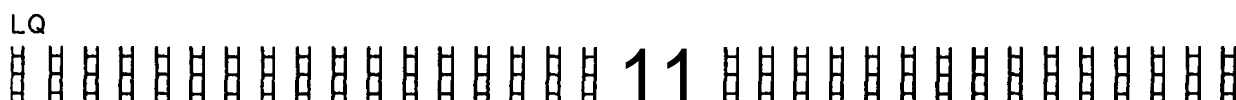
Figure 4-3. Bidirectional Alignment Adjustment (NLQ mode)

CHAPTER 5

TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES

CHAPTER 5

5.1 Overview

The FX-870/1 170 may exhibit different symptoms for the same problem. This makes troubleshooting difficult. This section provides simple and effective ways to facilitate troubleshooting. The following flowchart illustrates the main steps of the troubleshooting process.

```
              ( START )
                  |
         +----------------+
         | 5.2  | 5-3     |
         +----------------+
         | Repair by unit |
         | replacement.   |
         +----------------+
                  |
  +---------------+---------------------------+
  |                    |                      |
+-----------------+ +-----------------+ +-----------------+
| 5.3   | 5-1o    | | 5.4   | 5-10    | | 5.5      5-13   |
+-----------------+ +-----------------+ +-----------------+
| Repair of the   | | Repair of the   | | Repair of the   |
| BOARD           | | BOARD           | | printer         |
| ASSY, C076      | | ASSY, C094      | | mechanism.      |
| PSB/PSE.        | | MAIN.           | |                 |
+-----------------+ +-----------------+ +-----------------+
             |             |             |
             +-------------+-------------+
                           |
              [ The problem is corrected. ]
```
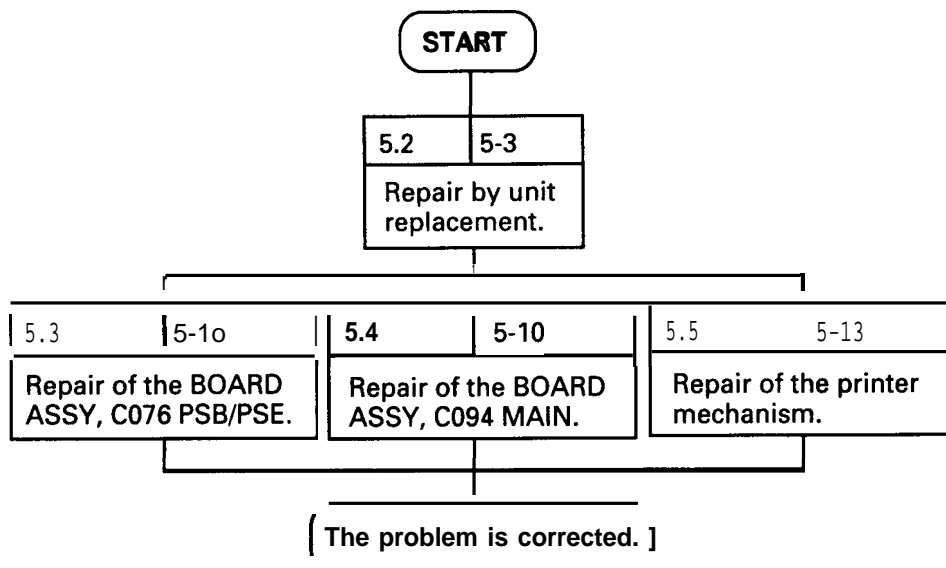
Figure 5-1. The Troubleshooting Procedure

The following tables provide troubleshooting information.

Table 5-1. Motor and Printhead Coil Resistance

Part	Coil Resistance
Motor Assembly, CR	5.0 ohms +/- 7% at 25 degrees C (77degrees F) CN13 on the main board 1,2,3, 4 pin@ phase A, $\overline{A}$, B, $\overline{B}$
Motor Assembly, PF	63 ohms +/-3 ohms at 25 degrees C (77degrees F) CN6 on the main board 1,2,3, 4 pin⇨ phase A, $\overline{A}$, B, $\overline{B}$
Printhead	16.5 ohms +/- 1.6 ohms at 25 degrees C (77degrees F) (Refer to Figure 5-2. of the head wire arrengement.)

[WIRE ASSIGNMENT

#2   #6   #4   TEMP 1 TEMP 2   #3   #7

① ③ ⑤ ⑦ ⑨ ⑪ ⑬

② ④ ⑥ ⑧ ⑩ ⑫ ⑭

COM. #8 #9   COM. #1 #5   COM.
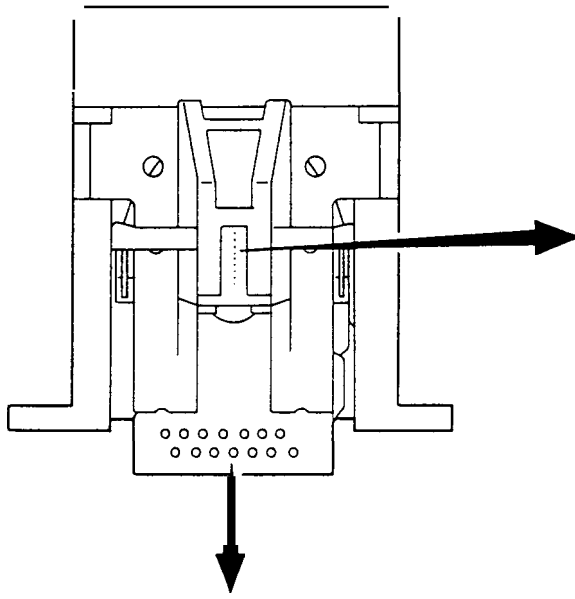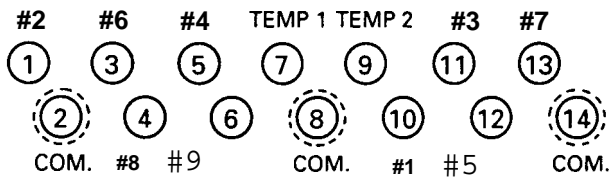
[TERMINAL ASSIGN MENT]

Coil Resistance :
16.5 ± 1.6Ω at 25°C
(Between each dot wire and common.)

Note: COM.2 = #2, #4, #6
       COM.8 = #7, #8, #9
       COM.14 = #1, #3, #5

Figure 5-2. Printhead Resistance

Table 5-2. Error Indication

Error Warning	Error	Cause
Buzzer beeps: *** ***	An error has occurred with the carriage position.	
Buzzer beeps: ** ** ** **	Memory error.	RAM abnormality.
Buzzer beeps: ** ** ** ** **	Memory error.	E^{2}PROM abnormality.
Buzzer beeps: **** **** **** **** ****	Paper out error.	•Continuous paper has run out. •There is no cut sheet paper in the CSF. •No paper was present at the start of a self test. •The CSF cannot eject a sheet.
Buzzer beeps: * * *	Paper out error.	•Single sheet feed is selected and no paper is present. •Continuous paper cannot be loaded. •Paper runs out after the PAPER FEED button has been pressed.
Buzzer beeps: ******* (continuously).	Paper release error.	The paper release lever is set to an inappropriate position.
All indicators blink simultaneously.	Fatal error.	
All indicator LEDs blink sequentially in the clockwise direction.	Voltage error.	The power supply voltage is abnormal.

Note: In the table above, each * represents one beep. See Table 1-21 for more information on buzzer functions.

5.2 Repair by Unit Replacement

Most printer problems can be corrected by replacing the defective unit. First, identify the problem from the symptoms **you observe using the table below. Then, follow the instructions in the corresponding flowchart to** correct the problem.

Table 5-3. Symptoms and Flowchart References

Symptom	Problem	Flowchart no.
Abnormal operation at power on	●**The carriage does not move.** ●**The indicator LEDs on the control panel do not light.**	**chart (1)**
Carriage operation abnormal	●**Carriage moves away from the home position at power on.** ●**The printer does not enter READY mode when the carriage returns to the home position.**	**chart (2)**
Self test printing abnormal (Carriage **operation is normal.)**	●**The printer does not print the self test.** ●**The printer does not print some of the dots.**	**chart (3)**
Paper feed abnormality	●**The printer does not feed the paper.** ●**The paper feed is irregular.**	**chart (4)**
Control panel operation abnormal	●**The printer does not feed the paper when you press the PAPER FEED button.**	**chart (5)**
Incorrect printing of data sent from the host computer	●**The printer prints data sent from the host computer incorrectly, but carriage operation is normal and the printer performs the self test correctly.**	**chart (6)**

Flowchart (1) abnormal operation at power on

```
─────────── WARNING ───────────
Do not touch the heat sink attached to the FET (Q1) when the printer is powered.
If you touch the heat sink, you may suffer from electric shock.
```

(START)

Is the AC input voltage normal?
Voltage range: 103.5-132 V
Voltage range: 198-264 V
— No → **Use the correct AC input voltage.** (No fluctuation from the recommended AC voltage range is permitted.)

↓ Yes

Is fuse F1 on the BOARD ASSY., C076 PSB/PSE blown?
— Yes → **Replace the fuse and disconnect CN14 on the BOARD ASSY., C094 MAIN.**

↓ No

When power is turned on again, is the new fuse also blown?
— No → (back to Measure the VP)
Yes ↓

Measure the VP (+35 VDC) at pin 10, CN2 of the BOARD ASSY., C076 PSB/PSE.

Is the output voltage normal?
— No →

↓ Yes

Measure the VL (+5 VDC) at pin 1, CN2 of the BOARD ASSY., C076 PSB/PSE.

Is the voltage normal?
— No →

↓ Yes

Replace the BOARD ASSY., C094 MAIN.

▽ END

Replace the BOARD ASSY., C076 PSB/PSE.

▽ END

Flowchart (2) carriage operation abnormal

```
                    ┌─────────────┐
                    │    START    │
                    └─────────────┘
                           │
                           ▼
                    ╱─────────────╲
                   ╱ Are connectors ╲
                  ╱  CN3, 4, 5, 6, 7, 8, 9, and 13  ╲      No     ┌────────────────────────┐
                 ╱ connecting the BOARD ASSY., C094 MAIN ╲────────▶│ Secure the connectors. │
                  ╲  and the printer mechanism  ╱               └────────────────────────┘
                   ╲   inserted securely?      ╱                           │
                    ╲─────────────╱                                        ▼
                           │                                         ╱───────────╲       Yes
                          Yes                                       ╱   Is the    ╲──────────────┐
                           │                                        ╲ problem corrected? ╱       │
                           ▼                                         ╲───────────╱               │
                                                                          │                      │
                                                                         No                      │
                                                                          ▼                       │
                  ╱───────────╲       No      ╱───────────────╲     No   ┌──────────────┐        │
                 ╱  Does the   ╲──────────────▶╱  Is the CR motor ╲───────▶│ Replace the  │       │
                 ╲ carriage move to the ╱      ╲ coil resistance correct ╱  │  CR motor.   │       │
                 ╲ home position? ╱           ╲ (5 ohms +/- 7 % at room ╱  └──────────────┘       │
                  ╲───────────╱               ╲  temperature)?  ╱              │                  │
                       │                        ╲───────────╱                 ▼                  │
                      Yes                            │               ╱───────────╲    Yes        │
                       │                            Yes             ╱   Is the     ╲──────────────┤
                       ▼                             │              ╲ problem corrected? ╱        │
               ┌──────────────────┐                 │               ╲───────────╱                │
               │ Replace the BOARD│                 │                    │                       │
               │ ASSY., C094 MAIN.│                 │                   No                        │
               └──────────────────┘                 ▼                    │                        │
                       │              ┌────────────────────┐             │                       │
                       ▼              │ Refer to Section 5.5,│◀───────────┘                       │
                    ╲END╱             │ Repairing the Printer│                                    │
                                      │ Mechanism.          │                                     ▼
                                      └────────────────────┘                                   ╲END╱
                                                │
                                                ▼
                                             ╲END╱
```

Note: If any coils in the CR motor **are shorted, also test the motor drivers on the BOARD** ASSY., C094 **MAIN.**

Flowhart (3) self test printing abnormal

```
                         ╭─────────────╮
                         │    START    │
                         ╰─────────────╯
                                │
    ┌───────────────────────────────────────────────────────┐
    │ Set the platen gap adjust lever to O and perform the   │
    │ self test. (To start the self test, turn on the printer│
    │ while holding down the PAPER FEED button.)             │
    └───────────────────────────────────────────────────────┘
                                │
                      ╱ Does the printer ╲      Yes
                     ◇  print the self test ◇──────────────────────┐
                      ╲    correctly?    ╱                         │
                                │ No                               │
                                ▼                                  │
                 ╱ Are connectors        ╲                         │
                ╱ CN3, 4, 5, 6, 7,8,9, and ╲   No  ┌────────────┐  │
               ◇ 13 connecting the BOARD     ◇─────│ Insert them│──┤
                ╲ ASSY.,C094 MAIN and the    ╱      │ correctly. │  │
                 ╲ printer mechanism        ╱       └────────────┘  │
                   ╲ inserted securely?   ╱                        │
                          │ Yes                                    │
                          ▼                                        │
                  ╱ Are the vertical ╲    No   ┌──────────────────┐│
                 ◇   lines aligned?   ◇────────│ Perform the      ││
                  ╲                  ╱          │ bidirectional    │┤
                          │ Yes                 │ printing adjustment│
                          ▼                     └──────────────────┘│
                  ╱ Is the printing ╲   Yes    ┌──────────────────┐ │
                 ◇    too light?     ◇─────────│ Adjust the platen │─┤
                  ╲                 ╱           │ gap.              │ │
                          │ No                 └──────────────────┘ │
                          ▼                                         │
                  ╱ Are the FFCs ╲    No      ┌──────────────────┐  │
                 ◇ properly inserted? ◇───────│ Secure the FFCs. │──┤
                  ╲              ╱             └──────────────────┘  │
                          │ Yes                                     │
                          ▼                    ┌──────────────────┐ │
              ┌──────────────────┐             │ Replace the BOARD│ │
              │ Replace the      │────────────▶│ ASSY.,C094 MAIN. │─┤
              │ printhead.       │             └──────────────────┘ │
              └──────────────────┘                     │            │
                          │                            ▼            │
                  ╱ Is the problem ╲  No     ╱ Is the problem ╲ Yes │
                 ◇   corrected?     ◇────────◇   corrected?    ◇────┤
                  ╲                ╱          ╲                ╱     │
                          │ Yes                       │ No          │
                          ▼                           ▼             ▼
                     ╲  END  ╱            ┌──────────────────┐   ╲ END ╱
                      ╲     ╱             │ Refer to Section │    ╲   ╱
                       ╲   ╱              │ 5.5, Repairing   │     ╲ ╱
                                          │ the Printer      │
                                          │ Mechanism.       │
                                          └──────────────────┘
```

Flowchart (4) paper feeding abnormal

Note: If **any coils in the PF motor are shorted, also test the motor drivers on the BOARD ASSY., C094 MAIN.**

Flowchart (5) control panel operation   abnormal

```
                        ┌──────────────┐
                        │    START     │
                        └──────┬───────┘
                               │
                               ▼
                        ╱ Is connector ╲            No    ┌──────────────────┐
                    ╱  CN12 connecting the BOARD ╲ ──────▶│ Insert connector │
                   ╱ ASSY., C094 PNL and the BOARD ╲      │ CN12 correctly.  │
                    ╲ ASSY., C094 MAIN inserted ╱         └────────┬─────────┘
                      ╲     securely?    ╱                          │
                          ╲         ╱                               ▼
                            │ Yes                 No          ╱ Is the problem ╲
                            │    ◀──────────────────────────╱   corrected?    ╲
                            │                                 ╲               ╱
                            │                                        │ Yes
                            │                                        ▼
                            │                                     ▽ END ▽
                            ▼
                    ╱ Does the printer ╲       No       ┌──────────────────┐
                   ╱  print the self     ╲ ────────────▶│ Repair the BOARD │
                    ╲ test correctly?   ╱               │ ASSY., C094 MAIN.│
                      ╲             ╱                    └────────┬─────────┘
                            │ Yes                                 │
                            ▼                                     ▼
                    ┌──────────────────┐              ╱ Is the problem ╲   Yes
                    │ Replace the BOARD │            ╱   corrected?     ╲ ─────┐
                    │ ASSY., C094 PNL.  │             ╲               ╱        │
                    └────────┬─────────┘                     │ No            │
                             │                               ▼               │
                    ╱ Is the problem ╲   No        ┌──────────────────┐     │
                   ╱   corrected?     ╲ ──────┐    │ Replace the BOARD │     │
                    ╲               ╱         │    │ ASSY., C094 PNL.  │     │
                          │ Yes              │    └────────┬─────────┘     │
                          │              ┌───┴───┐         │               │
                          │              │Repair the BOARD │◀──────────────┘
                          │              │ASSY., C094 MAIN │
                          │              └───────┬─────────┘
                          ●──────────────────────┘         ▽ END ▽
                          │
                          ▼
                        ▽ END ▽
```

Flowchart (6) incorrect printing of data sent from host computer

Note: The host computer is assumed to be operating normally.

```
                    ┌──────────┐
                    │  START   │
                    └──────────┘
                         │
         ┌───────────────────────────────┐
         │ Perform  the  self  test      │
         │ (Turn  on  the  printer       │
         │ while  holding down the       │
         │ PAPER FEED button).           │
         └───────────────────────────────┘
                         │
                   ╱─────────────╲          ┌──────────────────┐
                  ╱   Does the    ╲   No     │ See Section 5.3  │
                 ╱ printer print the ╲──────▶│ through 5.5.     │
                  ╲ self test correctly? ╱   └──────────────────┘
                   ╲─────────────╱
                         │ Yes
         ┌───────────────────────────────┐
         │ Check the printer's default settings. │
         │ See Section 1.5.1 for information on   │
         │ the default settings.         │
         └───────────────────────────────┘
                         │
                   ╱─────────────╲   Yes
                  ╱  Is the problem ╲─────────────────┐
                  ╲   corrected?   ╱                  │
                   ╲─────────────╱                    │
                         │ No                         ▼
         ┌───────────────────────────────┐      ╲─────────╱
         │ Replace the interface cable   │       ╲  END  ╱
         │ that connects the printer to  │        ╲─────╱
         │ the host computer.            │
         └───────────────────────────────┘
                         │
                   ╱─────────────╲   Yes
                  ╱  Is the problem ╲─────────────────┐
                  ╲   corrected?   ╱                  │
                   ╲─────────────╱                    │
                         │ No                         │
         ┌───────────────────────────────┐           │
         │ Replace the BOARD             │           │
         │ ASSY., C094 MAIN.             │           │
         └───────────────────────────────┘           │
                         │                            │
                   ╲─────────╱                  ╲─────────╱
                    ╲  END  ╱                    ╲  END  ╱
                     ╲─────╱                      ╲─────╱
```
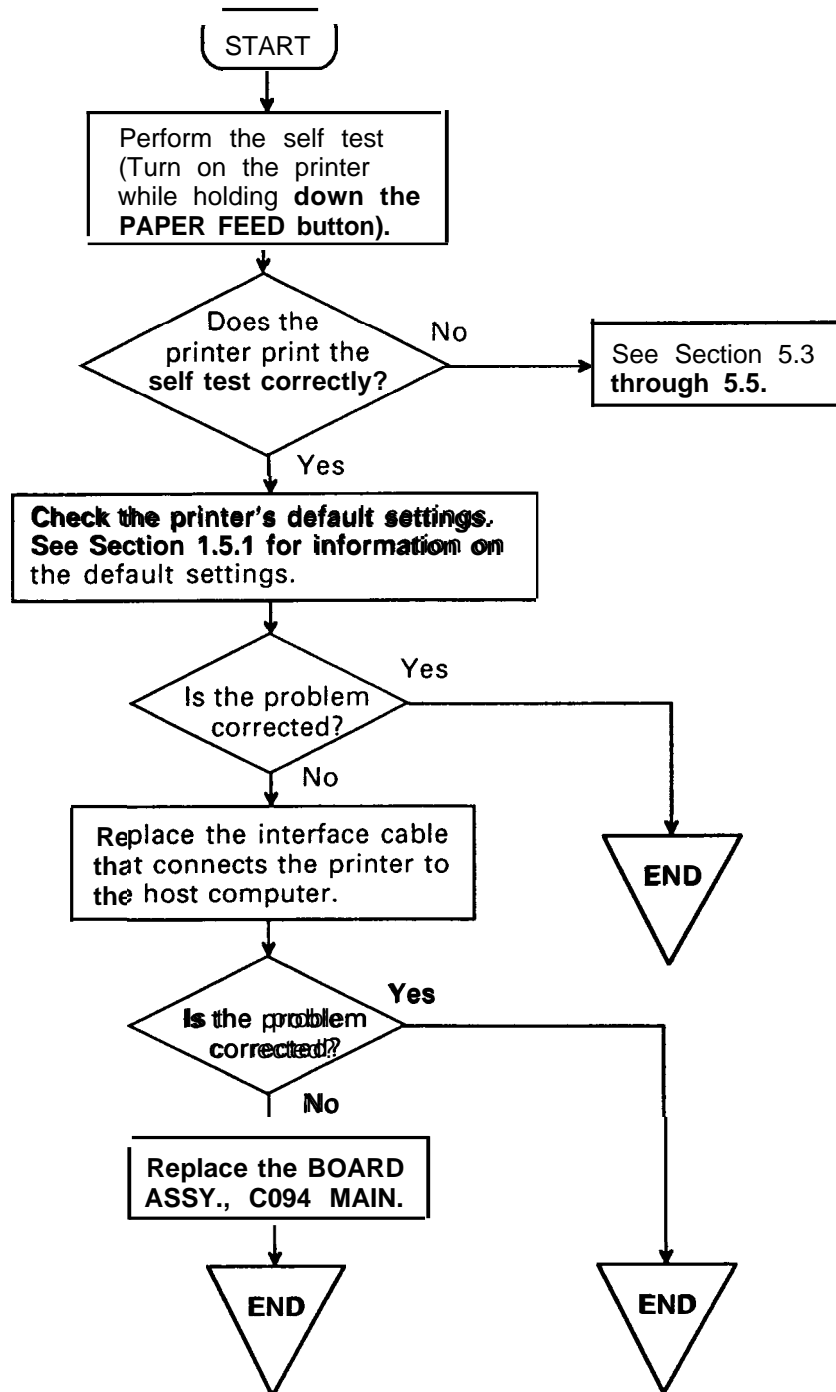
5.3 Repairing the Board Assembly, C076 PSB/PSE

This section provides instructions for repairing the BOARD ASSEMBLY, C076 PSB/PSE. It describes various problems, likely causes, checkpoints, and solutions. The checkpoint column provides proper waveforms, resistance values, and other information for each component of the C076 PSB/PSE.

————— WARNING —————

The **OPERATE button on the control panel turns on or** off only the secondary power circuit, so the primary power circuit is live as long as the printer is connected to an AC power outlet.
Do not touch the heat sink attached to the FET (Q1) when the printer is powered.

Table 5-4. Repairing the BOARD ASSEMBLY, C076 PSB/PSE
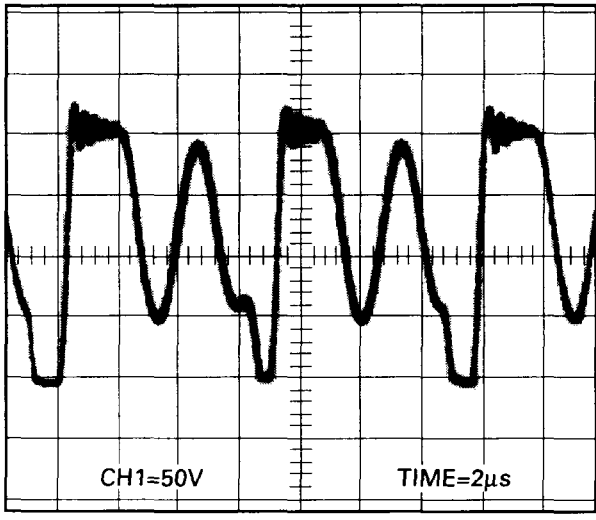
Problem	Cause	Checkpoint	Solution
The +35 V line is dead.	Diode bridge DB1 is dead.	Measure the DC voltage between pins 3 and 4 of DB1.	Replace DB1.
	The transformer coils are open.	Measure the resistance of the T1 transformer coils at pins 3-2, 5-4, 10-11, and 11-9.	Replace T1.
	Q1 is dead.	Check the voltage waveforms at Q1. CH1=50V TIME=2μs	Replace Q1.

Table 5-4. Repairing the BOARD ASSEMBLY, C076 PSB/PSE (Continued)
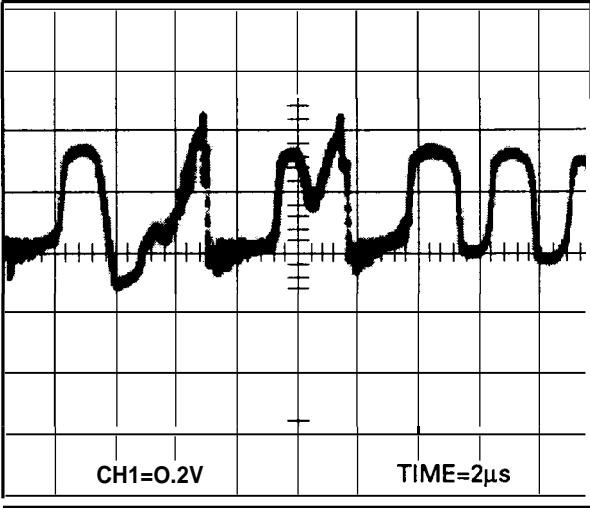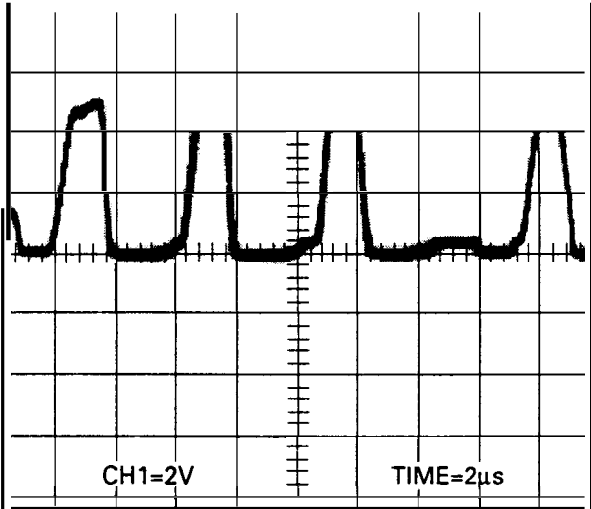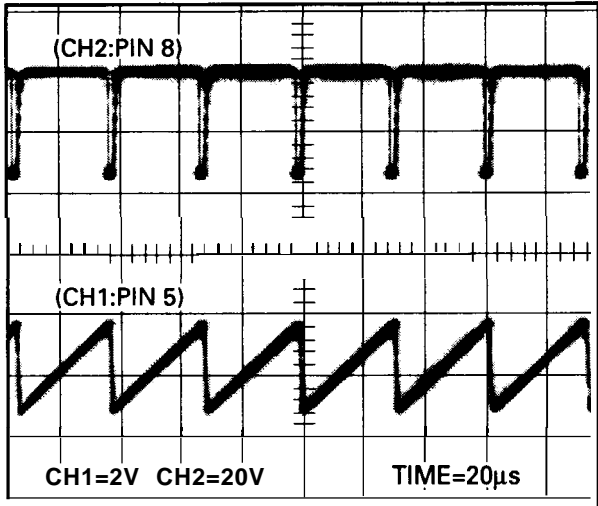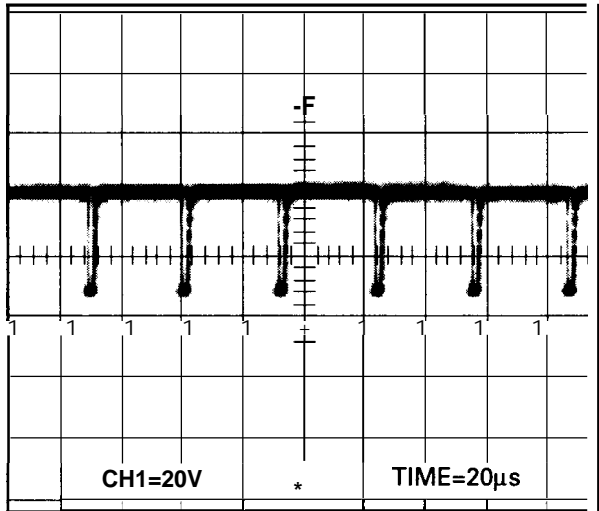
Problem	Cause	Checkpoint	Solution
The voltage of the +35 V line is below the specified value.	Q3, ICI, PC1, PC2 or ZD5 is dead.	**Check the voltage waveforms at Q3.** CH1=O.2V TIME=2μs	Replace Q3, IC1, PC1, PC2 or ZD51.
	Q2 is dead.	**Check the voltage waveforms at Q2.** CH1=2V TIME=2μs	Replace Q2.

Table 5-4. Repairing the BOARD ASSEMBLY, C076 PSB/PSE (Continued)

Problem	Cause	Checkpoint	Solution
The +5 V line is dead.	The +35 V line is dead.	Check the +35 V line.	Refer to the terns described above.
	C51 is dead.	Check the oscillation waveform (IC51 pin 5) and the switching waveform (IC51 pin 8).	Replace C51.
	Q51 or Q52 is dead.	Check the switching waveform at Q52 emitter.	Replace Q51 or D52.

5.4 Repairing the Board Assembly, C094 MAIN

This section provides instructions for repairing the BOARD ASSEMBLY, C094 MAIN. It describes various problems, symptoms, likely causes, checkpoints, and solutions. The checkpoint column provides proper waveforms, resistance values, and other information for each component of the C094 MAIN.

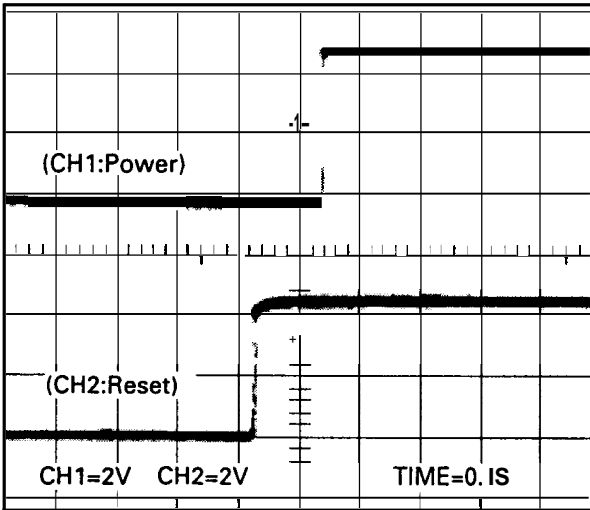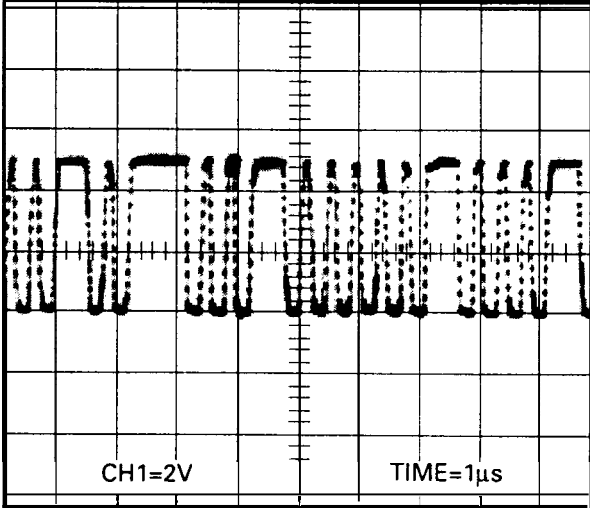Table 5-5. Repairing the BOARD ASSEMBLY, C094 MAIN

Problem	Symptom	Cause	Checkpoint	Solution
Abnormal operation at power on.	The CPU does not operate properly.	The reset circuit is defective.	Check the voltage waveforms of the VDD (+5 V)(IC4 pin 41) and ROUT (IC4 pin 15) when the power is turned on. (CH1:Power) (CH2:Reset) CH1=2V CH2=2V TIME=0. IS	Replace IC4.
		The control ROM is not selected.	Check the signal HIGH/LOW alternation (IC4 pin 4). CH1=2V TIME=1μs	Replace IC4.
		Either the ROM or the RAM is defective.		Replace IC2 or IC3.

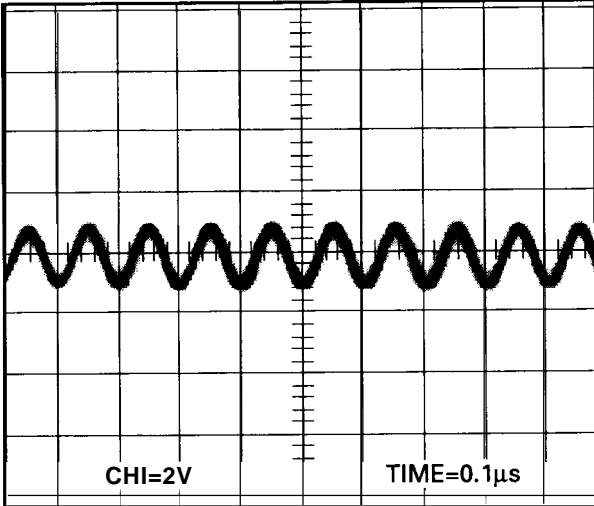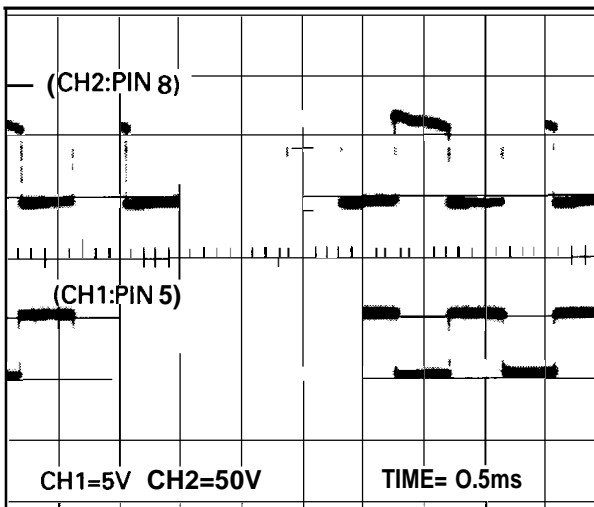## Table 5-5. Repairing the BOARD ASSEMBLY, C094 MAIN (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
Abnormal operation at power on.	The CPU does not operate properly.	The CPU is defective.	Check the oscillator signal (IC2C1 pin 27 or pin 28). CHI=2V　　TIME=0.1μs	If the signal is not correct, replace IC2C1. Otherwise, replace CR1.
Carriage operation abnormal.	The carriage does not operate at all.	IC6 is defective.	Check the input signal (pin 5) and the output waveform (pin 8). — (CH2:PIN 8) (CH1:PIN 5) CH1=5V CH2=50V　　TIME= 0.5ms	Replace IC6.

Table 5-5. Repairing the BOARD ASSEMBLY, C094 MAIN (Continued)
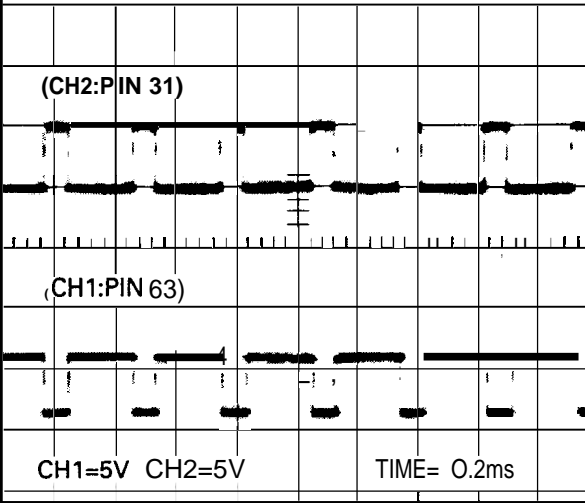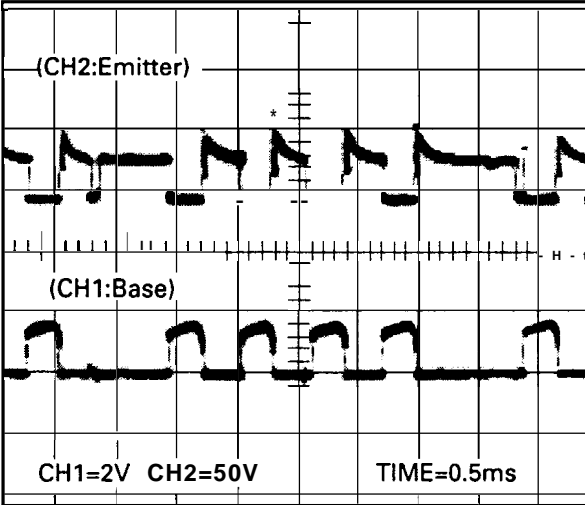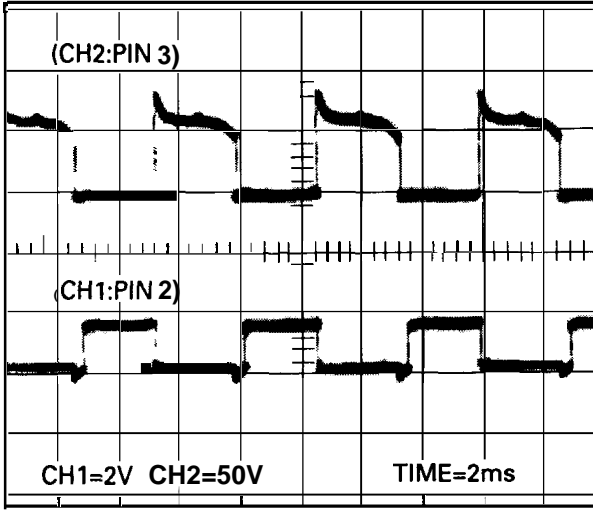
Problem	Symptom	Cause	Checkpoint	Solution
Self test printing abnormal	The printer does not print the self test.	IC4 is defective.	**Check the head pulse signal at pin 31 (input) and pin 63 (output).** (CH2:PIN 31) (CH1:PIN 63) CH1=5V CH2=5V TIME= 0.2ms	Replace IC4.
Self test printing abnormal.	A particular dot fails to print.	One of the head drive transistors is defective (Q2, 4,5,6, 8,9, 10, 11, or 12).	Check the head drive signal at the base and the emitter of each transistor. (CH2:Emitter) (CH1:Base) CH1=2V CH2=50V TIME=0.5ms	If the signal at the base is normal, replace the transistor. Otherwise, replace IC4.

Table 5-5. Repairing the BOARD ASSEMBLY, C094 MAIN (Continued)

Problem	Symptom	Cause	Checkpoint	Solution
Paper feed abnormal.	The printer does not feed the paper at all or the paper feed is irregular.	ICl is defective.	Check the input signal (pin 2) and the output waveform (pin 3). (CH2:PIN 3) (CH1:PIN 2) CH1=2V CH2=50V TIME=2ms	Replace ICl.
ncorrect rinting of data sent from the host computer.	Data is corrupted when the parallel interface is used.	Either IC4 or IC5 is defective.		Replace IC4 or IC5.

5.5 **Repairing the Printer Mechanism**

This section provides instructions **for repairing the printer mechanism. It describes various problems, symptoms, likely causes, checkpoints, and solutions. The checkpoint column shows the items to be checked, including the proper values to be set for each component of the printer mechanism. For replacement and adjustment instructions, see Chapter 3, Disassembly and Assembly, and Chapter 4, Adjustment. If the same symptom recurs after repair, select another item in the list of causes and repair the printer according to those instructions.**

Table 5-6. Repairing the Printer Mechanism

Problem	Symptom	Cause	Checkpoint	Solution
Carriage motor operation abnormal.	**The MOTOR, CR fails to rotate at power on.**	**Foreign substances are lodged in the gears or elsewhere in the mechanism.**	**Manually move the timing belt and check that this moves the belt pulley on the carriage motor.**	**Remove any foreign substances.**
		The MOTOR ASSY., CR is defective.	**Measure the coil resistance of the motor. The resistance should be approximately 5.0 ohms.**	**Replace the MOTOR ASSY., CR.**
Carriage movement abnormal.	**The MOTOR, CR rotates, but the carriage does not move.**	**The belt pulley is defective.**	**Check the pulley for damage or wear.**	**Replace the belt pulley.**
		The timing belt is defective.	**Check that the timing belt is properly inserted into the bottom of the carriage.**	**Reinsert the timing belt.**
			Check the timing belt for damage or wear.	**Replace the timing belt. Replace IC1.**
	The carriage moves slightly to the left and then stops.	**Lack of lubrication.**	**Manually move the carriage and check that it moves smoothly.**	**Clean and lubricate the carriage assembly.**
	The carriage moves to the left or right end and then stops.	**The DETECTOR, HP is defective.**	Check the DETECTOR, HP with a multi meter.	Replace the **DETECTOR, HP.**

Table 5-6. Repairing the Printer Mechanism (Continued)

Problem	symptom	Cause	Checkpoint	Solution
Self test printing abnormal.	The carriage moves, but the self-test printing is not executed.	The common wires in the printhead FFC are disconnected, or there is no continuity.	Check the common wires in the printhead FFC.	Replace the FFC.
	The printer does not print a particular dot.	The printhead is defective.	Measure the coil resistance of the printhead. The resistance should be approximately 16.5 ohms.	Replace the printhead. (If any pin is shorted, also check the drivers on the main board.
			Check if the dot wire is worn.	Replace the printhead.
	The printing is too light or the print density is not uniform.	The printhead is defective.	Check if the tip of the dot wire is worn.	Replace the printhead.
		The platen gap is not adjusted properly.	Set the LEVER, G. ADJUST to O and check the gap between the the printhead and the platen. The correct gap is 0.36-0.40 mm.	Adjust the gap as described in "Platen Gap Adjustment" in Chapter 4.
Paper feeding abnormal.	The printer prints but does not feed paper properly.	Foreign substances are lodged in the paper path.	Visually check the paper path for any foreign substances.	Remove any foreign substances.
		The MOTOR ASSY, PF is not driving the gear correctly.	Check the gears for damage or wear.	Replace the defective gear.
		The MOTOR ASSY., PF is defective.	Measure the coil resistance of the MOTOR ASSY.,PF. The resistance should be approximately 63 ohms.	Replace the MOTOR ASSY.,PF. (If any coil is shorted, also check the drivers on the main board.

Table 5-6. Repairing the Printer Mechanism (Continued)

Problem	symptom	Cause	Checkpoint	Solution
Ribbon feed abnormality.	The ribbon does not feed.	The ribbon cartridge is defective.	Remove the ribbon cartridge. Then rotate the ribbon feed roller manually to check that the ribbon cartridge feeds the ribbon normally.	Replace the ribbon cartridge.
		Foreign substances are caught in the gears.	Check that the ribbon driving gear rotates properly when the carriage is moved manually.	Remove any foreign substances or replace the ribbon cartridge.
	The ribbon feeds properly only when the carriage moves in one direction (left or right).	The planetary gear is defective.	Manually move the carriage and check that the planetary gear functions normally.	Replace the ribbon cartridge mechanism.
The paper gets stained with ink.	The surface of the pape in the printable area is stained with ink.	The ribbon mask is not positioned correctly.	Check that the ribbon mask is in the correct position.	Reinstall the ribbon mask.
		The platen gap is not adjusted correctly.	Set the LEVER, G, ADJUST to O and check the gap between the printhead and the platen. The correct gap is 0.36-0.40 mm.	Adjust the gap as described in "Platen Gap Adjustment" in Chapter 4.
DETECTOR, PE malfunction.	The printer does not stop printing after it reaches the paper end, or it prints when no paper is loaded, or it ejects paper when you press PAPER FEED button to load paper.	The DETECTOR, PE is defective.	Check the DETECTOR, PE.	Replace the DETECTOR, PE.

CHAPTER 6

MAINTENANCE

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CHAPTER 6

6.1 Preventive Maintenance

Preventive maintenance involves occasionally vacuuming the printer mechanism to remove dust and paper debris and regularly cleaning the case exterior with denatured alcohol. After cleaning the unit, check that it is properly lubricated as described in Section 6.2, below. Also inspect the springs and rollers to see that they are operating properly.

```
─────────── CAUTION ───────────
Disconnect the printer from the external AC power source before performing maintenance work.
Do not use thinner, trichloroethylene, or ketone-based solvents on the plastic components of the
printer.
```

6.2 Lubrication

EPSON recommends that the printer be lubricated at the points shown in Figure 6-2. Table 6-2 lists each lubrication point and its recommended lubricant. All the lubricants have been tested extensively and found to comply with the requirements of this printer. Table 6-1 describes the lubricants.

Before applying lubricant, be sure to clean the surface to be lubricated. Do not apply too much lubricant, or it may affect related parts.

Table 6-1. Lubricants

Type	Name	Quantity	Availability	Part No.
Grease	G-26	40mg	E	B702600001
Oil	O-2	40CC	E	B703700001

Table 6-2. Lubrication Points

Ref. No.	Lubrication Points	Lubricant
1	Platen gap adjustment slots on the LEFT FRAME (excluding the two slots at the bottom)	G-26
2	The arms and tab of the RD ASSEMBLY	G-26
3	The shaft end of the ROLLER ASSEMBLY, DRIVE	G-26
4	The ribbon drive gear train	G-26
5	The OIL PAD in the CARRIAGE ASSEMBLY	o-2
6	The cam surface of the CAM, CLUTCH, TRACTOR	G-26
7	The cam end of the SPUR GEAR, 34.5	G-26
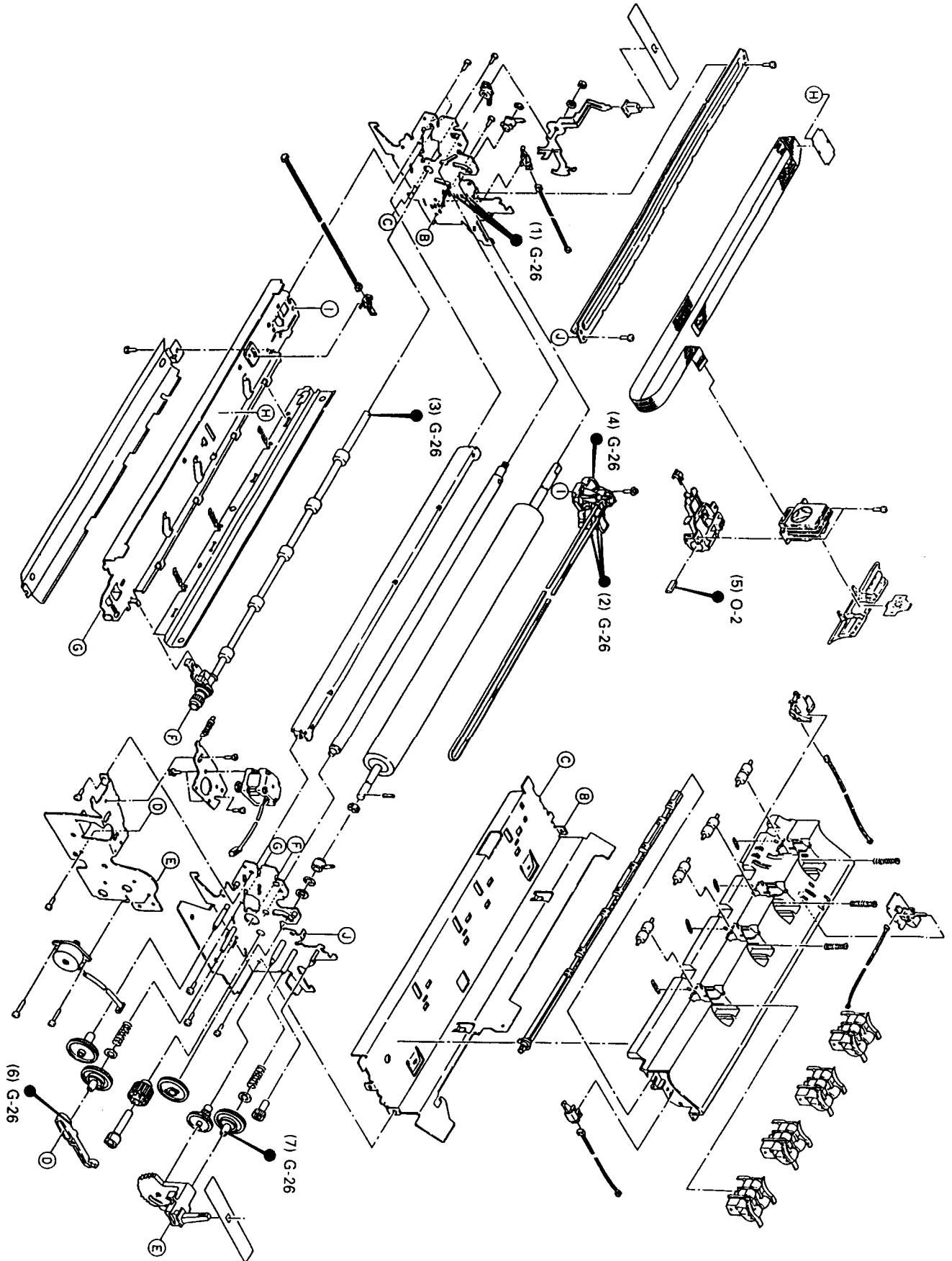
Figure 6-1. Lubrication Points

APPENDIX

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APPENDIX

A.1 Connector Summary

Figure A-1 illustrates the interconnection of the primary components. Table A-1 summarizes the functions and sizes of the connectors.
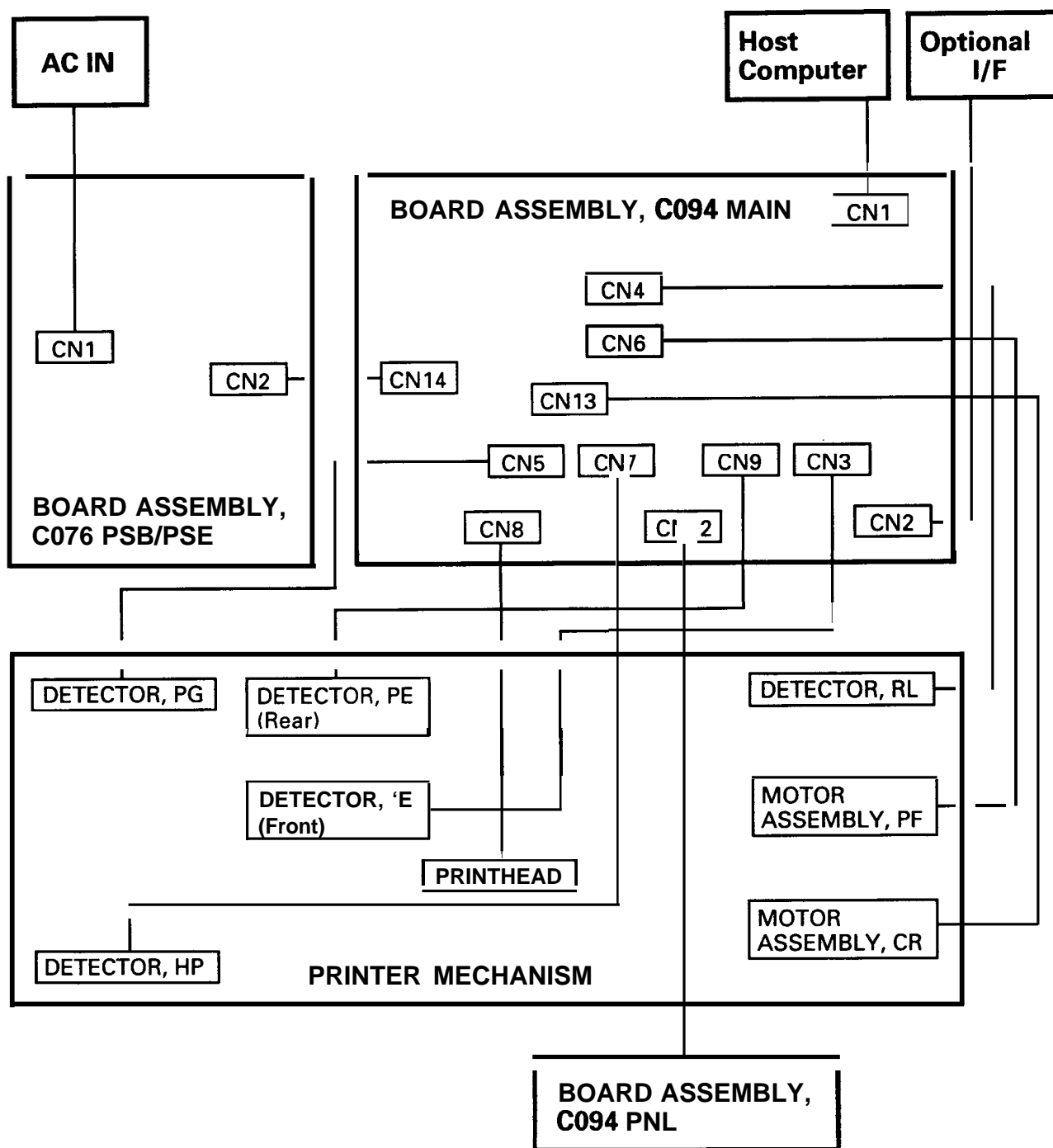
Figure A-1. Cable Connections

Table A-1. CO94 MAIN Board Connector Summary

Board	Connector	Function	Pins
BOARD ASSEMBLY,	CN1	**Host Computer**	**36**
C094 MAIN	CN2	**Optional Interface**	**36**
	CN3	**DETECTOR, PE (Front)**	**2** (Blue)
	CN4	DETECTOR, RL	2 **(White)**
	CN5	**DETECTOR, PG**	**2 (Black)**
	CN6	**MOTOR ASSEMBLY, PF**	**6**
	CN7	**DETECTOR, HP**	**2 (Yellow)**
	CN8	**PRINTHEAD**	**14**
	CN9	**DETECTOR,** PE (Rear)	3
	CN12	BOARD ASSEMBLY, **C094** PNL	10
	CN13	MOTOR ASSEMBLY, CR	5
	CN14	BOARD ASSEMBLY, C076 **PSB/PSE**	11

See Table 1-14 for CN1(Centronics interface).

Table A-2. CN2 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	+5	+5 VDC
2	-	+5	+5 VDC
3	-	+5	+5 VDC
4	-	+5	+5 VDC
5	-	+5	+5 VDC
6	-	+5	+5 VDC
7	0	TXD	Transmit Data
8	0	READY	Ready to Receive Data
9	I	RXD	Receive Data
10	-	NC	No Connection
11	0	RST	Reset
12	0	INH	Inhibit
13	I	CMREQ	Command Request
14	I	WRRDY	Write Ready
15	I	RDREQ	Read Request
16	0	WR	Write
17	0	RD	Read
18	0	Cs	Chip Select
19	-	GND	Signal Ground
20	-	GND	Signal Ground
21	-	GND	Signal Ground
22	-	GND	Signal Ground
23	-	GND	Signal Ground
24	-	GND	Signal Ground
25	0	A3	Address Bus Bit 3
26	0	A2	Address Bus Bit 2
27	0	A I	Address Bus Bit 1
28	0	AO	Address Bus Bit O
29	I/O	D7	Data Bus Bit 7
30	I/O	D6	Data Bus Bit 6
31	I/O	D5	Data Bus Bit 5
32	I/O	D4	Data Bus Bit 4
33	I/O	D3	Data Bus Bit 3
34	I/O	D2	Data Bus Bit 2
35	I/O	D1	Data Bus Bit 1
36	I/O	DO	Data Bus Bit O

Table A-3. CN3 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	PEF	Paper End, FRONT

Table A-4. CN4 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	LSW	Release Lever Position

Table A-4. CN5 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	GSW	Platen Gap Adjust Lever

Table A-6. CN6 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	0	PF A	PF Motor Phase A
2	0	PF Ā	PF Motor Phase Ā
3	0	PF B	PF Motor Phase B
4	0	PF B̄	PF Motor Phase B̄
5	0	PFCOM	PF Motor Common
6	0	PFCOM	PF Motor Common

Table A-7. CN7 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	HOME	CR Home Position

Table A-8. CN8 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	O	HD2	Head Data 2
2	o	C246	Head Drive Common
3	o	HD6	Head Data 6
4	o	HD8	Head Data 8
5	o	HD4	Head Data 4
6	o	HD9	Head Data 9
7	I	TMP	Head Temperature
8	o	C789	Head Drive Common
9	o	TMP	Head Temperature
10	O	HD1	Head Data 1
11	o	HD3	Head Data 3
12	o	HD5	Head Data 5
13	o	HD7	Head Data 7
14	o	C135	Head Drive Common

Table A-9. CN9 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	GND	Signal Ground
2	I	PER	Paper End, REAR
3	I	LED	Paper End, LED

Table A-10. CN12 (BOARD ASSEMBLY, C094 MAIN)

No	I/O	Signal Name	Function
1		+5	+5 VDC
2	O	READY	READY LED
3	O	STAT	STAT LED (Not equipped
4	O	FONT	FONT LED
5	O	COND	CONDENSED LED
6	I	PAUSE	PAUSE BUTTON
7	I	FONT	FONT BUTTON
8	I	PFEED	PAPER FEED BUTTON
9	I	OPERA	OPERATE BUTTON
10		GND	Signal Ground

Table A-n. CN13 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	O	CR A	CR Motor Phase A
2	O	CR $\overline{\text{A}}$	CR Motor Phase $\overline{\text{A}}$
3	O	CR B	CR Motor Phase B
4	O	CR $\overline{\text{B}}$	CR Motor Phase $\overline{\text{B}}$
5	O	CRCOM	CR Motor Common

Table A-12. CN14 (BOARD ASSEMBLY, C094 MAIN)

No.	I/O	Signal Name	Function
1	-	+5	+5 VDC
2	-	+5	+5 VDC
3	-	GND	Signal Ground
4	-	GND	Signal Ground
5	-	GND	Signal Ground
6	-	GP	Power Ground
7	-	GP	Power Ground
8	-	GP	Power Ground
9	-	+35	+35 VDC
10	-	+35	+35 VDC
11	-	Psc	Power Switch Signal
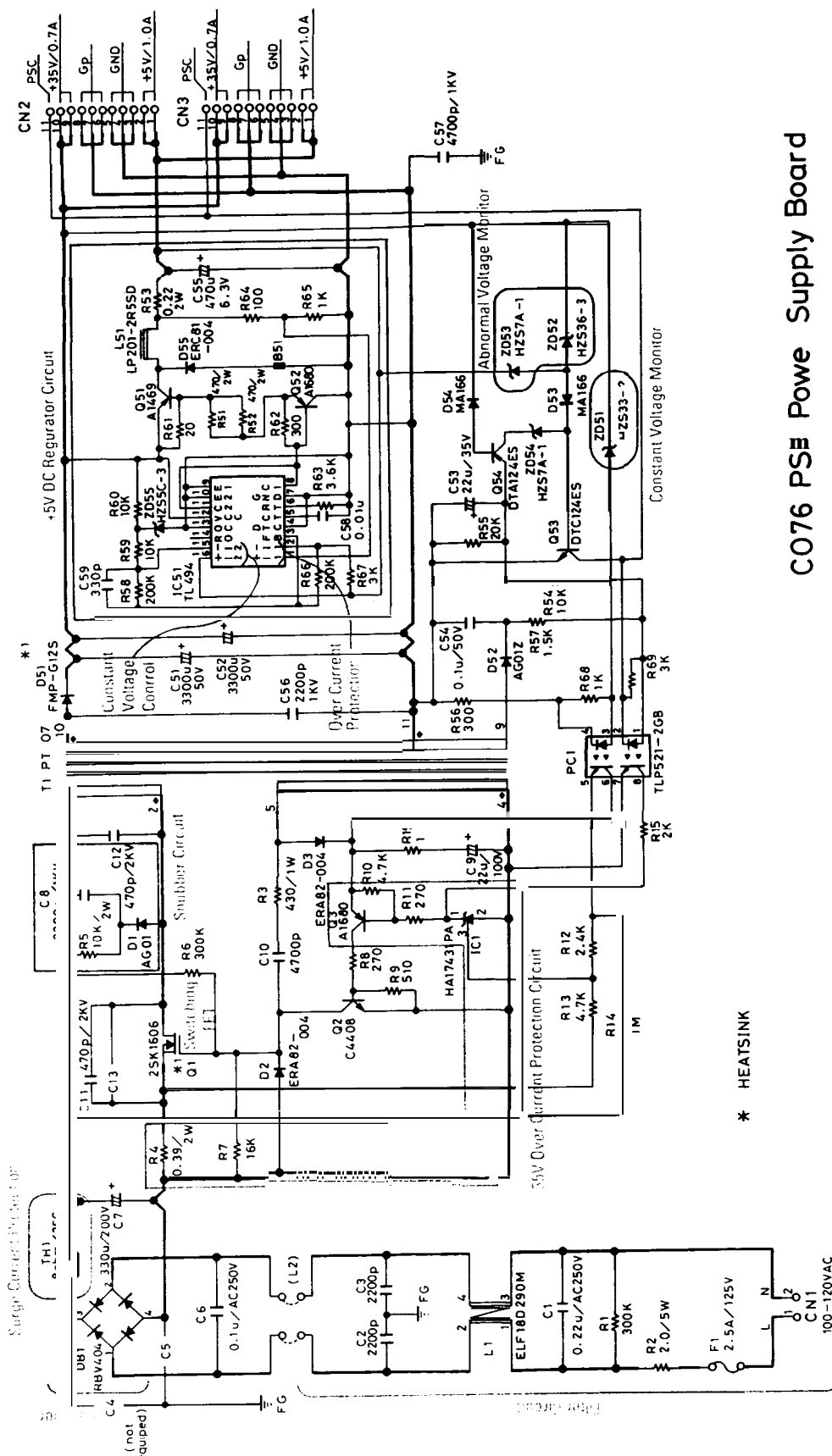
Figure A-4, BOARD ASSEMBLY, C076 PSB Circuit Diagram (Annotated)

EPSON