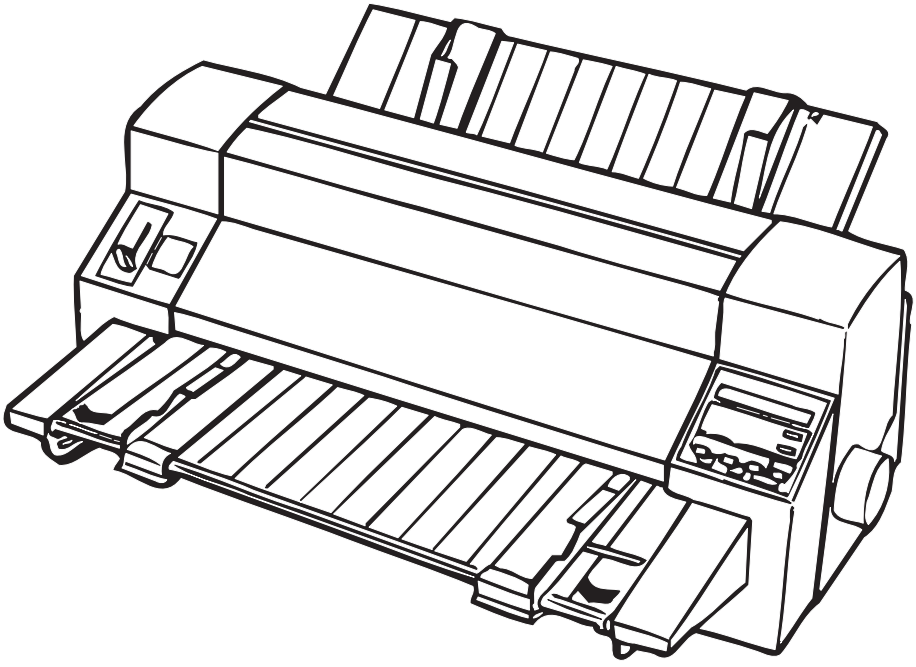
EPSON

24-PIN DOT MATRIX PRINTER

EPSON DLQ-3000+

SERVICE MANUAL



SEIKO EPSON CORPORATION

4008259

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PRECAUTIONS

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

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

CAUTION 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.

WARNING

1. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND PERIPHERAL DEVICES PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURES.
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.

CAUTION

1. REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY 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 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 MICROPROCESSORS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.
5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS BY THE MANUFACTURE; 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 DLQ-3000+.

The instructions and procedures included herein are intended for the experience repair technician, and attention should be given to die precautions on the preceding page. The Chapters are organized as follows:

CHAPTER 1. GENERAL DESCRIPTION

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

CHAPTER 2. OPERATING PRINCIPLES

Describes the theory of printer operation.

CHAPTER 3. DISASSEMBLY AND ASSEMBLY

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

CHAPTER 4. ADJUSTMENT

Includes a step-by-step guide for adjustment.

CHAPTER 5. TROUBLESHOOTING

Provides EPSON-approved techniques for troubleshooting.

CHAPTER 6. MAINTENANCE

Describes preventive maintenance techniques and lists lubricants and adhesives required to service the equipment.

APPENDIX

Describes connector pin assignments, circuit diagrams, circuit board component layout and exploded diagram.

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

REVISION SHEET

Revision	Issued Data	Contents
Rev. A	August 21 1997	First Release

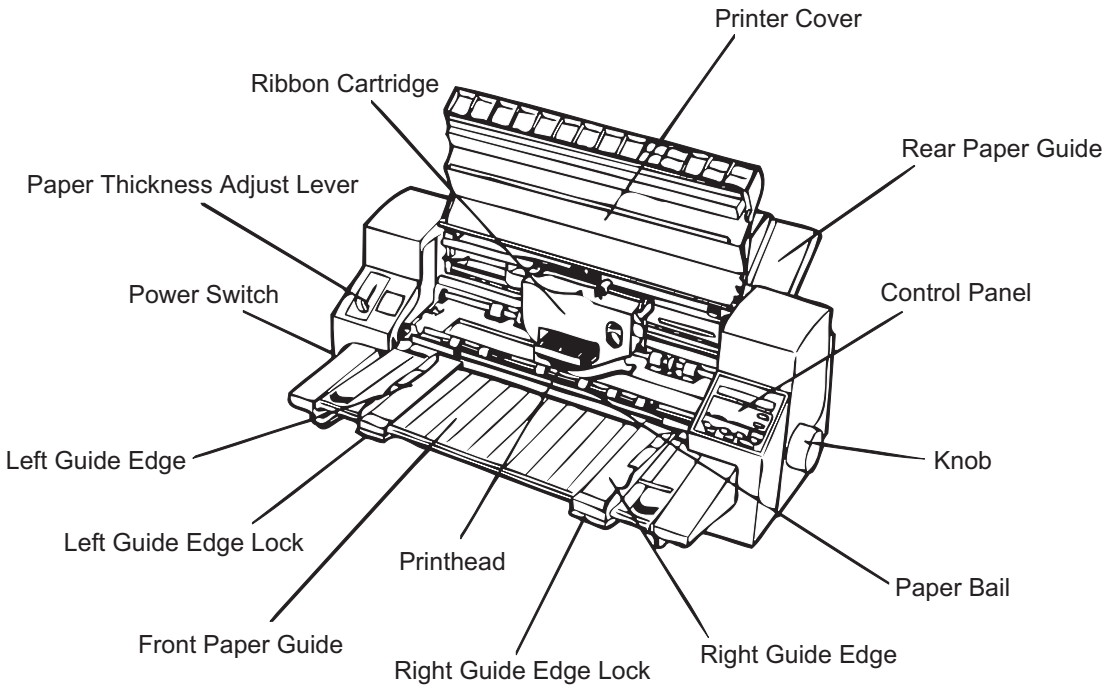
TABLE OF CONTENTS

Chapter 1
Product Description

1.1 Features

The DLQ 3000+, equipped with a Bi-directional parallel interface, is the most advanced EPSON 24-pin impact-dot printer. It prints on continuous multi-part form as well as on single sheet, which makes the printer highly usable in office environment . The main features of this printer are:

- Used in Network environment with parallel interface supported
  - Memory
  - CSF paper quantity sensor
  - Paper jam detection
- Enhanced duplex printing
  - 1 original plus 6 duplications in the copy mode
- Wide printable area
  - 70 line / A4 (0 mm can be set for the top and bottom margins at single print mode.)
- Paper thickness detection function supported
  - Enables the auto and manual platen gap adjustment
- Fonts
  - Bitmap fonts: 9 LQ and 1 draft typefaces
  - Scalable fonts: 4 typefaces
  - Bar-code fonts: 8 typefaces
- Character tables
  - Standard version: 11 tables
  - NLSP version: 30 tables
- Control codes
  - ESC/P2
  - IBM 2391 Plus Emulation
- Input buffer
  - 128 K byte
- Interface
  - Bi-directional parallel interface (IEEE-1284 nibble mode supported)
  - Serial interface (EIA-232D)
  - Type-B interface level 2 (Optional)
- Reliability
  - Total print volume: 9 million lines
  - Printhead life: 200 million strokes
  - Ribbon life: 6 million characters



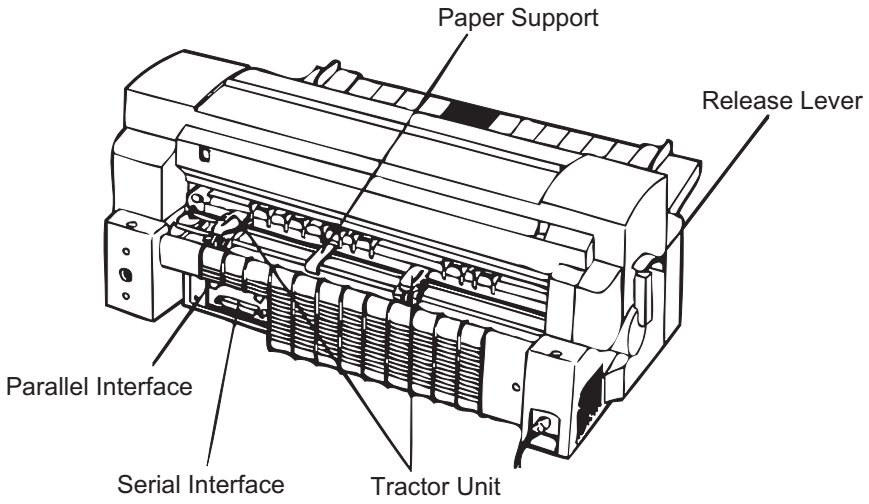


Figure 1-1. Exterior View of DLQ 3000+

1.2 Consumables and Options

Table 1-1. Accessories and Options

Part Number	Description
Consumable Supplies	
S015066	Ribbon cartridge (Black)
S015067	Ribbon cartridge (Color)
Optional Equipment	
C806830	Cut sheet feeder
C82307* / C82308*	32KB intelligent serial I/F card
C82310* / C82311*	32KB intelligent parallel I/F card
C82312*	Localtalk™ card
C82313*	32KB IEEE-488 I/F card
C82314*	Coax I/F card
C82315*	Twin-Ax I/F card
C82331*	Ethernet I/F card
C82345*	IEEE-1284 parallel I/F card
C82346	Multi Protocol Ethernet I/F card
Accessory Equipment	
	Power supply cable*[2]

Note:

1. *Asterisk at the end of the part numbers replaces the last digit of the part number, which varies by the market.*
2. *Can be an accessory item according as market.*

1.3 Hardware Specification

1.3.1 printing Specification

- ❑ Print method Impact-dot matrix
- ❑ Print pin arrangement 24-pin rhombus (See Figure 1-2.)

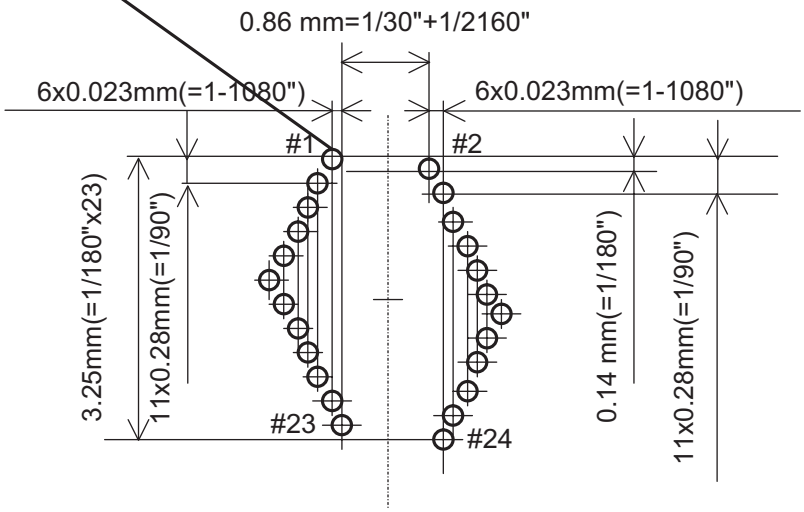


Figure 1-2. Pin Arrangement

- ❑ Printing direction Bi-directional printing with logic seeking
- ❑ Resolution See Table 1-2.

Table 1-2 .Printing Resolution

Printing Mode	Horizontal Density	Vertical Density	Adjacent Dot Print
High speed draft	90 dpi	180 dpi	No
Draft	120 dpi	180 dpi	No
Draft condensed	240 dpi	180 dpi	No
LQ	360 dpi	180 dpi	No
8-pin bit image	60, 80, 90 or 120 dpi	60 dpi	Yes
	120 or 240 dpi	60 dpi	No
24-pin bit image	60, 90, 120 or 180 dpi	180 dpi	Yes
	360 dpi	180 dpi	No
Raster graphics	180 or 360 dpi	180 or 360 * dpi	Yes

Note: When a color ribbon is installed, the printer can not print vertical 360 dpi graphics. In that case, the printer changes vertical density to 180 dpi.

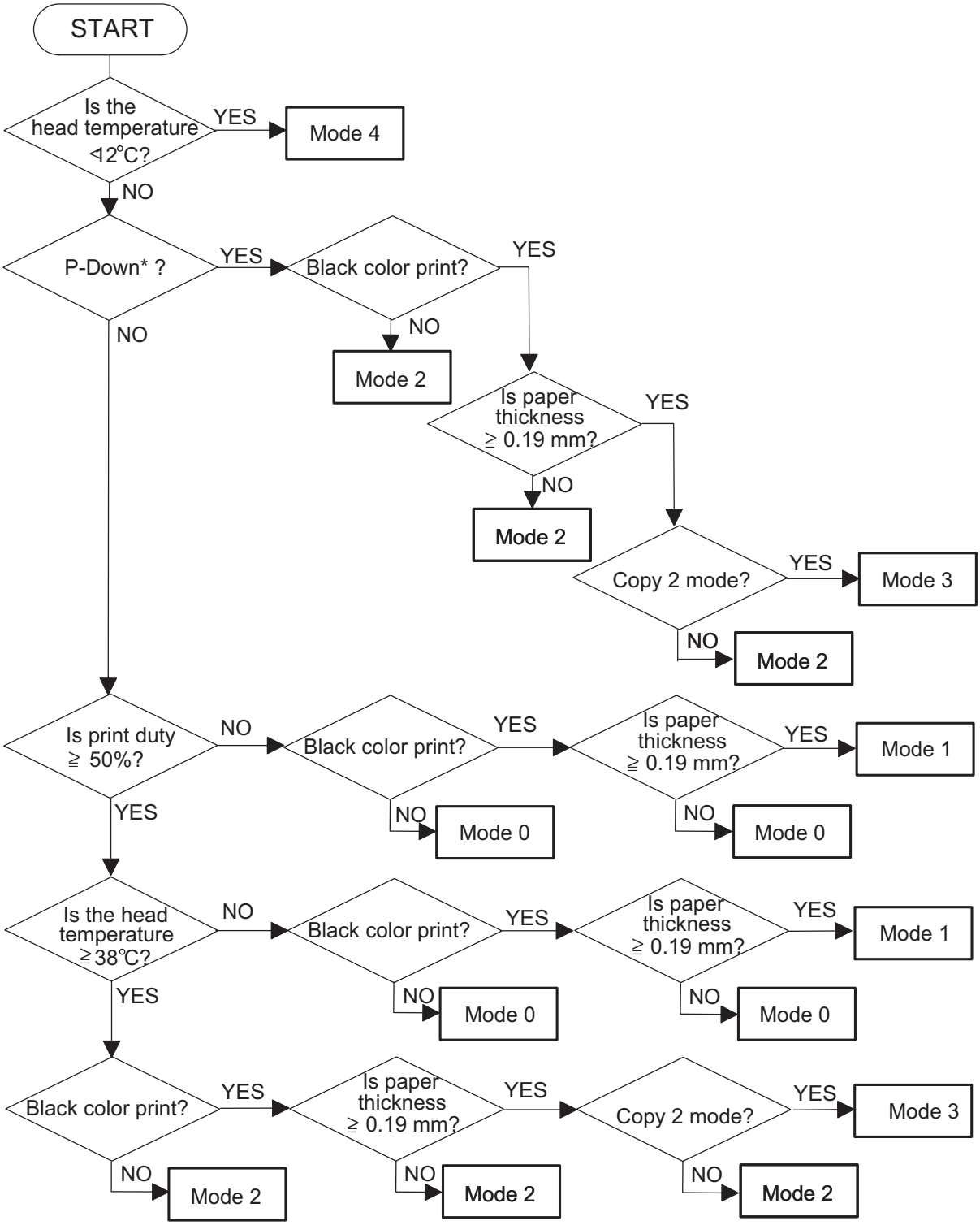
❑ Printing speed See Table 1-3.

Table 1-3. Printing Speed

Printing Mode	Character Size	Maximum Printing Speed				
		Mode 0	Mode 1	Mode 2	Mode 3	Mode 4
High speed draft	10 cpi	444	444	160	160	240
Draft	10 cpi	360	333	240	120	180
	12 cpi	432	400	288	144	216
	15 cpi	540	500	360	180	270
Craft condensed	17 cpi	309	286	206	103	154
	20 cpi	360	333	240	120	180
LQ	10 cpi	120	111	80	40	60
	12 cpi	144	133	96	48	72
	15 cpi	180	167	120	60	90
LQ condensed	17 cpi	206	190	137	68	103
	20 cpi	240	222	160	80	120
Raster (360 dpi)	10 cpi	20	20	20	20	20

Printing Speed Mode Selection

This printer is designed to control the printing speed according to the power supply voltage and printhead temperature. When the power supply voltage drops to the limit, the printer stops printing, then resumes the job at a slower speed to print the remaining data for the line. When the printhead temperature rises to the limit, the printer stops printing. Then it resumes printing at a slower speed if the printhead temperature recovers to the specified level. The printing speed mode is determined according to the flowchart shown in Page 1-6.



P-Down : Means that the line is the reprinted line after the power supply voltage drops. It is to prevent the printhead and the printer mechanism from being driven under the improper power supply voltage.

Figure 1-3. Printing Speed Selection Mode

1.3.2 Character Specifications and Control Codes

1.3.2.1 Coded Character Sets

- ASCII international and Legal international character sets *

USA	France	Germany	UK
Denmark 1	Sweden	Italy	Spain 1
Japan	Norway	Denmark 2	Spain 2
Latin America	Korea	Legal	

Note: *The codes for the international and legal characters are as follows: 23H, 24H, 40H, 5BH, 5CH, 5DH, 5EH, 60H, 7BH, 7CH, 7DH, 7EH*

- Standard version (11 character tables)

Italic table	PC437 (US, Standard Europe)
PC850 (Multilingual)	PC860 (Portuguese)
PC861 (Icelandic)	PC863 (Canadian French)
PC865 (Nordic)	Abicomp
BRASCII	Roman 8
ISO Latin 1	

- NLSP version (30 character tables)

Italic table	PC 437 (US, Standard Europe)
PC 850 (Multilingual)	PC 437 (Greek)
PC 852 (East Europe)	PC 853 (Turkish)
PC 855 (Cyrillic)PC 860	PC 857 (Turkish)
PC 866 (Russian)	PC 869 (Greek)
MAZOAWIA (Poland)	Code MJK (CSFR)
ISO 8559-7 (Latin, Greek)	ISO Latin 1T (Turkish)
Bulgaria (Bulgaria)	PC 864 (Arabic)
Estonia	PC 774 (LST 1283:1933)
ISO 8859-2	PC 866 LAT. (Latvian)
PC 860 (Portuguese)	PC 861 (Icelandic)
PC 865 (Nordic)	PCAPTEC (Arabic)
PC 708 (Arabic)	PC 720 (Arabic)
PCAR864 (Arabic)	Hebrew7 *[1]
Hebrew8 *[1]	PC862(Hebrew) *[1]

Note 1*: Theses character tables are not selected in the SelecType mode.*

1.3.2.2 Type Faces

- Bitmap fonts (10 type faces)

Roman	Sans Serif	Courier	Prestige
Script	Script C	OCR B	
Orator	Orator S	Draft	

- Scalable fonts (4 type faces)

Roman	Sans Serif	Roman T	Sans Serif H

- Bar-code fonts (8 type faces)

EAN 13	EAN-8	Interleaved 2 of 5	UPC-A
UPC-E	Code 39	Code 128	POSTNET

1.3.2.3 Rendition

- ASCII

Double-width	Double-height	Condensed
Bolded	Double-strike	Italics
Super/subscript	Outlined	Shadowed

Underlined (Single, Double, Single-broken, Double-broken line)
Strike-through (Single, Double, Single-broken, Double-broken line)
Over-scored (Single, Double, Single-broken, Double-broken line)

1.3.2.4 Combination of character tables and typefaces

Table 1-4. Character Tables and Type Faces

	Character Tables	Bitmap Fonts	Scalable Fonts
Standard version *1	**Italic table** **PC 437 (US Standard Europe)** **PC 850 (Multilingual)** **PC 860 (Portuguese))** **PC 861 (Icelandic)** **PC 863 (Canadian-French)** **PC 865 (Nordic)** **BRASCII** Abicomp Roman 8 ISO Latin 1	EPSON Draft EPSON Roman EPSON Sans Serif EPSON Courier EPSON Prestige EPSON Script EPSON OCR-B EPSON Orator EPSON Orator-S Epson Script C	EPSON Roman EPSON Sans Serif EPSON Roman T EPSON Sans Serif H
NLSP version *1	**Italic table** **PC 437 (US Standard Europe)** **PC 850 (Multilingual)** **PC 860 (Portuguese)** **PC861 (Icelandic)** **PC 865 (Nordic)**	EPSON Draft EPSON Roman EPSON Sans Serif EPSON Courier EPSON Prestige EPSON Script EPSON OCR-B EPSON Orator EPSON Orator-S Epson Script C	EPSON Roman EPSON Sans Serif EPSON Roman T EPSON Sans Serif H
	PC 864 (Arabic)	EPSON Draft EPSON Roman	(Not supported)
	PC 437 (Greek) PC 852 (East Europe) PC 853 (Turkish) PC 855 (Cyrillic) PC 857 (Turkish) PC 866 (Russian) PC 869 (Greek) MAZOWIA (Poland) Code MJK (CSFR) ISO 8859-7 (Latin/Greek) ISO Latin 1T (Turkish) Bulgaria (Bulgaria) Estonia PC 774 (LST 1283:1993) ISO 8859-2 PC 866 LAT. (Latvian)	EPSON Draft EPSON Roman EPSON Sans Serif EPSON Courier EPSON Prestige EPSON Script	(Not supported)
	PCAPTEC (Arabic) PC 708 (Arabic) PC 720 (Arabic) PCAR864 (Arabic)	EPSON Draft (Arabic) EPSON Naskh (Roman) EPSON Kufi (Sans Serif)	(Not supported)
	Hebrew7 *2 Hebrew8 *2 PC862(Hebrew) *2	EPSON Draft (Hebrew) EPSON Miriam (Roman) EPSON David (Courier)	(Not supported)

Note:

1: ESC R command is effective on the character tables with bold weight.

2: These character tables are not selected in the SelecType mode.

1.3.2.5 Memory Size

- ❑ Input buffer 128 K byte or 1k byte
- ❑ Download memory Approximately 10 K byte
- ❑ CG ROM NLSP Version: 8 M bit, Standard Version: 4 M bit

1.3.2.6 Character Size

- ❑ Character size
  - Bit map font 10.5 point
  - Scalable font 10.5 point
- ❑ Character matrixes See Table 1-5.

Table 1-5. Character Matrixes

Character	Horizontal Dots	Vertical Dots
Draft 10 cpi	12	24
Draft 12 cpi	10	24
Draft 15 cpi	8	16
LQ 10 cpi	36	24
LQ 12 cpi	30	24
LQ 15 cpi	24	16
LQ proportional	48 (maximum)	24

Notes:

1. *The character matrixes for high speed draft 10 cpi characters are made from the draft 12 cpi matrixes.*
2. *The character matrixes for 15 cpi character are also used for superscript and subscript characters.*

1.3.2.7 Control Codes

- ❑ ESC/P2
- ❑ IBM 2391 Plus Emulation

1.3.3 Paper Feed Specification

1.3.3.1 Friction Feed (Cut sheet)

❑ Paper Path

- Single sheet, envelopes — Front and rear insertion (Manual/CSF insertion)
- Multi-part form — Rear entry (Manual/CSF insertion)

Notes:

1. *Set the release lever to "FRICTION".*
2. *Do not load continuous paper (including folding paper).*
3. *Set the longer side of the envelope horizontally.*
4. *When setting No.6 envelope, align the left sheet edge guide with the marked position.*

1.3.3.2 Tractor Feed (Continuous paper)

❑ Paper Path

- Rear entry push tractor feed with paper parking function

Notes:

1. *Set the release lever to "TRACTOR".*
2. *Do not perform reverse feed for more than 1/6 inch.*
3. *Set the left and right sheet edge guides to the right and left ends of the front paper guide, respectively.*

1.3.3.3 Paper Feed Speed and Accuracy

❑ Minimum feed length — 1/360 inch (1/6, 1/8 or programmable with the increment of 1/360 inch)

❑ Feed speed

- 1/6 inch line feed — 42 ms
- Continuous feed — 6.0 IPS (inch/second)
  0.152 MPS (m/second)

1.3.4 Paper Specification

❑ **Cut sheet (Single sheet)**

Table 1-6. Cut sheet Specification : Single Sheet

		Minimum	Maximum
Width	Manual insertion	3.6 inch 92 mm	16.5 inch 420 mm
	CSF	3.9 inch 100 mm	16.5 inch 420 mm
Length	Manual insertion	3.5 inch 92 mm	16.5 inch 420 mm
	CSF	3.6 inch 92 mm	14.3 inch 364 mm
Thickness		0.0025 inch 0.065 mm	0.0047 inch 0.12 mm
Weight		52 g/m² 14 lb.	105 g/m² 27 lb.
Quality		Plain paper, Reclaimed paper	

Notes:

1. Reclaimed paper can be used under condition of room temperatures only.

2. Ensure that the paper is not curled, folded or crumpled.

❑ **Cut sheet (Multi-part form)**

Table 1-7. Cut sheet Specification : Multi-part Form

		Minimum	Maximum
Width	Manual insertion	3.6 inch 92 mm	16.5 inch 420 mm
	CSF	3.9 inch 100 mm	16.5 inch 420 mm
Length	Manual insertion	3.5 inch 92 mm	16.5 inch 420 mm *[1]
	CSF	3.6 inch 92 mm	14.3 inch 364 mm *[1]
Copies		1 original and 6 copies	
Thickness		0.0047 inch 0.12 mm	0.021 inch 0.53 mm
Weight (I sheet of a multi-part form)		40 g/m² 11 lb.	58 g/m² 15 lb.
Quality		Carbon-less multi-part paper	
Jointing		Line glue (top, right and left side)	

Notes:

1. Ensure that the paper is not curled, folded or crumpled.

2. The maximum length for the carbon-less multi-part paper is 297 mm with the left or right side of the form line-glued.

3. CSF does not feed paper which is glued by the right or left side.

❑ **Envelopes**

Table 1-8. Envelope Specification

		Minimum	Maximum
Envelopes (No.6)	Width	6.5 inch/165 mm	
	Length	3.6 inch/92 mm	
Envelopes (No.10)	Width	9.5 inch/241 mm	
	Length	4.1 inch/105 mm	
Thickness		0.0063 inch 0.16 mm	0.021 inch 0.52 mm
Weight		45 g/m² 12 lb. /m²	91 g/m² 24 lb./m²
Quality		Bond paper, Plain paper Airmail paper without glue at a flap	

Notes:

1. Fold the flap of the envelope inside before loading at CSF or manual insertion.

2. Difference in thickness within the same printable area must be 0.0098 inch or less.

❑ **Continuous paper**

Table 1-9. Continuous Paper Specification : Single Paper/Multi-Part Form

		Minimum	Maximum
Width		4.0 inch 101.6 mm	16 inch 406.4 mm
		4.0 inch 101.6 mm	22.0 inch 558.8 mm
Length (1 page)		3.5 inch 92 mm	16.4 inch 420 mm *[1]
Copies		1 original and 6 copies	
Total Thickness	Single sheet	0.0025 inch 0.065 mm	0.047 inch 0.12 mm
	1 sheet of multi-part form	0.0047 inch 0.12 mm	0.021 inch 0.53 mm
Weight	Cut sheet	52.3 g/m² 14 lb.	105 g/m² 27 lb.
	1 sheet of multi-part form	40 g/m² 11 lb.	58 g/m² 15 lb.
Quality		Plain paper, Reclaimed paper Carbon-less multi-part form	
Jointing *[1]		Must be one of the followings: - Point glue on the both sides - Tape staple on the both sides - Point glue on one side and tape staple on the other side ***Note:*** *Do not use the paper which is glued by the side or stapled.*	

❑ **Labels**

Table 1-10. Label Specification

	Minimum	Maximum
Label size	See Figure 1-4.	
Base sheet width	4.0 inch	16.0 inch
	101.6 mm	406.4 mm
Base sheet length (1 page)	4.0 inch	22.0 inch
	101.6 mm	559 mm
Base sheet thickness	0.0028 inch 0.07 mm	0.0035 inch 0.09 mm
Total thickness	0.0063 inch 0.16 mm	0.0075 inch 0.19 mm
Label weight	64 g/m²/17 lb.	
Quality	Plain paper or equivalent The base sheet must be continuous paper.	

Notes:

1. *Use labels in the condition of the room temperature only.*
2. *Labels backed with the continuous base sheet can be used only.*
3. *When the label sheet whose base sheet is exposed around the labels, adjust the platen gap manually to the portion covered with the label using PG adjust lever.*

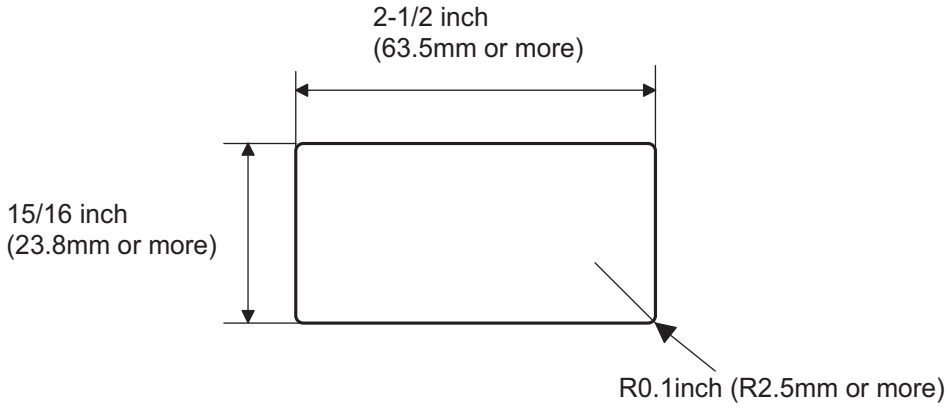


Figure 1-4. Label Size

❑ **Pre-print paper**

Table 1-11. Pre-Print Paper Specification

	Minimum	Maximum
Width	4.0 inch 101.6 mm	16.0 inch 406.4 mm
Length (1 page)	4.0 inch 101.6 mm	22.0 inch 559 mm
Total thickness	0.0025 inch 0.065 mm	0.047 inch 0.12 mm
Quality	The paper printed with the color which has the reflective rate of less than 60 %, such as black.	

❑ **Continuous forms with labels**

Table 1-12. Continuous Forms with Labels Specification

	Minimum	Maximum
Base sheet width	4.0 inch 101.6 mm	16.0 inch 406.4 mm
Base sheet length (1 page)	4.0 inch 101.6 mm	22.0 inch 559 mm
Total thickness	– –	0.021 inch 0.53 mm
Quality	Plain paper or equivalent Airmail paper without glue at a flap	

Note:
When using the continuous forms with labels, the label position must be registered properly. It can be performed through the utility "Label Position Registering Utility".

❑ **Overlapping multi-part forms**

Table 1-13. Overlapping Multi-Part Form Specification

	Minimum	Maximum
Base sheet width	4.0 inch	16.0 inch
	101.6 mm	406.4 mm
Base sheet length (1 page)	4.0 inch	22.0 inch
	101.6 mm	559 mm
Total thickness	–	0.026 inch
	–	0.65 mm
Jointing	Multi-part forms :Point glue Joint for the base sheet and multi-part form :Point glue	

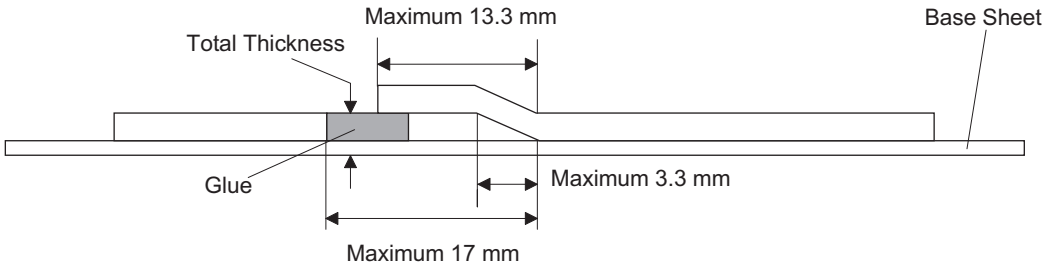


Figure 1-5. Overlapping multi-part Form Specification

❑ **Overlapping multi-part forms with labels**

Table 1-14. Overlapping Multi-Part Form with Labels Specification

	Minimum	Maximum
Base sheet width	4.0 inch	16.0 inch
	101.6 mm	406.4 mm
Base sheet length (1 page)	4.0 inch	22.0 inch
	101.6 mm	559 mm
Total thickness	–	0.026 inch
	–	0.65 mm
Jointing	Multi-part forms :Point glue Joint for the base sheet and multi-part form :Point glue	

Note: *When using overlapping multi-part forms with labels, the label position must be registered properly. It can be performed through the utility "Label Position Registering Utility".*

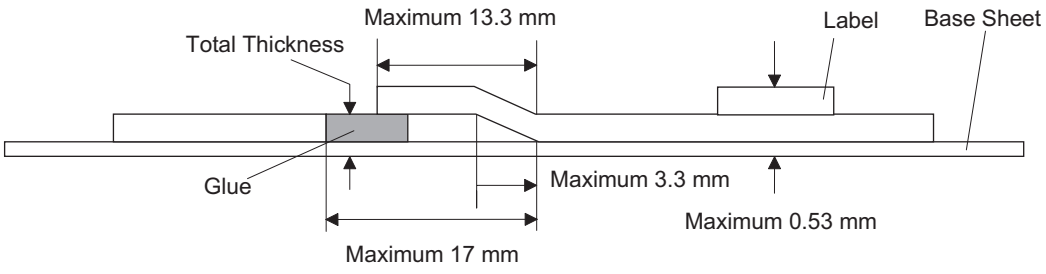


Figure 1-6. Overlapping multi-part Form with Labels Specification

1.3.5 Printable Area

This section describes printable area for various types of paper.

❑ **Cut sheet**

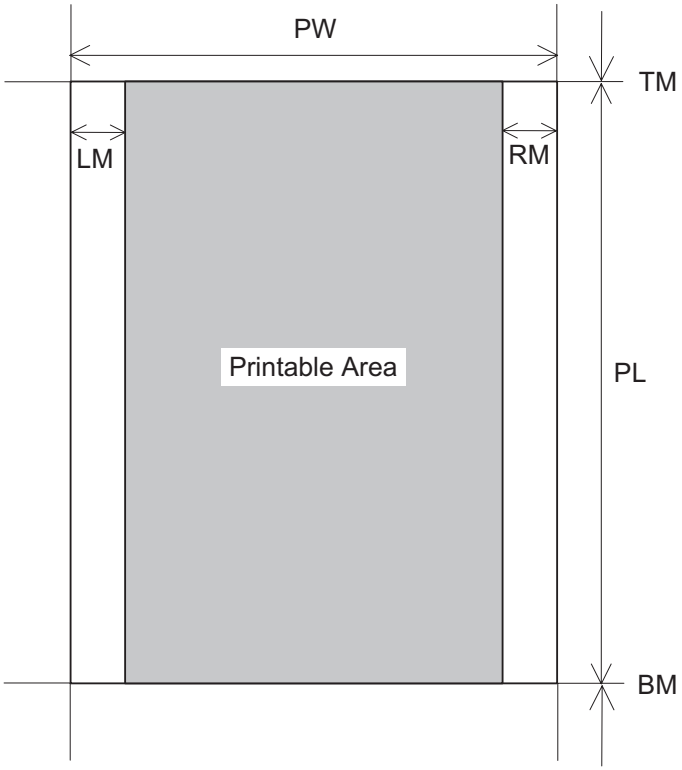


Figure 1-7. Printable Area for Cut Sheet

Table 1-15. Printing Area for Cut sheet

	Single cut sheet	Multi-part cut sheet
Paper width (PW)	Refer to Section 1.3.4.	Refer to Section 1.3.4.
Paper length (PL)	Refer to Section 1.3.4.	Refer to Section 1.3.4.
Left margin (LM)	3 mm (0.118”) or more	3 mm (0.118”) or more
	[A3 landscape] 31 mm (1.22”) or more	[A3 landscape] 31 mm (1.22”) or more
Right margin (RM)	3 mm (0.118”) or more	3 mm (0.118”) or more
	[A3 landscape] 20 mm (0.78”) or more	[A3 landscape] 20 mm (0.78”) or more
Top margin (TM)	0 mm (0”) or more	0 mm (0”) or more
Bottom margin (BM)	0 mm (0”) or more	0 mm (0”) or more
Width of printing area (WPA)	Maximum 346 mm (13.62”)	Maximum 346 mm (13.62”)

❑ **Continuous paper**

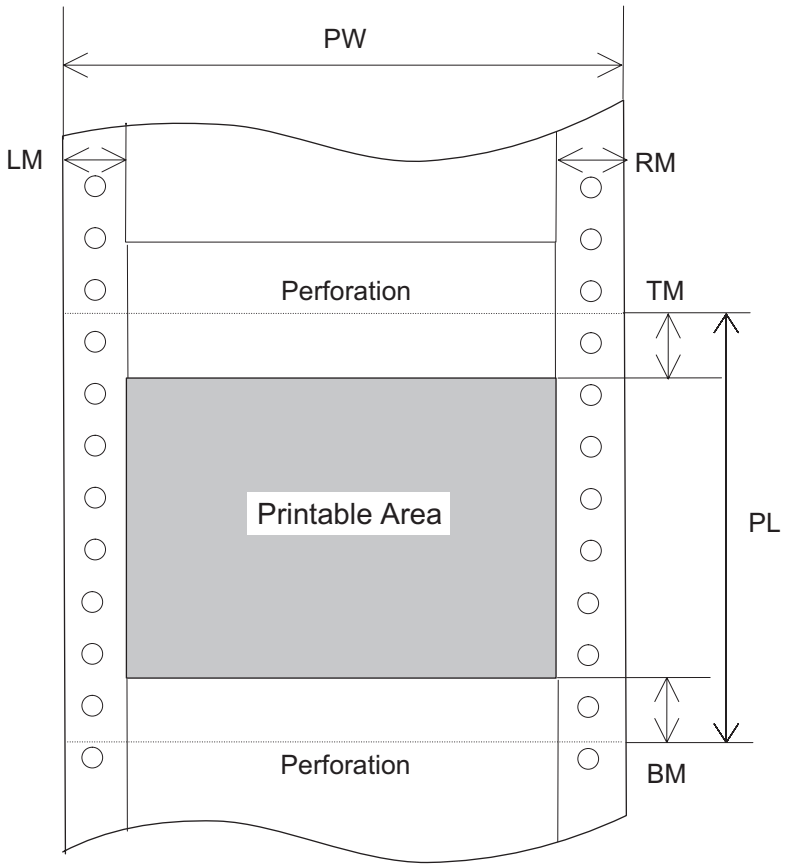


Figure 1-8. Printable Area for Continuous Paper

		Continuous paper
Paper width	(PW)	Refer to Section 1.3.4.
Paper length	(PL)	Refer to Section 1.3.4.
Left margin	(PM)	9 mm (0.354”) or more
Right margin	(LM)	9 mm (0.354”) or more
Top margin	(TM)	4.2 mm (0.165”) or more
Bottom margin	(BM)	4.2 mm (0.165”) or more

Notes:

1. In the top 75 mm are, the paper feeding pitch may be irregular.

2. Forms-override printing is available for 2 lines after the paper end is detected.(Paper feeding pitch is not guaranteed.) The end of the printable area is 4.2 m or more apart from the bottom edge of the paper.

3. When the page width is 16 inches, note the followings:

- *LM is 18 mm or more with the left tractor set at the farthest side toward the 136th column.*
- *RM is 18 mm or more with the right tractor set at the farthest side toward the 1st column.*

❑ Labels

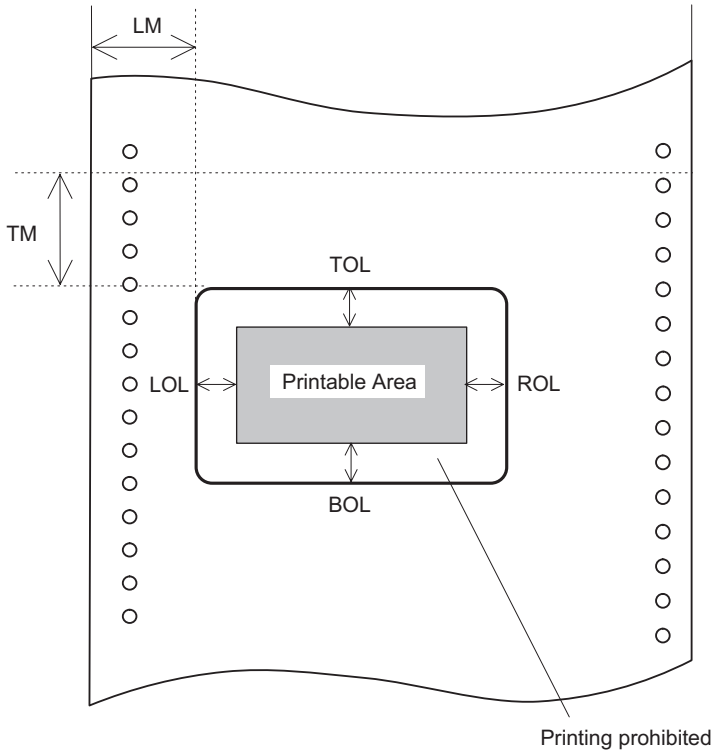


Figure 1-9. Printable Area for Labels

Table 1-16. Printable Area for Labels

		Continuous paper
Paper width	(PW)	Refer to Section 1.3.4.
Paper length	(PL)	Refer to Section 1.3.4.
Left margin	(LM)	12 mm (0.472”) or more
Top margin	(TM)	1.2 mm (0.0472) or more
Left margin on label	(LOL)	3 mm (0.118”) or more
Right margin on label	(ROL)	3 mm (0.118”) or more
Top margin on label	(TOL)	3 mm (0.118”) or more
Bottom margin on label	(BOL)	3 mm (0.118”) or more

Notes:

1. Do not feed paper backward.

2. Use only the specified paper path for continuous paper.

3. The paper feeding pitch in the top 75 mm (2.9”) may be irregular.

❑ **Envelops**

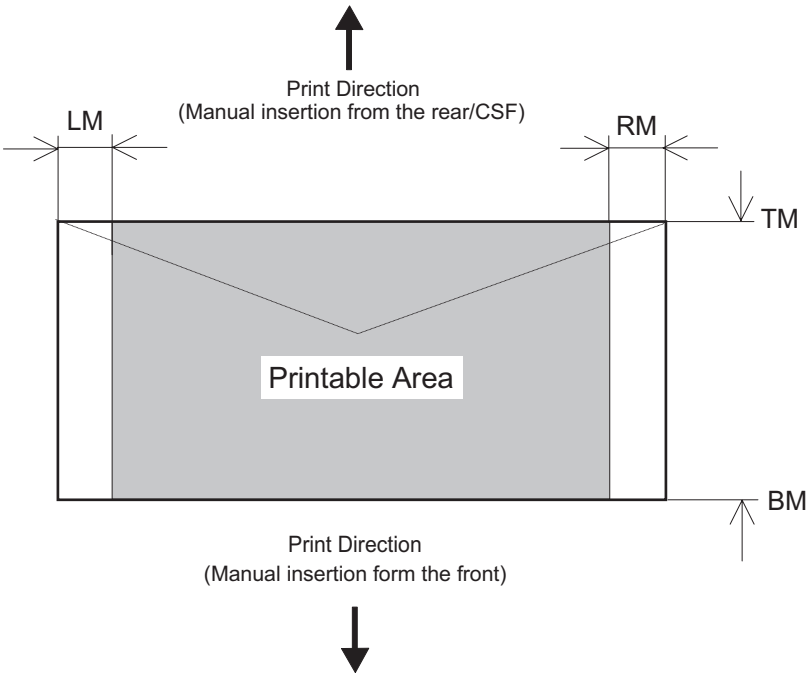


Figure 1-10. Printable Area for Envelopes

Table 1-17. Printable Area for Envelops

		Continuous paper
Paper width	(PW)	Refer to Section 1.3.4.
Paper length	(PL)	Refer to Section 1.3.4.
Left margin	(LM)	3 mm(0.118”) or more
Right margin	(RM)	3 mm(0.118”) or more
Top margin	(TM)	0 mm (0”) or more *[1]
Bottom margin	(BM)	0 mm (0”) or more

Note 1: *At CSF insertion:* 4.2 mm (0.16”) or more

❑ **Overlapping multi-part forms**

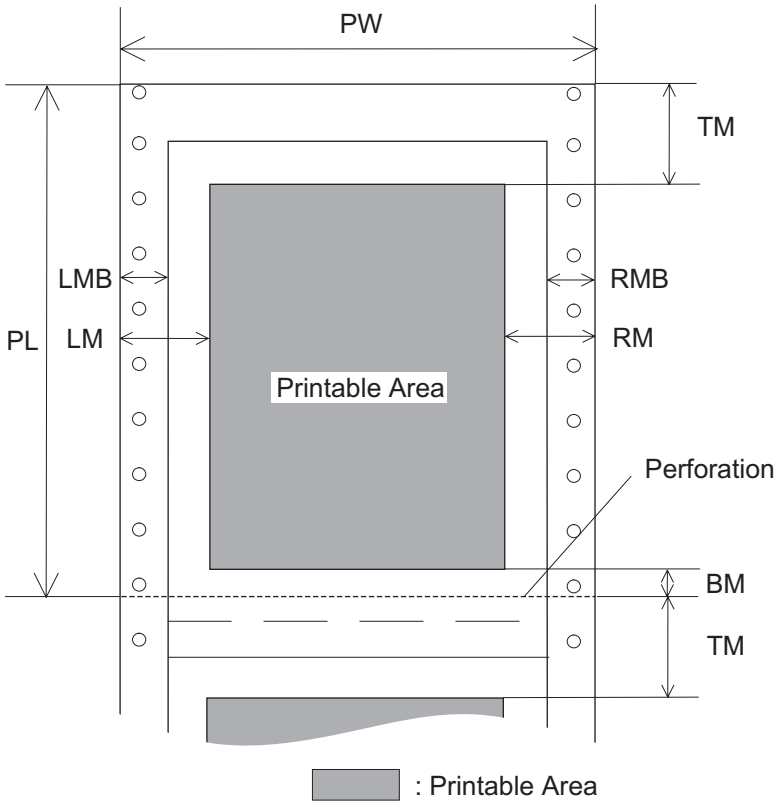


Figure 1-11. Printing Area for Overlapping Multi-part Forms

Table 1-18. Printing Area for Overlapping Multi-part Forms

	Continuous paper
Paper width (PW)	Refer to Section 1.3.4.
Paper length (PL)	Refer to Section 1.3.4.
Left margin (LM)	19 mm (0.748”) or more
Right margin (RM)	19 mm (0.748”) or more
Top margin (TM)	21.2 mm (0.835”) or more
Bottom margin (BM)	4.2 mm (0.165”) or more
Left margin from the multi-part form to the base sheet (LMB)	13 mm (0.512”) ± 3 mm (0.118”)
Right margin from the multi-part form to the base sheet (RMB)	13 mm (0.512”) ± 3 mm (0.118”)

Notes:

1. *Do not feed paper backward.*
2. *Use only the specified paper path for continuous paper.*
3. *The paper feeding pitch in the top 75 mm (2.9”) may be irregular.*
4. *Forms-override printing is available for 2 lines after the paper end is detected. The end of the printable area is 4.2 mm or more apart from the bottom edge of the paper.*

❑ **Continuous forms with labels**

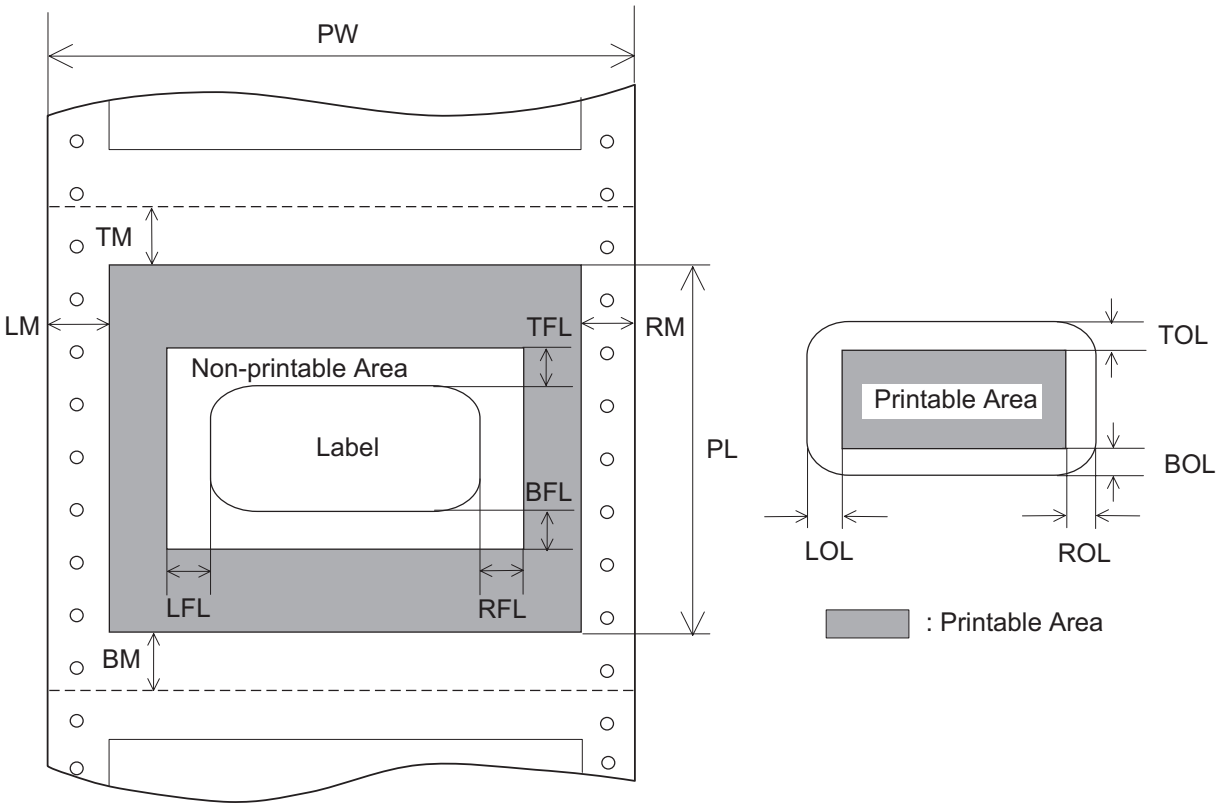


Figure 1-12. Printable Area for Continuous Forms with Labels

Table 1-19. Printable Area for Continuous Forms with Labels

		Continuous paper
Paper width	(PW)	Refer to Section 1.3.4.
Paper length	(PL)	Refer to Section 1.3.4.
Left margin	(LM)	9 mm (0.354”) or more
Right margin	(RM)	9 mm (0.354”) or more
Top margin	(TM)	4.2 mm (0.165”) or more
Bottom margin	(BM)	4.2 mm (0.165”) or more
Left margin for label	(LFL)	45 mm (1.77) or more
Right margin from label	(RFL)	45 mm (1.77) or more
Top margin from label	(TFL)	25 mm(0.984”) or more
Bottom margin from label	(BFL)	25 mm(0.984”) or more
Left margin on label	(LOL)	3 mm (0.118”) or more
Right margin on label	(ROL)	3 mm (0.118”) or more
Top margin on label	(TOL)	3 mm (0.118”) or more
Bottom margin on label	(BOL)	3 mm (0.118”) or more

Notes:

1. *Do not feed paper backward.*
2. *Use only the specified paper path for the continuous paper.*
3. *The paper feeding pitch in the top 75 mm (2.9”) may be irregular.*
4. *Forms-override printing is available for 20 lines after the paper end is detected. (Paper feeding pitch is not guaranteed.) The end of the printable are is 4.2 mm or more apart from the bottom edge of the paper.*

❑ **Overlapping multi-part forms with labels**

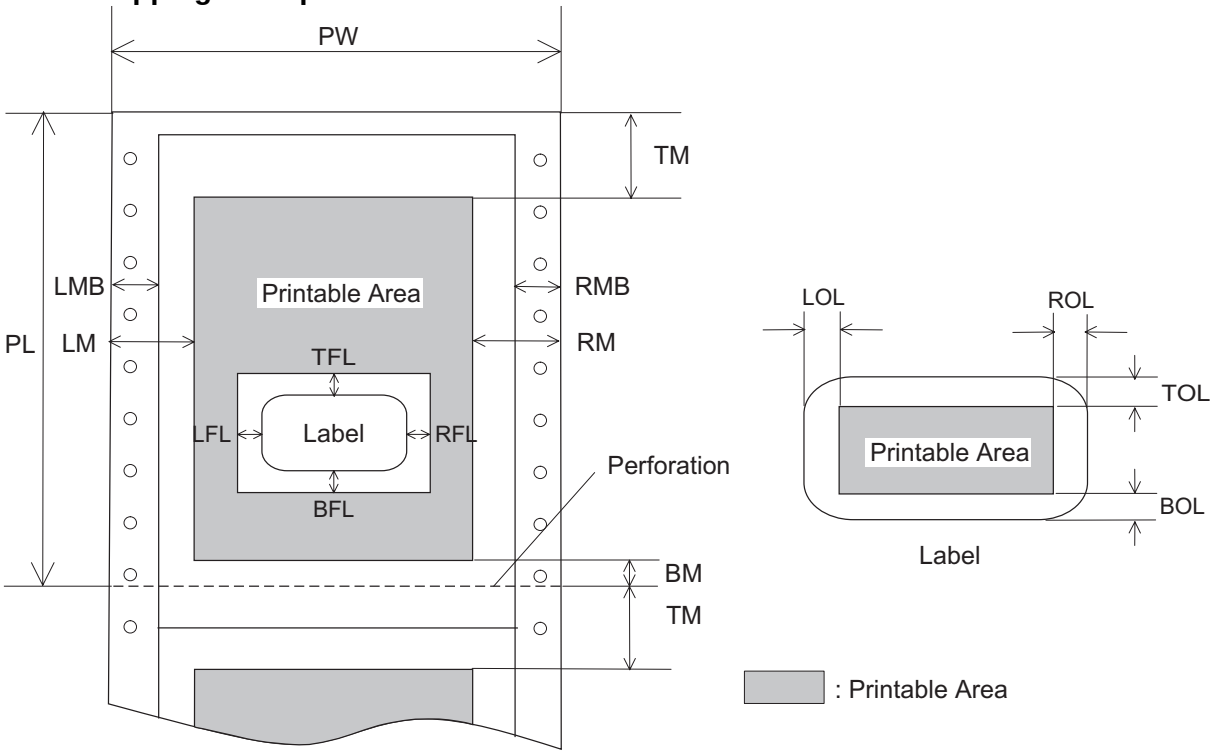


Figure 1-13. Printable Area for Overlapping Multi-Part Forms with Labels

Table 1-20. Printable Area for Overlapping Multi-Part Forms

	Continuous paper
Paper width (PW)	Refer to Section 1.3.4.
Paper length (PL)	Refer to Section 1.3.4.
Left margin (LM)	19 mm (0.748”) or more
Right margin (RM)	19 mm (0.748”) or more
Left margin from the multi-part forms to the base sheet (LMB)	13 mm (0.552”) ± 3 mm (0.118”)
Right margin from the multi-part forms to the base sheet (RMB)	13 mm (0.552”) ± 3 mm (0.118”)
Top margin (TM)	21.2 mm (0.835”) or more
Bottom margin (BM)	4.2 mm (0.165”) or more
Non-printable area (NA)	25.4 mm (1.0”) or more
Left margin from label (LFL)	45 mm (1.77”) or more
Right margin from label (RFL)	45 mm (1.77”) or more
Top margin from label (TFL)	25 mm(0.984”) or more
Bottom margin from label (BFL)	25 mm(0.984”) or more
Left margin on label (LOL)	3 mm (0.118”) or more
Right margin on label (ROL)	3 mm (0.118”) or more
Top margin on label (TOL)	3 mm (0.118”) or more
Bottom margin on label (BOL)	3 mm (0.118”) or more

Notes:

1. Do not feed paper backward.

2. The paper feeding pitch in the top 75 mm (2.9”) may be irregular.

3. *Forms-override printing is available for 20 lines after the paper end is detected. (Paper feeding pitch is not guaranteed.) The end of the printable are is 4.2 mm or more apart from the bottom edge of the paper*

1.3.6 Paper Thickness Detection

This printer is equipped with the automatic paper thickness adjust function. When the paper thickness lever is set to “Auto position”, the printer automatically measures thickness of each paper loaded to set the proper PG (platen Gap) the detected thickness. PG is also adjusted manually. See Table 1-21 which shows the adjust lever position and corresponding paper thickness and platen gap.

Table 1-21. PG Adjust Lever

Adjust lever position	Paper thickness (inch)		Paper thickness (mm)		PG	
	Maximum	Minimum	Maximum	Minimum	Inch	mm
-1	0.0024	0.0043	0.06	0.11	0.0138	0.35
0	0.0024	0.0043	0.06	0.11	0.0154	0.39
1	0.0043	0.0059	0.11	0.15	0.0169	0.43
2	0.0059	0.0075	0.15	0.19	0.0181	0.46
3	0.0075	0.0098	0.19	0.25	0.0197	0.50
4	0.0098	0.0122	0.25	0.30	0.0217	0.55
5	0.0122	0.0146	0.30	0.36	0.0240	0.61
6	0.0146	0.0165	0.36	0.42	0.0264	0.67
7	0.0165	0.0185	0.42	0.46	0.0280	0.71
8	0.0185	0.0201	0.46	0.49	0.0291	0.74
9	0.0201	0.0217	0.49	0.53	0.0307	0.78

Notes: *Switching to “Dark” in the copy mode is effective under the following conditions:*

- ❑ *In the “Auto” mode: Paper thickness is 0.2 mm or more.*
- ❑ *Manual adjustment: The lever is set to one of the positions in the range from 3 to 9.*

1.3.7 Ribbon Cartridge

1.3.7.1 Monochrome ribbon cartridge

- ❑ Color Black
- ❑ Ribbon fabric Nylon 66
- ❑ Ribbon dimension 25.5 mm (W) X 17 mm (L) X 1.5 mm (D)
- ❑ ribbon thickness 0.128 mm ± 0.007 mm
- ❑ Cartridge dimension 153 mm/6.0” (W) X 33 mm/1.3” (H) X 105 mm/4.1” (D)
- ❑ Ribbon life * 6 million characters
- ❑ Ribbon replacement Whole cartridge
- ❑ Item No. S015066

∗ At 10 cpi printing in the LQ mode. (48 dots per character)

1.3.7.2 Color ribbon cartridge

- ❑ Color Black Magenta, Cyan, Yellow
- ❑ Ribbon fabric Nylon 66
- ❑ Ribbon dimension 25.5 mm (W) X 17 mm (L) X 1.5 mm (D)
- ❑ ribbon thickness 0.128 mm ± 0.007 mm
- ❑ Cartridge dimension 153 mm/6.0” (W) X 33 mm/1.3” (H) X 105 mm/4.1” (D)
- ❑ Ribbon life * Black: 1.5 million characters
  Magenta 1.1 million characters
  Cyan 1.1 million characters
  Yellow 0.8 million characters
- ❑ Ribbon replacement Whole cartridge
- ❑ Item No. S015067

∗ At 10 cpi printing in the LQ mode. (48 dots per character)

1.3.8 Input Data Buffer

- ❑ Approximately 128 K byte/1K byte

1.3.9 Electric Specifications

120 V version

❑ Rated voltage	AC 120 V
❑ Input voltage range	AC 103.5 to 132 V
❑ Rated frequency renege	50 to 60 Hz
❑ Input frequency range	49.5 to 60.5 Hz
❑ Rated current	7 A (maximum)
❑ Power consumption	Approximately 60 W (ISO/IEC 10561 Letter pattern) Energy Star program compliant
❑ Insulation resistance	10 M ohms minute (Between AC line and chassis, 500 VDC)
❑ Dielectric strength	AC 1,000 V rms. for 1 minute or AC 1,200 V rms. for 1 second (Between AC line and chassis)

220 - 240V version

❑ Rated voltage	AC 220 to 240 V
❑ Input voltage range	AC 198 to 264 V
❑ Rated frequency renege	50 to 60 Hz
❑ Input frequency range	49.5 to 60.5 Hz
❑ Rated current	0.7 A (maximum)
❑ Power consumption	Approximately 60 W (ISO/IEC 10561 Letter pattern) Energy Star program compliant
❑ Insulation resistance	10 M ohms min. (Between AC line and chassis, DC 500 V)
❑ Dielectric strength	AC 1,500 Vrms. For 1 minute (Between AC line and chassis)

1.3.10 Safety Approvals

120 V version

❑ Safety standards	UL1950 with D3 CSA22.2 No. 950 with D3
❑ EMI	FCC part15 subpart B class B CSA C108.8 class B

220 - 240 V version

❑ Safety standards	EN 60950 (TÜV, NEMKO)
❑ EMI	EN 55022 (CISPR Pub.22) class B AS/NZS 3548 class B

1.3.11 CE Marking

220 - 240 V version

❑ Low Voltage Directive 73/23/EEC	EN60950
❑ EMC Directive 89/336/EEC	EN55022 class B EN61000-3-2 EN61000-3-3 EN50082-1 IEC801-2 IEC801-3 IEC801-4

1.3.12 Acoustic Noise

❑ Noise level — Approximately 55 dB (A) (According to ISO 7779)

1.3.13 Reliability

❑ Total print volume — 9 million lines (excluding printhead)
❑ Printhead life — 200 million strokes/pin (Monochrome ribbon)
100 million strokes/pin (Color ribbon)

❑ Ribbon life
- Fabric black ribbon life — 6 million characters*
- Fabric color ribbon — Black : 1.5 million characters*
  Magenta: 1.1 million characters*
  Cyan: 1.1 million characters*
  Yellow: 0.8 million characters*

* 1 character is formed with 48 dots.
At 10-cpi printing (LQ mode)

1.3.14 Environmental Conditions

Table 1-22. Environmental Condition

	Operating	Non-operating
Temperature	5 to 35 °C	-30 to 65 °C
	15 to 35 °C *[1]	-20 to 40 °C *[1]
	15 to 25 °C *[2]	—
Humidity *[3]	10 to 80 %	5 to 85 %
	10 to 80 % *[1]	5 to 85 % *[1]
	20 to 60 % *[2]	—
Resistance to shock	0.25G, 10 to 55 Hz (Directions: X,Y and Z)	0.50G, 10 to 55 Hz (Directions: X,Y and Z)
Resistance to Vibration	1G, Within 1 ms (Directions: X,Y and Z)	2G, Within 1 ms (Directions: X,Y and Z)

Notes:
1. When the optional film ribbon is used.
2. When the envelopes or labels are printed.
3. Without condensation

1.4 Interfaces

The EPSON DLQ-3000+ is equipped with the parallel and Mac serial interfaces and a card slot for an optional Type-B interface. This section provides information on each interface.

1.4.1 Parallel Interface

Forward Channel

- ❑ Transmission mode 8 bit parallel, IEEE-1284 compatibility mode
- ❑ Synchronization By /STROBE pulse
- ❑ Handshaking By /BUSY and /ACKNLG signal
- ❑ Signal level TTL compatible (IEEE-1284 level 1 device)
- ❑ Adaptable connector 57-30360 (Amphenol) or equivalent

Table 1-23. Signal level of TTL Compatible (IEEE-1284 level 1 device)

Parameter	Minimum	Maximum	Condition
VOH*	-	5.5 V	
VOL*	-0.5 V	-	
IOH*	-	0.32 mA	VOH = 2.4 V
IOL*	-	12 mA	VOL = 0.4 V
CO	-	50 pf	
VIH	-	2.0 V	
VIL	0.8 V	-	
IIH	-	0.32 mA	VIH = 2.0 V
IIL	-	12 mA	VIL = 0.8 V
CI	-	50 pf	

* A LOW logic level on the Logic H signal is as follows:
  2.0 V or less when the printer is powered off.
  3.0 V or more when the printer is powered on.
  The receiver provides an impedance equivalent to 7.5 K ohms to ground.

The BUSY signal is HIGH in the following cases:

- ❑ During data entry
- ❑ When the input data buffer is full.
- ❑ While /INIT signal is at low level
- ❑ During hardware initialization
- ❑ During the signal /ERROR or PE is LOW or HIGH, respectively.
- ❑ During the self-test printing mode.
- ❑ During the default setting mode.
- ❑ During the adjustment mode.

The /ERROR signal is LOW when one of the following errors has occurred:

- ❑ Printer hardware error (fatal error)
- ❑ Paper-out error

The PE signal is HIGH when the following error has occurred:

- ❑ Paper-out error

Table 1-24. Data Transmission Timing

Parameter	Minimum	Maximum
tsetup	500 ns	—
thold	500 ns	—
tstb	500 ns	—
tready	0	—
tbusy	—	500 ns
treply	—	—
tack	500 ns	10 μs
tnbusy	0	—
tnext	0	—
tt-out *[1]	—	120 ns
tt-in *[2]	—	200 ns

Note:

1. Rise and fall time for output signals

2. Rise and fall time for input signal

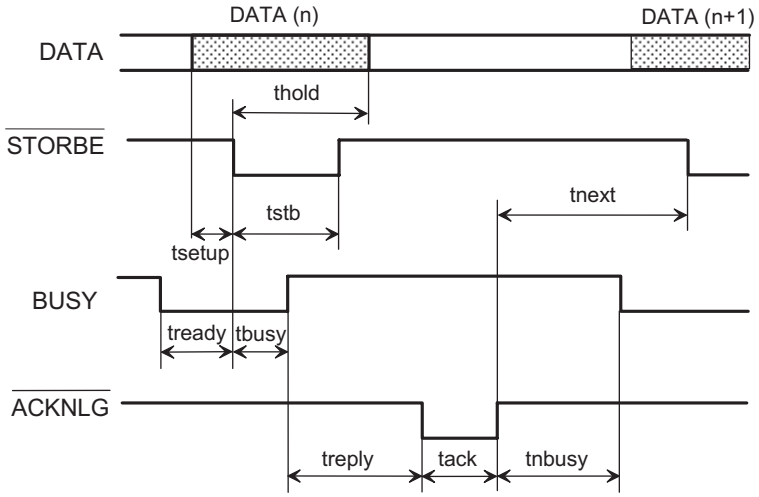


Figure 1-14. Data Transmission Timing Chart

Table 1-25 shows the connector pin assignment and signals for forward channel of the parallel interface.

Table 1-25. Connector Pin Assignments and Signals (Forward Channel)

Pin No.	Signal Name	Return GND Pin	I/O	Description
1	/STROBE	19	I	The strobe pulse. Read-in of data is performed at the falling edge of this pulse.
2-9	DATA 1-8	20-27	I	The data 0 to data 7 signals represent data bits 0 to 7, respectively. Each signal is at a HIGH level when data is logical 1 and a LOW level when data is logical 0.
10	/ACKNLG	28	O	This signal is a negative pulse indicating that the printer can again accept data.
11	BUSY	29	O	When this signal is at a HIGH level, the printer is not ready to accept data.
12	PE	28	O	When this signal is at a HIGH level, the paper empty status is detected.
13	SLCT	28	O	Always at a HIGH level when the printer is powered on.
14	/AFXT	30	I	Not used.
31	/INIT	30	I	The falling edge of a negative pulse or a LOW signal on this line causes the printer to initialize. Minimum 50 us pulse is necessary.
32	/ERROR	29	O	When the printer detects an error, this signal goes LOW.
36	/SLIN	30	I	Not used.
18	Logic H	—	O	Pulled up to +5V via 3.9 K-ohm resistor.
35	+5V	—	O	Pulled up to +5V via 3.3 K-ohm resistor.
17	Chassis GND	—	—	Chassis ground.
16,33,19-30	GND	—	—	Signal ground.
15,34	NC	—	—	Not connected.

Note)

*1. */* at the beginning of a signal means active low.*

2. The I/O column indicates the direction of the signal as viewed form the printer.

Reverse Channel

- ❑ Transmission mode — IEEE-1284 nibble mode
- ❑ Adaptable connector — Same as for the forward channel
- ❑ Synchronization — Refer to the IEEE-1284 specification
- ❑ Handshaking — Refer to the IEEE-1284 specification
- ❑ Data transmission timing — Refer to the IEEE-1284 specification
- ❑ Signal level — IEEE-1284 level 1 device
See the forward channel.

Table 1-26 shows the connector pin assignment and signals for reverse channel of the parallel interface.

Table 1-26. Connector Pin Assignment and Signals (Reverse Channel)

Pin No.	Signal Name	Return GND Pin	I/O	Description
1	HostClk	19	I	Clock signal from the host computer.
2-9	DATA 1-8	20-27	I	These signals represent parallel data on bits 2 to 9. Each signal is High when the data is logical 1 and LOW when the data is logical 0.
10	PtrClk	28	O	Clock signal from the printer
11	PtrBusy / Data bit 3,7	29	O	Busy signal from the printer. Data bit 3 or 7 in reverse channel.
12	AckDatareq / Data Bit 2,6	28	O	Acknowledge request signal. Data bit 2 or 6 in reverse channel.
13	Xflag/Data bit 1,5	28	O	X flag signal. Data bit 1 or 5 in reverse channel.
14	HostBusy	30	I	Busy signal from the host computer
31	/INIT	30	I	Not used
32	/Data Avail / Data bit 0,4	29	O	Data available signal. Data bit 0 or 4 in reverse channel.
36	1284-Active	30	I	1284 active signal.
18	Logic-H	—	O	Pulled up to +5V via 3.9 K-ohm resistor.
35	+5V	—	O	Pulled up to +5V via 3.3 K-ohm resistor.
17	Chassis GND	—	—	Chassis ground for the printer.
16,33, 19-30	GND	—	—	Signal ground.
15,34	NC	—	—	Not connected.

Note)

*1. */* at the beginning of a signal means active low.*

2. The I/O column indicates the direction of the signal as viewed form the printer.

- **Extensibility Request**
  The printer responds affirmatively when the extensibility request values are 00H or 04H, as follows:
  - 00H Request nibble mode reverse channel transfer.
  - 04H Request device ID using nibble mode rev channel transfer

- **Device ID**
  The printer sends following device ID string upon request:

```
[00H] [3DH]
MFG EPSON;
CMD ESCPL2, PRPXL24, BDC;
MDL DLQ-3000+;
CLS PRINTER;
```

1.4.2 Serial Interface

- ❑ Synchronization — Asynchronous
- ❑ Signal level — EIA-232D
  MARK (logical 1): -3 V to -25 V
  SPACE (logical): +3 V to +25 V
- ❑ Word format
  Start bit: 1 bit
  Data bit: 8 bit
  Parity bit: Odd, Even or Non
  Stop bit: 1 bit
- ❑ Baud rate — 300, 600, 1200, 2400, 4800, 9600 or 19200 bps
- ❑ Handshaking — DTR signal and XON/XOFF

  DTR = MARK, XOFF: Indicates that the printer cannot receive data.
  DTR = SPACE, XON: Indicates that the printer is ready to receive data.

  The DTR signal is MARK and XOFF code (DC3, 13H) is transmitted when the rest of the input buffer becomes 256 byte. The DTR signal is SPACE and XON code (DC1, 11H) is transmitted when the rest of the input buffer becomes 256 byte.
- ❑ Error handling — Parity error is detected only.
  (Overrun error and framing error are ignored.)
- ❑ Connector — 25-pin sub-miniature D-shell connector. (female)

Table 1-27. Connector Pin Assignment for Serial Interface

Pin No.	Signal Name	I/O	Function Description
1	Chassis GND	—	Chassis GND
2	TXD	Out	Transmits data
3	RXD	In	Receives data
4	RTS	Out	Request to send. Always SPACE level when the printer is powered on. Pulled up to +12 V via 4.7 L ohm resistor.
7	Signal GND	—	Signal GND
11	REV	Out	Connected directly to the DTR signal.
20	DTR	Out	Data terminal ready
others	NC	—	Not used. Not connected.

Note: *In and Out refers to the direction of the signal flow from the printer's point of view.*

1.4.3 Optional Interface

The EPSON DLQ-3000+ supports an optional Type-B interface (Level 2) with the following characteristics.

❑ Reply message

Table 1-28. Reply Message

Reply message	ESC/P2	IBM 2391 Plus
Main-type	MT24p, PW136cl10cpi, PRG(W0xxxx)rev	
Product name	DLQ-3000+	
Emulation type	ESCPL2, PRPXL24, BDC	
Entity type	EPSONLQ2	EPSONPRPXL24

❑ Reply for optional command

Table 1-29. Reply for Option Command

Option command No.	command name	Reply-A	Reply-B
00h	No Operation	—	—
01h	Start Hard Ware Reset	Accept	Execute OK
02h	Start Soft Ware Reset	Reject	—
03h	Send Main System Type	Accept	Execute OK
04h	Send Name Data	Reject	—
05h	Inquire Name Data	Accept	Execute OK
06h	Send Product Name	Accept	Execute OK
07h	Send Soft Ware Emulation Type	Accept	Execute OK
08h	Complete Buffered Data	Accept	Execute OK
09h	Stop Procedure	Reject	—
0Ah	Return Buffered Data	Reject	—
0Bh	Send Entity Type	Accept	Execute OK
0Ch	Send Status	Accept	Execute OK
0Dh	Quit Procedure	Reject	—
0Eh	Inquire ASCII Message	Reject	—
0Fh	Send ASCII Message	Accept	Execute OK
10h - 13h	(Reserved)	Unknown	—
14h	Inquire Emergency Message	Accept	Execute OK
15h	Send Emergency Reply	Accept	Execute OK
16h - 1Fh	(Reserved)	Unknown	—

❑ Supported Main Command and Sending Timing

Table 1-30. Supported Main Command and Sending Timing

Main Command	Command name	Sending Timing
01h	Start Software Reset	▪ /INIT signal on the standard parallel I/F ▪ Type-B I/F option command : 01h ▪ Panel Reset ▪ Cold Start
02h	Send option type	▪ Deciding the level of type-B I/F after power on.
04h	Send Name Data	▪ Type-B I/F option command : 05h
07h	Inquire Software Emulation Name	▪ Changing software Emulation Type
0Eh	Inquire ASCII Message	▪ Writing to DBIN register
14h	Inquire Emergency Reply	▪ Reply for Emergency command
15h	Send Emergency Message	▪ Receive Emergency Command

❑ **Emergency Command**

Table 1-31. Emergency Command

Command No.	Command name
0x00	Get device IC
0x01	Get all status

1.4.4 Printer language

❑ ESC/P2
❑ IBM 2391 Plus emulation
❑ EPSON Remote

1.4.5 Prevention Hosts from Data Transfer Time-out

Generally, hosts abandon data transfer to peripherals when a peripheral is BUSY continuously for dozens of seconds. To prevent this kind of time-out, the printer receives data very slowly, several bytes par minute, even the printer is in a busy state. This slowdown starts when the remainder of input buffer drops under several hundreds of bytes. Finally, the printer is BUSY continuously when the input buffer is full.

1.4.6 Interface Selection

The EPSON DLQ-3000+ has three types of interfaces: Parallel, Serial, and optional Type-B. Each interface can be selected manually by SelecType or automatically. Both modes are selected thorough the default setting mode.

- ❑ Manual selection
  One of the 3 interfaces can be selected by SelecType.
- ❑ Automatic selection mode (Enabled by SelecType)
  When the printer is powered on, the printer is initialized to the idle state scanning which interface receives data. Then the interface that receives data first is selected. When the host stops data transfer and the printer is in stand-by state for the seconds specified by SelecType, the printer is returned to the idle state. As long as the host sends data or the printer interface is busy state, the selected interface is left as it is.

Interface selection and interface state

Interface selection and the corresponding interface states are as follows:

- ❑ When an interface other than parallel interface is selected, the interface goes into the BUSY state.
- ❑ When an interface other than serial interface is selected, the interface sends XOFF and sets the DTR signal MARK.
- ❑ When an interface other than optional interface is selected, the printer sets “OFFLINE” bit of MNSTS register to the optional interface.
- ❑ When the printer is initialized and returned to the idle state:
  - The parallel interface goes into ready state.
  - The serial interface sends XON and sets the DTR SPACE and the printer resets OFFLINE bit of MNSTS register to the optional interface.

Note: *An interrupt signal such as /INIT signal on the parallel interface is not effective while that interface is not selected.*

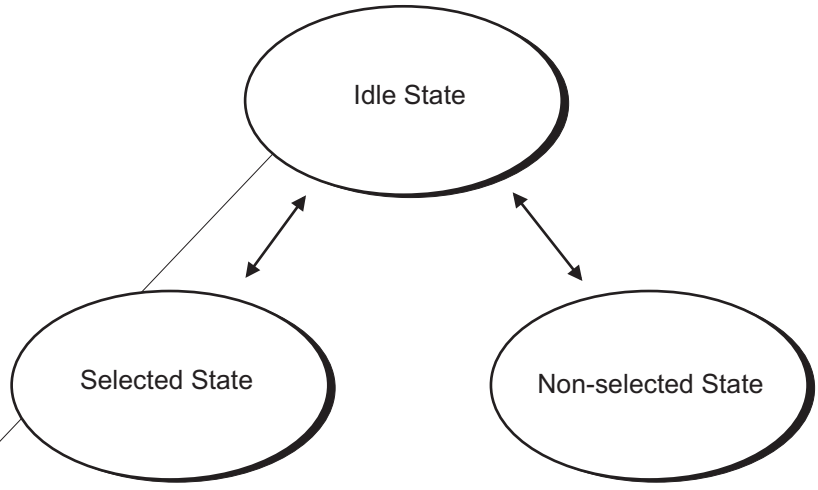


Figure 1-15. Interface Selection

1.5 Operation

This section describes the function of each button on the control panel and LED printer status indicators.

1.5.1 Control Panel

The control panel for this printer consists of 10 non-lock type push buttons, 4 LED indicators and 1 LCD. See Figure 1-16.

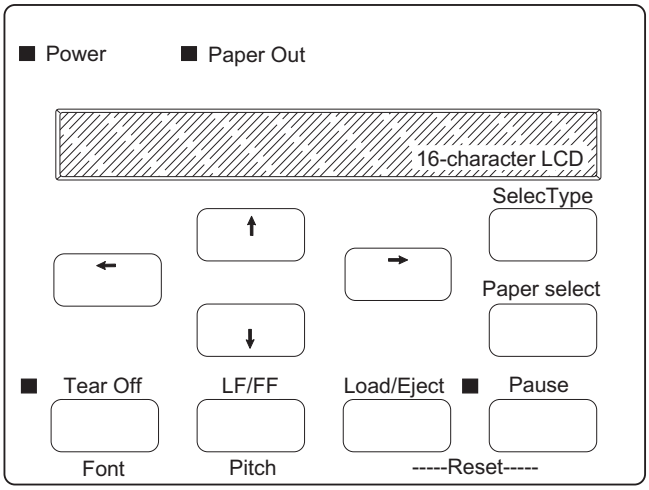


Figure 1-16. Control Panel

- ❑ LCD: 16 characters
- ❑ Power LEDs: Green
- ❑ Paper Out LED: Red
- ❑ Tear-off LED: Orange
- ❑ Pause LED: Orange

1.5.1.1 Button Operations

❑ ***Effectiveness***

Basically, all button operations are always effective except for the following cases.

- During printing, only the **Pause** button is effective.
- The **SelecType** button is only effective during the printer is in the standby status.
- **Load/Eject** and "**Pause**" buttons are not effective during the SelecType mode.

❑ ***Pause functions***

- Press the **Pause** button to stop printing.
- Press the **Pause** button again to resume printing.

Even if the **Pause** button is pressed, the interface continues to receive data until the input buffer is full and the CR moves to the ribbon changing position.

❑ ***Reset function***

Press the **Pause** and **Load/Eject** buttons simultaneously to initialize the printer. Refer to Section 1.5.5.

❑ Paper feed function

Table 1-32 shows the button operations and the corresponding paper feed functions.

Table 1-32. Paper Feed Functions

Operations		Function	
		Paper loaded	Paper out
Press **LF/FF** shortly.	Friction feed	Line feed	Load a sheet *2.
	Tractor feed	Line feed *1	Load continuous paper
Press **LF/FF** for a few seconds.	Friction feed	Form feed	Load a sheet *2.
	Tractor feed	Form feed *1	Load continuous paper
Press. **Load/Eject**	Friction feed	Eject	Load a sheet *2.
	Tractor feed	Paper park*1	Load continuous paper
Press ↓.	Friction feed	Micro feed (forward)	—
	Tractor feed	Micro feed (forward) *3	—
Press ↑.	Friction feed	Micro feed (backward)	—
	Tractor feed	Micro feed (backward)*3	—
Insert a sheet to the manual insertion slot. (Friction feed)		—	Load the inserted sheet. *2.

Notes)

1. *When the printer is in the tear-off state, these functions are performed after returning from the tear-off position.*
2. *Once a sheet is manually inserted, the printer enters manual insertion mode. While the mode is active, even if data is remaining in the buffer, the printer goes into a paper-out error state at each end of a sheet and waits for the next sheet to be inserted. CSF insertion is enabled again by loading sheets into the CSF or by initializing the printer.*
3. *↓ and ↑ buttons are used as described below:*
   - *Pressing the button continuously feeds paper forward*/backward* with a increment of 1/180 inch.*
   - *Pressing the button continuously feeds paper forward*/backward* slowly.*
   - *When the printer is in the tear-off state, these buttons are used to adjust tear-off position. The adjusted position is stored in the EEPROM.*

   ** To feed forward or backward means toward the front or rear of the printer, respectively.*

❑ Tear -off function

The printer has 2 types of tear-off functions; manual tear-off and auto tear-off. The manual tea-off is performed by pressing the **Tear Off** button . The auto tear-off is enabled by SelecType. These functions are same as for the conventional EPSON printers.

❑ Paper select function

Press the **Paper Select** button to select one of the following paper memory numbers.

- 0: All cases
- a(9): When the printer has the special paper information.

Note: *The **Paper Select** button is only effective without any paper set.*

1.5.1.2 Printer Status and LCD/LED Indicator Conditions

Table 1-33 shows the printer status and When the printer is in more than one status, the printer indicates the prime status. If they have the same priority, the status occurs first is indicated. The priority in the first column means that the status with the lower numbers have higher priority.

Table 1-33. Printer Status and LCD/LED Indicator Conditions

Priority	Printer State	LCD message	LED		
			Paper Out	Pause	Tear-Off
1	Fatal error *[1]	Please turn off	Blinks	Blinks	Blinks
2	Program reload mode	Program Mode	Off	Off	Off
3	Cover open error	Cover Open	On/Off *[6]	On	On/Off *[6]
4	Release lever operation error *[2]	Put Lever Back	Blinks	On	On/Off *[6]
5	Paper jam error	Paper Jam	Blinks	On	On/Off *[6]
6	Paper out error *[3]	Paper Out	On	On	On/Off *[6]
7	Incomplete changing paper path error *[4]	Wrong Paper Path	Off	On	On/Off *[6]
8	Paper size error *[5]	Wrong Paper Size	Off	On	On/Off *[6]
9	Eject error	Pull Paper Out	Blinks	On	On/Off *[6]
10	Printhead is overheated.	Please Wait	Off	Blinks	On/Off *[6]
11	Entry to SelecType 1	SelecType 1	Off	Off	Off
11	Entry to SelecType 2	SelecType 2	Off	Off	Off
12	Tear-off	Cut the paper	Off	On/Off *[6]	On
13	Data is in buffer but the printer is paused	Data in Buffer	Off	On	Off
14	Pause	Pause : #0	Off	On	Off
15	Bi-D adjustment	Bi-d adjustment	Off	Off	Off
15	Hex dump mode	Hex dump	Off	Off	Off
15	Ordinary printing	Printing : #0	Off	Off	Off
15	Test printing	Test Printing	Off	Off	Off
15	Setting printing	Setting Printing	Off	Off	Off
16	Standby	Ready : #0	Off	Off	Off

Notes)

1. Fatal error occurs when the printer is under any of the following conditions:

- *Power supply voltage is at an abnormal level.*
- *The printhead temperature is abnormal.*
- *Carriage does not move normally.*
- *Platen gap does not move normally.*
- *An error occurs while executing EEPROM commands or program reload mode.*
- *The printer control circuit does not work correctly.*

2. This error occurs when the friction lever is not set to the appropriate position.

3. *Paper-out error occurs when the printer is under any of the following conditions:*
   - *The printer does not load paper in spite of the attempt to load it.*
   - *The printer finishes printing 1-page data on a sheet manually inserted.*
   - *The end of the continuous paper has reached.*
4. *When the printer fails to change the paper path, this error occurs.*
5. *Paper size error occurs when the printer senses the condition that the currently loaded paper size does not match the selected paper size.*
6. *It depends on the combination of the printer status.*

1.5.1.3 Printer Status and Buzzer

The printer beeps to indicate several printer error status and failure operation. Printer status and the corresponding beeper sounds are as described in Table 1-34.

Table 1-34. Printer Status and Buzzer

Printer status	Beeper sound
Paper out error has occurred.	– – –
Paper size error has occurred.	– – –
Incomplete changing paper path error	– – –
Eject error has occurred.	– – –
Release lever operation error has occurred.	— — — — —
Paper jam error has occurred.	— — — — —
Fatal error has occurred.	— — — — —
Illegal operation in SelecType	–

Notes) The symbols "–" and "—" represent how a beep sounds.
"–": Sounds 100 ms with the interval of 100 ms.
"—": Sounds 500 ms with the interval of 100 ms.

1.5.2 SelecType

This printer provides SelecType function to change default settings.

1.5.2.1 SelecType Phase

See Figure 1-17 which shows the SelecType phase transitions. Boxes show printer states or SelecType phases. The boxes with shadow involves button operations.

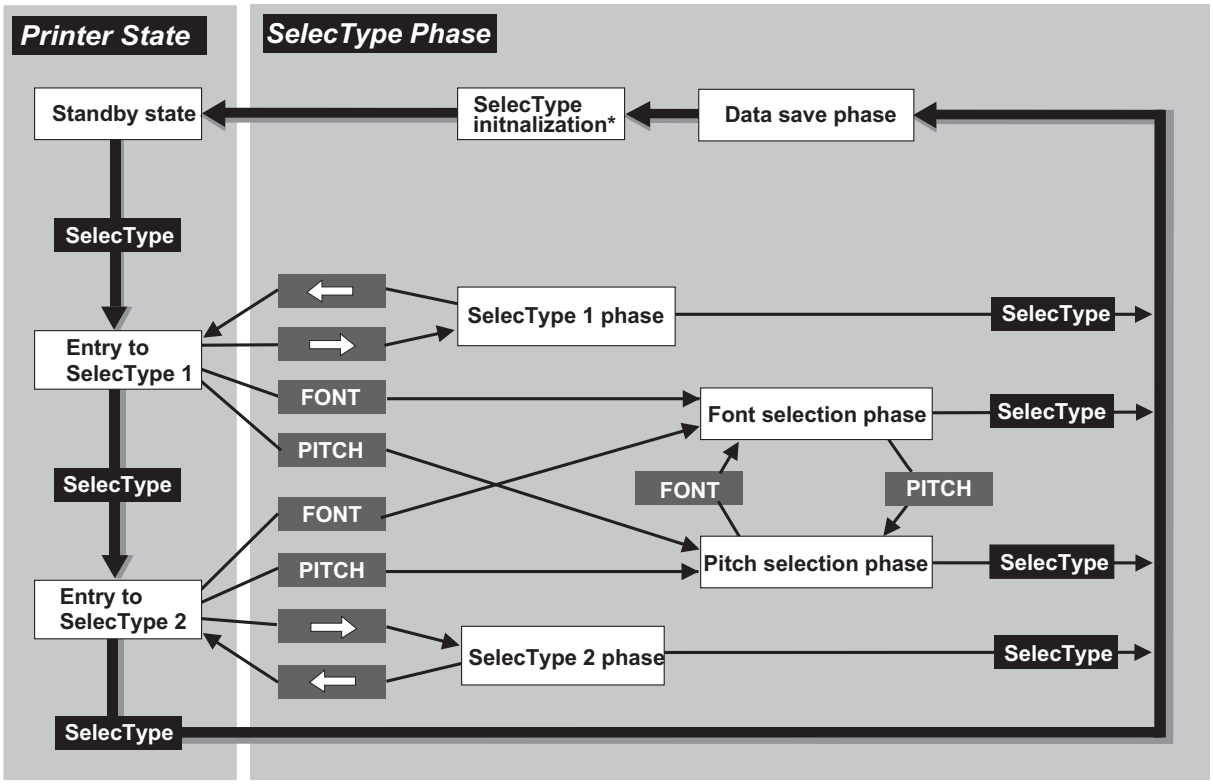


Figure 1-17. SelecType Phase Transitions

1.5.2.2 SelecType Operation

❑ SelecType 1 and 2 operations

Step 1. Selecting the feature

When the SelecType 1 or 2 starts, the first feature appears on the LCD. Scroll the features by pressing the "↑" (next) or "↓" (previous) button until the desired feature appears. Then press the "→" (enter) button, and the option menu for the selected feature is displayed.

Step 2. Keeping/Changing the option

The current option marked with "*" for the menu appears. To keep the option as it is, press the "←" button (escape) to return to the feature menu. To change the option, press the "↑" (next) or "↓" (previous) button to scroll the option menu. Then press the "→" (enter) button to fix the desired option. If the "Other" is selected, another option menu appears. In this case, select the desirable option in the above mentioned way.

Step 3. Return to the previous menu

Press the "←" button (escape) to return to the previous menu. Pressing the button several times to return to the SelecType 1 or 2 entry state.

Step 4. Exit

Press the "SelecType" button to exit the SelecType phase. With this operation, new settings are automatically stored in the EEPROM and are effective until they are changed again. This process is automatically followed by the SelecType initialization phase and the printer returns to the stand-by status.

[Initializing all settings to the standard]

Select "Standard Setting" in the SelecType 2 menu. The message "Ready?" is displayed. Then perform one of the followings:

- ❑ To execute the initialization:
  Press the "→" (enter) button. (All settings are reset to the standard and the printer returns to the feature menu.
- ❑ To return to the feature menu without executing the initialization
  Press the "←" button (escape).

Press the "**SelecType**" button to exit the SelecType mode.

❑ Font and Pitch Select Operation

Step 1. Displaying the current selection for the font/pitch

When the printer enters the Font/Pitch phase, the current option marked with "*" appears.

Step 2. Changing the font/pitch

Press the "↑" (next) or "↓" (previous) button until the desired font/pitch appears. Then press the "→" (enter) button to fix the selection. The selected font/pitch is marked with "*" as the result.

Step 3. Exit

Press the "SelecType" button to exit the Font/Pitch phase.

1.5.2.3 SelecType Option

Table 1-35 and Table 1-36 show the options available for the SelecType 1 and SelecType 2, Font and Pitch, respectively.

Table 1-35. SelecType 1 Option

Menu	Option	Note
T-margin Tractor	*8.5 mm from 4.2 mm to 8.5 mm + 25.4 mm	Increment : 0.14 mm (1/180")
T-Margin Manual R	*8.5 mm from 0 mm to 8.5 mm + 25.4 mm	Increment : 0.14 mm (1/180")
T-Margin Manual L	*8.5 mm from 0 mm to 8.5 mm + 25.4 mm	Increment : 0.14 mm (1/180")
T-Margin CSF	*8.5 mm from 0 mm to 8.5 mm + 25.4 mm	Increment : 0.14 mm (1/180")
Character Table	*NLSP version* *PC437 PC437 Greek PC850 PC852, PC853 PC855 PC857 PC864 PC866 PC869 ISO Latin 1T Code MJK Bulgaria Estonia ISO 8859-7 MAZOWIA PC774 ISO 8859-2 PC866LAT PCAPTEC PC 708 PC720 PCAR864 PC 860 PC865 PC861 USA – KOREA *Standard version* *PC437 PC850 PC860 PC861 PC863 PC865 Abicomp BRASCII ISO Latin 1 Roman 8 U.S.A – Korea	
Page Tractor	*11 inch 12 inch 8.5 inch 70/6 inch (A4) Other (See the right column.)	**Option for "Other":** xxx lines (from 24 to 132 lines at 1/6 line spacing)
Page CSF	*A4 Letter Other (See the right column.)	**Option for "Other":** xxx lines (from 24 to *132 lines)
B-Margin Tractor	*0.000 inch From 0 to 1 inch	Increment: 1/180 inch
Line spacing	*1/6 inch 1/8 inch	At 1/6 inch spacing
Left-Margin	*0 columns From 0 to 80 columns	
Right-Margin	*136 columns From 1 to 136 columns	
Print Direction	*Bi-directional Uni-directional Auto	

Note: *The current options are marked with "*".*

Table 1-36. Options for SelecType 2, Font and Pitch

Menu	Option	Notes
SelecType 2		
Language	*English French German Italian Spanish Portuguese	
Paper Type	*Normal Cards Envelopes	For cut sheet only
Overlapping Form	*Off On	For continuous paper only
Intensity Mode	*Normal Dark	Use the copy mode only when the depth of multi-part form printing is not enough.
Software	*ESC/P2 IBM 2391 Plus	
Auto CR (IBM)	*Off On	For IBM 2391 Plus emulation
A.G.M. (IBM)	*Off On	For IBM 2391 Plus emulation
Interface	*Auto Selection Parallel RS-232C Option Slot	
I/F Time-out	*10 sec. From 1 to 255 seconds	
Input Buffer	*On Off	
Baud Rate	300 BPS 600 BPS 1200 BPS 2400 BPS 4800 BPS 9600 BPS *19200 BPS	
Parity	*None Even Odd	
Auto Tear-off	*Off On	
Auto LF	*Off On	
0 Slash	*Off On	
Buzzer	*On Off	
Standard Setting	Ready?	
Font		
*Roman Sans Serif Courier Prestige Script OCR B Orator Orator S Script C Roman T Sans Serif H Draft H-Speed Draft		
Pitch		
*10 cpi 12 cpi 15 cpi 17 cpi 20 cpi Proportional		

Note: *The current options are marked with "*".*

1.5.3 Functions at Power On

This printer has the following 7 service modes. To enter each mode, press specified button (buttons) while holding down the Power switch.

❑ Test Printing
- Button — LQ mode: **LF/FF** button with the power switch On.
  Draft mode: **Load/Eject** button with the power switch On.
- Result — Alphanumeric characters are printed continuously.
- Exit — Press the **Pause** button and turn the printer Off.
- Interface state — All interfaces keep a busy state during the test printing.

❑ Hex Dump Mode
- Buttons — **LF/FF** and **Load/Eject** buttons with the power switch On.
- Result — The printer prints the message "Hex Dump" and then starts printing received data in the both hexadecimal code and corresponding characters. If corresponding character does not exist, "." (period) is printed instead.
- Exit — Press the **Pause** button to print data remaining in buffer. Then turn off the printer to exit the mode.

❑ Setting Printing
- Button — **SelecType** button with the power switch On.
- Result — Firmware version and user changeable default setting menu (SelecType menu) along with their options are printed with the subtitles in the selected language.
- Exit — When the printing is complete, the printed sheet or continuous paper is ejected or fed to the tear-off position, respectively. Then the printer returns to the standby status.
- Interface State — All the interfaces keeps a busy state during the printing.

Note: *In each mode mentioned above, when the printer fails to load paper, the printer goes into the Paper-out error status. In this case, insert a sheet and press the* ***Load/Eject*** *button. (In the Hex Dump mode, the message "Hex Dump" is printed at first. Then the printer waits for data.)*

❑ Bi-D adjustment (Refer to Section 1.5.4.)
- Button — **Pause** button with the power switch On.

❑ Program Reload Mode (Refer to Section 1.5.5.)
- Buttons — **Tear Off**, **LF/FF**, **Load/Eject** and **Pause** buttons with the power switch On.

❑ EEPROM Clear
- Buttons — **SelecType**, **Paper Select**, and **Pause** buttons with the power switch On.
- Result — Resets the printer to the standard factory setting, which is not always proper setting for each market.
  (This function is used only for emergency.)

❑ Clear the driving line count for ribbon changing timing
- Button — **Paper Select** button with the power switch On.
- Result — Clears the value for the driving line count stored in the EEPROM.

1.5.4 Bi-D Adjustment Mode

This printer has the Bi-D adjustment mode which enables users to align vertical lines. Refer to Table 1-37 and Figure 1-18.

Table 1-37. Bi-D Adjustment Item

Items	Order
Draft mode	1
Bit Image (ESC * 26H) mode	2
LQ mode	3

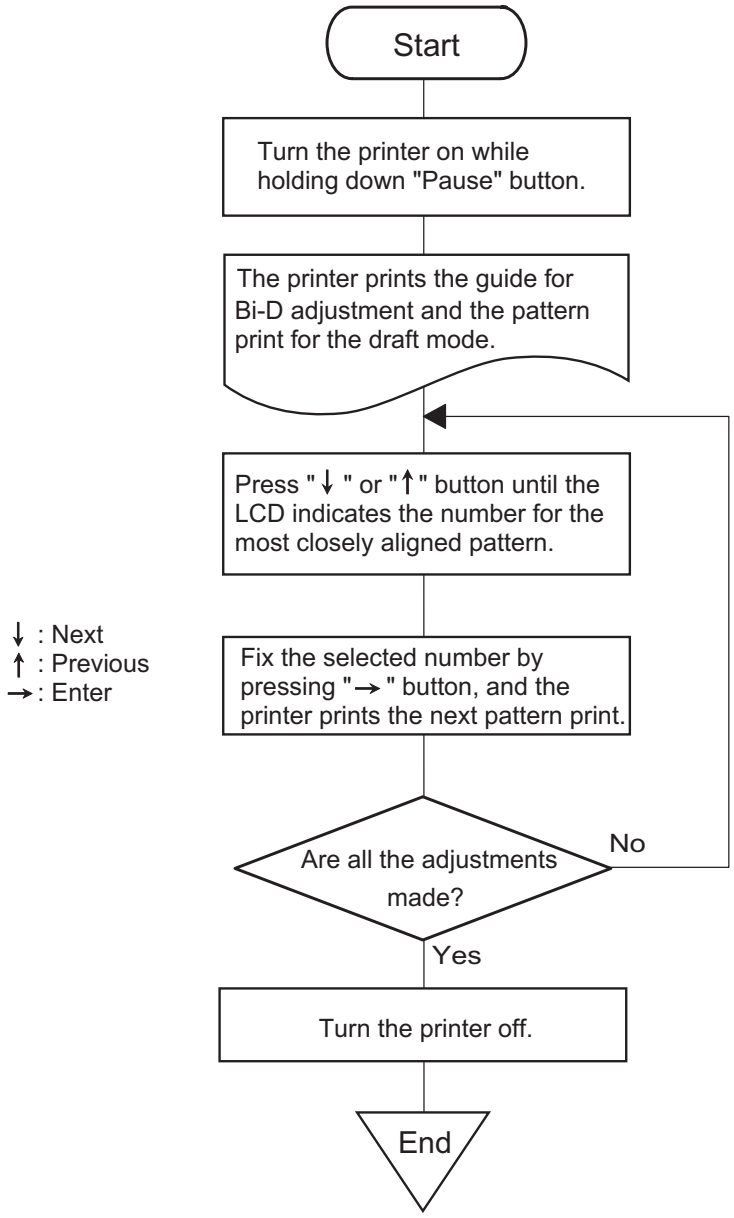


Figure 1-18. Bi-D Adjustment Flowchart

1.5.5 Program Reload Mode

The printer has a 512-K byte Flash-EEPROM as a printer control software and a boot-strap program storage. This Flash-EEPROM can erase all the data in itself at once electrically and reprogram. Using this mode, the printer control software can be changed completely. Refer to Chapter 3 for details.

1.5.6 Initialization

1.5.6.1 Printer Initialization

This printer has 5 initialization types: Power-on initialization, Operator initialization, Initialization by the control panel operation, Software initialization and SelecType initialization.

Power-on Initialization

- ❑ Triggers
  - Turning on the printer
  - Cold reset command (Remote RS command)
- ❑ Actions performed
  - Initializes the printer mechanism.
  - Clears input data buffer.
  - Clears download character set.
  - Clears print buffer.
  - Sets default values.

Operator Initialization

- ❑ Trigger
  - The printer recognizes the /INIT signal (negative pulse) of parallel interface.
- ❑ Actions Performed
  - Clears input data buffer.
  - Clears download character set.
  - Clears print buffer.
  - Sets default values.

Initialization by the control panel operation

- ❑ Trigger
  - Pressing the **Pause** and **Load/Eject** buttons for 3 seconds.
- ❑ Actions performed
  - Clears input data buffer.
  - Clears print buffer.
  - Sets default values.

Software Initialization

- ❑ Trigger
  - ESC @ commend
- ❑ Actions Performed
  - Clears print buffer.
  - Sets default values.

SelecType Initialization

- ❑ Trigger
  - Exiting the SelecType mode
- ❑ Actions Performed
  - The printer settings are reset to the default except the download definition is not cleared.
  - The printer is put into the standby status.

1.5.6.2 Initialize Defaults to the Standard

The use changeable defaults can be initialized to the standard settings by SelecType. The standard settings are shown in Table 1-38.

Table 1-38. Standard Settings

Items		Standard settings
Font		Roman
Pitch		10 cpi
Character Table		PC437
Page Length	Tractor	11 inch
	CSF	132 lines
Line Spacing		1/6 inch
Top Margin	Tractor	8.5 mm
	Manual Rear	8.5 mm
	Manual Front	8.5 mm
	CSF	8.5 mm
Bottom Margin	Tractor	0.0 mm
Left Margin		0 column
Right Margin		136 columns
Print Direction		Bi-directional
Message Language		English
Software		ESC/P2
Interface		Auto Selection
Interface Auto Selection Time-out		10 seconds
Input buffer		ON
Serial interface	Baud Rate	19200 bps
	Parity	None
Auto Tear-off		Off
Auto LF		Off
Auto CR (IBM 2391 PLUS)		Off
AGM (IBM 2391 PLUS)		Off
Over-lapping Forms		Off
Paper Type (Cut sheet)		Normal
Intensity Mode		Normal
0 slash		Off
Buzzer		On

1.6 Main Components

This printer is composed of the following components:

- ❑ Printer mechanism
- ❑ Main control board C210MAIN
- ❑ PSB/PSE board C124 PSB/PSE
- ❑ Control panel
- ❑ Housings

1.6.1 C210MAIN Board

The C210MAIN consists of the followings:

- ❑ CPU (H8/3033
- ❑ CG-ROM
- ❑ EEPROM
- ❑ Flash-ROM/P-ROM for the program ROM
- ❑ Gate array (E05B46)
- ❑ DRAM
- ❑ Drivers

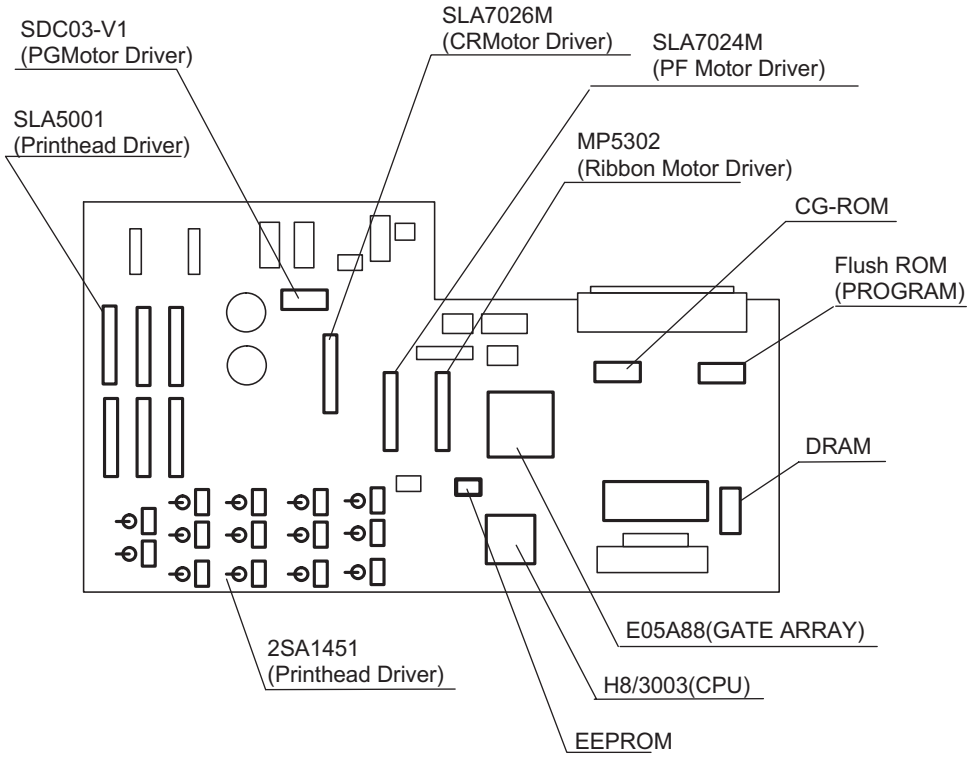


Figure 1-19. C210MAIN Board Component Layout

1.6.2 C124PSB/PSE Board

The electoral circuit board of this printer consists of 2 switching regulator circuits.

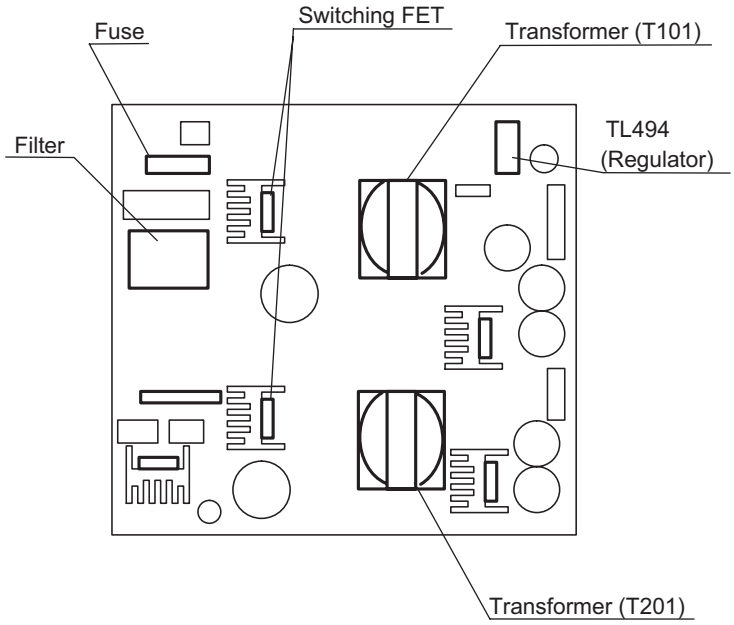


Figure 1-20. C124PSB/PSE Board Component Layout

1.6.3 Printer Mechanism

The printer mechanism of this printer is composed of the followings:

- ❑ CR motor
- ❑ Ribbon motor
- ❑ 2 cooling fans
- ❑ CR mechanism
- ❑ PF motor
- ❑ PG motor
- ❑ Paper feed mechanism

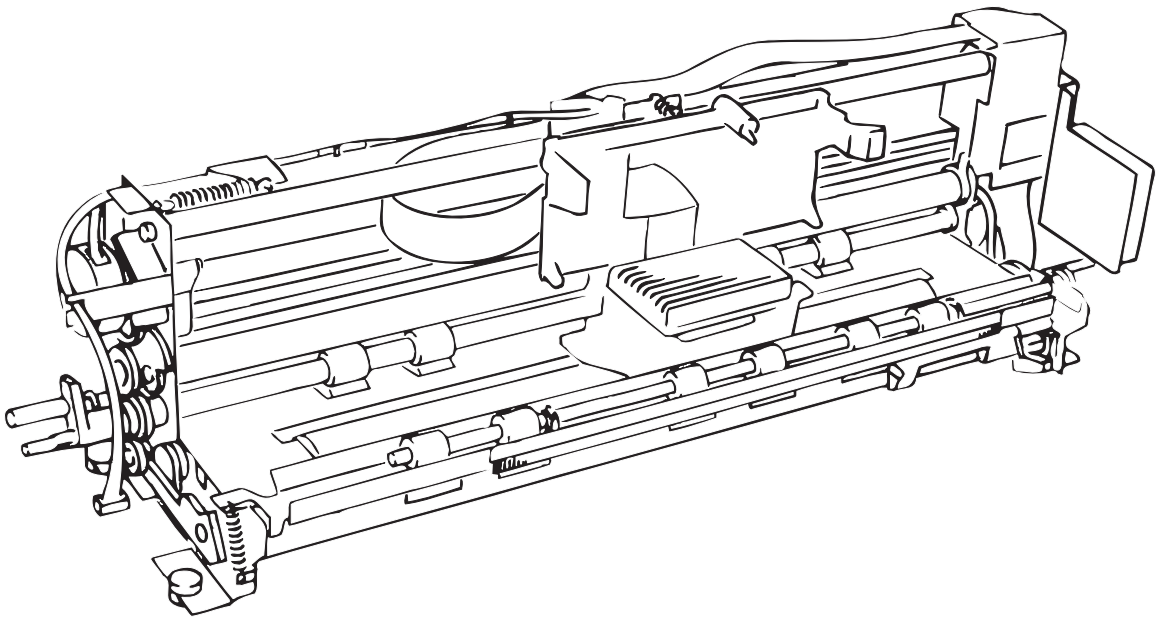


Figure 1-21. Printer Mechanism

1.6.4 Housing

This printer is composed of the following housings:

- ❑ Bottom frame assembly
- ❑ Upper housing assembly
- ❑ Printer cover assembly
- ❑ Upper connector cover
- ❑ Lower housing assembly
- ❑ Rear shield cover
- ❑ Rear cover

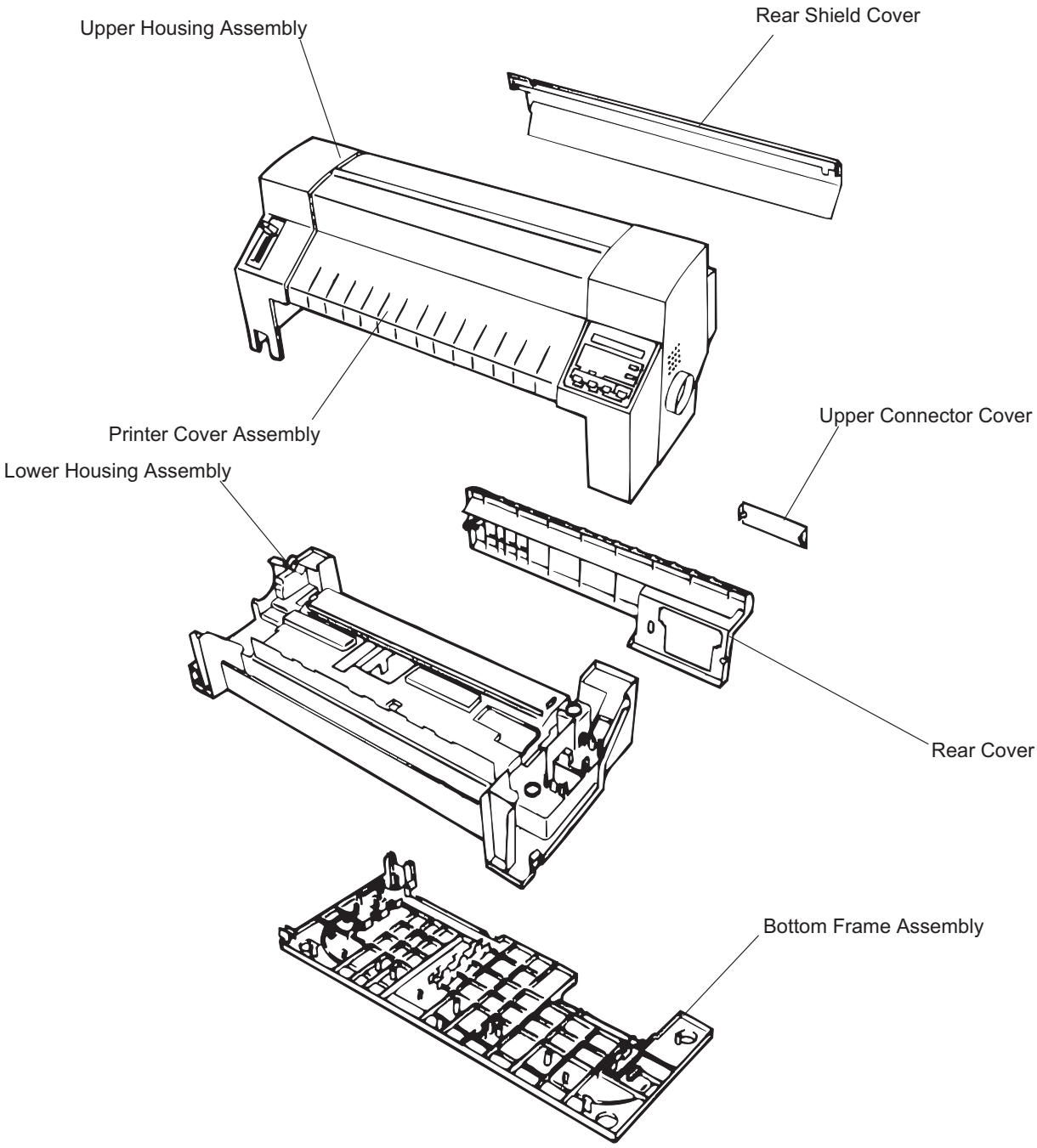


Figure 1-22. Printer Housings

Chapter 2
Operating Principle

2.1 Printer Mechanism Operating Principles

This chapter describes the operating principles of the printer mechanism (M-5P60).

2.1.1 Printing Mechanism

❑ Printhead

The printing mechanism of this printer is composed of the 24-pin impact dot printhead and a ribbon mask. The printhead has 12 pin wires in each of 2 rows, which are aligned in an rhombic layout. (See Figure 1-2 in Chapter 1.) Each wire has its own drive coil.

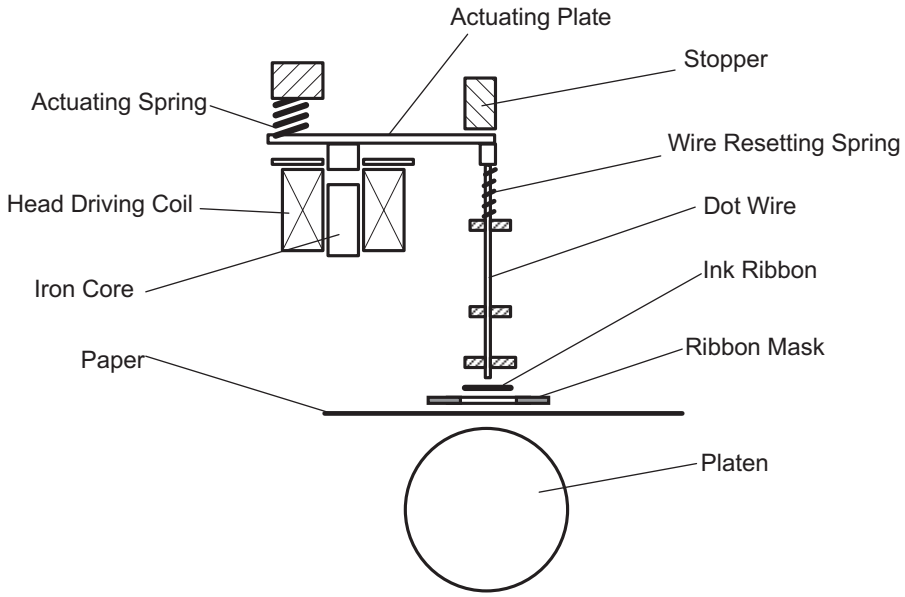


Figure 2-1. Structure of the printhead

❑ Printing process

1. The printing signal transmitted from controller circuit to the head driver circuit is converted into the head drive voltage, which energizes a corresponding coil. The energized coil then magnetizes the iron core.
2. The magnetized iron core draws the actuating plate which joins to the dot wire. This movement rushes the wire toward the platen.
3. When the dot causes impact to the platen, it presses the ribbon to the paper, where a dot prints.
4. When the coil energizing is terminated, the iron core, losing magnetic force, is returned to the standby position by the bounce of the platen and tension of the actuating spring.

The printing mechanism has an integrated thermistor to detect head temperatures. The detected temperature is converted into an electrical signal and fed back to the controller circuit. This information as well as paper thickness is used as a basis for determining printhead driving mode to ensure high printing quality. It is particularly important to keep the head temperature at a proper level constantly to minimize burning and deterioration of the dot wires in the printhead, which are caused by the rise in the head temperatures due to continuous printing. When the head temperature is below the specified level, the appropriate driving mode is selected based on the detected temperature to keep the wires respondent. (Refer to Section 1.3.1 in Chapter 1.) See Table 2-1 in Page 2-2 for the printhead specification.

Table 2-1. Printhead Specification

Item	Description
Printing method	Impact dot printing
Number of wires	24 wires (14 wires on each of 2 rows in an rhombic layout)
Wire diameter	0.20 mm
Head life	Monochrome fabric ribbon: 200 million strokes / wire Color ribbon: 100 million strokes / wire
Weight	180 g
Coil resistance	8.19 ± 0.5 Ω (at 25° C)
Response period	Normal mode: 462 µs
Drive voltage	31.5 to 38.5 V
Driving condition	• Normal drive copy mode (when multi-part form or thick paper is used.) • High duty condition (head temperature is high) • Cold mode (head temperature is low.)
Environmental condition	Temperature: 5 to 55° C Humidity: 10 to 85 %
Printhead drive method	Flywheel type

2.1.2 CR (Carriage) Mechanism

The CR mechanism consists of the CR movement mechanism, external cooling fan, and platen gap adjustment mechanism.

❑ CR movement mechanism

The CR is supported by 2 CR guide shafts by its high and low ends. The stepping motor used for the CR motor enables the CR to move to any positions. The motor also sends torque to the timing belt pulley to drive the timing belt. The timing belt with one of the edges fixed to the head carriage moves the head carriage along the carriage guide shaft from right to left or vice versa according to the direction the CR motor rotates. Since the length of the belt is affected by the change in temperature, belt tension spring is attached to keep the belt with a constant tension. The HP sensor (Home Position sensor) is located at the reference position (on the right side as seen from the front) in the printer mechanism. Photo-coupler system used for the sensor detects the CR when the flag of the CR crosses emission. It is only operated when the printer is turned on, and once it is detected, CR movement is put under the open-loop control system. After the controller circuit determines where to move the CR according to the received data, it converts the distance to the position into the corresponding phase change pulse and outputs it to the CR motor. If the CR home position is detected during printing or the printer initialization, it indicates the status that the printer fails to detect the home position at a correct position and an error occurs as a result. CR speed is controlled by the CR motor drive frequency which depends on the printing data.

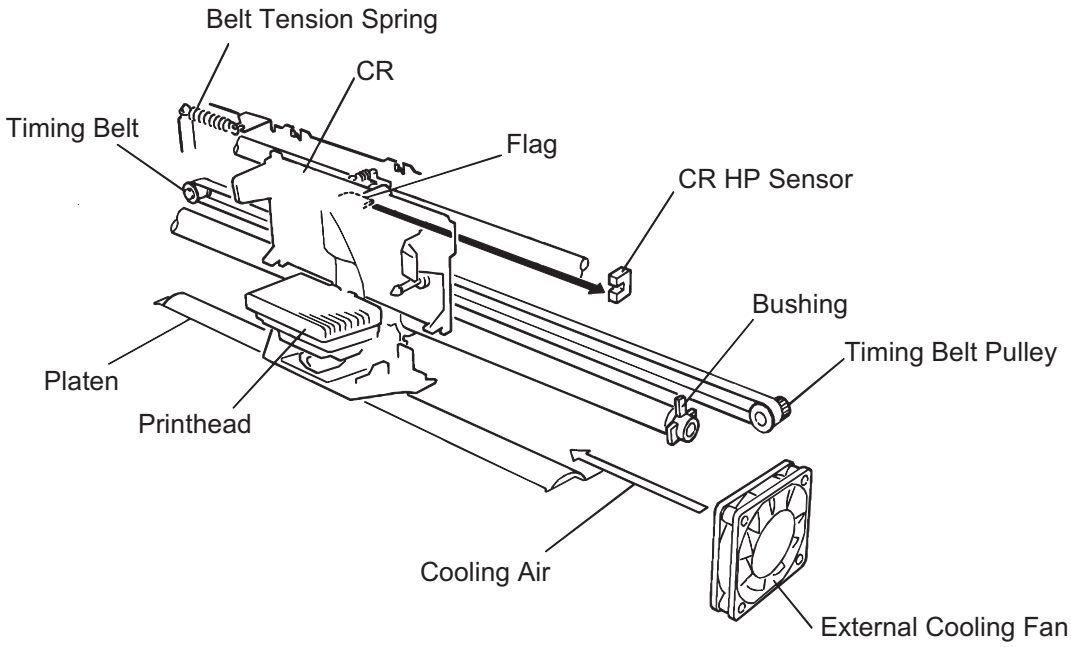


Figure 2-2. CR Mechanism

❑ External cooling fans

This printer is equipped with 2 cooling fans. One, located at the left bottom of the printer, eliminates excess heat from the circuit boards. The other one is externally attached to the right side of the printer mechanism to blow the air directly to remove excess heat from the printhead.

Table 2-2. External Cooling Fan Unit Specification

Type	DC brush-less motor (ball bearing built in)
Power supply voltage	35 VDC ± 10 %
Consumption current	0.07 A or less
Rotating speed	3800 rpm or more

2.1.3 PG (Platen Gap) Adjustment Mechanism

PG adjustment is made manually and automatically. In the manual PG adjustment mode, the proper PG is originally set for the paper to be loaded by manually operating the PG adjust lever located at the left front of the printer. On the other hand, the automatic PG adjustment function lets the printer automatically measure the paper thickness and set the proper PG for the thickness. This mode is activated by setting the PG adjust lever to the automatic side. Figure 2-3 shows the PG adjustment mechanism.

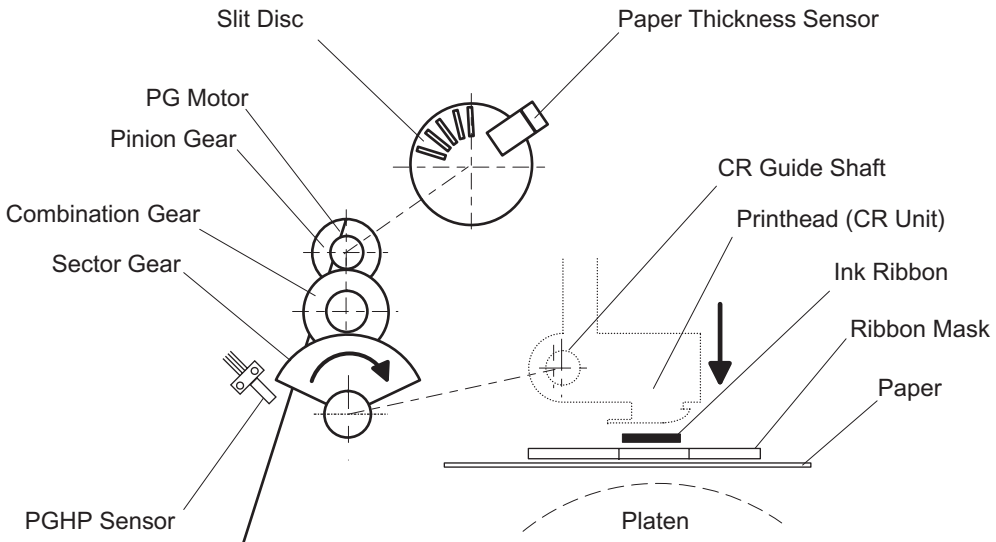


Figure 2-3. PG adjustment Mechanism

The PG adjustment mechanism located at the left top of the printer mechanism unit consists of the PG motor, CR guide shaft, sectorial gear, combination gear, PG home position sensor, and paper thickness sensor., After the PG is determined by the controller circuit according to the paper thickness, the PG motor rotates corresponding amount. The torque from the PG motor is transmitted via the motor pinion gear, combination gear and sectorial gear to the CR guide shaft. Since the shaft is eccentric, the CR on the shaft moves from or toward the platen as the shaft moves, depending on the direction the motor rotates. Seeing from the left side of the printer mechanism, the clockwise or counterclockwise rotation of the CR guide shaft narrows or widens the PG, respectively. The PG home position is detected when the sectorial gear pushes the actuator on the PG home position sensor.

❑ Manual PG adjustment function

This function allows the user to set the proper PG manually by setting the PG adjust lever to one of the steps from -1 to 9. The selected step is converted into 4-bit data using adjustment switches and the data is transferred to the controller circuit, where the PG is determined based on the information.

Table 2-3. PG and PG Adjust Switch

PG lever Steps	Adjust switch condition				Corresponding paper Thickness (PT)	PG width (mm)	Print mode
	#1	#2	#3	#4			
-1	O	O	–	O	0.06=<PT<=0.11	0.35	Normal
0	–	O	–	O	0.06=<PT<=0.11	0.39	Normal
1	O	–	–	O	0.11<PT<=0.15	0.43	Normal
2	–	–	–	O	0.15<PT<=0.19	0.46	Normal
3	O	O	O	–	0.19<PT<=0.25	0.50	Copy 1/2
4	–	O	O	–	0.25<PT<=0.30	0.55	Copy 1/2
5	O	–	O	–	0.30<PT<=0.36	0.61	Copy 1/2
6	–	–	O	–	0.36<PT<=0.42	0.67	Copy 1/2
7	O	O	–	–	0.42<PT<=0.46	0.71	Copy 1/2
8	–	O	–	–	0.46<PT<=0.49	0.74	Copy 1/2
9	O	–	–	–	0.49<PT<=0.53	0.78	Copy 1/2
Automatic	–	–	–	–	0.06=<PT<=0.53	Note 1	Note 2

Note)

1. PG width corresponds to the detected paper thickness.

2. Copy mode is used for paper with the thickness of 0.2 mm or more.

❑ Automatic PG adjustment function

PG is automatically adjusted based on the paper thickness detected paper thickness sensor which consists of the slit disc and the photo-electric transfer. Paper thickness is detected in the following order:

1. PG home position is detected.
2. The gap between the platen surface and the printhead is measured by pressing the printhead to the platen through the ribbon mask and ink ribbon.
3. The paper thickness is by pressing the printhead to the paper surface through the ribbon mask and ink ribbon.
4. The printer sets the proper PG based on the measurement done in the step 2 and 3.

PG is determined for each paper loading action. When the CSF is used, this function is activated when the printer is turned on. It is also performed when the paper quantity sensor in the hopper is reset. However, no printing is performed during this operation. (Refer to Section 2.3.10.)

2.1.4 Ribbon Feed/Ribbon Shift Mechanism

Ribbon feed/ribbon shift mechanism, located at the upper part of the CR, is composed of the ribbon motor, ribbon wind-up mechanism inside the ribbon cartridge, ribbon shift mechanism, and color ribbon cartridge sensor. The torque from the ribbon motor, the only motor which drives these mechanisms, is transmitted to each mechanism by changing the direction for rotating the motor, as described below:

- Forward rotation (Clockwise): Color/Black ribbon shift
- Backward rotation (Counterclockwise): Ribbon feed

A stepping motor used for the ribbon motor enables the CR to move to and stop at any position. The color ribbon cartridge sensor detects which of color or black ribbon cartridge is installed and switches the ribbon motor between the monochrome ribbon mode and color ribbon mode according detected cartridge. The printer refers to the switch mode of the sensor when the printer is turned on or resuming the operation after the cover open error is detected. The motor is controlled by the open-loop system. While the motor is used for the ribbon shift, the color home position sensor detects the reference position (black) to manage the color ribbon shift. The motor drive speed and phase excitement mode changes in accordance with printing modes such as copy mode, normal mode and color mode.

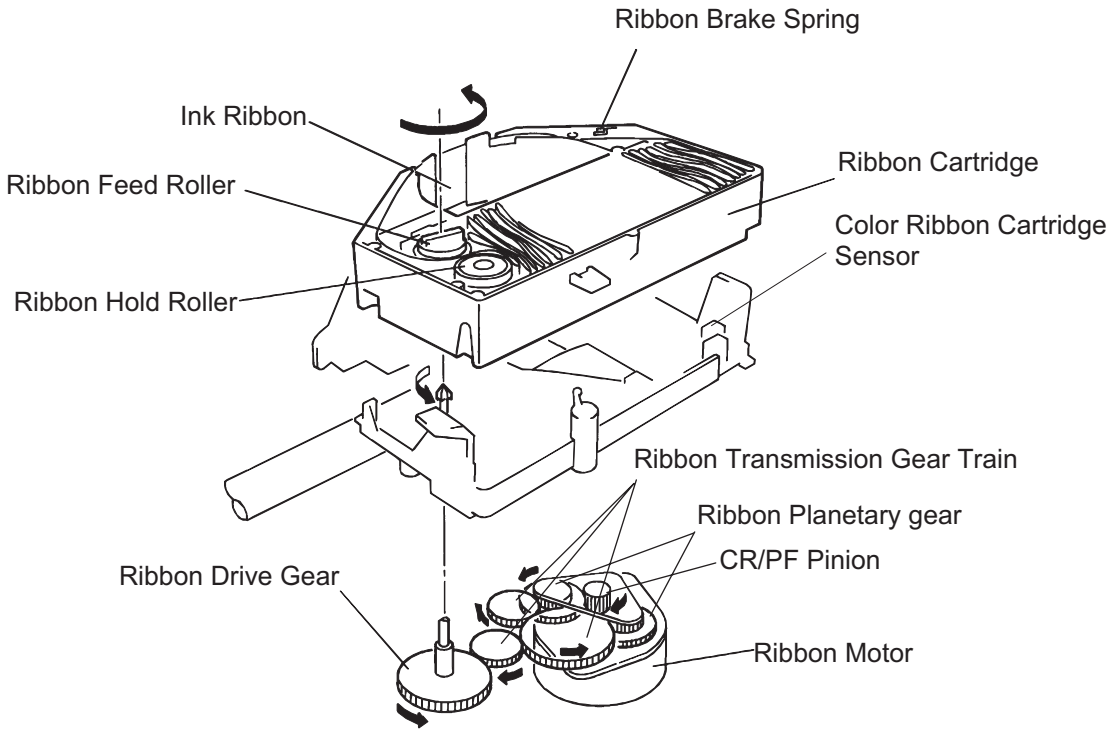


Figure 2-4. Ribbon Feed/Ribbon Shift Mechanism

Table 2-4. Color Ribbon Cartridge Sensor Specification

Detecting method	Mechanical switch system
Rated voltage/current	5 to 10 mA/5 VDC ± 5%
Switch mode	Monochrome ribbon mode : HIGH Color ribbon mode: LOW

2.1.4.1 Ribbon Feed Mechanism

The ribbon feed mechanism is composed of the ribbon feed mechanism in the carriage, ribbon motor and ribbon cartridge. When the ribbon motor rotates counterclockwise, the ribbon drive pulley is driven to feed the ribbon. See Table 2-5 which shows how the torque is differently transmitted via the gear train.

Table 2-5. Ribbon Motor Rotation and Torque Transmission

Rotational direction	Torque transmission
C.C.W. (for ribbon feed)	Ribbon motor pinion → Ribbon planetary gear → Ribbon transmission gear train →Ribbon drive gear
C.W. (for ribbon shift)	Ribbon motor pinion → Ribbon planetary gear → Ribbon transmission gear (A) →Ribbon transmission gear (B) → CS reduction gear → CS drive cam → CS drive lever

The endless ink ribbon in the ink cartridge is routed between the ribbon feed roller and the ribbon hold roller. When the ribbon feed roller engaged with the ribbon drive gear is driven, the ribbon between the rollers winds up. The ribbon brake spring is set at the exit in the cartridge to wind the ribbon tightly.

2.1.4.2 Ribbon Shift Mechanism

The ribbon shift mechanism, which is composed of the ribbon motor, ribbon shift gear train and color HP (Home Position) sensor, shifts the ribbon cartridge back and forth on CR unit. Both black and color ribbons have the width of 1 inch. The black ribbon is entirely soaked with the black ink, and the color ribbon is composed of 4 colored bands of black, red, blue and yellow. When the color ribbon cartridge is installed on the CR, it is detected by the color HP sensor, and the printer enters the color ribbon mode. With this mechanism, the color print with 7 different colors is enabled. The printer shifts the color ribbon cartridge to the black band position before shifting to another color each time the printer is turned on or the cover open error is cleared. This is operated to avoid ribbon's getting caught in the printhead and resultant failure in ribbon shifting. The printer enters the monochrome ribbon mode when the black ribbon is installed. In this mode, the printer shifts the cartridge with ¼ of the ribbon width under the following condition in order to lengthen the ribbon life:

- 10 cut sheets or 10 pages of continuous paper has been continuously printed after the last shift.
- The release lever setting is changed.
- Continuous paper is loaded.

The cartridge positioning spring behind the cartridge, having the positioning pin at the top, holds the ribbon cartridge firmly to act in the direction the CS drive lever is pressed down. The ribbon motor sends torque to the CS drive lever, which shifts the cartridge between any color bands, starting from the reference position, the position for the black belt. The reference position is detected by the color HP sensor.

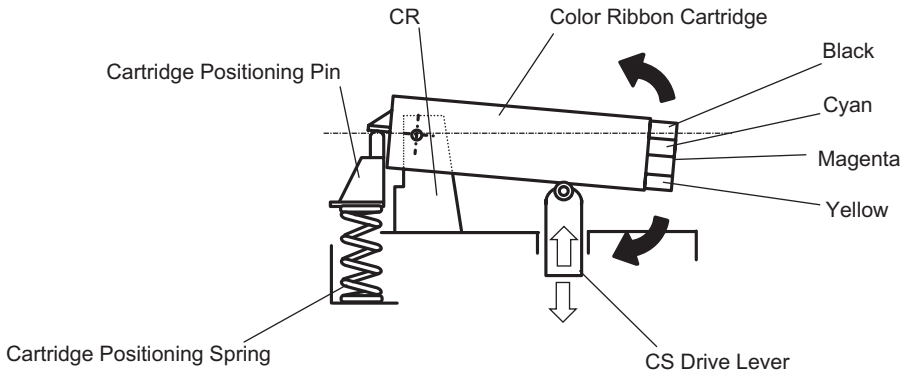


Figure 2-5. Ribbon Shift Mechanism

Half-toning colors are created by printing a color on top of another, as shown in Table 2-6. The printer prints the brighter color first to prevent the ribbon from being stained.

Table 2-6. Coloring Sequence

Print color	Print ribbon	
	First print	Second print
Black	Black	–
Magenta	Magenta	–
Cyan	Cyan	–
Yellow	Yellow	–
Green	Yellow	Cyan
Orange	Yellow	Magenta
Violet	Magenta	Cyan

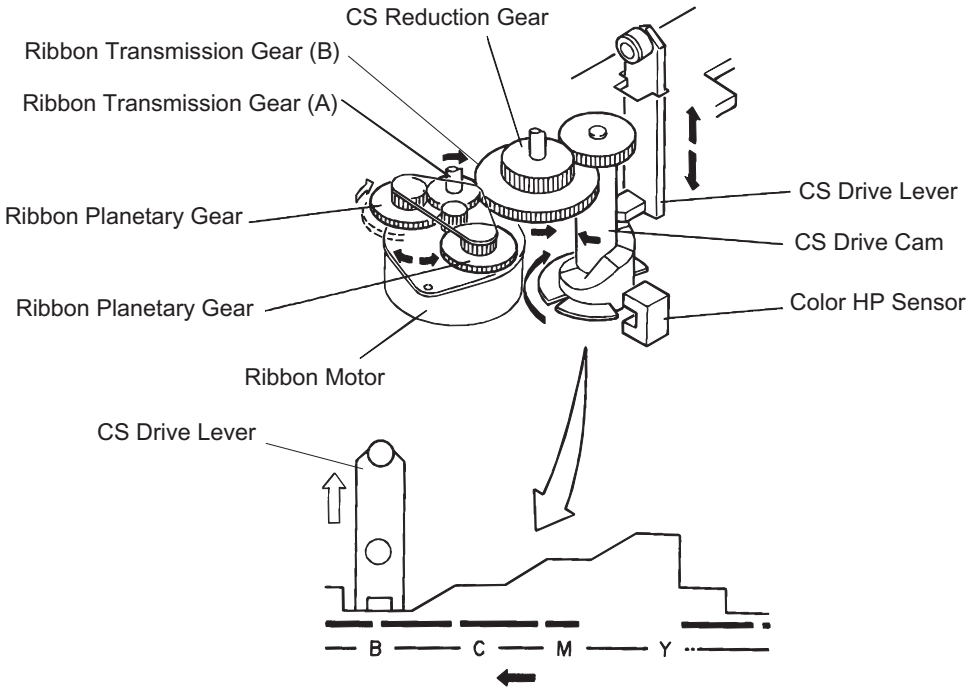


Figure 2-6. Ribbon Shift Gear Train Mechanism

2.1.5 Paper Feed Mechanism

The paper feed mechanism consists of the platen roller, PF roller (Paper Feed roller), paper eject roller, PF motor (Paper Feed motor), tractor unit, PEW sensor (Paper Width sensor), front/rear paper sensor, release sensor, paper jam sensor, and paper shift mechanism.

2.1.5.1 Core of the Paper Feed Mechanism

This printer feeds paper by sliding it horizontally. Paper feed operation varies depending on the release lever setting condition, as described below:

- ❑ In the friction mode
  Paper is held by the front paper bail and the for roller assemblies (2 upper and 2 lower rollers) under the CR guide shaft.
  - Feeding method: Front feeding (automatic), Rear feeding (manual), CSF feeding
  - Ejecting method: Front ejection

- ❑ In the tractor mode
  Switching the lever setting from the friction mode to the tractor mode puts the printer into the tractor mode. In the tractor mode, the drive is disengaged from the rollers by the release mechanism, and transmitted to the tractor side.
  - Feeding method: Tractor
  - Ejecting method: Front ejection

- ❑ In the paper jam removal mode
  Torque is disengaged from all the rollers in this mode. (See Section 2.1.5.3.) A stepping motor is used for the PF motor, which enables the paper to move to and stop at any position regardless of the direction. The motor is controlled by the controller circuit by the open-loop system. It refers to the signals output from the sensors in the mechanism to determine the amount to slide paper and the corresponding motor pulse. Torque sent from the PF motor equally splits to the front and rear paper feed drive rollers via the 2 timing belts. If the belt tension is inappropriate (either too loose or too tense), the front and rear rollers lose balance and paper jam is caused as the result. To balance the belt tension with each other, reinstall the PF motor to the proper position. The PF motor is fixed with 2 screws and the adjusting part such as the PF tension shaft. (See chapter 3 for detailed procedure.)

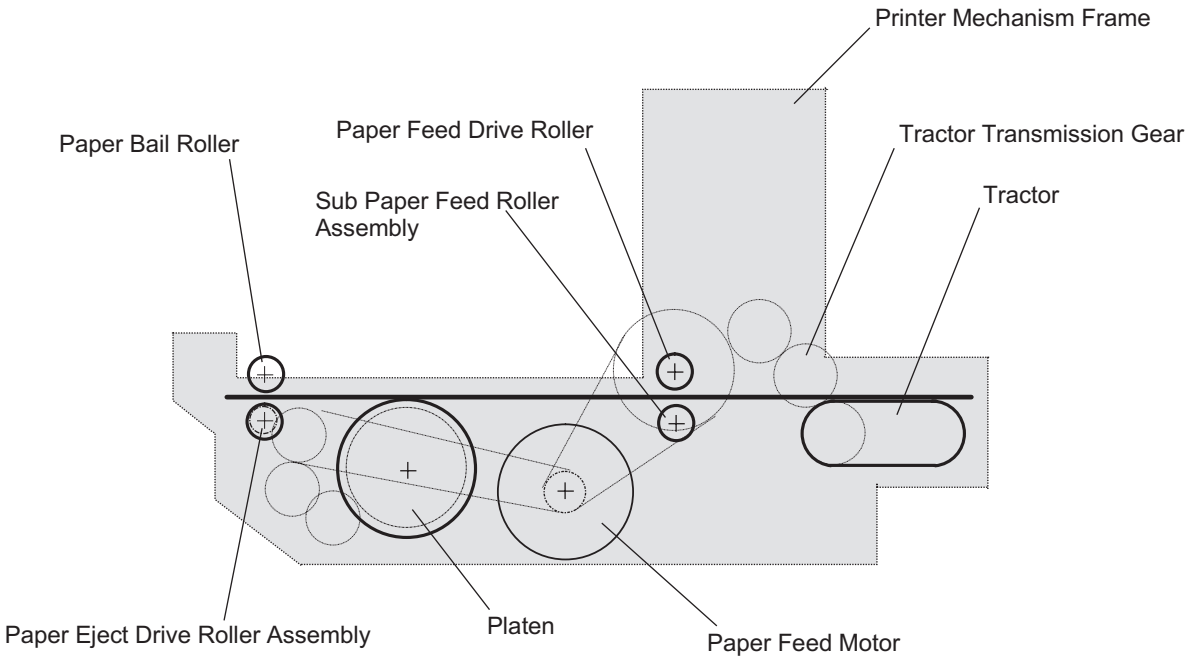


Figure 2-7. Core of the Paper Feed Mechanism

2.1.5.2 Paper Feed Sensor Mechanism

The paper feed sensor mechanism is composed of the right/left PEW (Paper Width) sensors, front/rear paper sensors and paper jam sensor. These sensors detect conditions such as top and rear paper edge positions, paper width and paper jam. The paper feed sensor mechanism monitors detected conditions and feeds back the information to the CPU, which controls paper feeding. The feed-back timing for a read signal is selected by the CPU depending on the movements of the paper feed and carriage motors. Figure 2-8 illustrates the paper feed sensor mechanism. Table 2-7 lists the paper feed sensor functions.

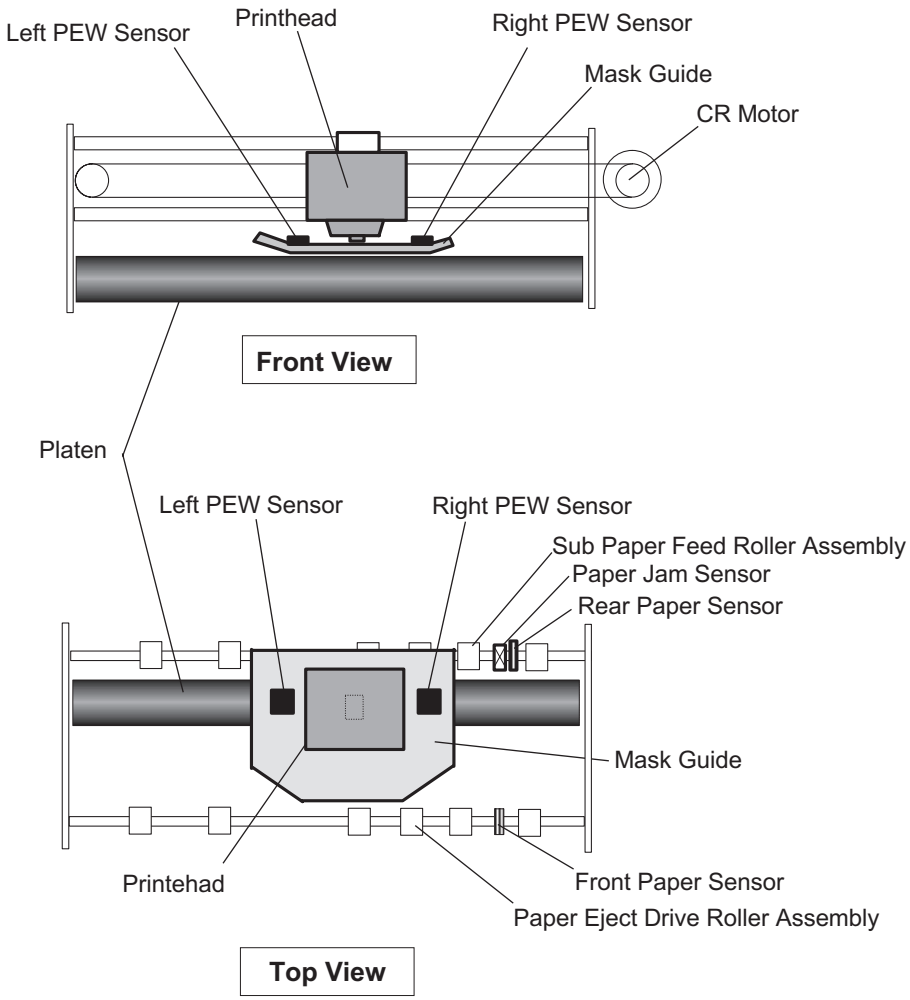


Figure 2-8. Paper Feed Sensor Mechanism

Table 2-7. Functions of the Paper Feed Sensor

Sensor	Detection	Function
Right/left PEW sensors	Paper width measurement (detects the left and right paper edges)	Selects the left and right margins.
	Paper bottom detection (detects the rear edge.)	Depending on o the CR position, one of the sensors is used. If one of the sensors detects paper, it is regarded “Paper is loaded”. If both sensors don’t detect paper, it is regarded “No paper is loaded”.
	Paper end detection	Ensures the paper feed and paper eject action.
Left PEW sensor alone	Leading edge detection at loading paper (detects the paper top.)	Determines the top margin.
Front/Rear paper sensors	Detects the leading/rear edge of the paper.	Determines the top/bottom margin.
	Paper end detection	Ensures the paper feed and paper eject action.
Rear paper sensor alone	Detects the leading/rear edges of the paper	Detects the leading edge and printable area for the black-solid print paper.
Front paper sensor alone	Detects the leading edge of the paper	Performs front paper feeding.
Paper jam sensor	Paper jam detection	Detects paper jam condition in the front/rear paper feed direction.

Notes)

1. *When the printer is powered on, if any of the right/left PEW sensor and front/rear paper sensor detects paper, the printer does not detect the leading edge of the paper but the paper end condition.*
2. *Left and right margin for cut sheet and continuous paper are switched by the release sensor.*

❑ Black solid mode
This printer is equipped with the black solid print mode. In this mode, the printer prints regardless of the reflection rate of the paper.

❑ Paper jam detection
The paper jam sensor monitors a signal output for each step (1/216 inch per step). If the output signal becomes the same as the one for power on time and the following signals for the specified numbers of steps remain the same, the status is regarded as the paper jam error, and the CPU indicates the paper jam error.

2.1.5.3 Release Mechanism

The release mechanism consists of the release lever, sub release lever, release lever link and release sensor. It switches the paper path between cut sheet mode (including CSF mode), continuous paper mode and paper jam removal mode in accordance with the release lever setting. It is performed by switching the torque from the PF motor and adding /releasing pressure toward/from the rollers in the paper feed mechanism. The release lever shifts the release lever link via the sub release lever to add friction to paper or to release pressure from the paper.

- ❑ Cut sheet mode
  The torque from the PPF motor is transmitted to the PF mechanism side, where the paper is fed with friction added by the sub paper loading roller assembly.
- ❑ Continuous paper mode
  The torque from the PF motor is transmitted to the tractor gear via the tractor gear train to feed continuous paper. The sub paper loading rollers are used to hold and feed the paper only.
- ❑ Paper jam removal mode
  To set the release lever to this mode releases the paper bail as well as the sub paper loading rollers. In this full release condition, the jammed paper can be manually ejected

The release sensor detects whether the release mechanism is in the cut sheet mode or continuous paper mode, and sends the information to the controller circuit.

Table 2-8. Release Mechanism Mode

	Cut sheet mode	Continuous paper mode	Paper jam removal mode
Paper eject lever assembly	Closed	Open	Open
Paper loading drive roller	Closed	Closed	Open
Tractor transmission gear and tractor gear condition	Disengaged	Engaged	Engaged
Release sensor state	Open	Closed	Closed

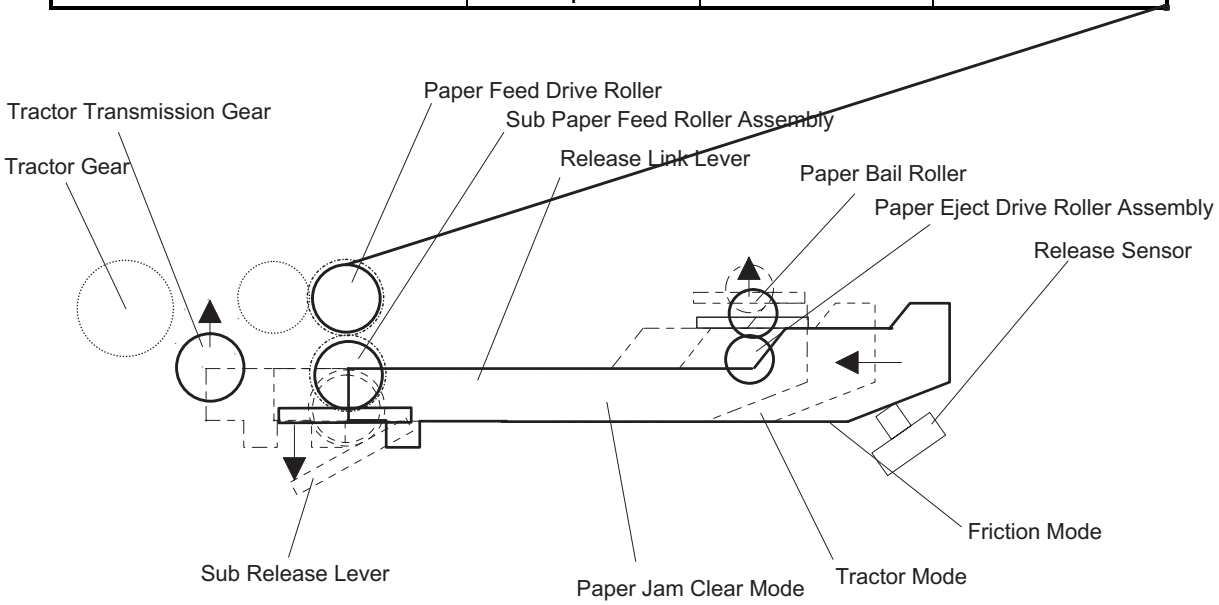


Figure 2-9. Release Mechanism

2.2 Circuit Operating Principles

The power source of this printer is composed of the power switch, AC cable and C124 PSB/PSE board. It supplies DC voltage used to control the printer operation.

2.2.1 Power Supply Voltage

The electrical circuit of this printer uses an RCC (ringing choke converter) type switching regulator, which outputs DC voltage required to operate the printer. DC voltage is divided into 3 blocks: +35 VDC (CH. A), +35 VDC (CH. B) and +5 VDC, as listed below.

Table 2-9. DC Voltage Application

Voltage level	Connector No.	Application	
+35 VDC ± 10%	CN2	CH. A	• CR motor • Printhead drive voltage
		CH. B	• Printhead • Cooling fan motor • PF motor • Ribbon motor • Vpp of the flush memory
+5 VDC ± 5%	CN3	Logic	• Hold voltage for the PF motor • Hold voltage for the ribbon motor • Serial I/F level converter • Type-B I/F power supply voltage • I/F power supply

2.2.2 Power Supply Circuit Operation

The AC power source is supplied to the PSB/PSE board via the AC cable, power switch and fuse. The AC voltage is full-wave rectified using the diode bridge (DB1) and smoothed by the condenser. The surge cut circuit by SCR reduces the rush current at power-on.

❑ ***Over current protection circuit on the primary side***

IC101 and IC201 detect the input voltage of the primary side. If the input voltage is normal, the current does not flow into the shunt-regulator. However, if the over current flows into the input voltage line, the shunt-regulator goes on and Q103 (Q203) goes on and Q101 (Q201) goes off.

❑ ***+35 VDC block***

For the 35VDC block, the voltage is applied with AC/DC conversion between the primary and secondary sides via coil T101 and T201. The amount of voltage and current output to the secondary circuit is controlled at the gate by the on/off operation of the main switching MOS FET (Q101 and Q201). Control is fed back to the Q101 and Q201 from each protection circuit and controller circuit.

[+35 VDC line over current protection circuit]

If the voltage level for the +35 VDC line drops below +13 V, Q153 (Q253) and Q154 are turned on by the detector circuit which consists of the R173 (R273) and R174 (R274), then the PC102 goes on and the current cuts off as the result. At this time, the delay circuit which consists of C157 and R154 makes the delay time. When the printer is turned on, the protection circuit can not start operation since the delay circuit acts to prevent the drivers on the main control board from rising before the +5 VDC lines rises up.

❑ ***+5 VDC block***

The +5 V line is produced out of the stabilized and smoothed +35 V by the Regulator IC TL494. Since the regulator internally has the stabilizing and smoothing circuit, information on stabilization is not fed back to the primary side except for the information on the over current protection circuit. When the output level of the +5 VDC is abnormally high, the status is fed back to the primary side via the Zener diode (ZD153) and PC102, then The gate for switching FET Q101 or Q201 is shortened to avoid abnormal operation of the mechanism.

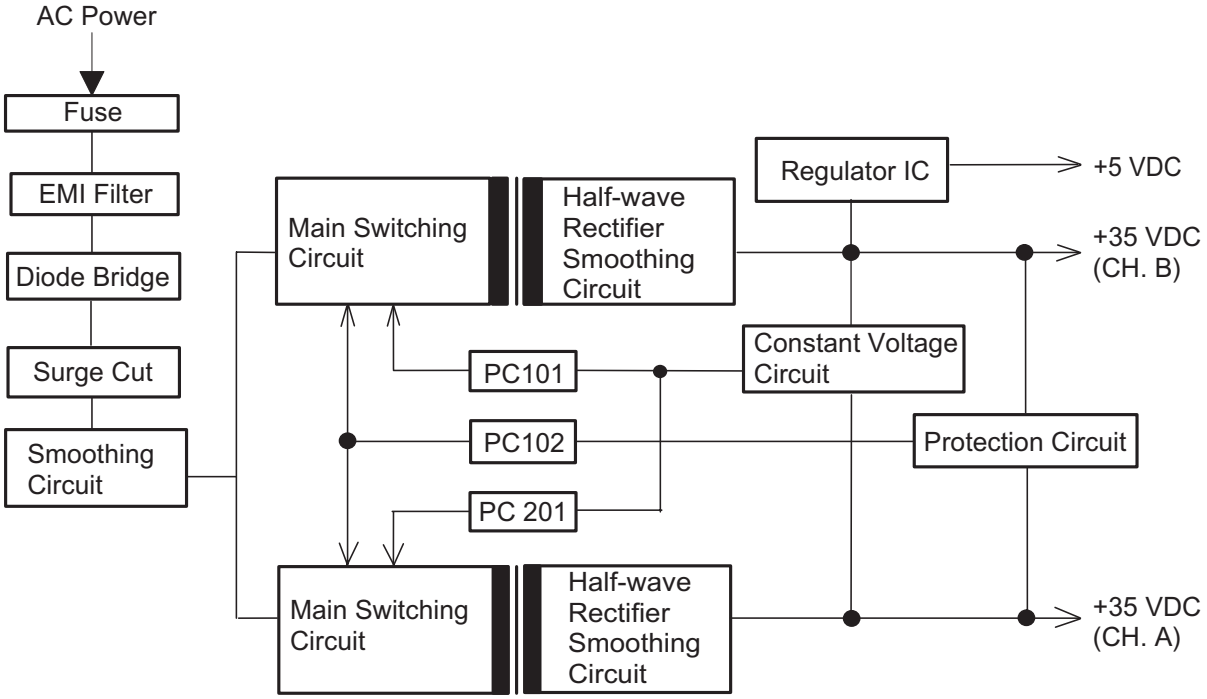


Figure 2-10. Power Circuit Block Diagram

2.3 Controller Circuit

This section describes the controller circuit of this printer. This printer uses a 112-pin/QFP-type/16-bit microprocessor H8/3003 (IC16) for the CPU and drives it with the clock frequency of 14.7 MHz. The control program is stored in the 1-Mbit Flash-ROM (IC15) or PROM (IC18).The CPU receives the external reset signal and control the printer based on the control program. When the Flash-ROM is in use, the control program can be transferred by way of the parallel interface. DRAM is used as a work area and buffers. A non-volatile memory EEPROM (IC23) stores information such as default values, customer data, total printing amount value and PG adjustment value. The gate array E05B46 (IC25) controls the following:

Clock	Addresses	Memory	DRAM	Parallel I/F
Type-B I/F	Ports	Motors	Bitmap	Printheads

It is also used for the PG measurement. The gate array E05A89 functions as the panel interface controlled by the CPU. It is directly attached to the control panel circuit board to simplify the circuits. See Table 2-10 which lists the main ICs and their functions.

Table 2-10. Main ICs and their Functions

IC	Location	Function
CPU (H8/3003 equivalent)	IC16	The main CPU of the controller circuit
Gate Array (E05B46)	IC25	Controls systems and peripheral devices.
Gate Array (E05A89) (built in the panel circuit board.)	–	Functions as the I/F between the control panel and controller circuit.
Flash-ROM	IC15	Stores the control program.
PROM	IC18	Stores the control program when the Flash-ROM is not equipped.
CG (8-Mbit MROM)	IC21	Character generator
CG (4/8-Mbit MROM)	IC24	Character generator
DRAM (HM514260 equivalent)	IC26	Manages buffers and work area. (4Mbit)
EEPROM (AT93C66 equivalent))	IC23	Stores values for default setting, customer data and so on.
Reset IC (RST592D)	IC22	• Resets hardware • Rests Flash-ROM (Recovery from the reset condition is done for Flash-ROM prior to the CPU and gate arrays.)
Reset IC (RST594E)	IC20	• Reset hardware • Resets the CPU and gate arrays.
CR motor driver (SLA7026)	IC7	Drives the CR motor by constant current/uni-polar drive.
PF motor driver (SLA7024M)	IC6	Drives the PF motor by constant current/uni-polar drive.
Ribbon driver (MP5320)	QM2	Drives the ribbon motor on the CR by constant current/uni-polar drive.
PG motor (SDC03-V1)	QM1	Drives the PG motor by constant current/uni-polar drive.
Serial I/F transceiver IC (MAX232CWE)	IC14	Transceiver circuit for the serial I/F
Shunt regulator (TL431)	IC19	Produces the reference voltage (power supply for the stabilizing the +5V) for the A/D converter.
3-terminal regulator (LM75L12)	IC17	Stabilizes 12V power supply voltage for head pre-drive.

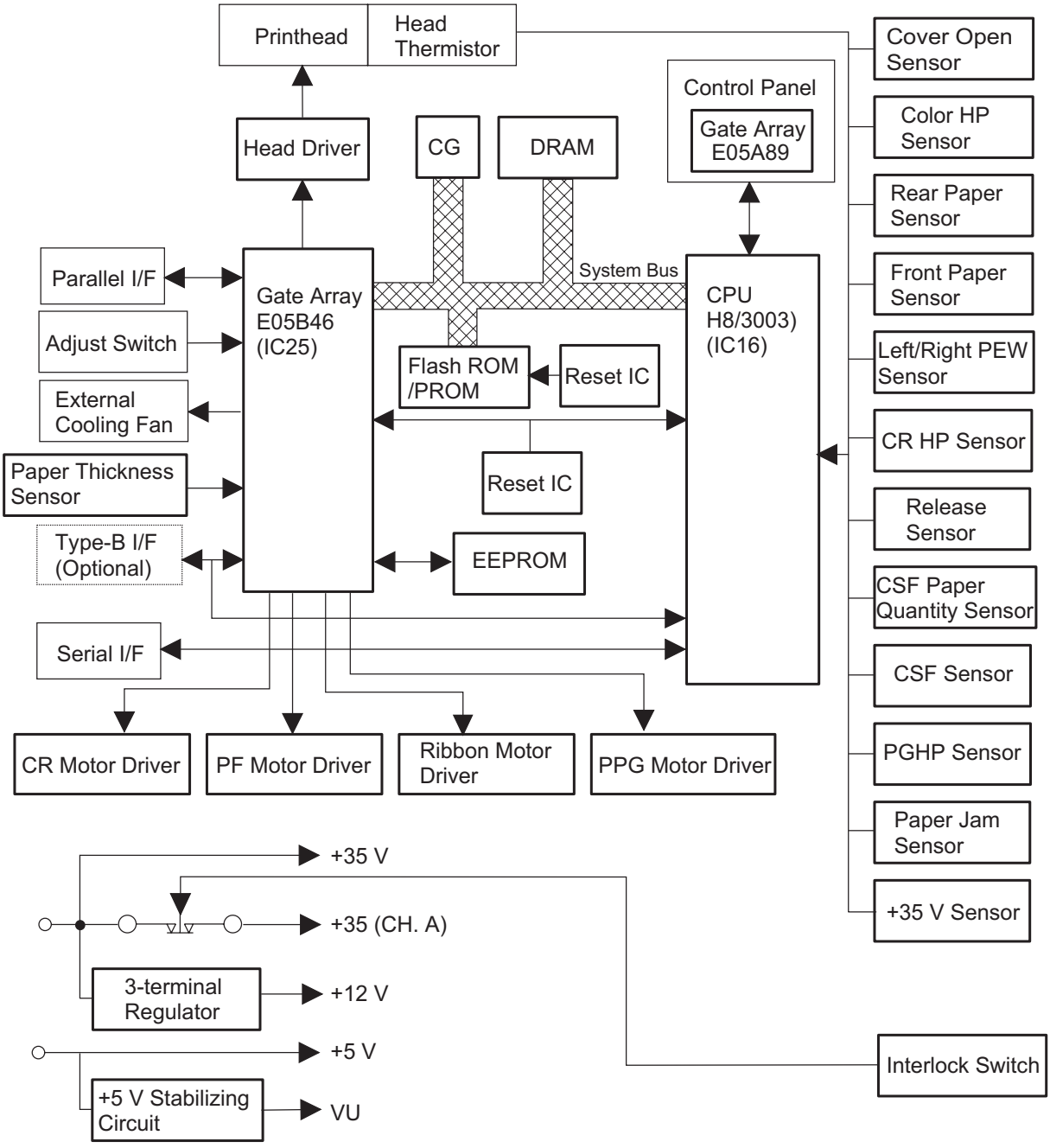


Figure 2-11. Controller Circuit Block Diagram

2.3.1 Interface Circuit

This section gives information on the parallel/serial interfaces of the DLQ-3000+.

- Bi-directional parallel interface
  The gate array E05B46 manages the IEEE-1284 nibble mode function using the internal IFU (Interface Unit). It latches data from the host computer by the /STB signal and automatically sends the BUSY signal. When the data is stored in the buffer, the gate array clears the BUSY and sends /ACK back to the host computer.
- Serial interface
  Received data RXD sent from the host computer (i.e. RECEIVED DATA, which is also applied to an optional interface.) is transferred to the CPU via the transceiver IC, and then to the input buffer. The CPU directly outputs TXD data (TRANSMIT DATA). The codes DC1/DC2 and DC3 are outputs when the input buffer is full, and DC1 is output when the buffer memory recovers to the normal level. The signal REV (same as DTR:DATA TERMINAL READY) is output to the port PC0 of the CPU to control the DTR. The printer resumes printing when the CR code is received or the input buffer is full.
- Type-B interface
  Type-B interface is also controlled by the gate array E05B46.

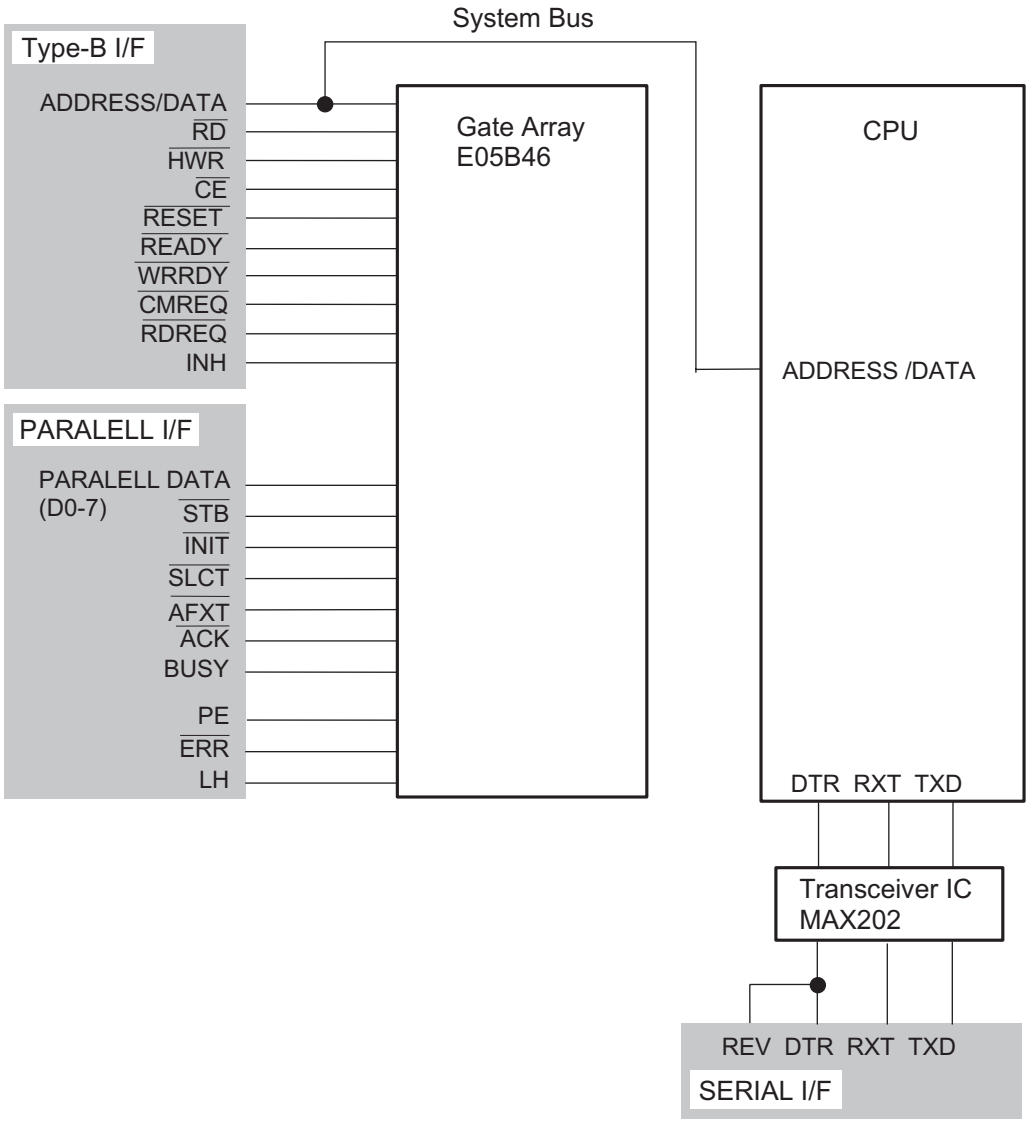


Figure 2-12. Interface Circuit Block Diagram

2.3.2 Reset Circuit

The hardware reset circuit for this printer has 2 reset ICs: RST592D (IC22) and RST594E (IC20). When the +5 v for logic line is unstable dew to power-on, it outputs the reset signal until the +5 VDC line is stabilized to avoid abnormal operation of the printer. RST592D monitors the Flash-ROM with the threshold voltage set at approximately 4.2 VDC. It outputs the reset signal until the +5 VDC line is stabilized to 4.2 VDC. The Flash-ROM recovers from the reset condition before the CPU and the gate arrays recover from the reset condition. RST594E monitors the CPU and the gate arrays. The threshold voltage is set at approximately 4.2 VDC. The reset signals is kept output until the +5 VDC line is 4.2 VDC. Since the reset signal from the RST592D is sent to the manual reset terminal (MRST) in the RST594E via the output port of the CPU, the Flash-ROM recovers from the reset condition before the CPU and the gate arrays recover from the reset condition.

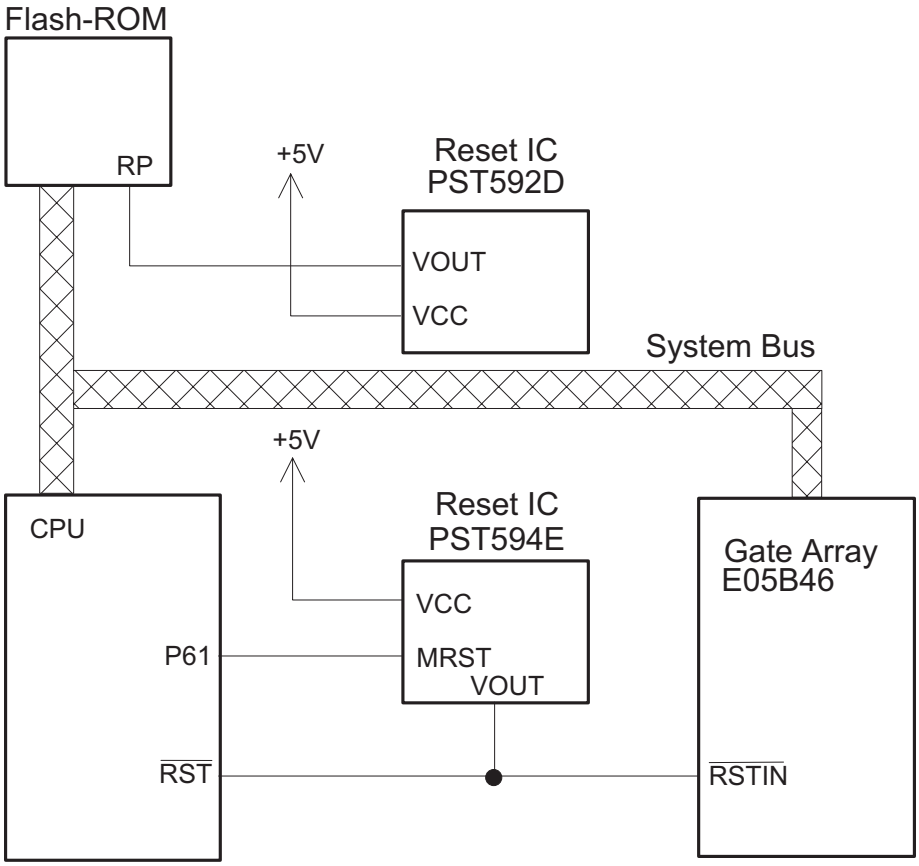


Figure 2-13. Reset Circuit Block Diagram

2.3.3 Memory Back-up Circuit

When the printer power is turned off, mainly the following data is backed up in the EEPROM AT93C66 (IC23).

- ❑ Paper length, TOF, TEAR OFF, left and right margins, line spacing, pitch selection, character code, character fonts, high speed print, print direction, customer code
- ❑ Interface setting
- ❑ Values used for controlling the mechanism (condition for all the sensors)
- ❑ Adjusted values used for controlling the mechanism (i.e. Bi-D adjustment, PG adjustment and PG α value)
- ❑ IPD ID for the boot strap program
- ❑ The first operation date, accumulated print amount, accumulated power-on time and timing for ribbon replacement

Data to be backed up is transferred by the gate array as serial data. At printer power off, the gate array outputs the chip select signal ESC from port 126 and data to be backed-up is sent to the EEPROM from port 124 (EDO) before the power supply voltage completely drops. The data stored in the EEPROM is read by sending data to the EDI terminal in the gate array when the printer is turned on. ECK is the clock signal for synchronization.

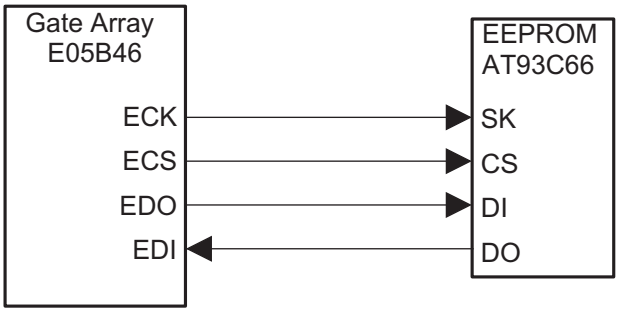


Figure 2-14.Memory Back-up Circuit Block Diagram

2.3.4 Ribbon Motor Controller/Driver Circuit

A PM-type stepping motor is used for the ribbon motor of this printer. It is driven by 1-1 phase or 2-2 phase excitation mode, based on the selected rotational speed. This motor rotates in the both forward and backward directions and can stop at any position. Signal PFA, /PFA, PFB and /PFB are output to drive each phase from the gate array (E05B46) via the transistor array MP5302. Common voltage change signal (RF_R/H : Run/Hold) is output from a port of the same gate array. To hold, both faces are driven simultaneously using the 5 VDC line. To switch between Run and Hold is operated by the signals RF_R/H output from the gate array. While in the color ribbon mode, the printer switches mode between the copy mode and normal mode according to the signal output from the paper thickness sensor. See Table 2-11 for the ribbon motor drive term.

Table 2-11. Ribbon Motor Drive Term

Motor type	4 phases / 48-pole / PM-type stepping motor
Power supply voltage	35 VDC ± 10%
Coil resistance	76 Ω ± 10% (at 25°C per phase)
Drive frequency	At color select:460, 600 pps At ribbon feed:320, 640, 770 pps
Excitation mode	At color select:2-2 phase At ribbon feed:2-2, 1-1 phase
Consumption current (mA/motor)	1-fold speed (fabric ribbon):350 - 390 At color select Copy mode: 550 or less Normal mode: 400 or less
Drive mode	Constant current uni-polar drive (VPB line)

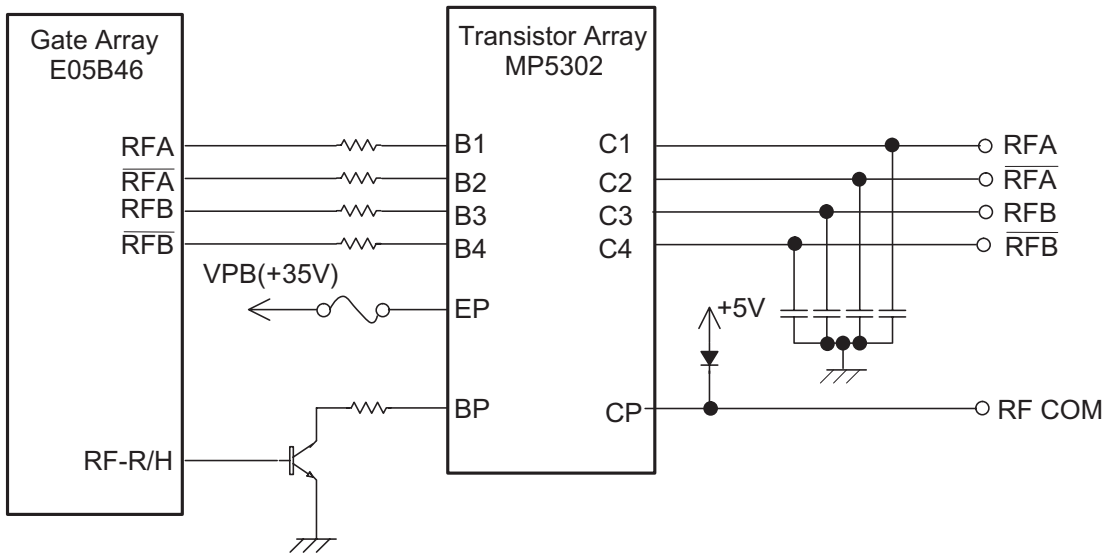


Figure 2-15. Ribbon Motor Driver circuit Block Diagram

2.3.5 PF (Paper Feed) Motor Controller/Driver Circuit

Since this printer uses a hybrid-type stepping motor for the PF motor, it allows the paper to move to and stop at any position, regardless of the direction for feeding paper. The motor is driven by 1-2 phase with the open-loop system. Signals for 4 phases (PFA, /PFA, PFB and /PFB) are output from the gate array E05B46 (IC25) driven by the motor drive IC SLA7024M (IC6). To hold the motor, 2-2 phase is driven by the hold signal (PFIO) output from the same gate array. See Table 2-12 which specifies the PF motor terms.

Table 2-12. PF Motor Drive Term

Motor type	4 phases / 200-pole / HB-type stepping motor
Power supply voltage	35 VDC ± 10%
Coil resistance	5.0 Ω ± 10%
Drive frequency	1430 – 7200 pps
Driving mode	Constant current uni-polar drive
Excitation mode	1-2 phase/2-2 phase (RUSH/HOLD)
Paper feed speed	42 m second (6 IPS intermittent drive)
Minimum step	0.07 mm (1/360")/step
Consumption current (mA/motor)	6 IPS (1-2 phase): 1.3 A/phase HOLD (2-2 phase): 0.35 A/phase

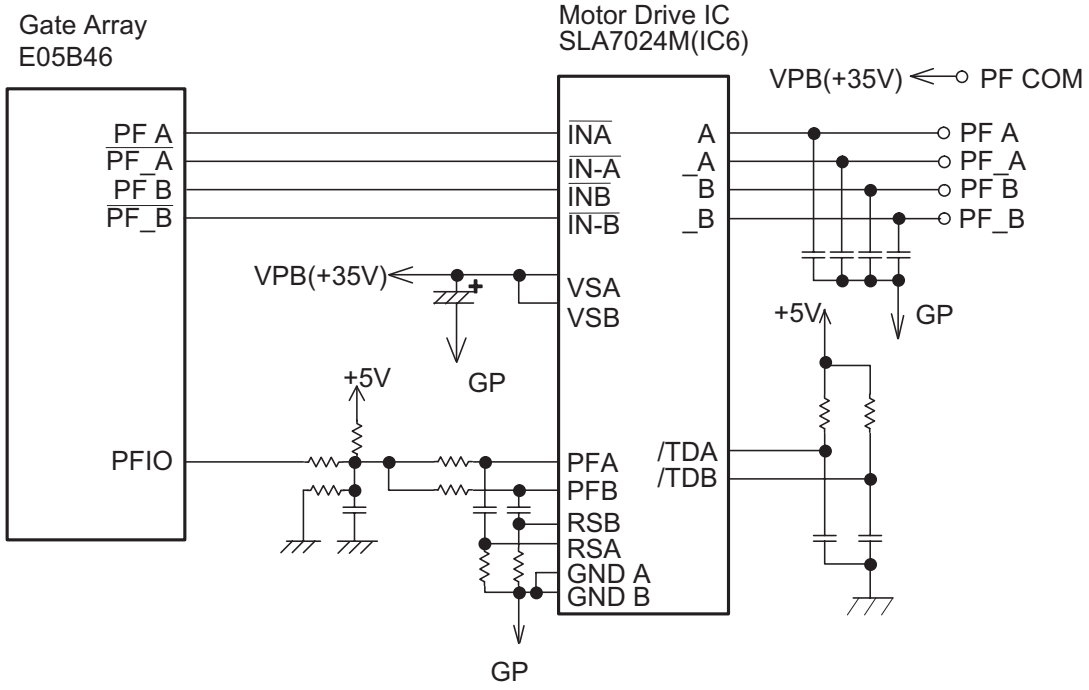


Figure 2-16. PF Motor Drive Circuit Block Diagram

2.3.6 CR (Carriage) Motor Controller/Driver Circuit

The CR motor for this printer is a hybrid-type stepping motor, which enables the CR to move to and stop at any position exactly, using both forward and backward rotation. It is controlled by the open-loop system and driven by 1-2 phase, 2-2 phase or W1-2 phase (for micro step), depending on the CR speed. This motor is controlled by the signals for 4 phases (PFA, /PFA, PFB and /PFB) output from the gate array E05B46 (IC25) via the drive IC SLA7026M (IC7). The motor is also controlled by W1-2 phase for micro step. In this mode, the micro step current set signals (/CASA1, 2 and CASA 1, 2) are output to divide each set current for phase A and B into 4 steps with the range of 0 to 100 %. These 4 steps are divided further into 8 steps, which varies depending on the combination with the continuity timing.

Table 2-13. CR Motor Specification

Motor type	4 phases/200-pole/HB-type stepping motor
Power supply voltage	35 VDC ± 10% (31.5 – 38.5 VDC)
Coil resistance	1.1 Ω ± 10% (at 25°C/phase)
Drive frequency	960 to 5760 pps
Consumption current	2-2 phase, 4-fold speed: 2.5 A/phase 1-2 phase, 2/3-fold speed: 2.0A/ phase W1-2 phase, 1-fold speed: 1.5A/ phase
Excitation mode	1-2 phase/2-2 phase/W1-2 phase drive

Note) *Drive frequency and excitation mode vary with print speed.*

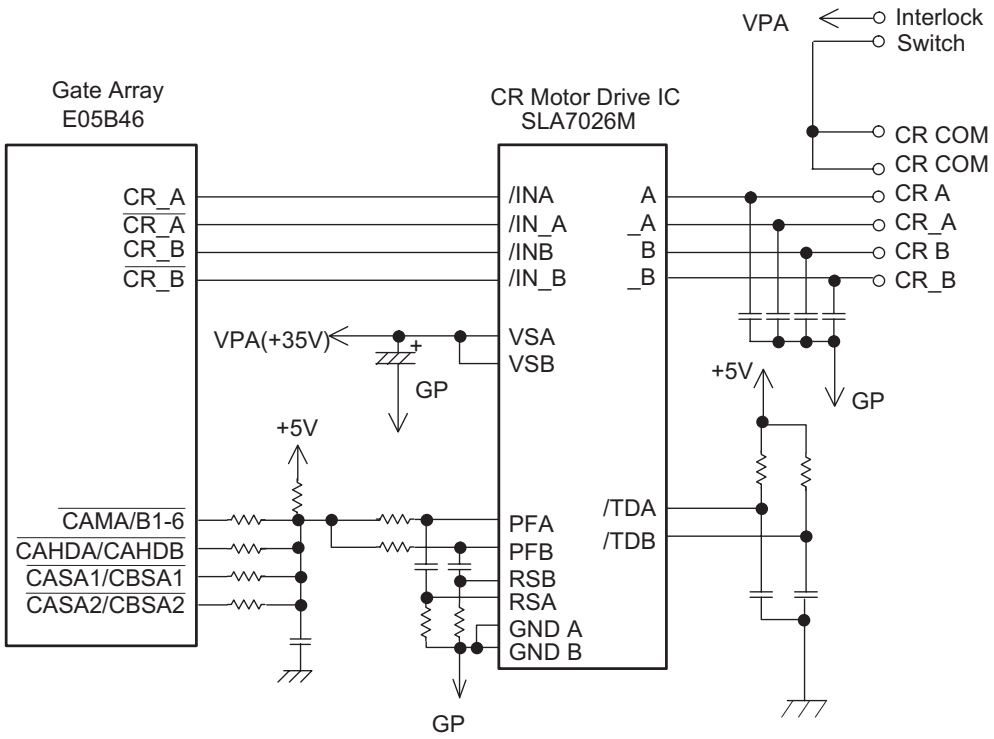


Figure 2-17. CR Motor Drive Circuit Block Diagram

Table 2-14. 2-2 Phase Drive

Step No.	Phase A	Phase /A	Phase B	Phase /B
1	On	–	On	–
2	On	–	–	On
3	–	On	–	On
4	–	On	On	–

Note) : *Applicable when the CR moves from 1st to 136th column direction.*

Table 2-15. 1-2 Phase Drive

Step No.	Phase A	Phase /A	Phase B	Phase /B
1	On	–	On	–
2	On	–	–	–
3	On	–	–	On
4	–	–	–	On
5	–	On	–	On
6	–	On	–	–
7	–	On	On	–
8	–	–	On	–

Note) : *Applicable when the CR moves from 1st to 136th column direction.*

Table 2-16. W1-2 Phase Drive

Step No.	Phase A	Phase /A	Phase B	Phase /B
1	On (70.7%)	–	On (70.7%)	–
2	On (43.1%)	–	On (100%)	–
3	–	–	On (100%)	–
4	–	On (43.1%)	On (100%)	–
5	–	On (70.7%)	On (70.7%)	–
6	–	On (100%)	On (43.1%)	–
7	–	On (100%)	–	–
8	–	On (100%)	–	On (43.1%)
9	–	On (70.7%)	–	On (70.7%)
10	–	On (43.1%)	–	On (100%)
11	–	–	–	On (100%)
12	On (43.1%)	–	–	On (100%)
13	On (70.7%)	–	–	On (70.7%)
14	On (100%)	–	–	On (43.1%)
15	On (100%)	–	–	–
16	On (100%)	–	On (43.1%)	–

Note)

1. Applicable when the CR moves from 1st to 136th column direction.

2. Values shown in ( ) are current rates.

2.3.6.1 Bi-D Adjustment Function

Bi-D adjustment is performed to align dots vertically for the Bi-directional printing. This is accomplished by delaying the print timing pulse on which the carriage moves from the 136th column to the 1st, using the print timing pulse when the carriage moves from the 1st to 136th column as reference. Since print timing pulse varies according to the carriage speed, the adjustment should be implemented for each speed mode. For this printer, the adjustment can be made for the 4-fold, 2-fold and the default speeds.

2.3.6.2 Interlock Function

The mechanical cover open switch is serially connected to the common (VPA) on the CR motor. When the printer cover is open, the interlock function acts so that the motor does not rotate.

2.3.7 Printhead Controller/Driver Circuit

The printhead of this printer has 24 head coils (12X2 lines) driven by the constant current coil driver circuit which consists of 2 transistors (PNP and NPN) and MOSFET. The printhead is driven by the flat wheel system. The transistors turn on and off the head coil voltages (VPA, VPB) according to the printing pulse A. MOSFET turns on and off the GP according to the printing pulse B. If the 2 printing pulses are driven by different printing timings, the head drive waveform shown bellow appears, since the printing pulse B controls the drive waveform for the period of time "T" after the printing pulse A was driven. This is to adjust the head drive waveform to avoid decline in respond speed at continuous printing.

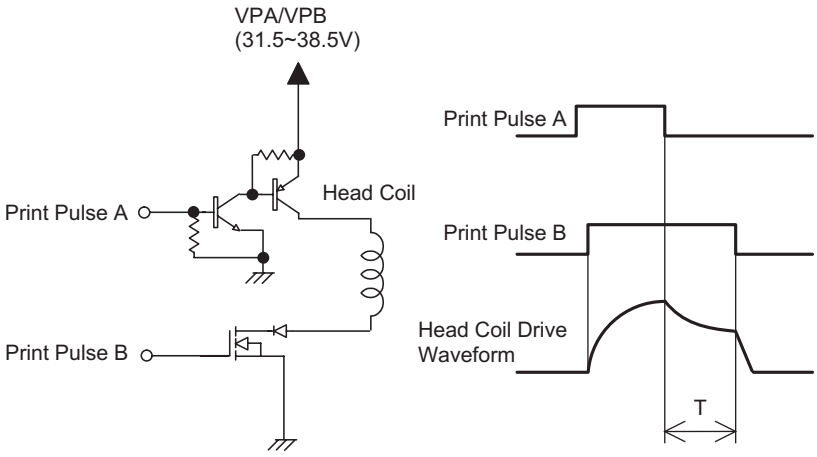


Figure 2-18. Printhead Drive Waveform

Data from the host computer is expanded into image data (CG data) and latched in the gate array E05B46. The head data is allocated in the gate array. The latched data is processed internally in the gate array and output while the signal NHPW/PHPW is active.

Table 2-17. Printhead Controller/Driver Circuit Specification

Head drive voltage	35 VDC ± 10%
Responding waveform	462 seconds (2.16 KHz, normal mode, normal condition)
Drive current	Peak time: 3.3 A (at 5°C, copy 2 mode)

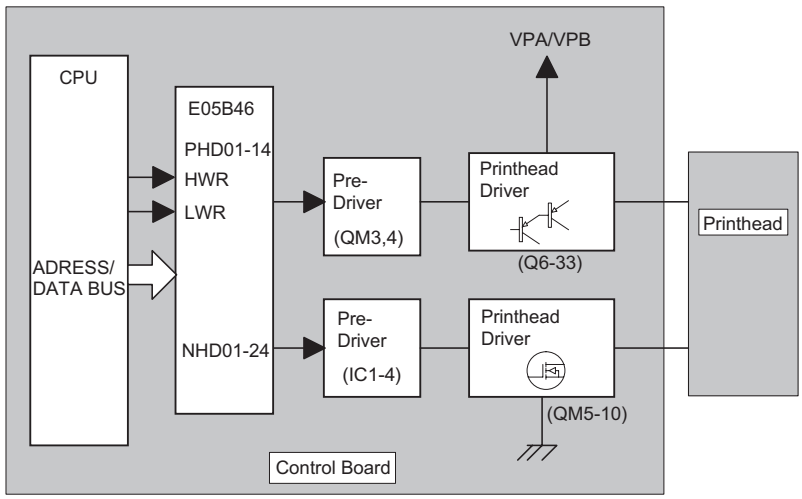


Figure 2-19. Printhead Controller/Driver Circuit Block Diagram

2.3.8 Control Panel Circuit

E05A89, the gate array for the control panel I/F, has the LCD driver, LED driver and panel switch input circuit built in. The serial I/F is used for signal transmission between the control panel and the main control board. The cover open sensor signal on the logic line is directly sent to the main control board via the control panel board. If the printer cover is open, an interlock switch function is activated for safety and puts the printer inactive state.

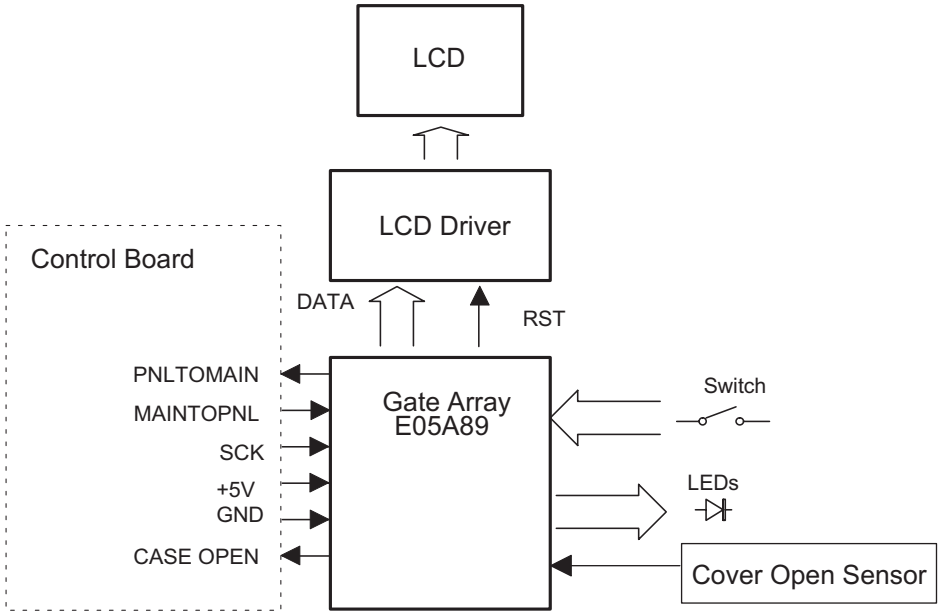


Figure 2-20. Control Panel Circuit Block Diagram

2.3.9 PG (Platen Gap) Motor Driver Circuit

Since a PM-type stepping motor is used for the PG motor, the motor can rotate in the both forward and backward direction and stop anywhere. The torque from the PG motor moves the CR guide shaft to obtain the proper PG. (Refer to Section 2.1.3.) The motor is driven by 2-2 phase. Signals for 4 phases (PGA, PGAN, PGB and PGBN) are output from the gate array E05B46 via the transistor array SDC03-V1. To hold the motor, the hold signal (PGI) is output from the same gate array. Then the transistors 2SC3859 (Q4) and SHA03-V1 (Q3) are turned off to change the drive voltage from PBS (+35V) to the 5 VDC. See Table 2-18 for PG motor specification.

Table 2-18. PG Motor Specification

Motor type	4 phases/8-pole/PM-type stepping motor
Power supply voltage	35 VDC ± 6%
Coil resistance	250 ± 18Ω
Consumption current (per 1 phase)	Rush: 0.2 A on the average Hold: 0.02A
Drive frequency	350 pps
Drive mode	Constant current uni-polar drive
Excitation mode	Uni-polar constant voltage drive, 2-2 phase drive
Rotational direction	CW: Widens the PG CCW: Narrows the PG

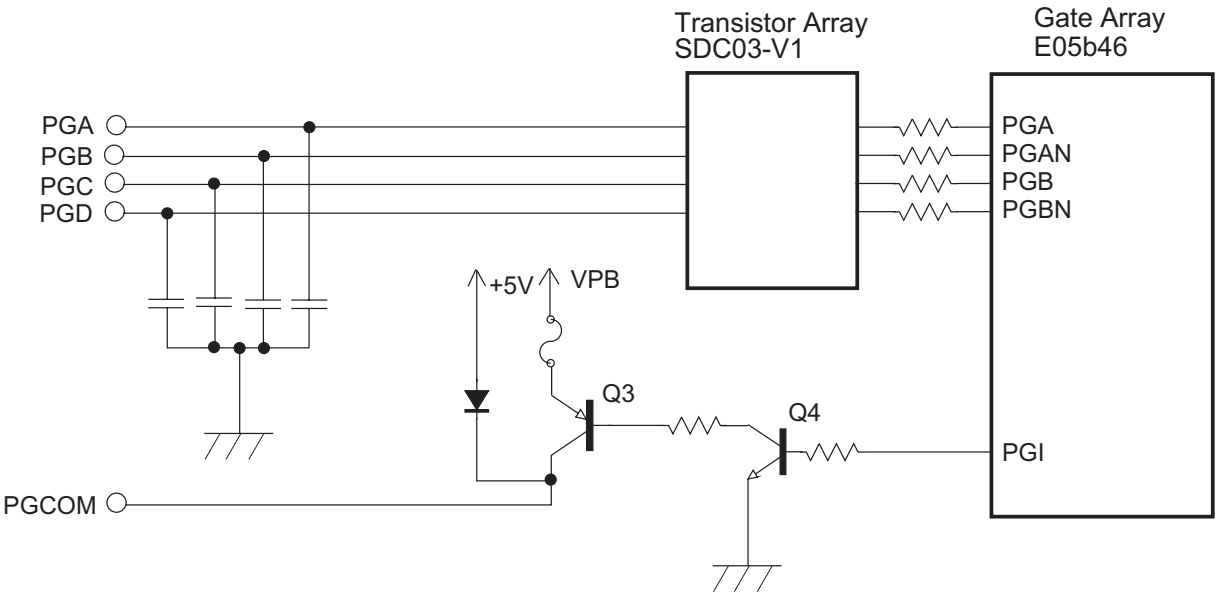


Figure 2-21. PG Motor Drive Circuit Block Diagram

2.3.10 Paper Thickness Detecting Circuit

PG is detected by the paper thickness sensor which consists of the slit disc and the photo-electric transfer element. See Table 2-19 and Figure 2-22 for the paper thickness sensor specification and paper thickness sensor circuit block diagram, respectively.

Table 2-19. Paper Thickness Sensor Specification

Detecting method	Photo interrupt system
Power supply voltage	5 VDC ± 5%
Outputs	In 2 channels, TTL level
Minimum detecting thickness	0.008 mm
Detecting range	0 to 0.53 mm

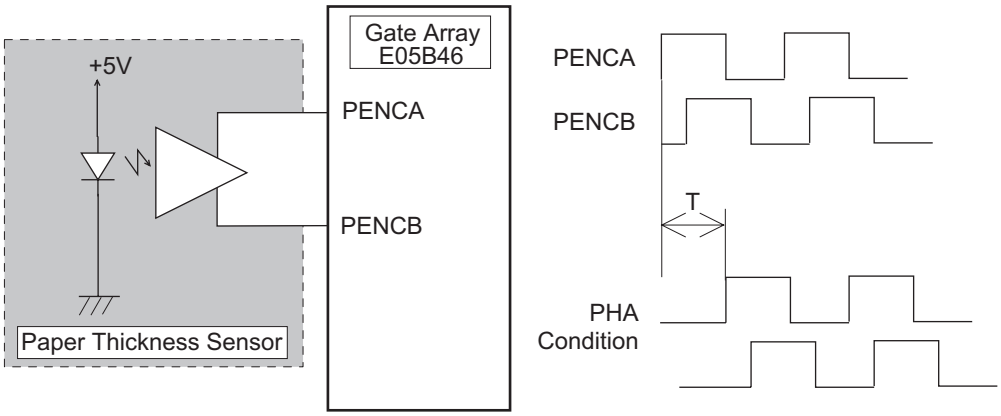


Figure 2-22. Paper Thickness Sensor Circuit Block Diagram

To determine the paper thickness, the printer monitors the waveforms output from the PG sensor, as shown in Figure 2-22. “T” output for PHD shows a period of time in which 2-chanel pulses PENCA and PENCB change for 180°. The printer counts the different numbers of pulses output while the printhead moves from PG home position to the platen surface and surface of the loaded paper to determine the paper thickness which corresponds to the difference between 2 values. The numbers of pulses are counted in the following order:

1. After the printer power is turned on, the PG home position is detected.
2. Distance between the printhead and platen surface is measured
   While the printhead is moving from the PG home position toward the platen surface, the waveform stays at a constant level and when that status exceeds for specified period of time, the printer assumes that the printhead has reached the platen. The PG motor consequently stops rotating and the numbers of the pulses output during this operation is counted and the value is fed back to the CPU.
3. The printhead returns to the stand-by position.
4. The distance between the PG home position and loaded paper surface is measured in the same procedure.

Paper thickness is determined for each paper loaded. The last values for the platen position and PG before power-off are stored in the EEPROM and are no lost if the printer power is turned off.

2.3.11 Paper Jam Sensor

This printer is equipped with the paper jam sensor mechanism which consists of the magnetized roller attached to the same shaft for the sub loading roller assembly and the sensor (hall element) located beside the rear paper sensor. Having no contact with the loading drive roller assembly, the magnetized roller rotates independently along paper. Table 2-20 shows the paper jam sensor specification.

Table 2-20. Paper Jam Specification

Detecting element	Hall element
Outputs	In 1 channel, TTL level
Power supply voltage	5 VDC ± 5%

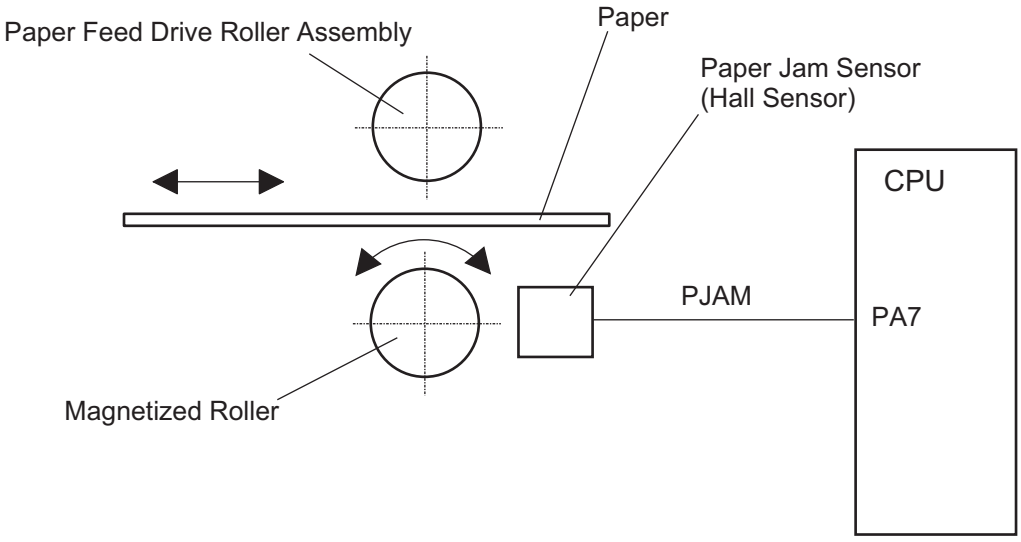


Figure 2-23. Paper Jam Sensor Block Diagram

The CPU reads the signal output directly from the paper jam sensor for each step (1/216 inch / step). If the current signal condition is the same as the previous one, it indicates the status that the magnetized roller is not rotating, which is considered paper jam. When the printer detects that condition continuously for the specified numbers of the output signals, it indicates the paper jam error, and enters non-printing status. The paper jam signal conditions for normal state and paper jam state are shown in Figure 2-24.

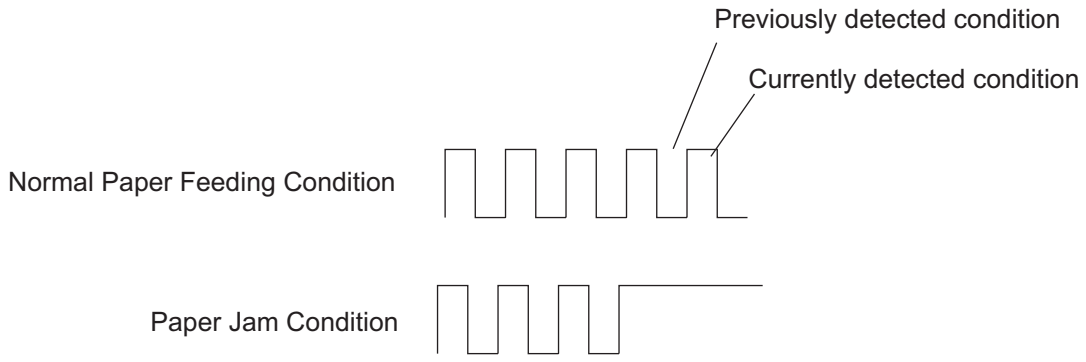


Figure 2-24. Paper Jam Sensor Signals

Paper jam detection starts after each paper loading motion regardless of the paper feed direction. However, the sensor ignores the pulse output while the paper feed direction is changed.

2.3.12 Other Sensor Circuits

This printer is equipped with other sensors to monitor printer condition in detailed.

- ❑ Head thermistor
  The head thermistor detects temperatures around the head and sends the information with the analog signal to the CPU A/C converter using the internal resistance (16.5K Ω). This information prevents worn-out and shorter life of the drive coils due to over duty printing, and protects printhead during operation at low temperatures.
- ❑ +35 VDC monitor
  The CPU monitors head drive voltage by detecting the +35 VDC line with the internal A/D converter. The printer changes the print mode according to the detected change in the head drive voltage.
- ❑ Cover open sensor
  Cover open sensor, located at the top right of the upper housing, detects the printer cover's open/close condition. The output signal is reversed by the digital transistor and input to the CPU interruption port via the filter circuit which consists of the resistor and condenser.

Table 2-21. Cover Open Sensor Specification

Detecting method	Mechanical switch
Power supply voltage	5 VDC ± 5%
Detecting mode	Cover open : LOW Cover closed : HIGH

- ❑ Color HP (Home Position) sensor
  Color HP sensor uses a photo interrupter system. When the home position for the color ribbon cartridge is detected, the output signal is pulled up to 10 KΩ, then input to the CPU port via the filter circuit which consists of the resistance and the condenser.

Table 2-22. Color HP Sensor Specification

Detecting method	Photo interrupter system
Output system	Open collector system Resistance to voltage:30V or less Sink current : 0.3 mA or less
Switch mode	In the home position : LOW Off the home position : HIGH

Note) *After the printer is powered on or the cover open is detected, the printer refers to the switching mode of this sensor.*

- ❑ Rear paper sensor
  Rear paper sensor is located on the right side of the paper jam sensor. The output signal is pulled up by 6.2 KΩ, then input to the CPU port via the filter circuit which consists of the resistor and the condenser.

Table 2-23. Rear Paper Sensor Specification

Detecting method	Mechanical switch (connector switch) system
Rated current/voltage	0.6 – 1.0mA, 5VDC ± 5%
Switch mode	Paper detected : LOW No paper detected : HIGH

❑ Front paper sensor

Front paper sensor detects TOF position as well as paper presence condition. It uses a photo interrupter system. However, one end of the detecting lever is mechanically used to detect the leading edge of the paper, and the other end is to cut in between the photo interrupter sensor to detect paper. The output signal is pulled up to 10 KΩ, then input to the CPU port via the filter circuit which consists of the resistor and the condenser.

Table 2-24. Front Paper Sensor Specification

Detecting method	Photo interrupter systems
Output system	Open collector system Resistance to voltage:30V or less Sink current : 0.3 mA or less
Detecting mode	Paper detected : LOW No paper detected : HIGH

❑ Right/left PEW sensor

Right/left sensors are located on the left and right column direction with the CR on the mask guide in between. They don't only detect paper but the paper width so as to determine the right and left margins. The output signal is output to the CPU A/D converter.

Table 2-25. Right/left PEW Sensor Specification

Detecting method	Photo micro sensor system
Output system	Collector
Power supply voltage	5 VDC ± 5%

❑ CR home position sensor

The output signal for this sensor is pulled up to 10K Ω, then input to the CPU A/D converter via the filter circuit which consists of the resistor and the condenser.

Table 2-26. CR Home Position Sensor Specification

Detecting method	Photo coupler system
Output system	Open collector system Resistance to voltage:30V or less Sink current : 0.3 mA or less
Power supply voltage	5 VDC ± 5%
Switching mode	In the home position : LOW Off the home position :HIGH

❑ Release sensor

The output signal for this sensor is pulled up to 6.2K Ω, then input to the CPU port via the filter circuit which consists of the resistor and the condenser.

Table 2-27. Release Sensor Specification

Detecting method	Leaf switch (mechanical) system
Rated current/voltage	0.6 to 1.0mA, 5VDC ± 5%
Switch mode	Cut sheet mode : Close Continuous paper mode : Open Paper jam removal mode : Open

- CSF sensor
  CSF sensor uses terminals for the CSF paper quantity sensor. The output signal for this sensor is pulled up to 10K Ω, then input to the CPU via the filter circuit which consists of the resistor and the condenser.

Table 2-28. CSF Sensor Switch Mode

Switch mode	CSF installed:	LOW
	No CSF installed:	HIGH

- CSF paper quantity sensor
  CSF sensor, a potentiometer, is not attached to the printer but to the CSF. It monitors paper quantity in the hopper and send the analog signal to the internal A/D converter of the CPU.
- PGHP (Platen Gap Home Position) sensor
  The output signal for this sensor is pulled up to 390Ω, then input to the CPU port via the filter circuit which consists of the resistor and the condenser.

Table 2-29. PGHP Sensor Specification

Detecting method	Micro switch system
Power supply voltage	5 VDC ± 5%
Switch mode	In the home position: LOW Off the home position :HIGH

Chapter 3
Disassembly and Assembly

3.1 Overview

This chapter describes the procedures for disassembling and assembling the printer. Be sure to read the precaution prior to disassembly and assembly.

⚠ WARNING

- ***The temperature of the printhead can be very high during printing. Therefore, always make sure that the printhead is cool enough to handle it.***
- ***Be sure to disconnect the AC power cable from the socket and disconnect the interface cable prior to disassembling the printer.***

⚠ CAUTION

- ***Use only specified tools to keep the printer at its optimum condition.***
- ***Use only specified lubricants and adhesives.***
- ***Be sure to perform any specified adjustments.***
- ***Before disassembling, remove all options and accessories such as a sheet guide and a ribbon cartridge.***

3.1.1 Tools

Make sure you use the tools listed in Table 3-1 when disassembling and assembling the printer.

Table 3-1. Tools

Tools	Availability	Part No.
Phillips screwdriver #2	Y	B743800200
Box driver	Y	B741700200
Thickness gauge set	Y	B776702201
Round-nosed pliers	Y	B740400100
Nippers	Y	B740600100
Tweezers	Y	B741000100
ET holder	Y	B74800500

Note) *Y: Available in the market.*

Be sure to used specified types of screws when assembling the printer.

Table 3-2. Screw Types

Abbreviation	Part name
CB	Cross-recessed Bind head screw
CBB	Cross-recessed Bind head B-tight screw
CBS	Cross-recessed Bind head S-tight screw
CBB (P4)	Cross-recessed Bind head B-tight sems screw
CP (P4)	Cross-recessed Pan head sems screw
CC	Cross-recessed Cup head screw

3.1.2 Checks after Repair

The check list shown below contains items to be checked after repairing the printer. Make sure that you use the list to ensure that printer performance is up to the standard before returning the printer to the customer.

Table 3-3. Check List after Repairing

Item	Location	Check points	Check
Printing	Printhead	Are any dots missing?	☐ Check ☐ Unnecessary
	CR mechanism	Is the ribbon mask bent?	☐ Check ☐ Unnecessary
		Does the CR move smoothly? ☐ Noise ☐ Dust, Debris ☐ Lubrication	☐ Check ☐ Unnecessary
		Is color shifting OK?	☐ Check ☐ Unnecessary
		Is the CR motor overheated?	☐ Check ☐ Unnecessary
	Paper feed mechanism	Is paper fed smoothly? ☐ Noise ☐ Dust, Debris ☐ Lubrication	☐ Check ☐ Unnecessary
		Is the PF motor overheated?	☐ Check ☐ Unnecessary
		Is the platen damaged?	☐ Check ☐ Unnecessary
	Paper paths	Is paper selection smooth?	☐ Check ☐ Unnecessary
		Are tractor teeth OK?	☐ Check ☐ Unnecessary
		Is there any foreign matter lodged in the paper paths?	☐ Check ☐ Unnecessary
	PG adjustment mechanism	Does the PG move smoothly when measuring the PG.	☐ Check ☐ Unnecessary
		Is the PG properly set?	☐ Check ☐ Unnecessary
	Self-test	Is the test successful?	☐ Check ☐ Unnecessary
	On-line test	Is the test successful?	☐ Check ☐ Unnecessary
	Printhead	PG adjustment	☐ Check ☐ Unnecessary
	Print	Bi-D adjustment	☐ Check ☐ Unnecessary
	Paper feed	Belt tension adjustment	☐ Check ☐ Unnecessary
	PG mechanism	PG motor backlash adjustment	☐ Check ☐ Unnecessary
Version up	Control program	The program version is _____.	☐ Check ☐ Unnecessary
Shipping	—	Are the ribbon cartridge and adjusting tools removed?	☐ Check ☐ Unnecessary
	—	Are the accessories came with the printer all packed?	☐ Check ☐ Unnecessary

3.2 Disassembly and Assembly

This section describes how to disassemble the printer. Unless otherwise specified, no assembly procedures are included, since it is usually performed by reversing the disassembly procedures. Points to note at disassembling and assembling are described under the heading **WORK POINTS**. Adjustments required after assembling are described under the heading **REQUIRED ADJUSTMENTS**. Be sure to follow the instructions and perform any necessary adjustments. The procedure for disassembling the main component is shown below:

1) Printhead replacement
2) Rear cover removal
3) Electrical board removal
4) Control panel removal
5) Upper housing assembly removal
6) Printer mechanism disassembly

Refer to the exploded diagrams in Appendix for detailed part engagement and location.

Note) *Perform "Control program reload" when C210 MAIN and sub boards are replaced.*

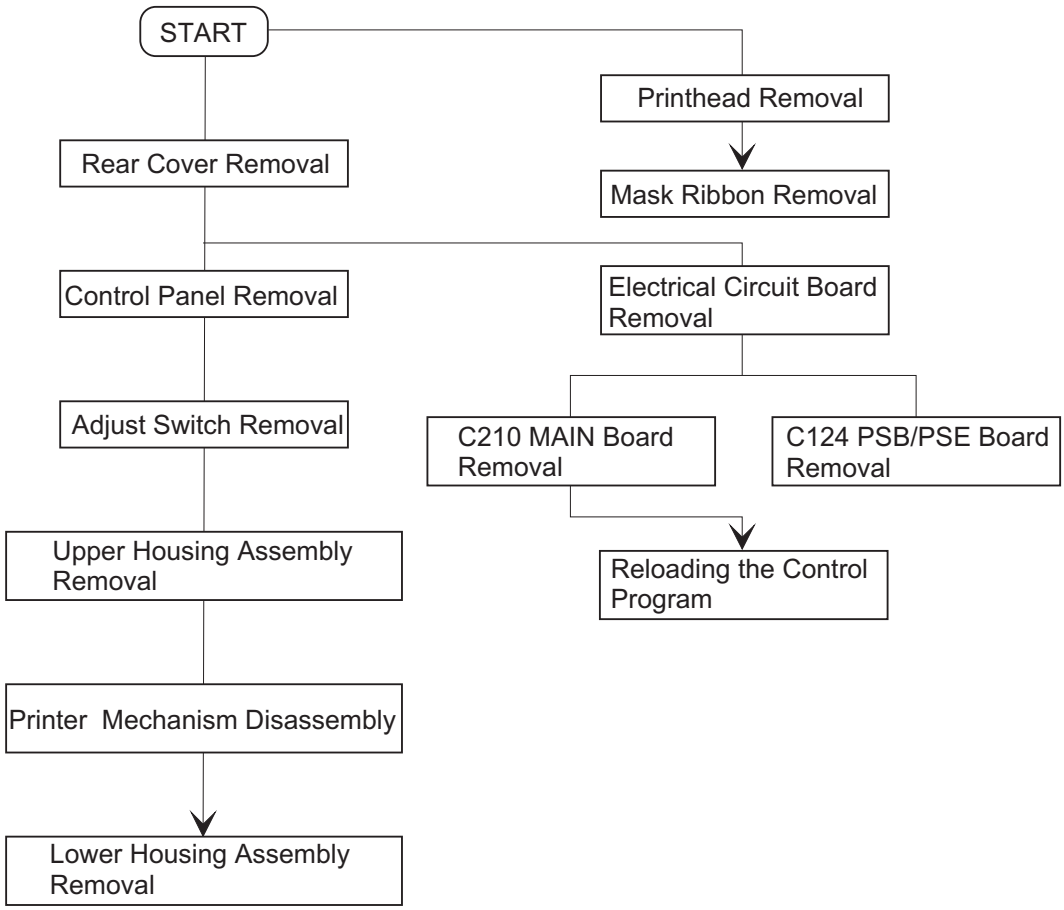


Figure 3-1. Disassembly Flowchart

3.2.1 Printhead Replacement

3.2.1.1 Printhead Removal

You can remove the printhead without removing the upper housing assembly or printer mechanism.

Step 1) Open the printer cover assembly, and remove 2 screws (CBS, 3X12) securing the printhead.

Step 2) Lift up the printhead a little and release the head FFCs from the clips in the CR assembly. Then disconnect the FFCs from the printhead.

Step 3) Remove the printhead from the CR assembly.

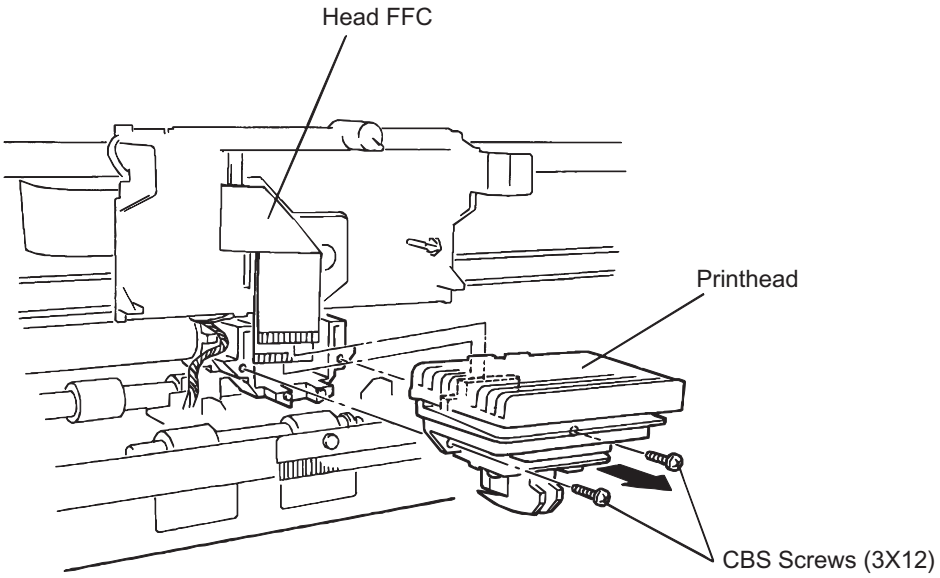


Figure 3-2. Printhead Removal

⚠ CAUTION

- ***Perform "Platen gap adjustment" after replacing the printhead.***
- ***When replacing the printhead, replace the ribbon mask along with the printhead.***

3.2.1.2 Ribbon Mask Removal

This section describes how to remove the ribbon mask holder which must be removed when adjusting the platen gap. (Refer to Chapter 4 Adjustment.)

Step 1) Remove the printhead. (See Section 3.2.1.1.)
Step 2) Release the harnesses for the PEW sensors from the cable clamp.
Step 3) Flip the paper eject lever assembly toward the front.
Step 4) Widening the right and left tabs at the rear of the ribbon mask holder, remove the ribbon mask holder by shifting it forward.
Step 5) Remove the ribbon mask from the ribbon mask holder.

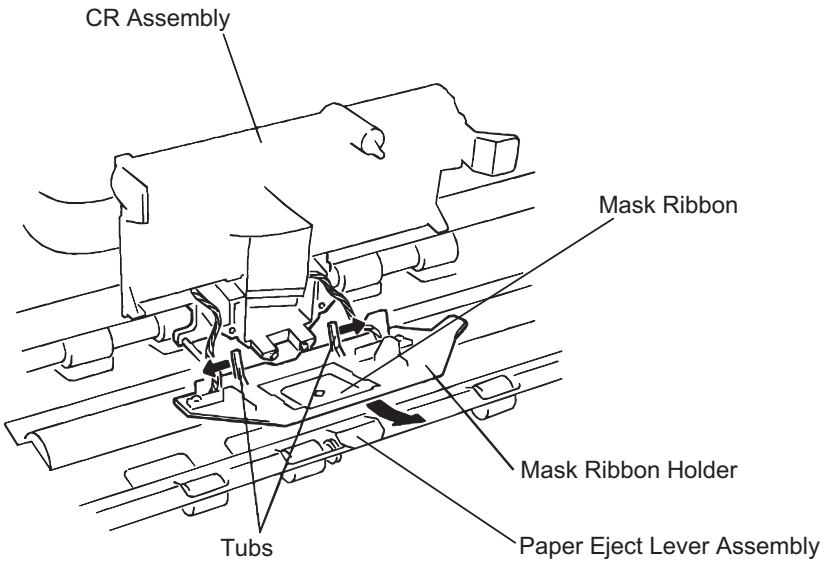


Figure 3-3. Ribbon Mask Holder Removal

3.2.2 Electrical Board Removal

The electrical circuit for this printer consists of the C210 MAIN board and C124 PSB/PSE board. You can remove this board by removing the rear cover only.

3.2.2.1 Rear Cover Removal

Step 1) Remove 2 screws (CBS, 3X12) securing the upper connector cover, and remove the upper connector cover.
Step 2) Remove 2 screws (CBB, 3X12 and 3X40) securing the rear cover to the lower housing.
Step 3) Take the rear cover out to the rear and then remove it.

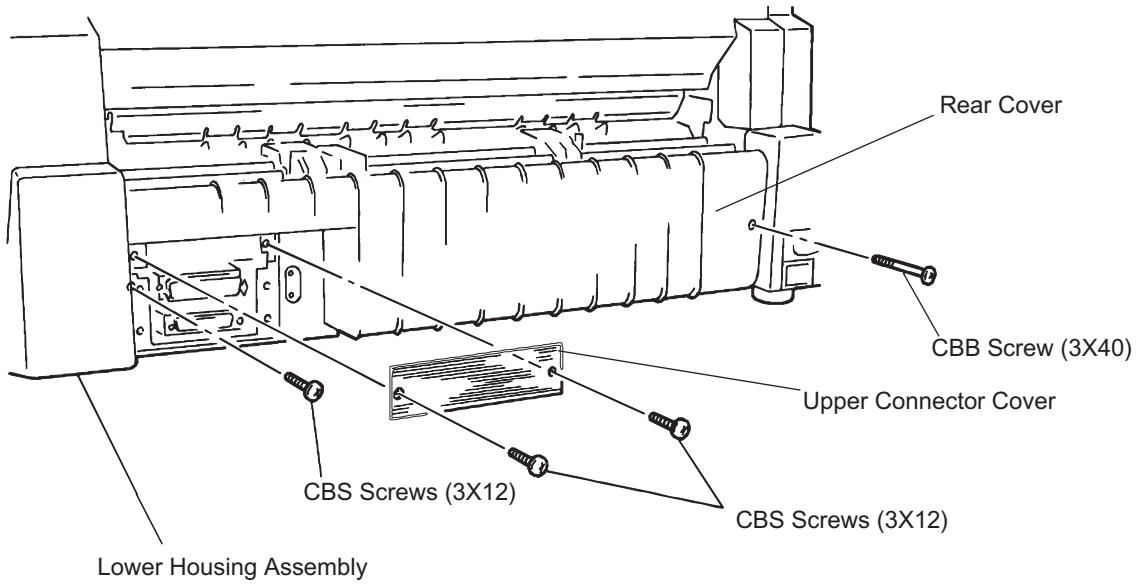


Figure 3-4. Rear Cover Removal

3.2.2.2 C210 MAIN Board Removal

Step 1) Remove the rear cover. (See Section 3.2.2.1.)
Step 2) Remove 1 screw (CBS, 3x8) securing the C210 MAIN board and the FG terminal from the control panel to the shield plate.
Step 3) Disconnect all harnesses from the connectors on the C210 MAIN board.
Step 4) Remove 2 screws (CBS, 3X6) securing the C210 MAIN board and the main frame at the bottom of the I/F shield plate.
Step 5) Remove 2 screws (CBB, 3X10) securing the C210 MAIN board and main frame to the bottom housing assembly and a grounding ware for the printer mechanism, then remove the C210 MAIN board and the main frame.

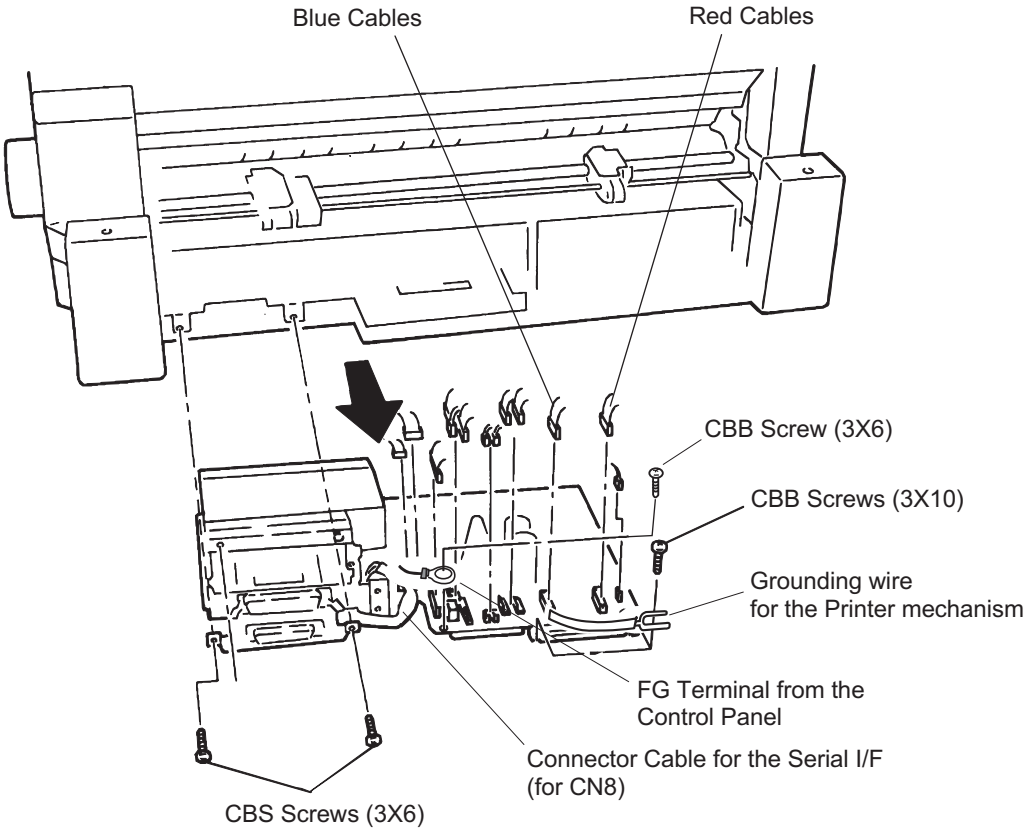


Figure 3-5 . C210 MAIN Board and MAIN Frame Removal

Step 6) Remove 2 screws (CBS, 3X6) securing the Type-B shield case to the I/F grounding plate, and 2 screws (CBS, 3X6) securing the Type-B shield case and the C210 MAIN board to the main frame.
Step 7) Disconnect the harness for the serial I/F from CN8.
Step 8) Remove earth spring (B) from the I/F grounding plate.
Step 9) Remove I/F guide board from the C210 MAIN board.
Step 10) Remove 2 screws (CBS, 3X6, behind the I/F grounding plate) securing the C210 MAIN board to the main frame and 2 screws (CP, 3X6) securing the I/F grounding plate to the C210 MAIN board.
Step 11) Remove 3 screws (CBS, 3X6) securing the C210 MAIN board to the main frame. Then remove the C210 MAIN board.

⚠CAUTION

When connecting the FG terminal, keep the cable away from the Q2.

WORK POINT

- ***When connecting the connectors, connect one to the other of the same color. Pay special attention to CN1 (red harness) and CN2 (blue harness). If they are connected improperly, the head coil or C210 MAIN board may be damaged. (See Figure 3-5.)***
- **Perform "Control program reload" and any necessary adjustments when C210 MAIN board is replaced. (Refer to Section 3.3. and Chapter 4 "Adjustment".)**

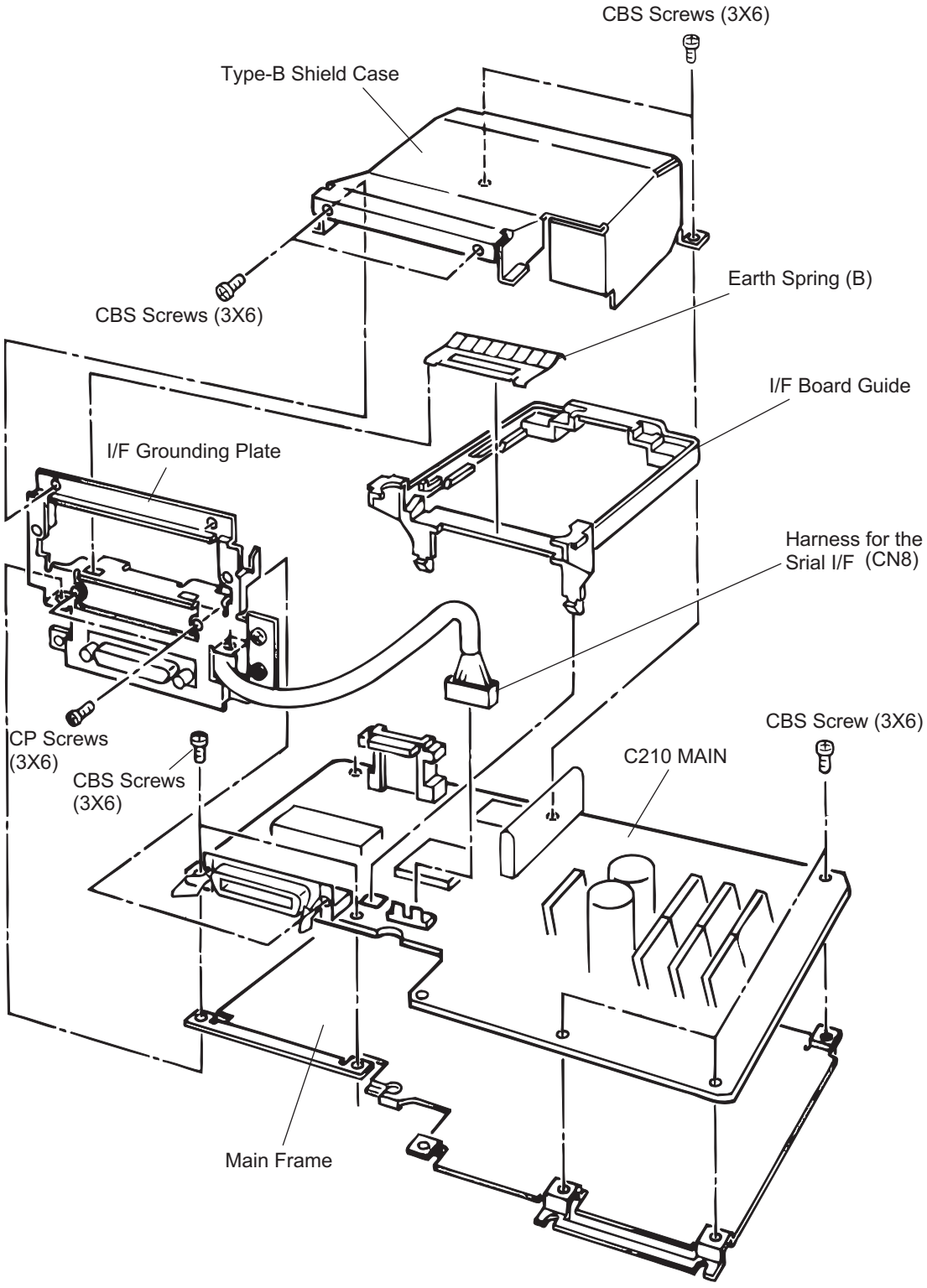


Figure 3-6. C210 MAIN Board Removal

3.2.2.3 C124 PSB/PSE Board Removal

Step 1) Remove the rear cover. (See Section 3.2.2.1.)
Step 2) Remove 2 screws (CBS, 3X6) securing the power supply board and the C124 PSB/PSE board to the shield plate.
Step 3) Disconnect all harnesses one by one from the connectors on the C124 PSB/PSE board as taking out the C124 PSB/PSE board on the power supply frame gradually, then remove the C124 PSB/PSE board.

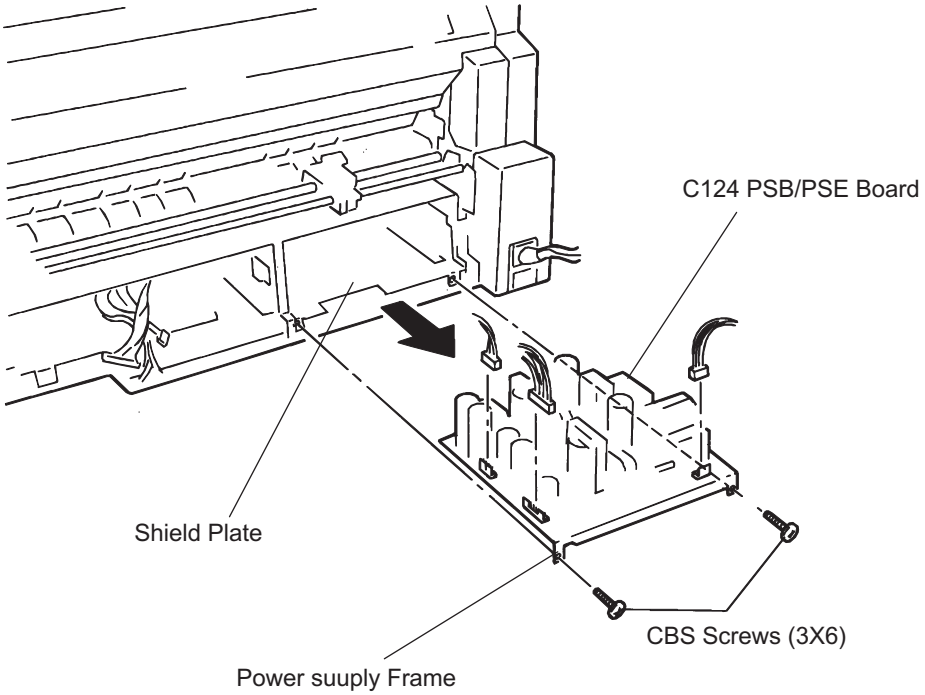


Figure 3-7. C124 PSB/PSE Board Removal

3.2.3 Control Panel Removal

Step 1) Open the printer cover assembly.
Step 2) Insert your hand to the back of the panel and release the hooks securing the control panel to the upper housing assembly. Then Remove the control panel along with the harnesses.
Step 3) Remove 1 screw fixing the FG terminal (red head side) of the harness to the control panel. Then remove the FG terminal.
Step 4) Disconnect the harnesses for the cover open sensor and the control panel from the connectors on the control panel board to remove the control panel from the printer.

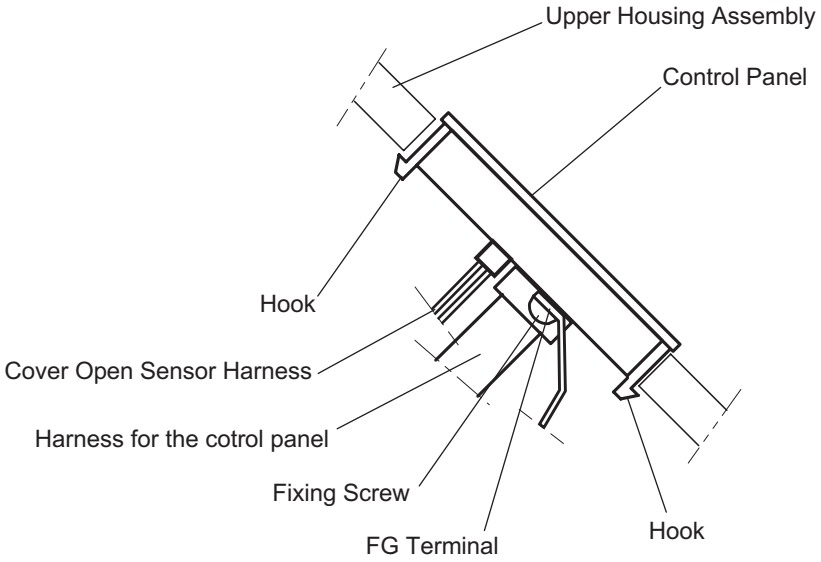


Figure 3-8. Control Panel Removal

3.2.4 Adjust Switch Removal

Step 1) Open the printer cover assembly.
Step 2) Insert your hand to the back of the adjust switch (Refer to Figure 3-10 for location.), and release 2 hooks fixing the adjust switch to the upper housing assembly. Then remove the adjust switch along with the harness for the adjust switch and the FG terminal.
Step 3) Remove 1 screw fixing the FG terminal to the adjust switch. Then remover the FG terminal from the adjust switch.

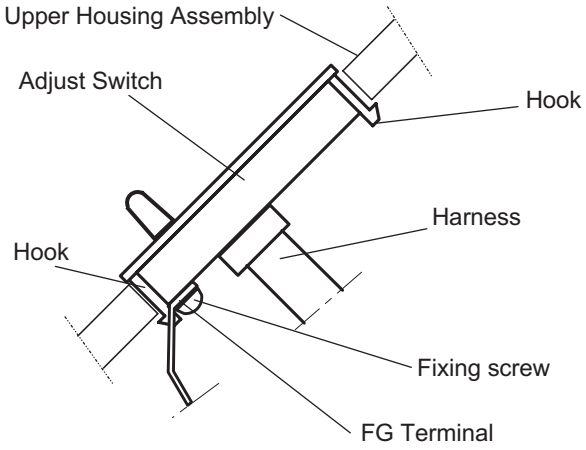


Figure 3-9. Adjust Switch Removal

3.2.5 Upper Housing Assembly Removal

Step 1) Remove the knob and the release lever.
Step 2) Open the printer cover assembly.
Step 3) Remove the control panel. (See Section 3.2.3.)
Step 4) Remove the adjust switch. (See Section 3.2.4.)
Step 5) Disconnect the harness (red cable from the printer) from the connector (red cable from the interlock switch) located under the control panel.
Step 6) Remove 2 screws (CBB, 4X16) securing the upper housing assembly to the lower housing assembly.
Step 7) Using a driver or equivalent, release 2 hooks (on the right and left sides of the lower housing assembly, near the front) securing the upper housing assembly to the lower housing assembly. Then lift up the upper housing assembly and remove it.

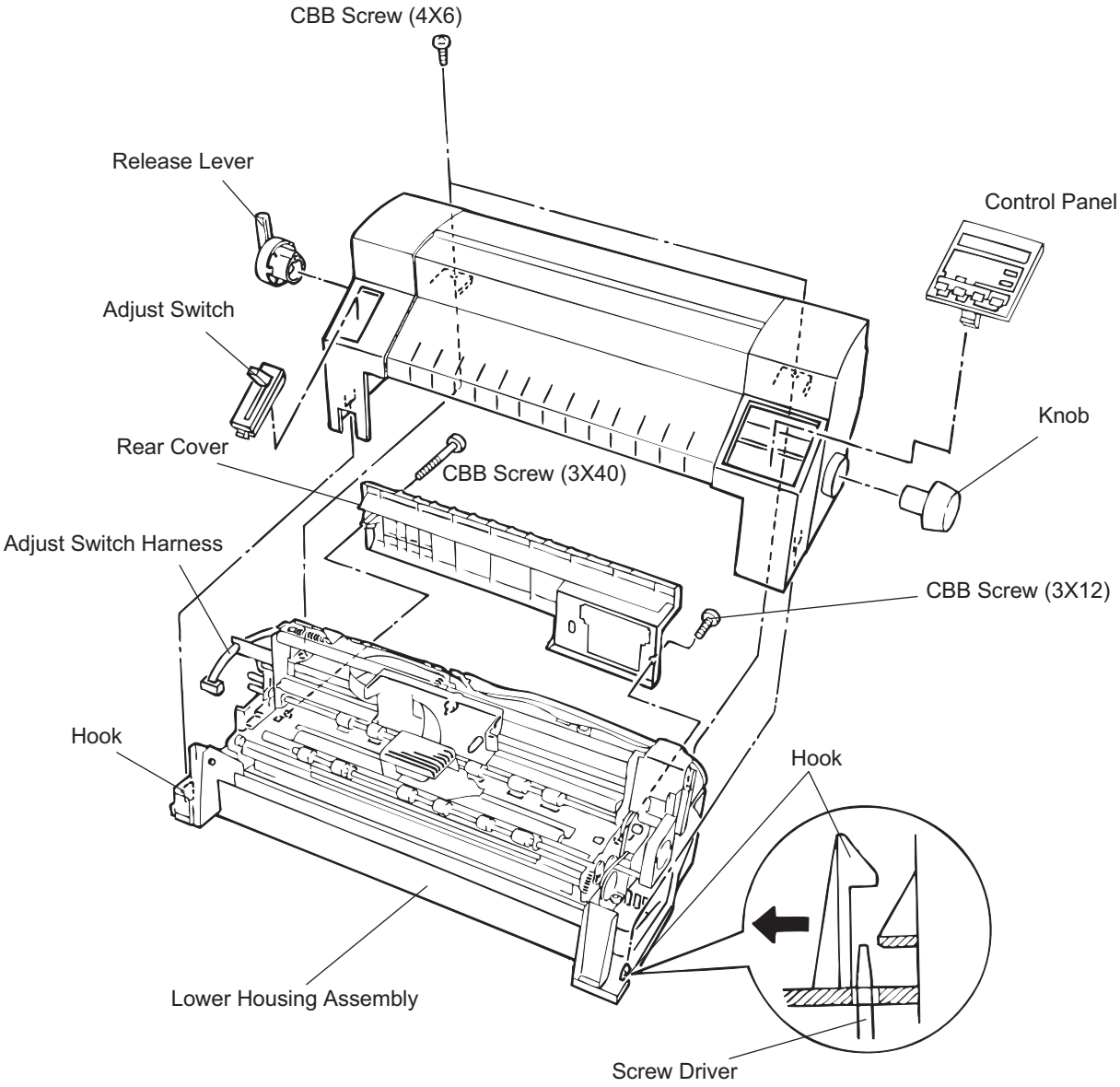


Figure 3-10. Upper Housing Assembly Removal

3.2.6 Printer Mechanism Removal

This section describes procedures for disassembling the printer mechanism.

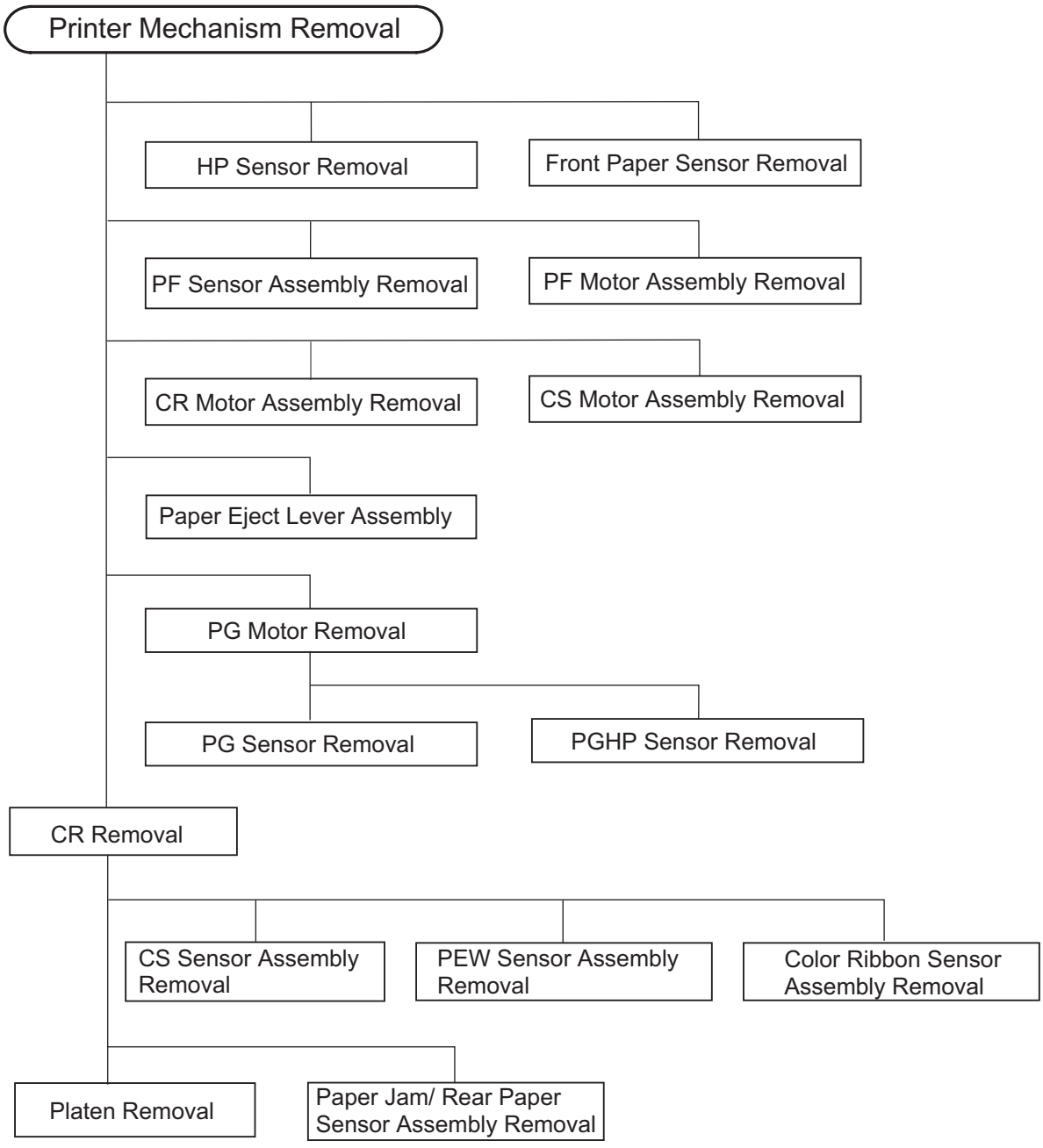


Figure 3-11. Printer Mechanism Removal

3.2.6.1 Printer Mechanism Removal

Step 1) Remove the upper housing assembly. (See Section 3.2.5.)
Step 2) Remove the rear cover and a screw (CBB, 3x10) securing the grounding wire and the MAIN board to the main frame. Then remove the grounding wire. (See Section 3.2.2.2.)
Step 3) Remove 4 FFCs and a harness (2 pins) for the rear paper sensor from the connectors on the sub board.
Step 4) Disconnect the harnesses from the relay connectors.
Step 5) Remove 2 screws (CBS, 3X6) securing the right and left grounding plates to the right and left sides of the printer mechanism, respectively.
Step 6) Remove 1 screw (CBS, 3X6) fixing the FG terminal to the right end of the printer mechanism, and remove the FG terminal.
Step 7) Remove 4 screws (CBB, P4, 4X25) securing the printer mechanism to the lower housing assembly. Then lift up the printer mechanism and remove it.

⚠CAUTION

Be sure to connect the harnesses to the relay connectors of the same colors.

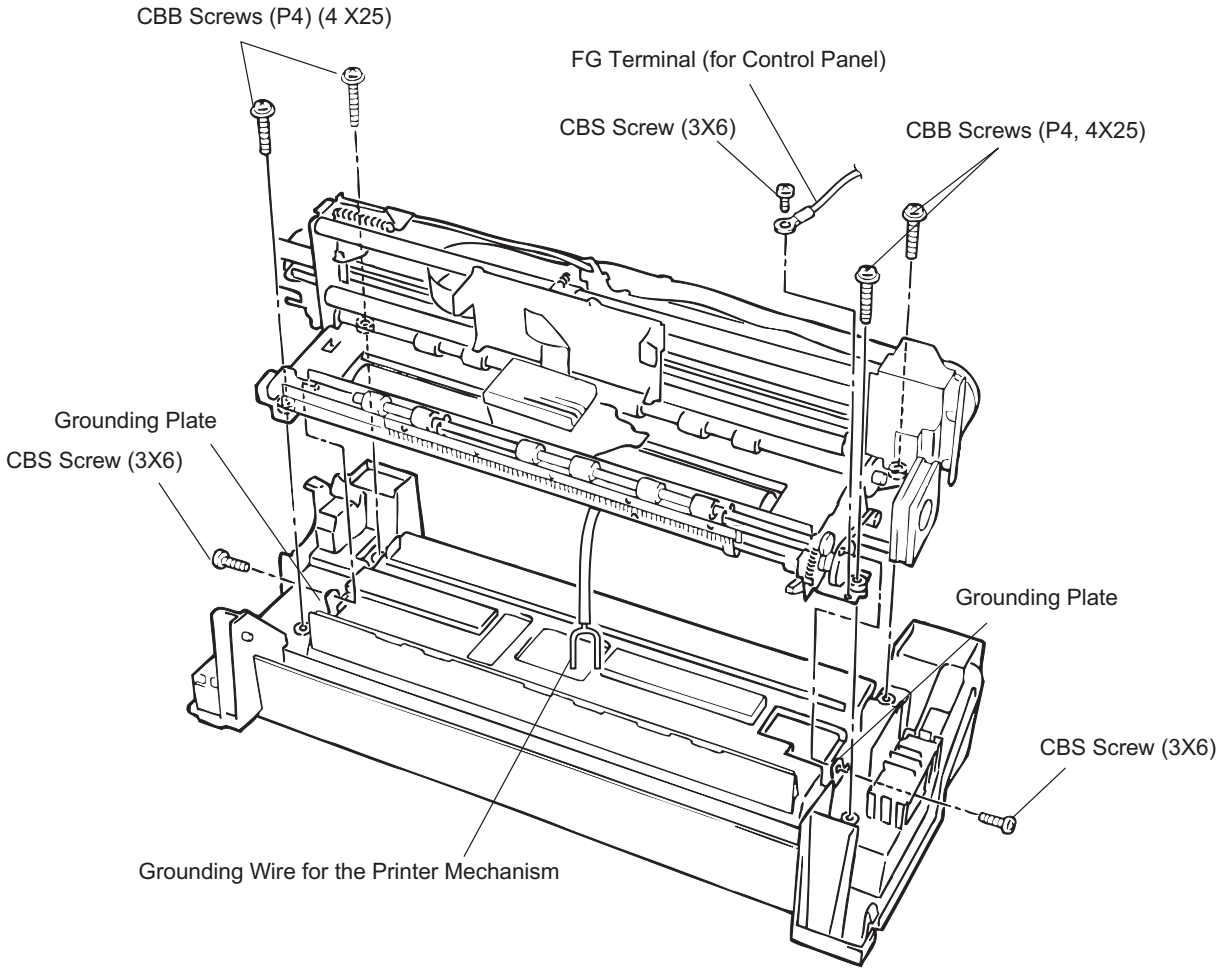


Figure 3-12. Printer Mechanism Removal

3.2.6.2 HP (Home Position) Sensor Assembly Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Release the hooks securing the HP sensor assembly to the CR frame, and remove the sensor.

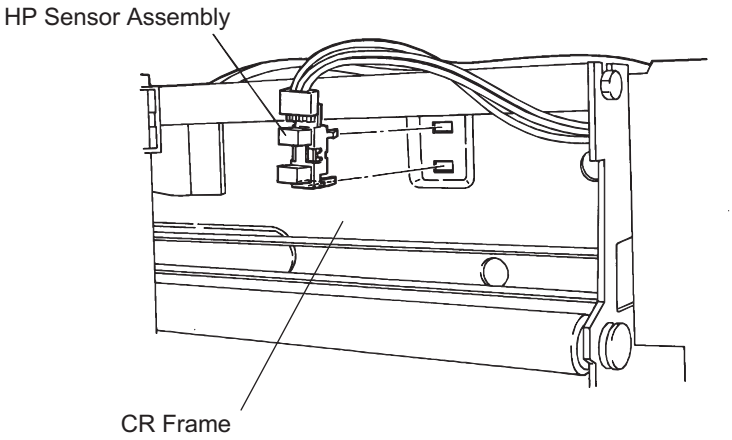


Figure 3-13. HP Sensor Removal

3.2.6.3 Front Paper Sensor Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Release the joint for the detection lever and the front paper sensor, and release the hook securing the front paper sensor to the right frame assembly in the printer mechanism. Then remove the front paper sensor.

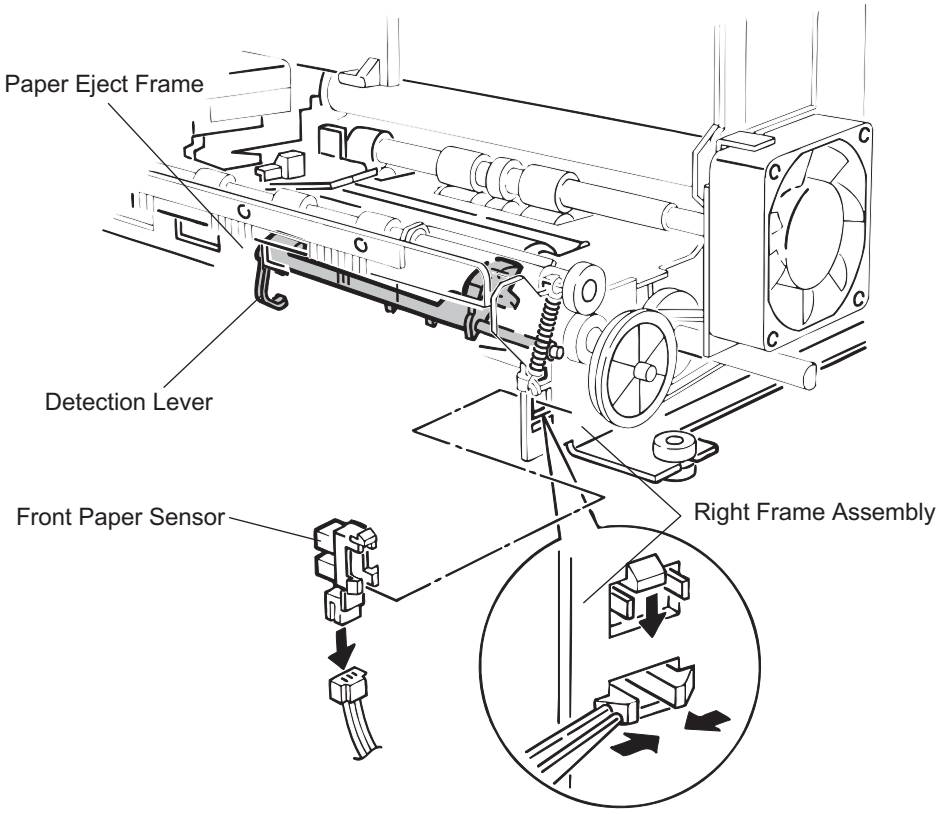


Figure 3-14 Removal. Front Paper Sensor Removal

3.2.6.4 PF Sensor Assembly Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Release the hooks attaching the PF sensor to the left frame. Then remove the sensor.

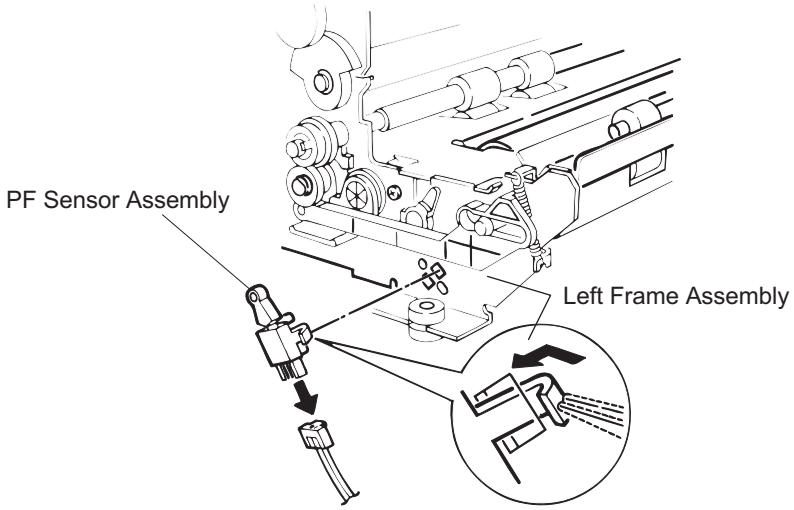


Figure 3-15 Removal. PF Sensor Assembly Removal

3.2.6.5 PF Motor Assembly Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Disconnect the harness for the PF motor assembly from the right side of the printer mechanism.
Step 3) Remove 1 screw (CBS, 3X6) securing the grounding plate to the bottom of the printer mechanism. Then remove the grounding plate.
Step 4) Remove 2 screws (CP, P4, 3X6) securing the PF motor assembly to the right side of the printer mechanism.
Step 5) Remove the PF tension shaft from the PF motor assembly, and remove the PF motor assembly.

WORK POINT

Perform "Belt tension adjustment". (Refer to Chapter 4 Adjustment.)

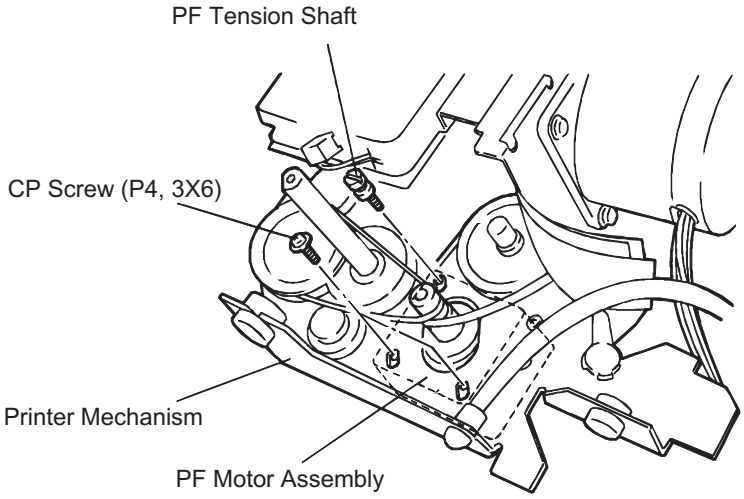


Figure 3-16. PF Motor Assembly Removal

3.2.6.6 CR Motor Assembly Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove 1 extension spring (3275) on the top edge of the printer mechanism to loosen the timing belt.

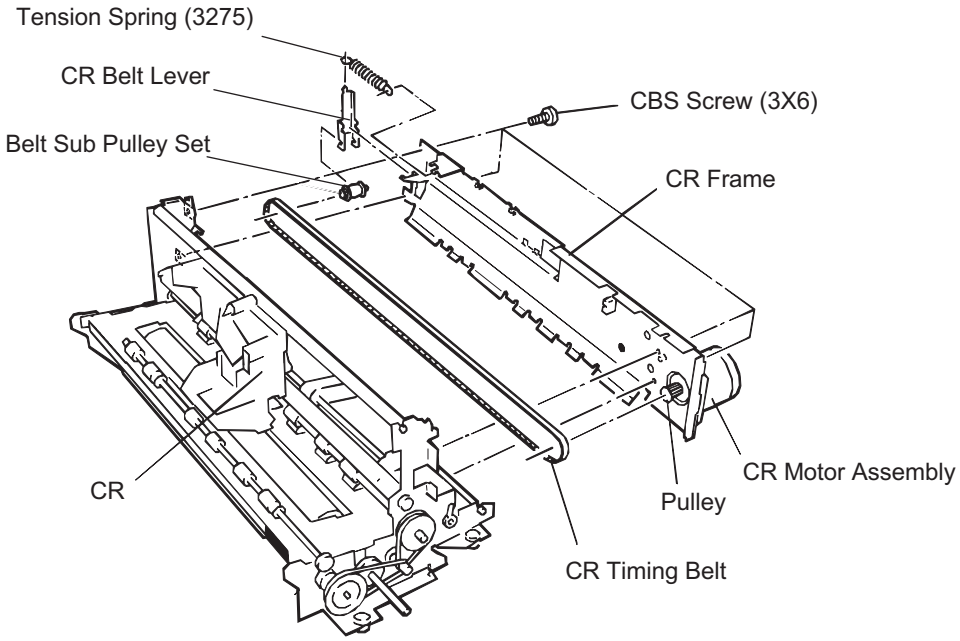


Figure 3-17. CR Motor Assembly Removal

Step 3) Remove 1 screw (CBS, 3X6) securing the grounding plate for the external cooling fan FFC, and remove the grounding plate for the FFC.
Step 4) Remove 4 screws (CS, 3X16) securing the CR motor assembly to the CR frame and 1 screw (CBS, 3X6) securing the CR motor grounding plate to the CR frame. Then remove the CR motor assembly.

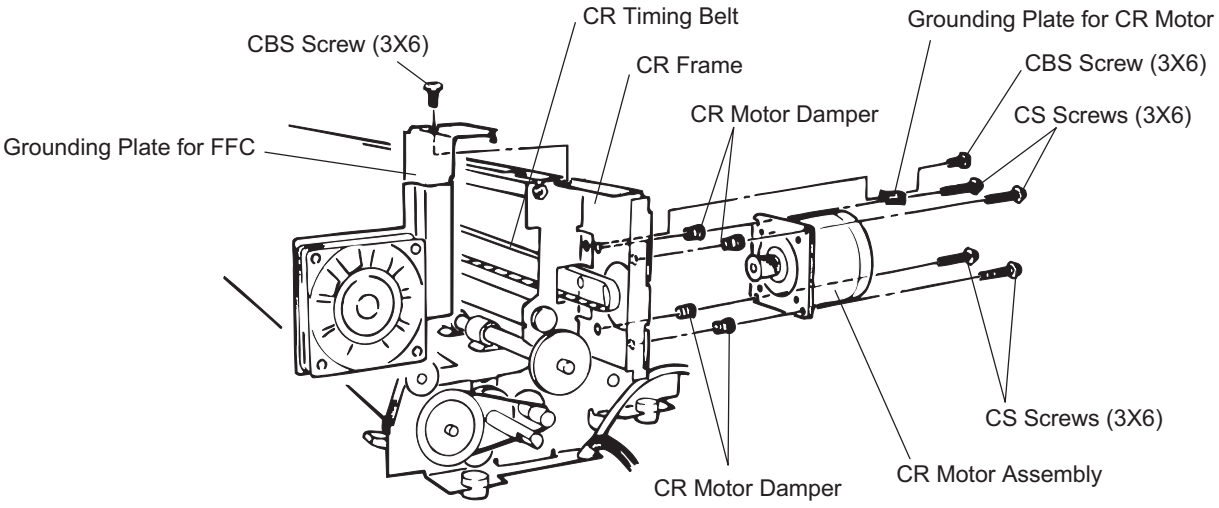


Figure 3-18. CR Motor Assembly Removal

WORK POINT

Perform "Bi-D adjustment" after replacing the CR Assembly or removing/replacing the timing belt.

3.2.6.7 CS (Color Shift) Motor Assembly Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Slide the CR left, and disconnect the harness for the CS motor assembly from the CS board assembly located at the back of the CR.

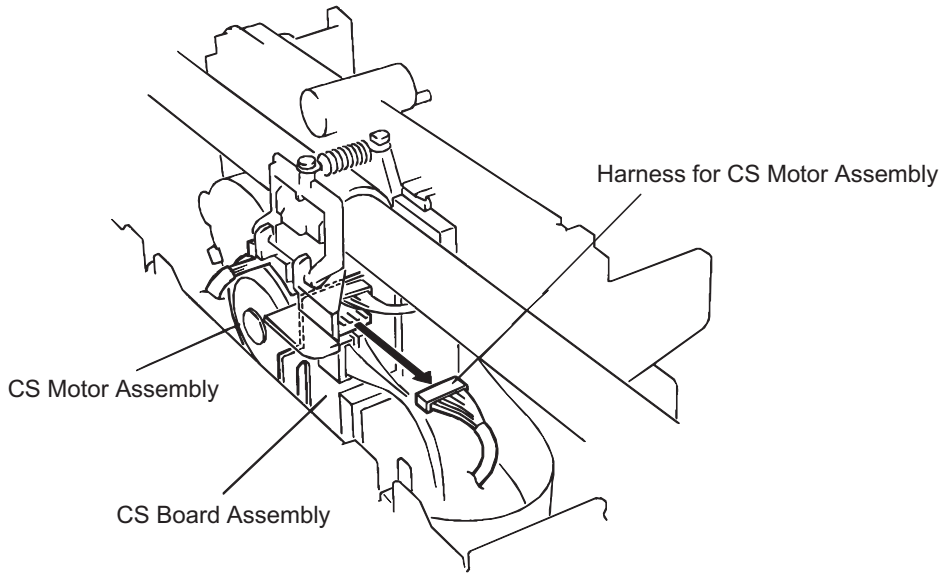


Figure 3-19. CS Motor Assembly Removal

Step 3) Slide the CR back to the right end, and remove 2 screws (CBS, O, 3x6) securing the CS motor assembly to the CR.
Step 4) Slide the CR left again. Then lift up the CS motor assembly and remove it.

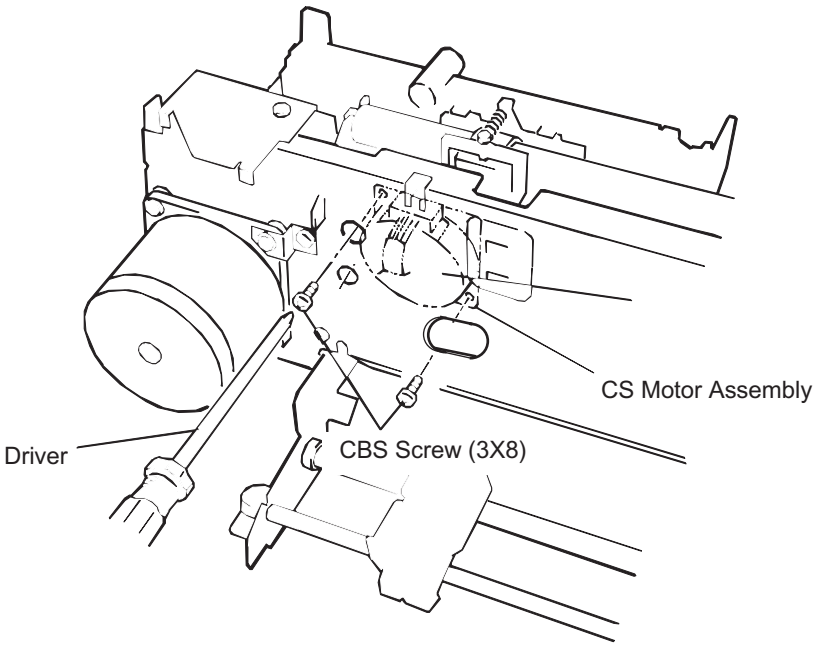


Figure 3-20. CS Motor Assembly Removal

3.2.6.8 Paper Eject Lever Assembly

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove right and left extension springs which are crossed from the right and left ends of the paper eject lever assembly to the right and left frame assemblies, respectively. Then remove the springs.
Step 3) Remove 1 E-ring fixing the paper eject lever assembly to the right frame assembly.
Step 4) Lift up the rear edge of the paper eject lever assembly and shift it left to release the right end of the lever from the pin. Then remove the paper eject lever assembly.

⚠CAUTION

Right and left extension springs are 2 different parts. Therefore, be sure to mount them to the correct sides of the printer mechanism.

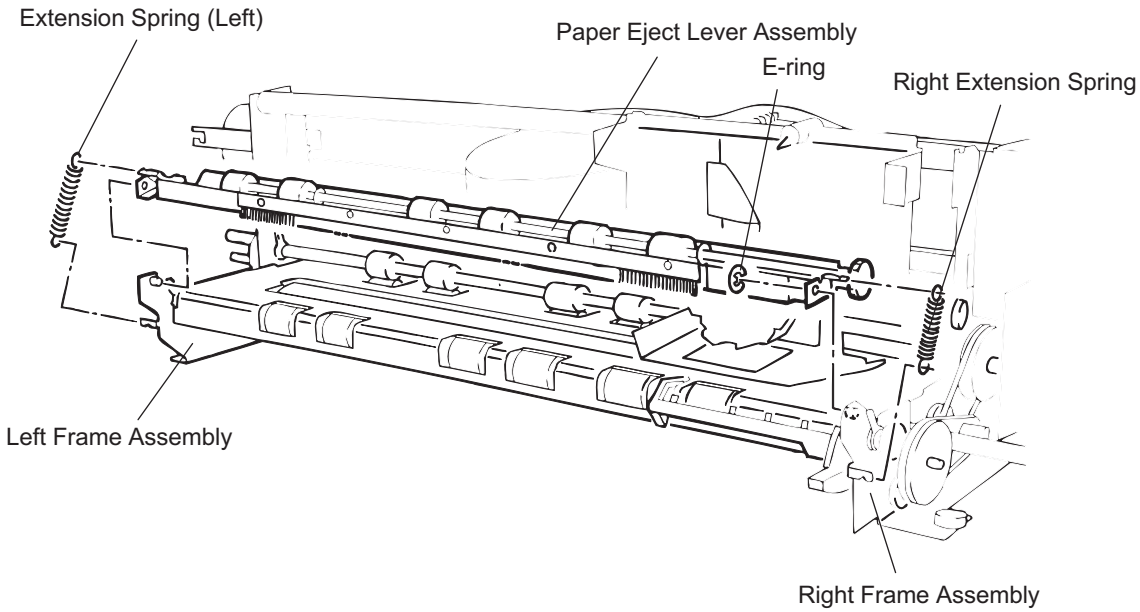


Figure 3-21. Paper Eject Lever Assembly

3.2.6.9 PG Motor Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove the harness for the PG motor from the cable clamp in the printer mechanism.
Step 3) Remove 2 screws (CP, O, 3X6) securing the PG motor to the printer mechanism, and remove the PG motor.

WORK POINT

Backlash for the PG motor and the combination gear(8, 26) is 0.1 ± 0.05 mm.

3.2.6.10 PG Sensor Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove the PG motor. (See Section 3.2.6.9.)
Step 3) Remove the harness for the PG sensor from the cable clamp.
Step 4) Remove 1 screw (CBS, 3x6) securing the PG sensor to the printer mechanism, and remove the PG sensor.

3.2.6.11 PGHP Sensor Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove the PG motor. (See Section 3.2.6.9.)
Step 3) Remove 1 intermediate gear from the left side of the printer mechanism.
Step 4) Remove 1 screw (CP, 2X8) securing the PGHP sensor to the left of the printer mechanism, and remove the PGHP sensor.

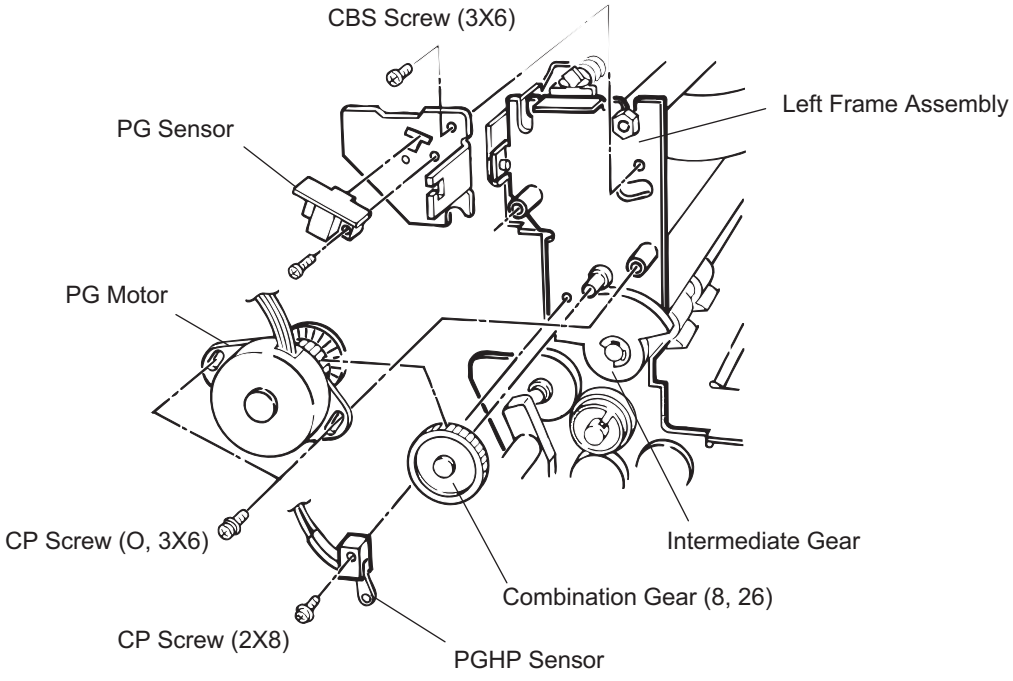


Figure 3-22. PG Adjustment Mechanism Removal

3.2.6.12 CR Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Release the hooks fixing the head cable holder to the CR frame, and remove the head cable holder along with the head FFC.

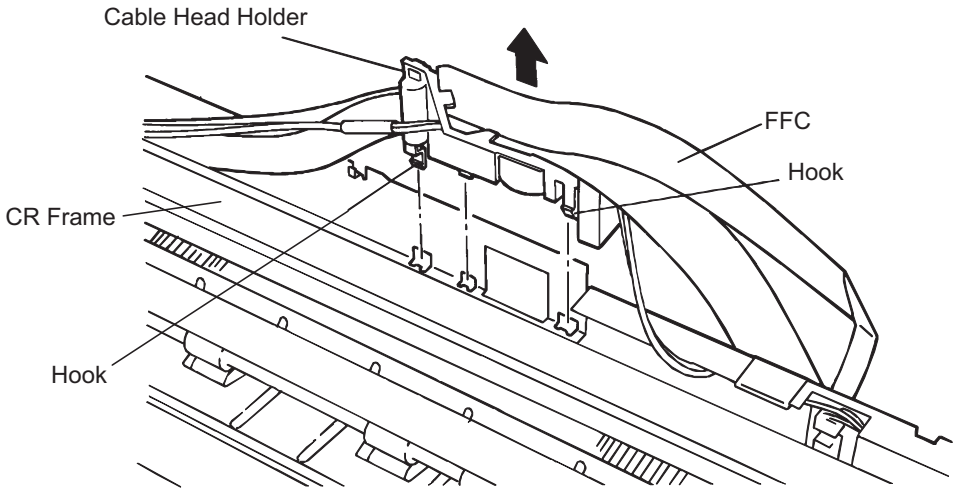


Figure 3-23. Head Cable Holder Removal

Step 3) Remove the head FFC from the head cable holder.
Step 4) Remove the grounding plate for FFC, and remove the head FFC from the printer mechanism. (See Section 3.2.6.6.)
Step 5) Loosen the timing belt. (See Section 3.2.6.6.)
Step 6) Remove the CR motor assembly, and remove the timing belt. (See Section 3.2.6.6.)
Step 7) Remove the pressure spring between the left frame and the lower CR guide shaft pushing the lower CR guide shaft.

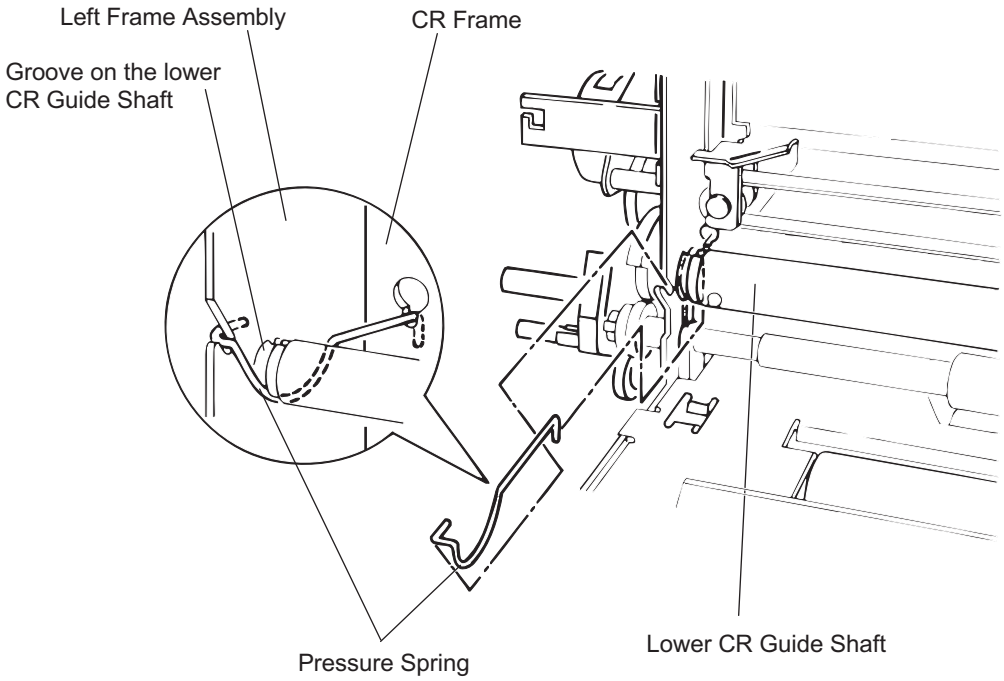


Figure 3-24. Pressure Spring Removal

Step 8) Remove 4 screws (CBS, 3X6) securing the CR frame to the printer mechanism. Then remove the CR frame by moving it upward and then to the rear, releasing the engagement with the sub belt pulley.

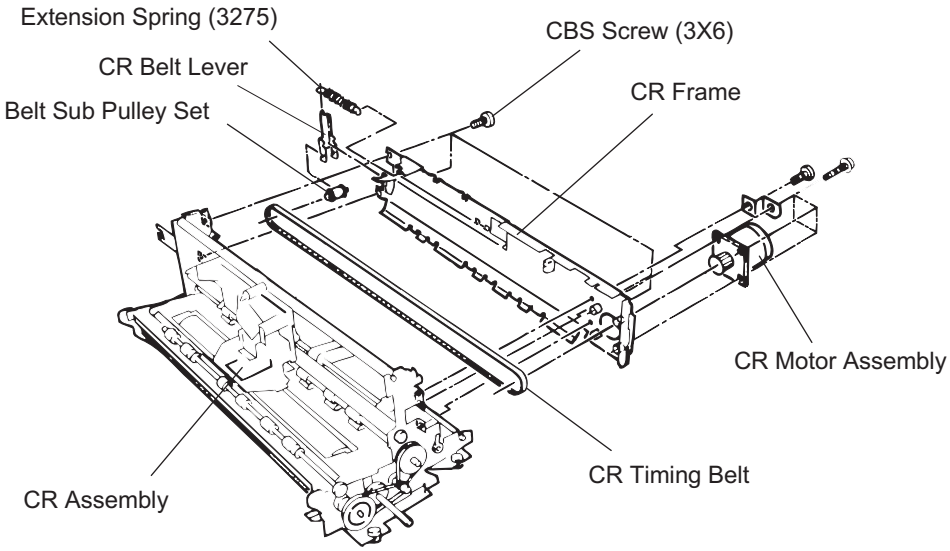


Figure 3-25. CR Frame Removal

Step 9) After removing the PG motor (See Section 3.2.6.9,) and the intermediate gear (See Figure 3-22.), remove the E-ring fixing the sector gear to the lower CR guide shaft. Then remove the gear.

Step 10) Remove 2 screws (CBS, 3X6 ; CP, O, 3X10) on the lower CR guide lever securing the right end of the lower CR guide shaft to the printer mechanism. Then remove the lower CR guide lever and release the lower CR guide shaft.

Step 11) Remove 2 hexagon nuts (OW) securing the upper CR guide shaft to the printer mechanism.

Step 12) Dismount the extension spring (154) on the CR, and remove the upper CR guide shaft by lifting it up.

Step 13) Push the parallelism adjust bushing and the leaf spring on the right end of the lower CR guide shaft inward, and remove the CR along with the shaft.

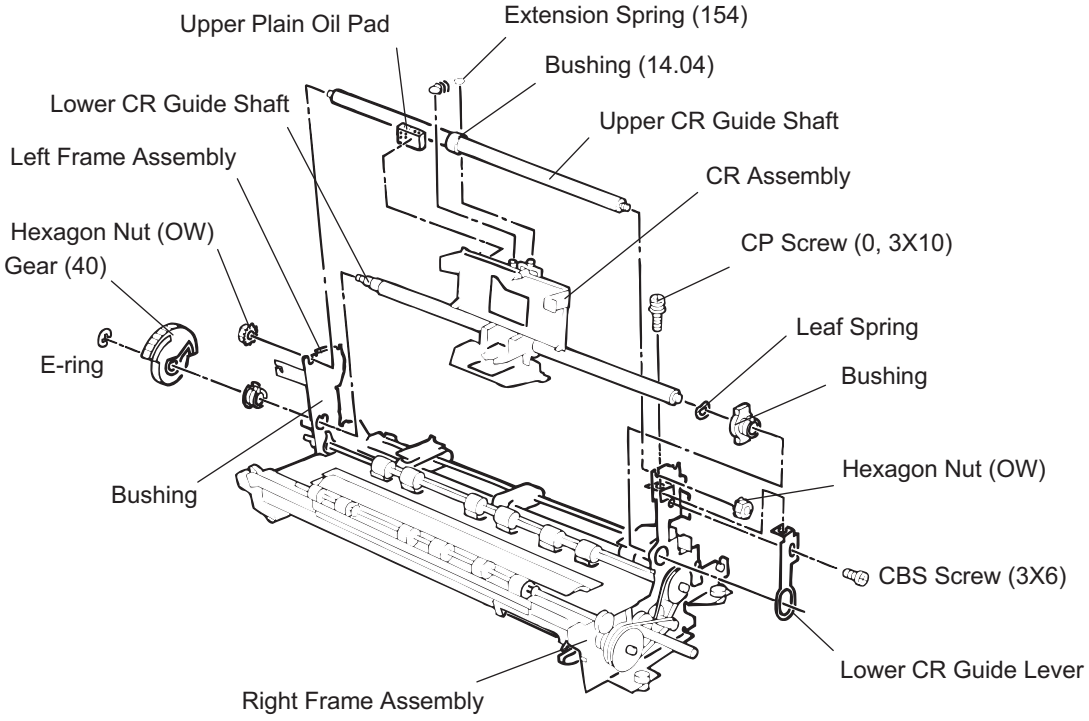


Figure 3-26. CR Removal

WORK POINT

- *When installing the timing belt to the CR, make 3 - 10 teeth of the belt appear, as shown in the figure below.*
- *When installing the upper CR guide shaft, ensure that the upper plain oil pad is installed between the upper CR guide shaft and the CR.*
- *When installing the parallelism adjust bushing, set it with the groove facing up.*

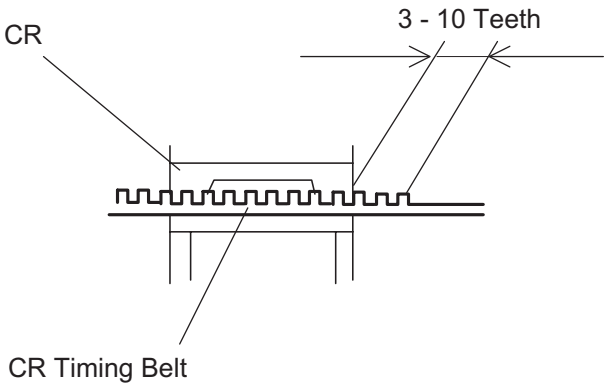


Figure 3-27. Timing Belt Installation

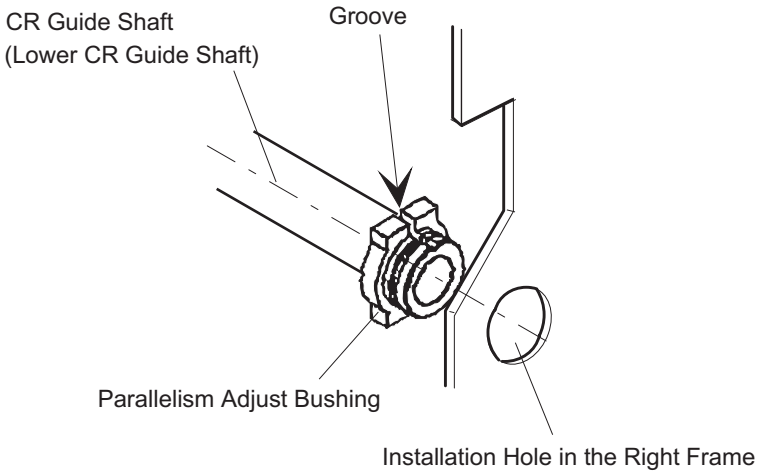


Figure 3-28. Parallelism Adjust Bushing Installation

3.2.6.13 CS Board Assembly Removal

Step 1) Remove the printhead. (See Section 3.2.1.1.)
Step 2) Remove the CR. (See Section 3.2.6.12.)
Step 3) Remove 1 screw (CBS, 3X12) securing the ribbon cartridge holder to the CR.
Step 4) Release 6 hooks fixing the ribbon cartridge holder to the back of the CR. Then remove the ribbon cartridge holder.

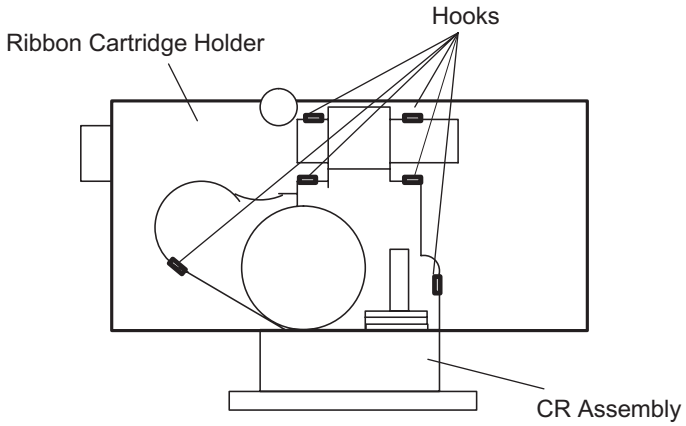


Figure 3-29. Hooks at the Back of the CR

Step 5) Disconnect harnesses for the PEW board assembly, color ribbon sensor assembly, and CS motor assembly from the CS board assembly.
Step 6) Disconnect the FFC for the CS motor assembly from the ribbon cartridge holder, and remove the CS board assembly from the CR.

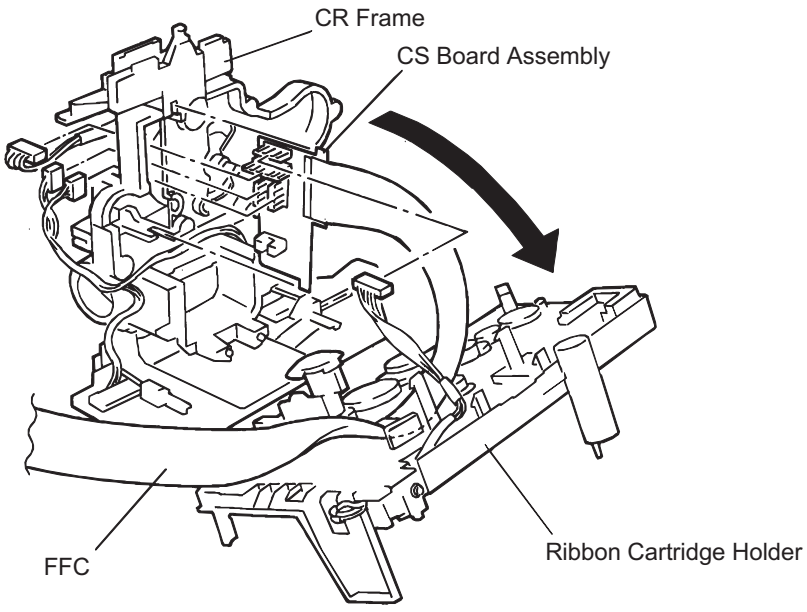


Figure 3-30. CS Board Assembly Removal

⚠ CAUTION

- ***CS board assembly can be removed without removing the CR from the printer mechanism. In case you omit Step 2 (CR removal), note the followings:***
  - ***When removing the CS board assembly, note the direction in which the cutout part of the cam faces. Set the cam as shown in Figure 3-31 so that it is not damaged by the photo-coupler in the CS board assembly.***
  - ***Inside the ribbon cartridge holder, there is a gear train used for ribbon feed and color shift. Since the gears in the gear train tend to disengage easily, do not touch the gear train when removing the ribbon cartridge holder.***
- ***When installing the ribbon cartridge holder, set the CS cam with the cutout side facing to the sensor.***

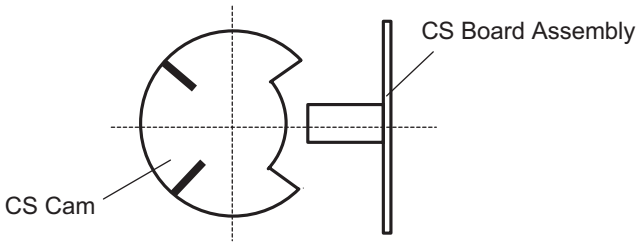


Figure 3-31. Removing The CS Cam

3.2.6.14 PEW Sensor Assembly Removal

Step 1) Remove the printhead. (See Section 3.2.1.1.)
Step 2) Remove the CR. (See Section 3.2.6.12.)
Step 3) Remove the ribbon cartridge holder. (See Section 3.2.6.13, Step 4.)
Step 4) Disconnect harnesses for the right and left PEW sensors from the connectors on the CS board assembly.
Step 5) Remove 2 screws (CBS, 2.5 X 5) securing the PEW sensors to the mask ribbon holder.

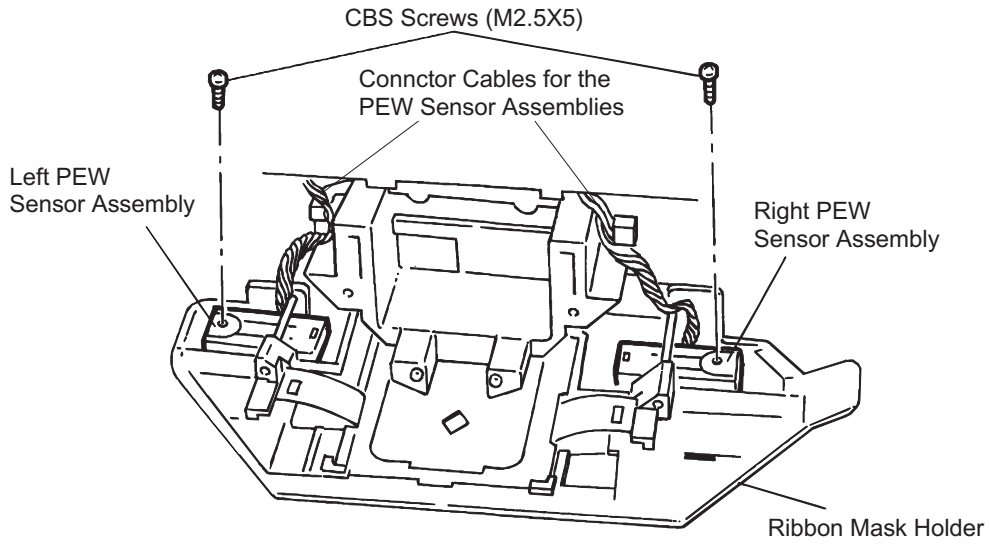


Figure 3-32. PEW Sensor Assembly Removal

3.2.6.15 Color Ribbon Sensor Removal

Step 1) Remove the printhead. (See Section 3.2.1.1.)
Step 2) Remove the CR. (See Section 3.2.6.12.)
Step 3) Remove the ribbon cartridge holder. (See Section 3.2.6.13, Step 4.)
Step 4) Disconnect the harness for the color ribbon sensor from the connector in the CS board assembly.
Step 5) Remove 1 screw (CS, 2X8) securing the color ribbon sensor, and remove the sensor.

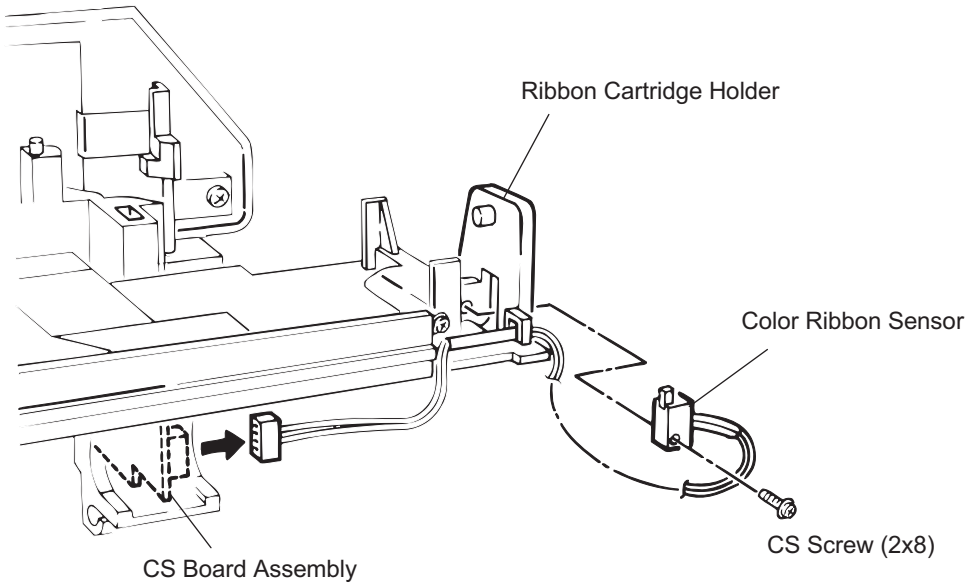


Figure 3-33. Color Ribbon Sensor Removal

3.2.6.16 Platen Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove the CR. (See Section 3.2.6.12.)
Step 3) Loosen 2 screws (CP, O, 3X6) securing the PF motor assembly to the right frame and the PF tension shaft. Then slide the PF motor to the front and remove the rear and front PF timing belts.
Step 4) Remove the paper loading roller pulley at the right end of the paper loading drive roller and 1 combination gear (16, 34, 93).

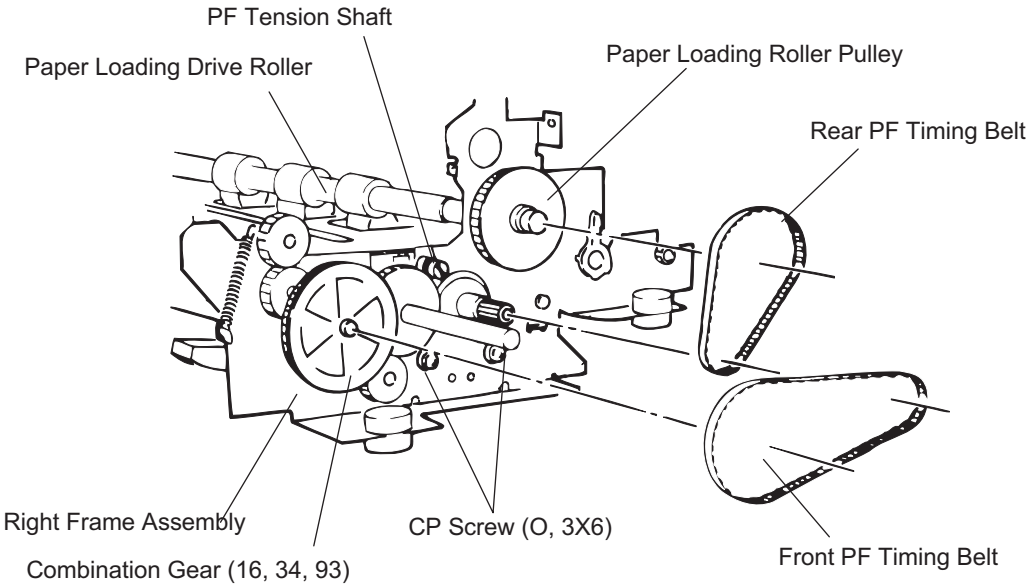


Figure 3-34. Gear Removal (1)

Step 5) Remove 1 gear (16) at the left end of the sub paper loading roller assembly and 1 combination gear (16, 20) at the left end of the paper loading drive roller.

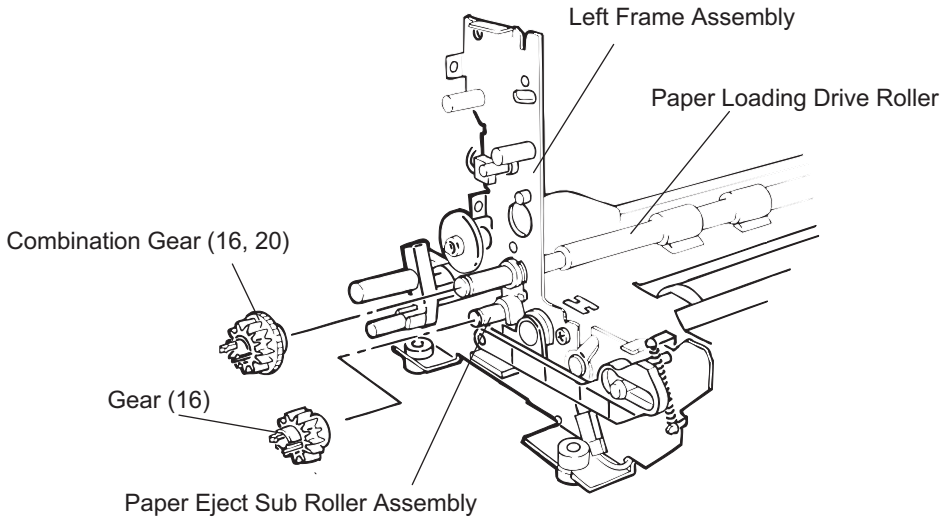


Figure 3-35. Gear Removal (2)

Step 6) Turn the platen shaft busing at the right end of the paper loading drive roller to release it.
Step 7) Shift the paper loading drive shaft right, and remove the shaft by moving it left.
Step 8) Remove the spacer attached to the front paper sensor, and disengage the detection lever from the paper guide plate. (See Section 3.2.6.3.)
Step 9) Remove 4 screws (CBS, 3x6) securing the paper guide to the right and left frames, then remove the paper guide by lifting it up.
Step 10) Turn the right and left platen shaft bushings to release engagement with the right and left frames, respectively. Then lift up the platen and remove it.

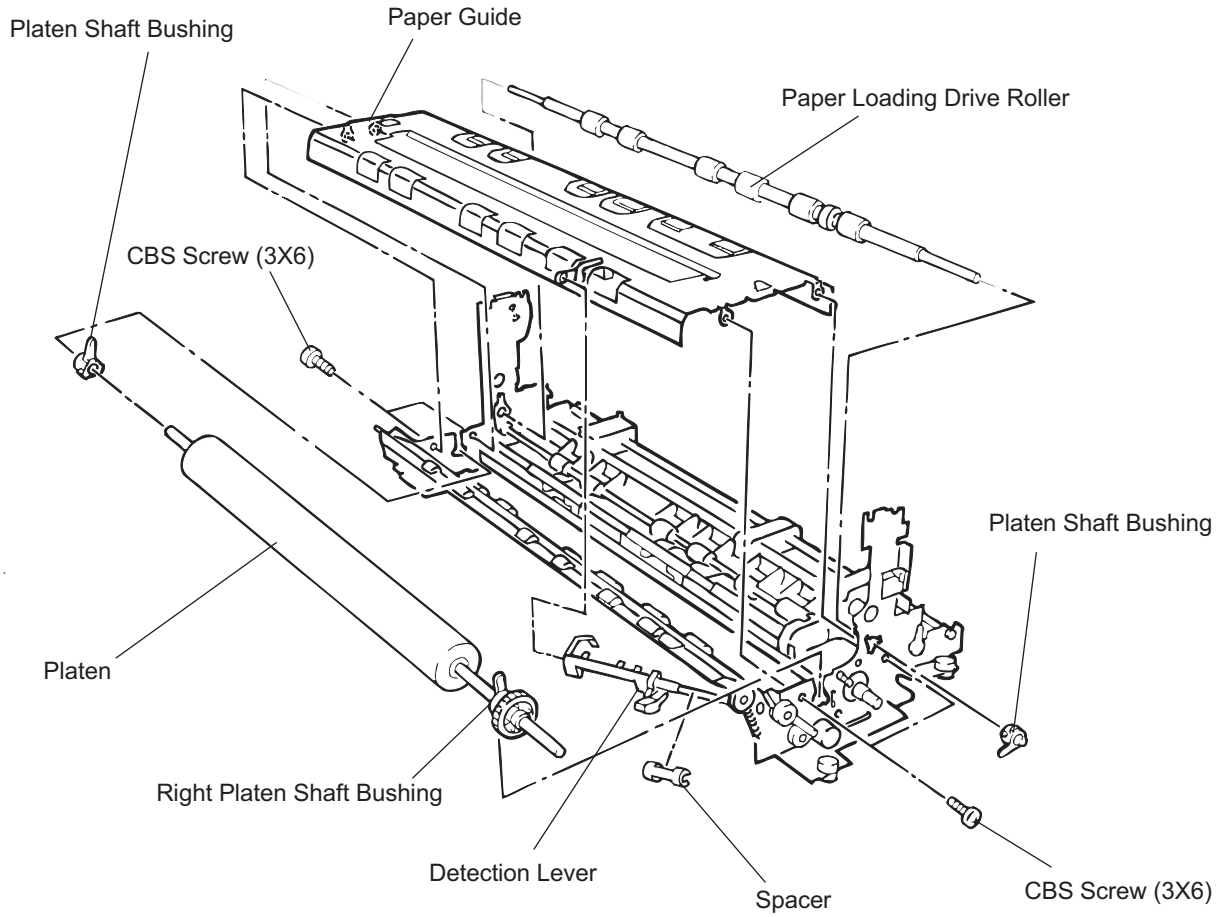


Figure 3-36. Platen Removal

3.2.6.17 Paper Jam Sensor / Rear Paper Sensor Removal

Step 1) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 2) Remove the harness for the rear paper sensor from the cable clamp in the printer mechanism.
Step 3) Remove the HP sensor assembly. (See Section 3.2.6.2.)
Step 4) Remove the CR. (See Section 3.2.6.12.)
Step 5) Remove the platen. (See Section 3.2.6.16.)
Step 6) Remove 1 screw (CBB, 3X6) securing the sensor holder to the base frame.
Step 7) Release the hooks fixing the paper jam sensor to the base frame. Then remove the paper jam sensor and the rear paper sensor together with the sensor holder.

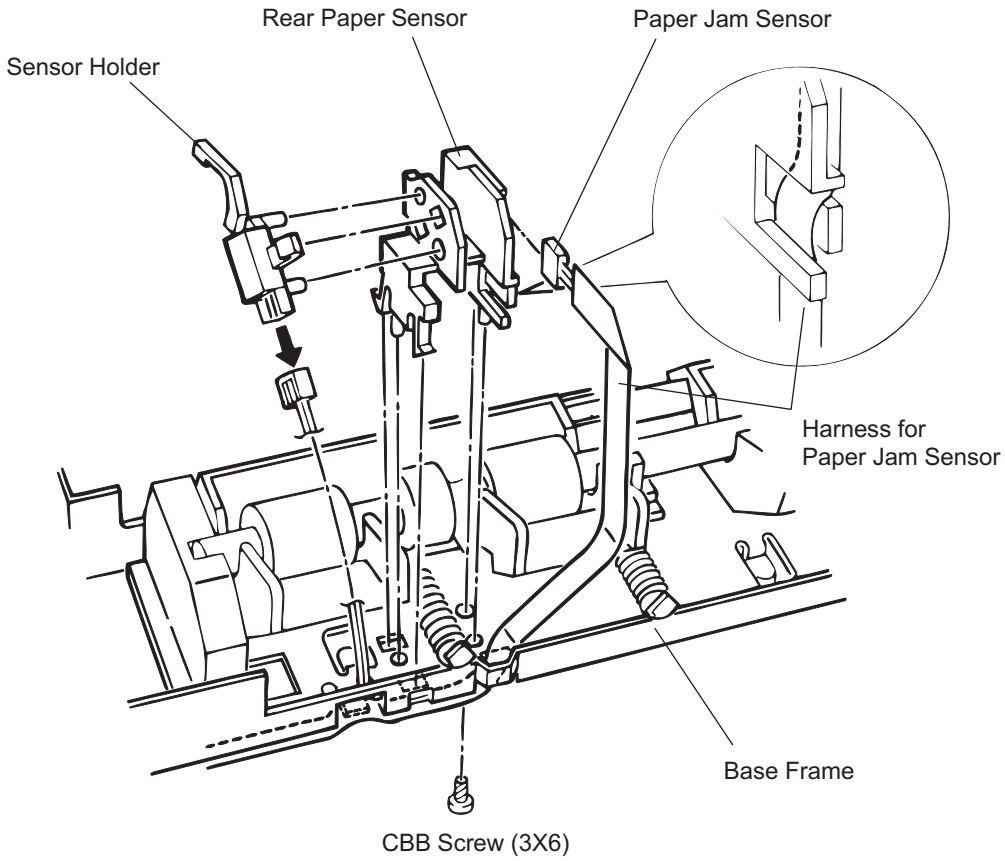


Figure 3-37. Paper Jam Sensor / Rear Paper Sensor Removal

3.2.7 Lower Housing Assembly Removal

Step 1) Remove the rear cover. (See Section 3.2.2.1.)
Step 2) Remove the C210 MAIN board and C124 PSB/PSE board. (See Section 3.2.2.2 and Section 3.2.2.3.)
Step 3) Remove the upper housing assembly. (See Section 3.2.5.)
Step 4) Remove the printer mechanism. (See Section 3.2.6.1.)
Step 5) Remove 4 screws (CBB, 4X16) securing the lower housing assembly to the bottom housing assembly, and release hooks on the bottom housing assembly fixing the lower housing assembly.
Step 6) Remove the power switch from the lower housing assembly.
Step 7) Lift up the lower housing assembly and remove it.

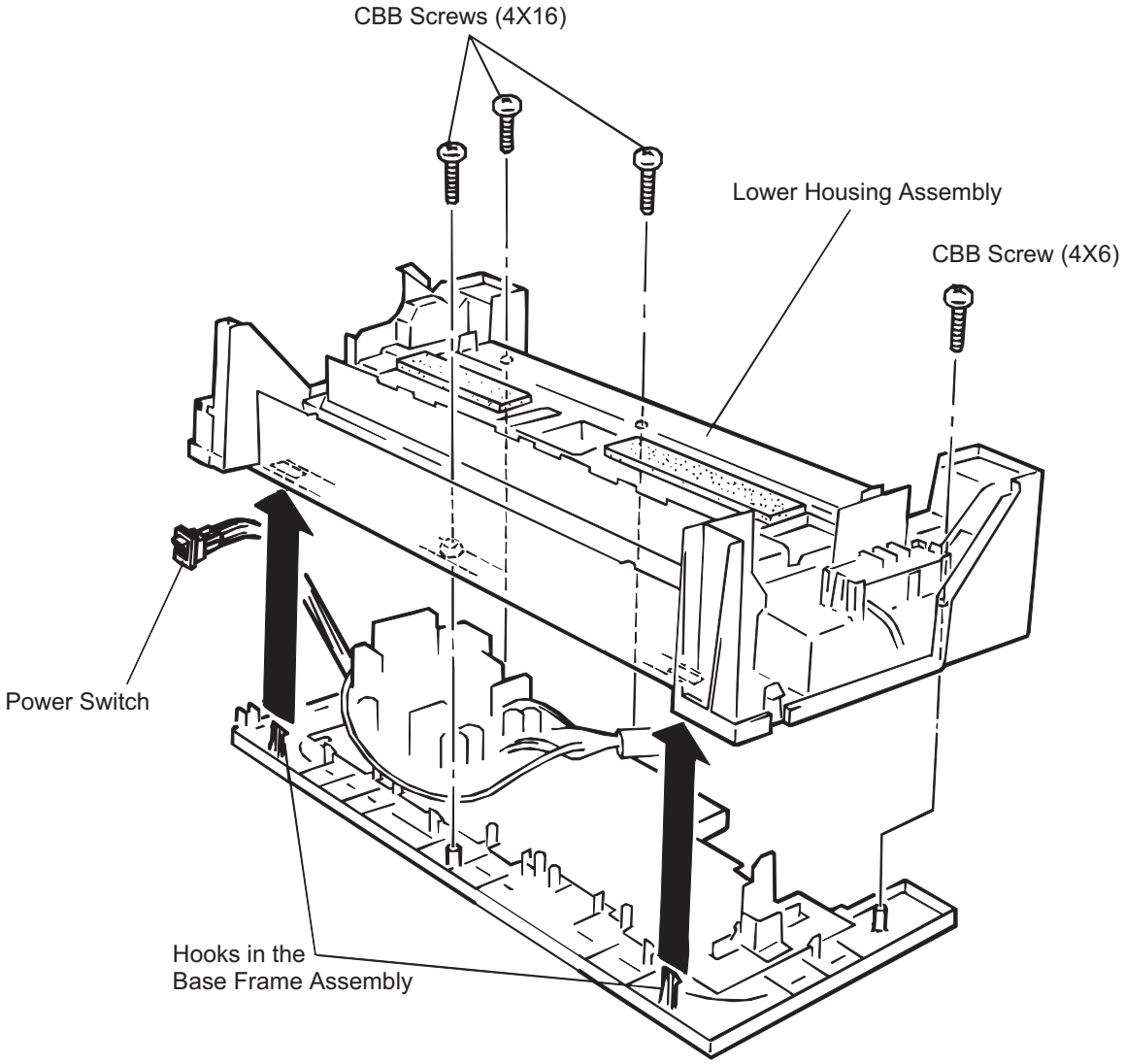


Figure 3-38. Lower Housing Assembly Removal

3.3 Reloading the Control Program

If the printer control program of this printer is stored in Flash memory, the program must be reloaded through a parallel interface. This operation is especially required when the C210 MAIN board is replaced, since the control program is not equipped with the new board. This section describes procedure for reloading the printer control program. The host computer used to reload the program is DOS/V, and the files used to reload the program consists of the IPL (hexadecimal) and the main program. (Refer to Chapter 1 for details.)

Step 1) Connect the printer to the host computer with a parallel interface.
Step 2) Start the host computer and select the drive path for the reload program.
Step 3) Press the **Tear Off**, **LF/FF**, **Load/Eject and Pause** buttons while turning on the printer, and the printer enters the program reload mode and the message “Program Mode” appears on the LCD.
Step 4) Transfer the files by “Copy” command function as described below;

```
>COPY    IPL file name    PRN    [Return]
>COPY    Data file name for the main program    PRN    [Return]
```

Then the reload program starts and the PC transfers the printer control program to the printer.
Step 5) When the printer LCD displays “Check Sum ****, turn the printer power off, and the control program reload mode is carried out.

Note) *“**** “ varies depending on the main program file.*

⚠ CAUTION

- ***If an error occurs during the operation, return to Step 3 to repeat the operation.***
- ***If the program does not complete because the printer is powered off or an error occurs during the operation, the last program is still effective and controls the printer functions.***

Chapter 4
Adjustment

4.1 Overview

This chapter describes adjustments required after disassembling the printer or replacing parts or units. Table 4-1 lists the disassembled/removed parts/units and corresponding adjustment items. Perform adjustment in the order listed.

Table 4-1. Adjustment Item

Disassemble/Removed Parts/Units	Adjustment Items
Printhead removal/replacement	PG adjustment
Main control board replacement	1. Customer data setting 2. Bi-D adjustment
Printer mechanism replacement	Bi-D adjustment
CR motor removal/replacement	Bi-D adjustment
CR unit removal/replacement	1. PG adjustment 2. Bi-D adjustment
PF motor removal/replacement	Belt tension adjustment
Timing belt replacement	1. PG adjustment 2. Bi-D adjustment
Platen roller removal/replacement	1. PG adjustment 2. Belt tension adjustment 3. Bi-D adjustment

4.2 Adjustment

4.2.1 Platen Gap (PG) Adjustment

Platen gap adjustment involves the following operations:

- ❑ CR guide shaft parallelism adjustment
- ❑ Platen gap reference value measurement and write operation

❑ CR guide shaft parallelism adjustment
The parallelism adjust bushing rotates eccentrically toward the center of the location hole in the right side frame, and it makes the right end of the CR guide shaft move toward or from the platen roller as the parallelism adjust bushing rotates. The parallelism adjustment is made to set the CR guide shaft parallel to the platen roller by turning the parallelism adjust bushing. With this adjustment, the printhead moves in parallel with the platen roller.

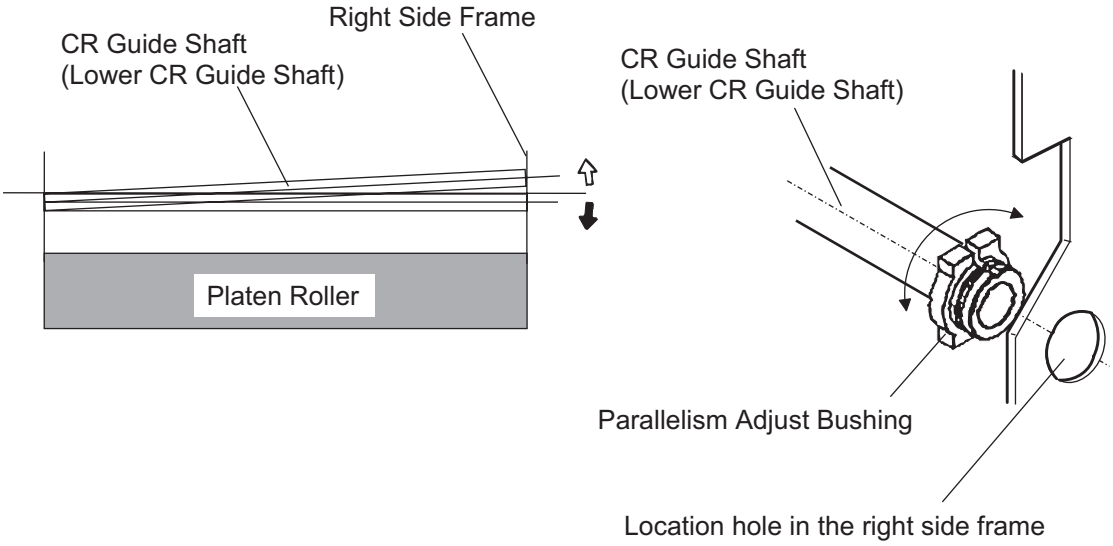


Figure 4-1. CR Guide Shaft Parallelism Adjustment

❑ PG reference value measurement and write operation
The PG reference value is measured by inserting 3 different thickness gages (0.39 mm, 0.55 mm and 0.72 mm) between the printhead and the platen roller. The PG reference value measurement operation is required to compensate for physical unevenness which is unique to each printhead. The PG reference value write operation writes the following values into the EEPROM using the adjustment program:

- ❑ Value "**α**" (1-digit number marked at the head nose side.)
- ❑ 3 values (β1, β2 and β3) measured with the thickness gauges

Perform CR guide shaft parallelism adjustment first, then the PG reference value measurement and write operation.

4.2.1.1 Parallelism Adjustment

Step 1) Remove the upper housing assembly. (See Section 3.2.5.)
Step 2) Remove the printhead. (See Section 3.2.1.1.)
Step 3) Remove the ribbon mask. (See Section 3.2.1.2.)
Step 4) Reinstall the prnthead.
Step 5) Open the paper eject lever assembly. Loosen 2 screws (CBS, 3x6 and CP (O), 3x10) securing the lower CR guide lever to the right frame enough to move the lever. (See Figure 3-26 in Chapter 3.)
Step 6) Slide the CR unit to the left end.
Step 7) Turn the CR guide shaft forward until the thickness gauge (0.39 mm) fits in between the platen roller and the printhead.
Step 8) Slide the CR to the right end.
Step 9) Turn the parallelism adjust bushing so that the PG meets the following specification:

Specification: ***The thickness gauge (0.37 mm or 0.41 mm) fits in between the platen roller and the printhead, and it can be removed with a little force (50 fg).***

Step 10) Repeat the steps from 6 to 9 until the printhead and the platen roller are parallel with the difference of 0.02 mm or less between the right and left ends of the roller.
Step 11) Fasten the screw when the adjustment is accomplished.

When this adjustment is made, you are to proceed to the next operation “Platen gap reference value measurement and write”.

⚠CAUTION

- ***When removing the printhead, be sure to turn the printer off and unplug the power cable from the AC power socket.***
- ***Do not turn the platen roller during the platen gap adjustment.***
- ***Once you remove the ribbon mask, do not reinstall it until “PLATEN GAP INPUT” is carried out.***

4.2.1.2 PG Reference Value

❑ **Platen gap reference value measurement**

Step 1) Turn the platen roller to set the white eccentricity mark to the top. (This operation sets the PG narrowest.)

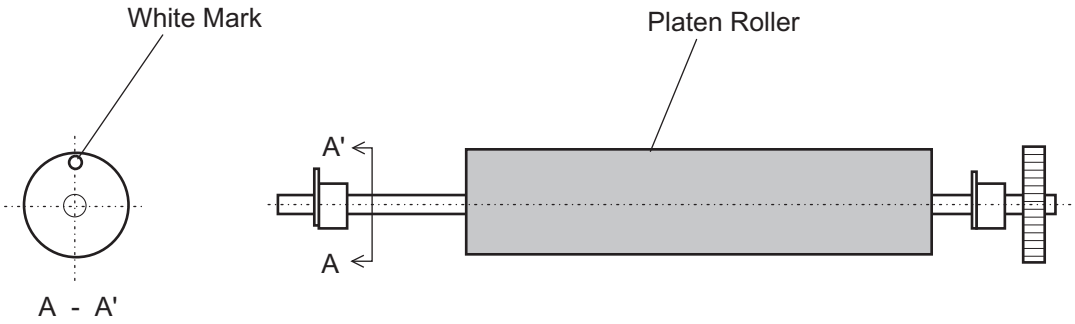


Figure 4-2. Eccentricity Mark

Step 2) Set the release lever to the cut sheet mode.
Step 3) Set the PG adjust lever to the “Auto” (the lowest).
Step 4) Put the interlock switch and cover open sensor disabled condition.
Step 5) Connect the printer and the host computer with a parallel interface cable, and turn the printer on first and then the computer.
Step 6) Start the adjustment program, and the main menu below appears on the screen:

```
DLQ-3000+/VP-4200
CHECK PROGRAM
REV. *
1. Platen Gap Adjustment
2. Bi-D Adjustment
3. END

If ready, press 1-3 and the “RETURN” key.
```

Step 7) Input “1” to select “**1. Platen Gap Adjustment**” and press the “Return” key, and the platen gap adjustment menu below appears on the screen:

```
PLATEN GAP

1. ALPHA INPUT
2. PLATEN GAP MEASUREMENT
3. PLATEN GAP INPUT
4. PLATEN GAP VERIFICATION

ALPHA = 0
```

Step 8) Input “1” to select “**1. ALPHA INPUT”**.
Step 9) When the monitor show the ”**ALPHA INPUT**” menu, input the value which is marked on the printhead nose side for the **“α”** value, and the menu returns to the “**PLATEN GAP**“ menu.

⚠CAUTION

Unless ALPHA value is input, the program does not proceed to the next operation.

Step 10) Input "2" to select "**2. PLATEN GAP MEASUREMENT**", and the following menu appears on the screen:

```
Set the thickness 0.39mm.

OK    : [RETURN] key input.
```

Step 11) Insert the thickness gauge (0.39 mm) between the printhead and the platen roller.

Step 12) Using "Space", "8", "2" and "Return" keys, determine the "β" value (BETA). (See the descriptions below.)

"β" (BETA) : The value determined when the thickness gauge can be removed with slight strength (50 ± 10 gf).

- BETA 1 = Value for 0.39 mm-thick gauge
- BETA 2 = Value for 0.55 mm-thick gauge
- BETA 3 = Value for 0.72 mm thick gauge

The keys to be used and the corresponding functions are as follows:

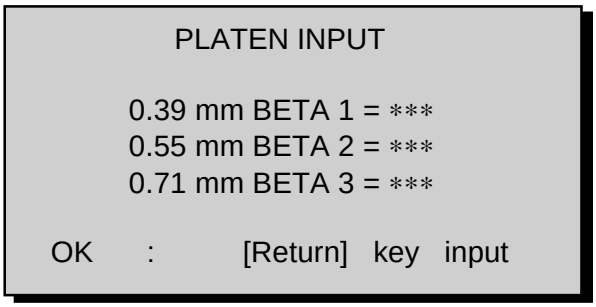
- "Space" key = Narrows the PG 1 step.
- "8" key = Narrows the PG 10 steps.
- "2" key = Widens the PG 10 Steps.
- "Return" key = Sets the value and proceeds to the following thickness or exits this menu.

Perform the same operation with the 0.55 mm-thick gauge and then 0.72 mm-thick gauge according to the message. The determined value for each thickness is displayed on the screen and stored in the computer

Step 13) When the operation with the 0.72 mm-thick gauge is carried out, the **"PLATEN GAP**" menu appears and you are to proceed to the next operation "Platen gap reference value write operation".

❑ **Platen gap reference value write operation**

Step 1) Input "3" to select "**3. PLATEN GAP INPUT**", and the determined "BETA" values for 3 thickness gauges are indicated on the screen.



Step 2) Ensure that the indicated values are correct and press "Return" key.

Step 3) To write the values into the EEPROM on the main control board, leave the computer on and turn the printer off. (Before turning the printer power back on, install the ribbon mask and the ribbon for the next adjustment.)

⚠CAUTION

- ***When the following condition occurs, return to the step "Platen gap reference value measurement":***
  - ***The determined value is abnormal.***
  - ***The message "Repeat the PG measurement again form the first step." is indicated.***
- ***During the measurement, keep the platen eccentricity mark at the top and never turn the platen roller.***
- ***Do not turn off the computer power until the platen gap adjustment is executed.***

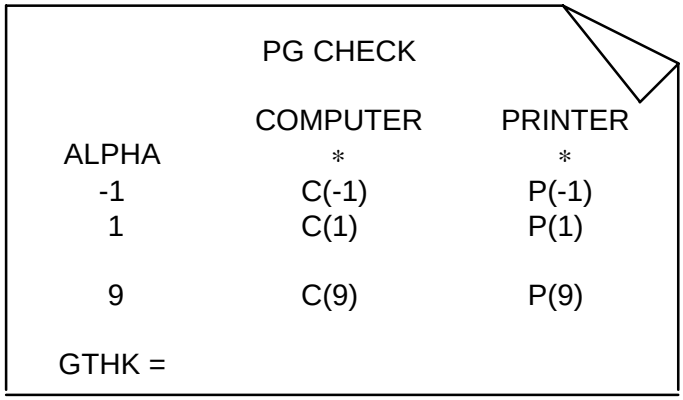
❑ PG adjustment value verification

Step 1) Install the ribbon mask and the ink ribbon to the printer and the CR, respectively. (Make sure that the printer power is off and the printer power cable is unplugged from the AC power socket.)

Step 2) Switch the release lever setting to the continuous paper mode and set the paper which meets the specification to the tractor.

Step 3) Turn the printer On.

Step 4) Input "4" to select "**4. PLATNEN GAP VERIFICATION**" from the menu "**PLATEN GAP**", and the paper is automatically loaded. Then the printer prints the PG amount for each step (from 1 to 9), as shown below, and indicates "Data X" and "GTHK" (paper thickness) on the LCD panel.
***Note**: Values for ∗, C, P and X are parameters in the hexadecimal.*



Step 5) Verify the followings:
- PG values indicated for the computer and printer are identical.
- Value for GTHK is in the range from **23 to 87**.

If the result is not correct, perform the platen gap adjustment again.

Step 6) If the results in the output and LCD indication are normal, turn the printer off. To proceed to the next adjustment menu "**Bi-D Adjustment**", stop the program once and start it again to enter the main menu.

4.2.2 Belt Tension Adjustment

Perform this adjustment whenever you removed or replaced the PF motor.

Step 1) Loosen 2 screws fixing the PF motor enough to move the motor.

Step 2) Install the front and rear PF timing belts.

Step 3) Press down the tension gauge onto the PF tension shaft at the angle of 45°. Then tighten the PF tension shaft when the tension gauge indicates a value in the range from 700 to 750 gf.

Step 4) Tighten the motor fixing screw.

⚠CAUTION

Be careful not to damage the gear (30) on the platen roller while adjusting the belt tension.

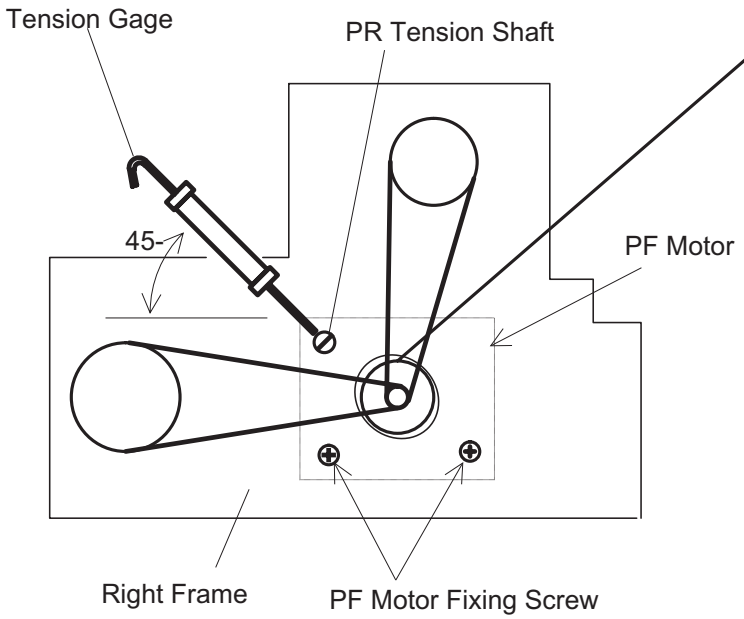


Figure 4-3. Belt Tension Adjustment

4.2.3 Customer Data Setting

This operation is required when the main control board is replaced or default values must be reset to the factory values. This operation does not require any adjustment program but the panel operation.

Step 1) Turn the printer on.
Step 2) Press the button "**SelecType**" on the control panel to enter the SelecType mode. (Refer to Chapter 1, Section 1.4.3.1.)
Step 3) Select "**Standard Setting**" from the options for SelecType 2 and press "→", and the default setting values are returned to the factory values.

4.2.4 Bi-d Adjustment

Make this adjustment after any of the following units is replaced:

- ❑ Printer mechanism
- ❑ Main control board
- ❑ CR unit
- ❑ Timing belt
- ❑ CR motor

This adjustment can be performed with either the adjustment program or control panel operation. This section, however, only refers to the procedure with the adjustment program. (See Chapter 1, Section 1.4.4.1 for Bi-D adjustment performed through the control panel.)

Step 1) Connect the printer and the host computer with a parallel interface cable, and turn the printer on first then the computer.
Step 2) Set continuous paper (13.5 inch 1P) on the printer.
Step 3) Starts the adjustment program, and the main menu below appears:

```
DLQ-3000+/VP-4200
CHECK PROGRAM
REV.*
1. Platen Gap Adjustment
2. Bi-D Adjustment
3. END

If ready, press 1-3 and the "RETURN" key.
```

Step 4) Input "**2**" to select **"Bi-D Adjustment**" and press "Return" key, and the Bi-D adjustment value input menu shown below appears:

```
Bi-D ADJUSTMENT

DRAFT (-12 - 12)      :      ?
```

Step 5) Input “0” (initialization value) for the draft mode and press “Return” key. Then perform the same operation for the Bit Map and LQ modes as they appear. When the last value (for LQ) is input, the message on the screen is as shown below:

```
Bi-D ADJUSTMENT

      DRAFT        (-12 - 12)      : ? 0
      Bit Image    (-12 - 12)      : ? 0
      LQ           (-12 - 12)      : ? 0
OK : [RET] key input   RETRY : [ESC] key input
```

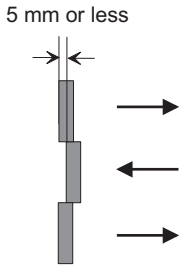
If you input incorrect values, press “ESC” key, and the main menu appears again to let you retry. If values are correct, press “Return” key, and the message below appears:

```
Bi-D ADJUSTMENT PRINTING
      DRAFT        : 0
      Bit Image    : 0
      LQ           : 0
OK : [RET] key input   RETRY : [ESC] key input
```

Step 6) Press “Return” key, and the printer prints 3 patterns for each mode in 3 rows. (The middle row shows the pattern for the value “0”.)

Step 7) Look at the middle part of each row and select the pattern which is most closely aligned and input the value. Make sure that the selected pattern meets the following specification:

Specification: The gap between right and left passes is 0.05 mm or less.



Perform this operation for the draft mode, bit image mode and then the LQ mode.

Step 8) When all values are input, press “Return” key and the printer prints the selected pattern for each mode.

Step 9) Look at the patterns and press “ESC” key to retry. To exit the Bi-D adjustment menu, press “Return” key.

```
Bi-D ADJUSTMENT INPUT

      DRAFT        : ? *
      Bit Image    : ? *
      LQ           : ? *

OK : [RET] key input   RETRY : [ESC] key input
```

Chapter 5
Troubleshooting

5.1 Overview

This chapter describes how to solve printer's abnormal operations. Since abnormal phenomenon varies in wade range, be sure to follow the instruction given here for proper judgments and remedies.

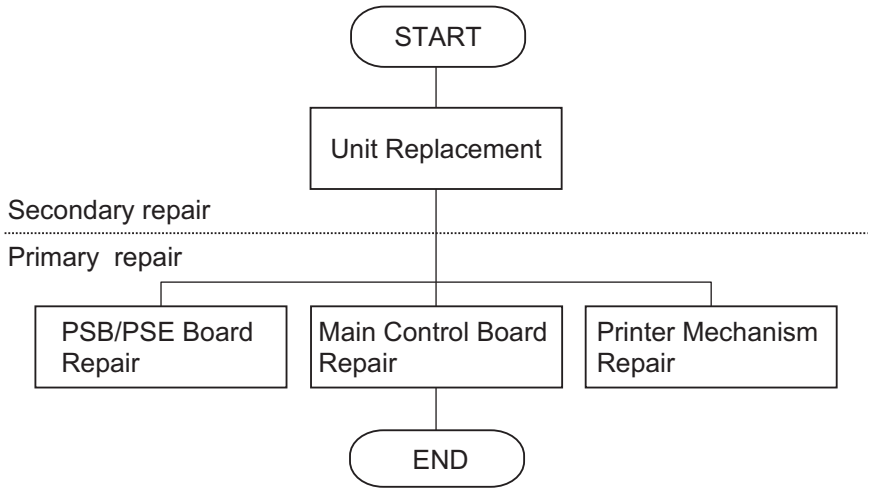


Figure 5-1. Troubleshooting Procedure

The first step of the procedure consists of unit replacement. After any unit is replaced, carry out any necessary adjustments and lubrication. (Refer to Chapter 4 and Chapter6.) Table 5-1 lists the measuring instruments used for troubleshooting.

Table 5-1. Measuring Instruments Necessary for Troubleshooting

Name	Recommendable specification
Oscilloscope	Measuring range : more than 50 MHz
Multimeter	Digital multimeter is more recommendable than analog one.

This printer, which is equipped with the self-diagnosis function, beeps when it detects an abnormal phenomenon. Table 5-2 shows the printer status and abnormal operations indicated by the beep sounds.

Table 5-2. Printer Status and Corresponding Beeps

Printer status	Beeper sound
Paper out error has occurred.	• • •
Paper size error has occurred.	• • •
Incomplete changing paper path error	• • •
Eject error has occurred.	• • •
Release lever operation error has occurred.	— — — — —
Paper jam error has occurred.	— — — — —
Fatal error has occurred.	— — — — —
Illegal operation in SelecType	•

Notes) The symbols "•" and "—" represent how a beep sounds.
"•": Sounds 100 ms with the interval of 100 ms.
"—": Sounds 500 ms with the interval of 100 ms.

5.2 Unit Repair and Replacement

This section contains flowcharts which let you isolate faulty units by following the flowchart for the problem. Refer to Table 5-3 to determine the flowchart to follow.

Table 5-3. Symptoms and Corresponding Flowchart

Problem	Description	Flowchart No.
The printer does not operate at all.	• The LEDs and LCD on the control panel indicate nothing. • Printer mechanism is not initialized.	Flowchart 1
The printer indicates an error after turning on the printer.	• 1 or more LEDs go on or blink and a message appears on the LCD. • After the printer mechanism is initialized, an error is indicated.	Flowchart 2
Self-test does not print properly.	• The printer does not print. • 1 or more dots are missing. • Low print quality • Monochrome print and color print switch improperly.	Flowchart 3
Paper is fed abnormally.	• The printer does not feed paper. • Paper feed length is irregular. • Paper jams frequently.	Flowchart 4
The control panel does not operate properly.	• Control panel button operation does not affect the printer operation properly. • Panel indication is improper. • SelecType mode does not operate properly. • Printer settings set through the control panel are not effective.	Flowchart 5
The printer does not operate properly.	• The printer run the self-test properly, but does not print data from the host correctly. • The printer does not print. • While the printer is in operation, the host computer goes in an error status.	Flowchart 6

Flowchart 1 : The printer does not operate at all.

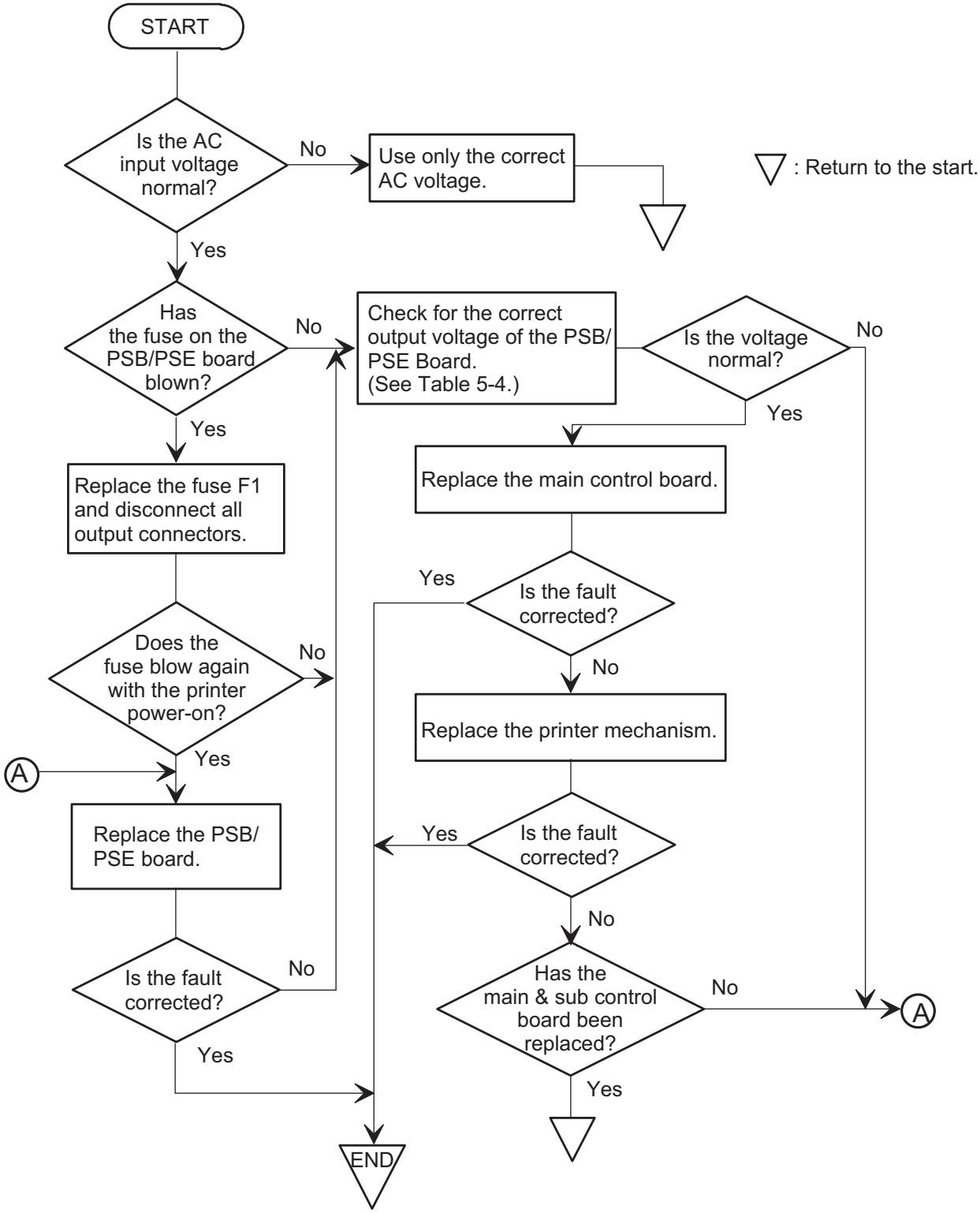


Figure 5-2. Flowchart 1

Flowchart 2 : The printer indicates an error after turning on the printer.

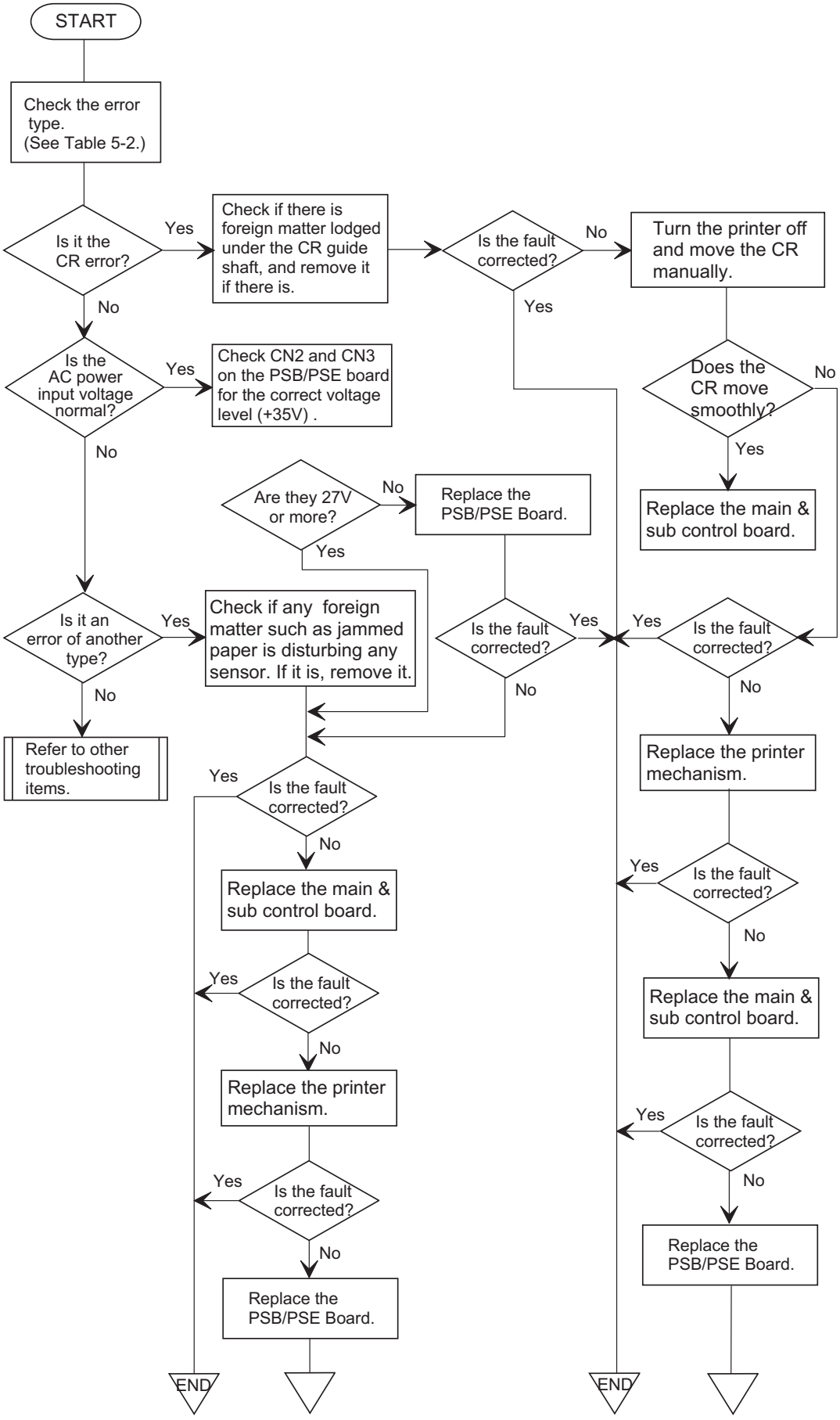


Figure 5-3. Flowchart 2

Flowchart 3 : Self-test does not print properly.

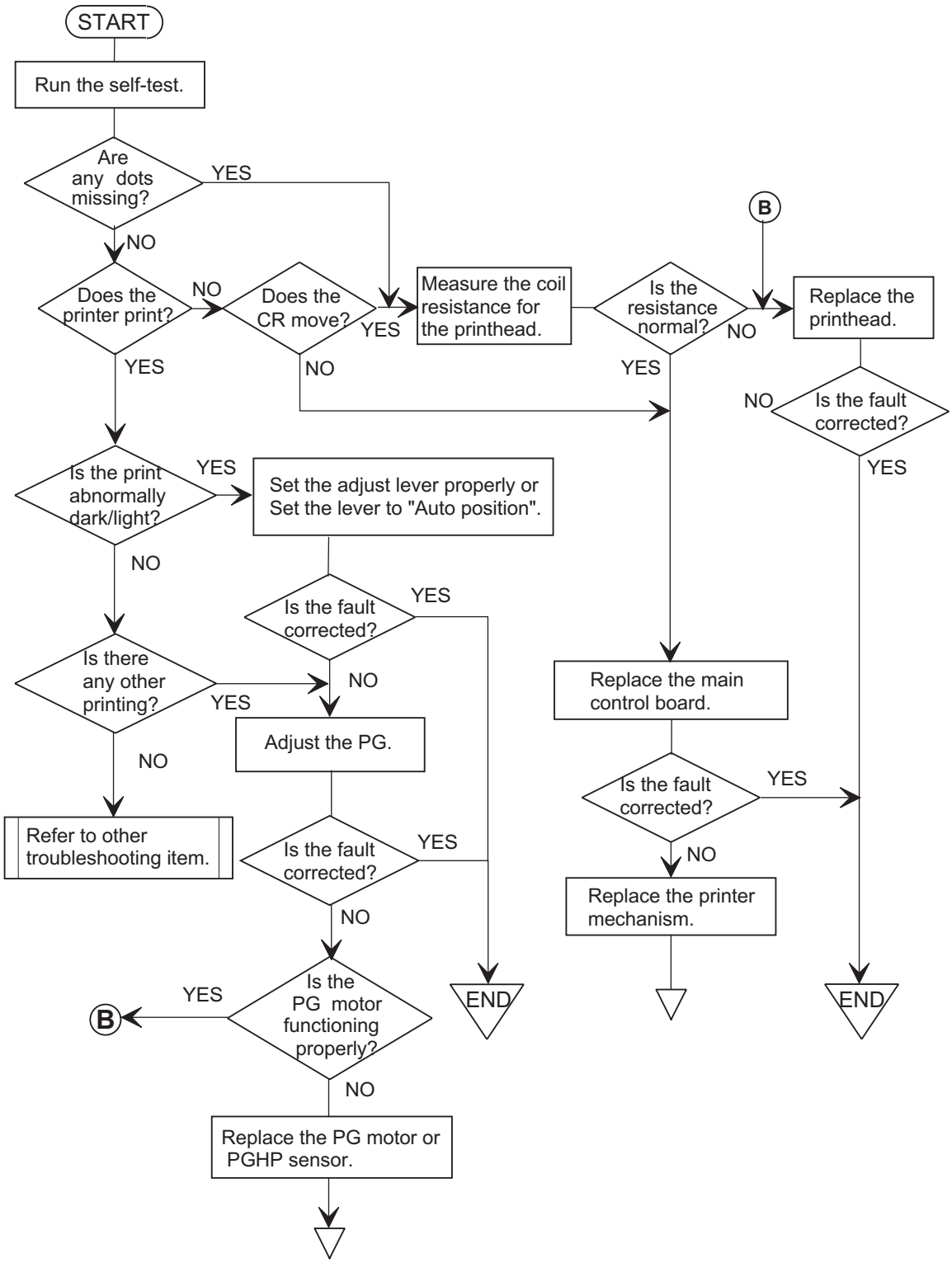


Figure 5-4. Flowchart 3

Flowchart 4 : Paper is fed abnormally.

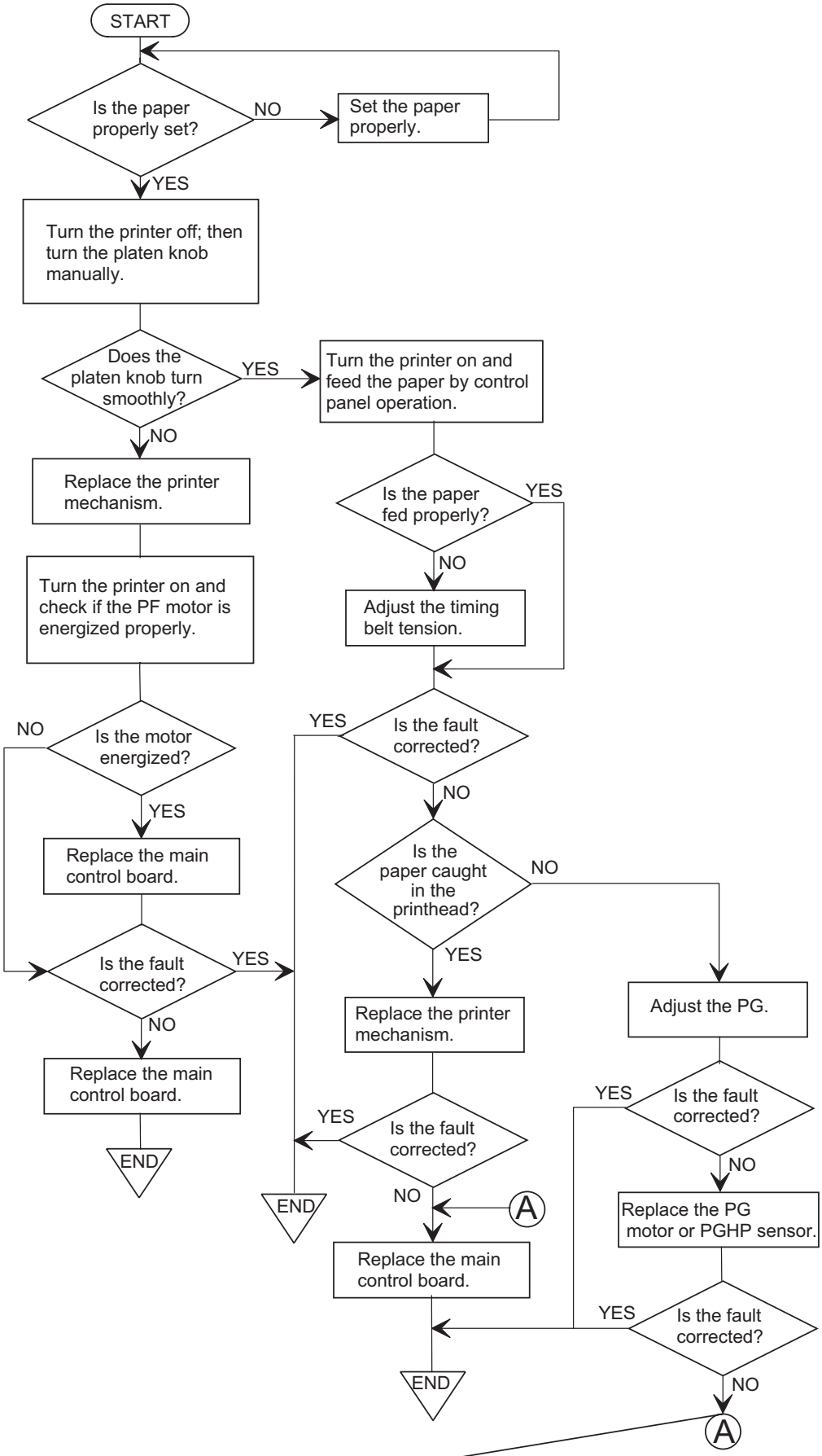


Figure 5-5. Flowchart 4

Flowchart 5 : The control panel does not operate properly.

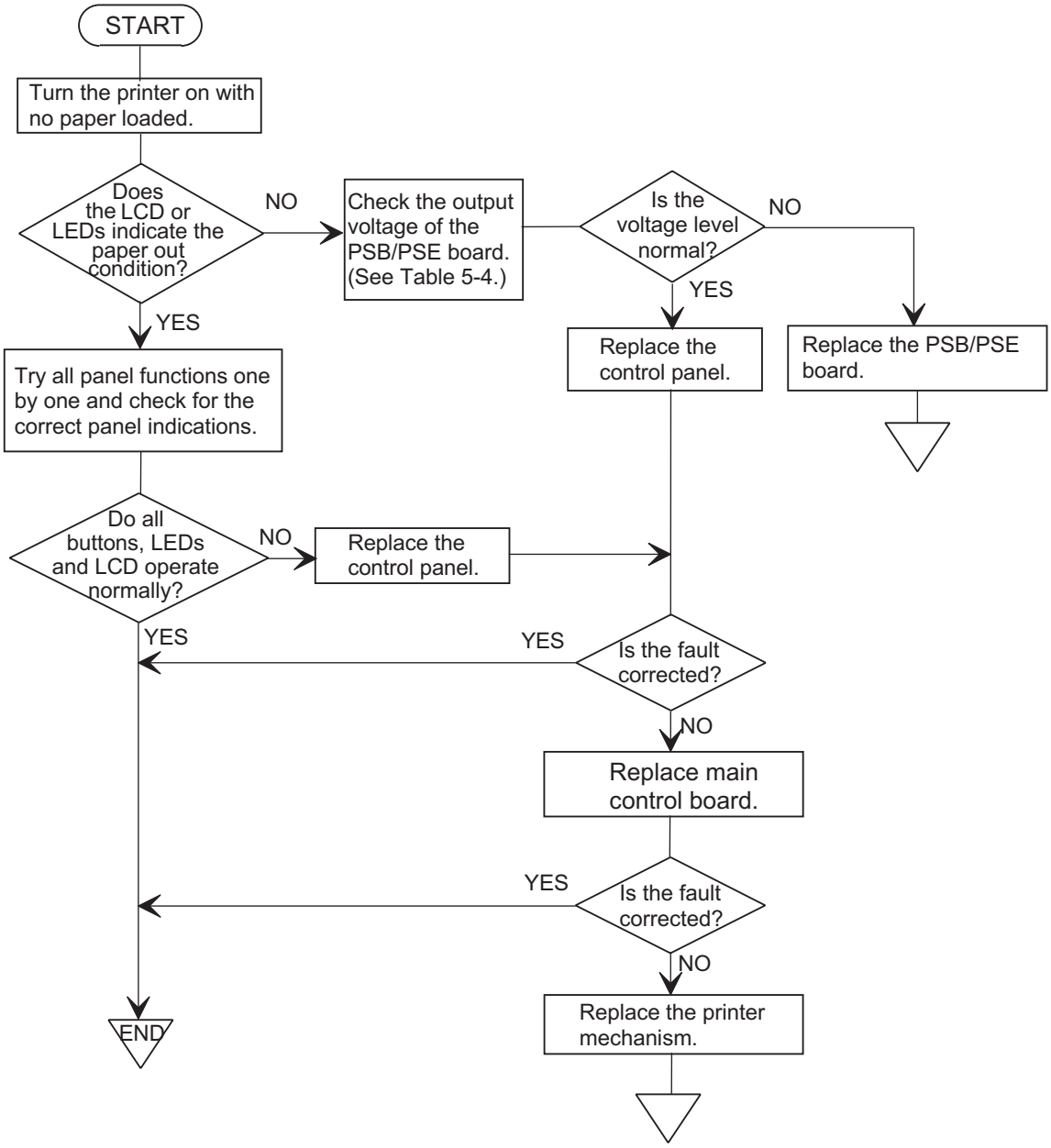


Figure 5-6. Flowchart 5

Flowchart 6 : The printer does not operate properly.

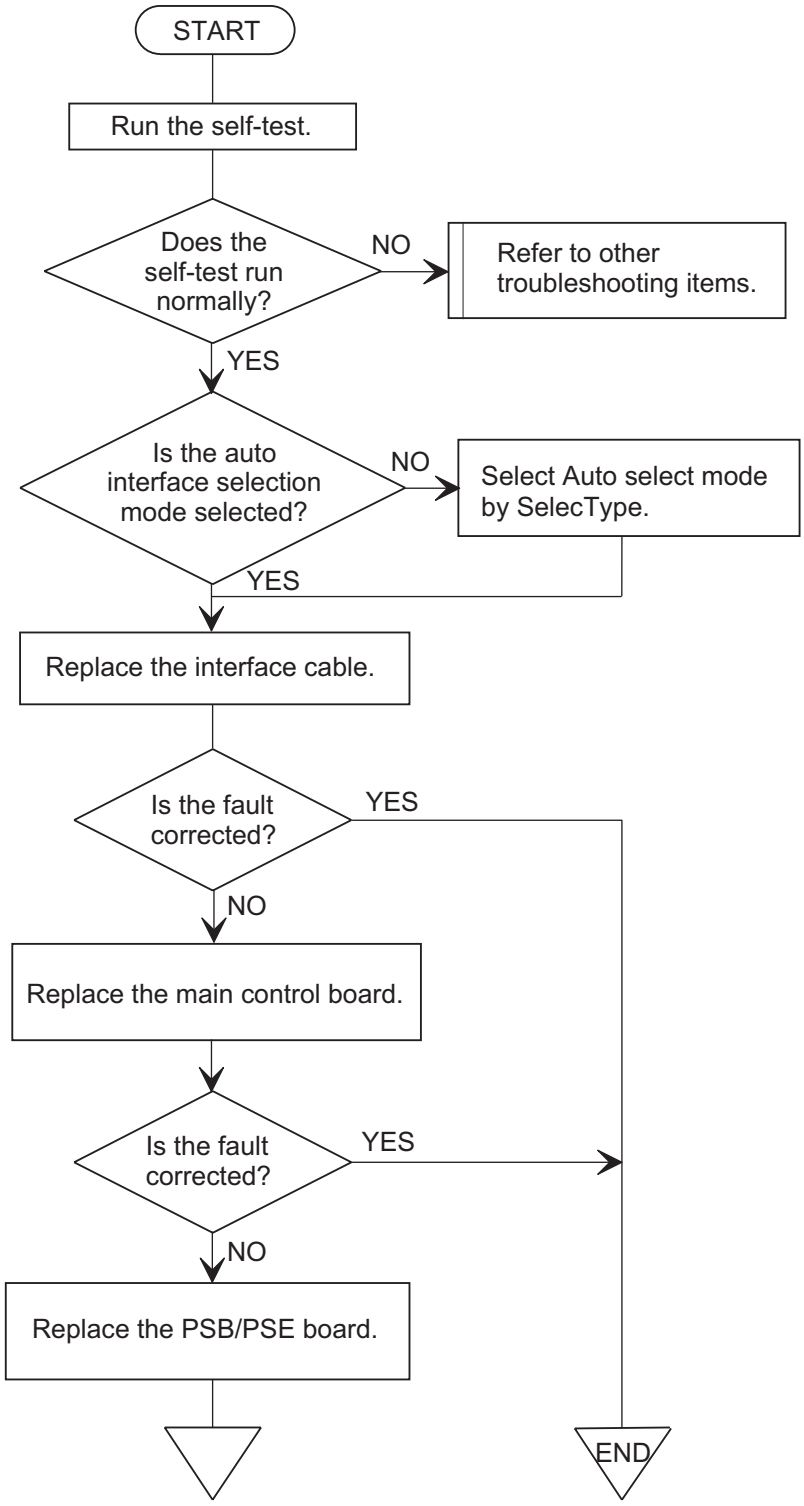


Figure 5-7. Flowchart 6

Table 5-4. Output Voltage of the PSB/PSE Board

Connector No.	Pin No.	Output voltage
CN2	1,2,3	+35 V (CH.B)
	4,5,6	Gp B
	7,8	GL
	9,10	+5 V
CN3	1,2,3	+35 V (CH.A)
	4,5,6	Gp A

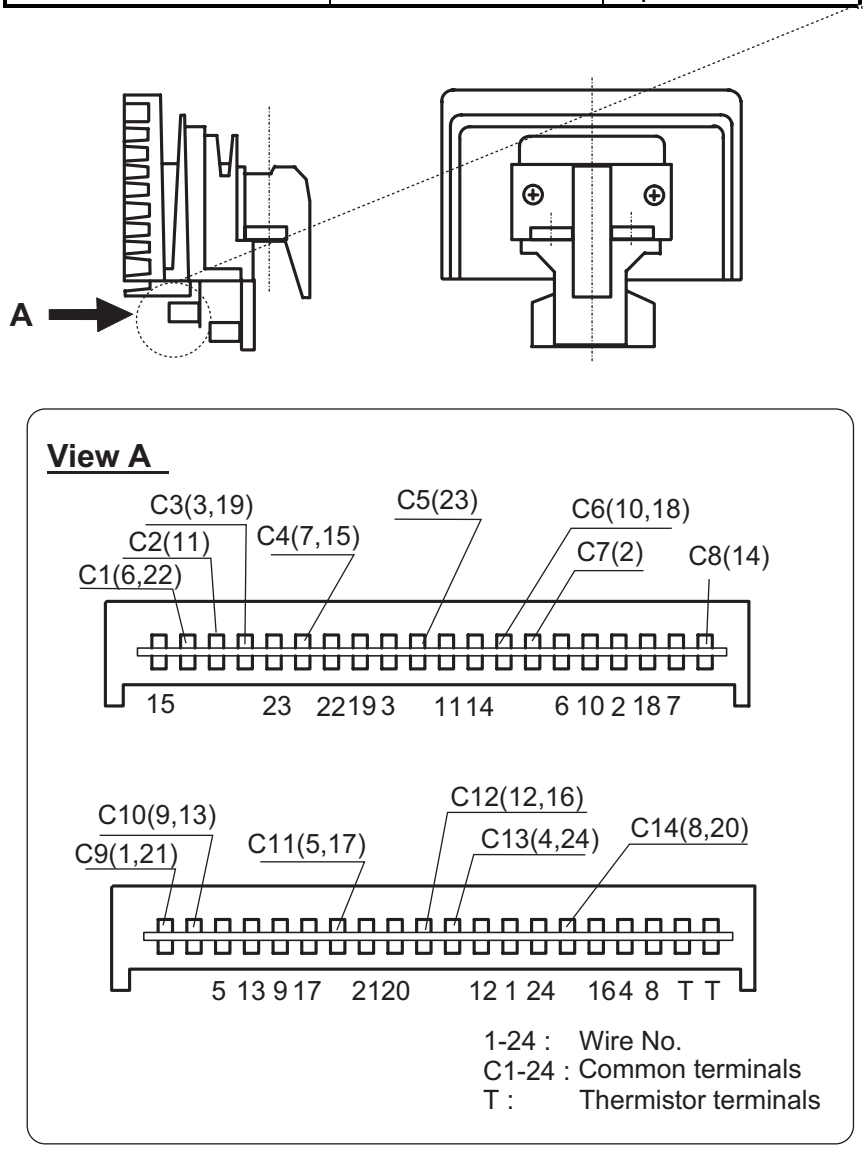


Figure 5-8. Printhead Connector Pin Assignment

Head coil resistance can be measured between the same numbered common terminal and wire. Normal resistance value for the printhead coil is:

8.19 ± 0.5 Ω (at 25°C)

Use a multimeter to check the motor coil resistance and transistor continuity, as shown in Table 5-5, Table 5-6 and Table 5-7.

Table 5-5. Motor Coil Resistance

Connector No.	Common pin No.	Test pin No.	Test method	Normal value
CN4 (CR motor)	5,6	1,2,3,4	Place 1 lead on pin 5 or pin 6, and set the other on each terminal of the 4 phases.	Approximately 1.1 Ω (at 25° C)
CN4 (PF motor)	17	13,14, 15,16	Place 1 lead on pin 17, and set the other to each terminal on the 4 phases.	Approximately 5.0 Ω (at 25° C)
CN4 (PG motor)	7,8	9,10, 11,12	Place 1 lead on pins 7 and 8, and set the other on each terminal of the 4 phases.	Approximately 250 Ω (at 25° C)
CN3 (Ribbon motor)	7	8, 9, 10, 11	Place 1 lead on pin 7, and set the other to each terminal on the 4 phases.	Approximately 76 Ω (at 25° C)

Table 5-6. Printhead Driver Test Point

Transistor No.	Test method (With the printer power off, and set the multimeter to Ω or diode check mode.)	Meter reading
Q6 to Q33	Connect the leads to the base and collector or emitter, then reverse the lead.	Neither open or close completely.

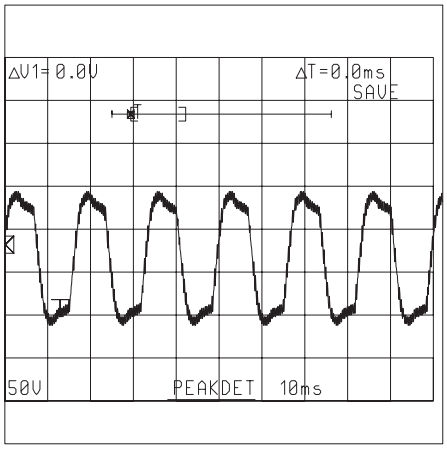
Table 5-7. Sensor Test Point

Sensor connector No.	Test method (With the printer power off, and set the multimeter to Ω or diode check mode.)	Meter reading
CN3 (Color ribbon cartridge sensor)	Place 1 lead on pin 13 and the other on the ground; then install the color ribbon cartridge to the CR unit.	Meter should toggle between open and short.
CN3 (Rear paper sensor)	Place 1 lead on pin 16 and the other on the ground; then activate the sensor actuator.	Meter should toggle between open and short.
CN5 (PGHP sensor)	Place 1 lead on pin 22 and the other on the ground; then activate the sensor actuator.	Meter should toggle between open and short.
CN5 (Release sensor)	Place 1 lead on pin 20 and the other on the ground; then change the release lever setting.	Meter should toggle between open and short.
CN5 (Adjust switch)	Place 1 lead on one of the pins from 9 to 12 and the other on the ground; then change the adjust switch setting.	Meter should toggle between open and short.
CN14 (Interlock switch)	Place 1 lead on pin 1 and the other on the pin 2; then open and close the printer cover.	Meter should toggle between open and short.

5.3 Repair of C124 PSB/PSE Board

This section describes how to repair the PSB/PSE board to the component. Table 5-8 shows the abnormal conditions and corresponding causes, check points and solutions. Select the condition from the table and perform any necessary check and repair.

Table 5-8. C124 PSB/PSE Board Repair

Condition	Cause	Check point	Solution
■ Symptom : Normal voltage is not output.			
Fuse is blown out soon after replaced.	Line filter circuit is defective.	Check C1 to C4 or L4 for a short circuit with the AC line.	Replace any defective component.
	Rectification or smoothing circuit is defective.	Check the followings for short circuit: – DB101 – All (+) terminals between C111 and DB101 – T101 and T201 (See Note 1.)	Replace the PSB/PSE board, DB101 or any associated defective component.
All output voltages are abnormal. (Due to the circuit structure, when the +35 V output is abnormal, all other output voltages are affected.)	Diode bridge DB101 is defective.	Check that the voltage output from pin 3 (+) and pin 4 (-) on DB101 is as follows: – C124 PSB : Approximately 170V – C124 PSE : Approximately 300V (See Note 2.)	Replace the PSB/PSE board, DB101 or any associated defective component.
	Soft start circuit (surge circuit) is defective.	❑ Check that DC voltages at the both ends of R2 and R3 are 0 V. ❑ R2 and R3 are open, TY101 is bad, or R124, D103, or T101/201 which are used to turn on TY101 is bad.	Replace PSB/PSE board or any associated defective component.
	Switching FET Q101 or Q201 is defective.	Check for the correct switching operation of Q101/201 by checking if the waveform output from pins 6 and 7 of the T101/201 primary coil is correct, as shown below.  Figure 5-9. Switching Waveform	Replace the PSB/PSE board, DB101 or any associated defective component.

Notes:

1. DB101 is possibly shortened as a result of the short circuit of other components behind DB101.

2. Degradation of some component behind DB101 may suppress the DB101 output voltage

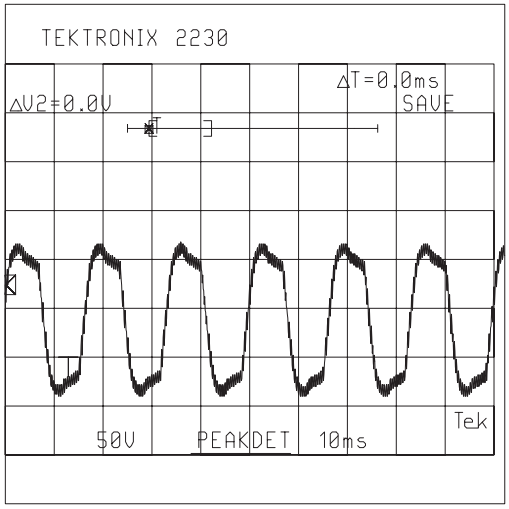
Table 5-9. C124 PSB/PSE Board Repair (continued)

Condition	Cause	Check point	Solution
■ Symptom : Normal voltage is not output. (continued)			
(continued) All output voltages are abnormal.	T101 or T201 is defective.	Check T101/T201 for the followings: – Pins 6/7 for the input voltage to the primary coil – Output voltage of the corresponding pins on the secondary side. (See Note 1.)	Replace the PSB/PSE board, T101/T201 or any associated defective component.
	Diode D151 or D251 is defective.	Check that the correct voltage (+35V) is output from the both terminals of C151/C251. If no voltage is output, T101/T201 is defective.	Replace the PSB/PSE board, D151/251 or any associated faulty part.
	Over current protection circuit is defective.	Check the transistor Q154. (Collector is at Gp level.) – If it's on, Q153/Q253 or other peripheral circuit part is defective. – If it's off, PC102 or components behind or Q101/Q201 in the main switching circuit is defective.	Replace the PSB/PSE board, Q154 or any associated faulty part.
	Over voltage protection circuit is defective.	❑ Check the transistor Q155. (Collector is at Gp level.) –If it's on, Q155, ZD153 or a peripheral part of Q155 is defective. –If it's off, a circuit part behind PC102 or Q102 in the main switching circuit is defective. ❑ Check if Q155 is on because the voltage for +5 V line is abnormally high. –If it's on, IC151 or a peripheral circuit part is defective. –If it's off, PC102 is defective. (See Note 2.)	Replace the PSB/PSE board, Q155 or any associated faulty part.

Notes:

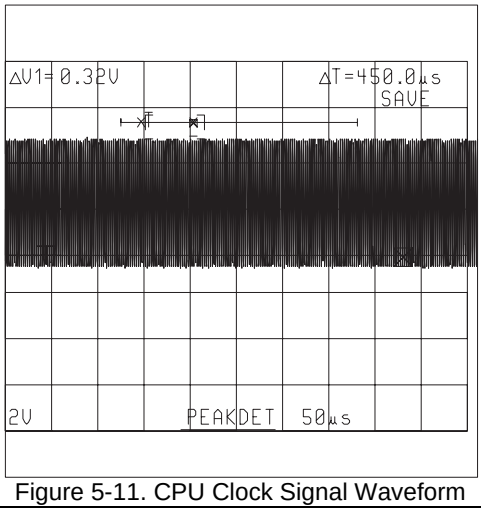
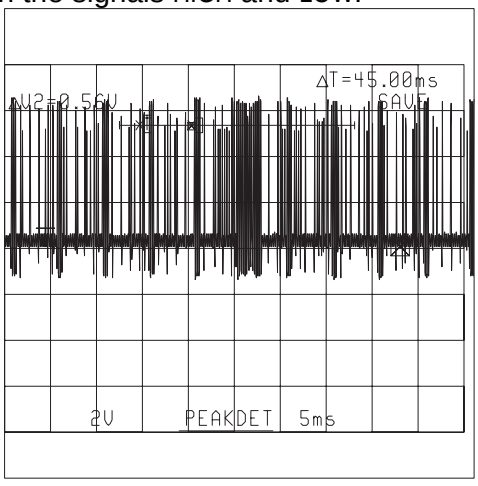
1. *Degradation of a component behind the secondary coil may suppress the T101/ T201 output voltage.*
2. *Once PC102 (photo-thyristor) turns on, it does not turn off until C111 is discharged. Therefore, be sure to wait for a few minutes before turning the power on again.*

Table 5-10 . C124 PSB/PSE Board Repair (continued)

Condition	Cause	Check point	Solution
■ Symptom : Normal voltage is not output. (continued)			
(continued) All output voltages are abnormal.	+35 VDC stabilizing circuit is defective.	Check the waveform output from pin 4 of the photo-coupler PC101/ PC201 is as shown below. (Constant wave-form should be output when the printer is in normal and stand-by status.) – If the correct waveform as shown below is output, check Q101/Q201 for the switching waveform. Then, check operation of the Q102/Q202, Q103/Q203 and peripheral circuit parts. – If the waveform is abnormal, PC101/PC201, ZD151, ZD181–ZD185 or any peripheral circuit part is defective.  Figure 5-10. PC101/PC201 Waveform	Replace the PSB/PSE board or any associated faulty part.
Output of +5 V is abnormal, while output of +35 V is normal.	IC151 is defective.	Check pin 21 of IC151 for the output voltage. If it's abnormal, IC151 is defective.	Replace the PSB/PSE board, IC151 or faulty peripheral parts.
	Smoothing circuit is defective.	Check if the correct voltage (approximately 5 V) is input between (+) and (-) terminals of IC154. If not, L151 or C154 is defective.	Replace the PSB/PSE board, L151, or C154.

5.4 Repair of C210 MAIN Board Component

Table 5-11. Repair of C210 MAIN Board

Condition	Cause	Check point	Solution
■ Symptom : The printer does not operate at all.			
Reset signal is not released.	Reset circuit is defective.	After turning on the printer, check if the signal output from pin 1 on IC22 and IC20 is LOW for a while. (See Note 1.)	Replace the main control board.
	The signal VOUT is not output.	Check if +5 V is normal. Then check pins 3 and 4 of the connector CN10.	Replace the PSB/PSE board.
CPU is not functioning.	The clock signal is not output.	Check that the waveform shown below is output from pins 74 and 75 of IC16.  Figure 5-11. CPU Clock Signal Waveform	Replace the main control board or CR1.
	Flash-ROM is defective.	Reload the printer control program. (See Chapter 3.) If the condition is not corrected, Flash-ROM is defective.	Replace the main control board.
	CPU is defective.	Check pins 27 – 43 of IC16 for change in the signals HIGH and LOW.  Figure 5-12. CPU Data Bus	Replace the main control board.

Note:

1. Reset signal is originally output from IC22 to reset Flash-ROM. Then, it is sent to the CPU and gate array via IC20.

Table 5-12. Repair of C210 MAIN Board

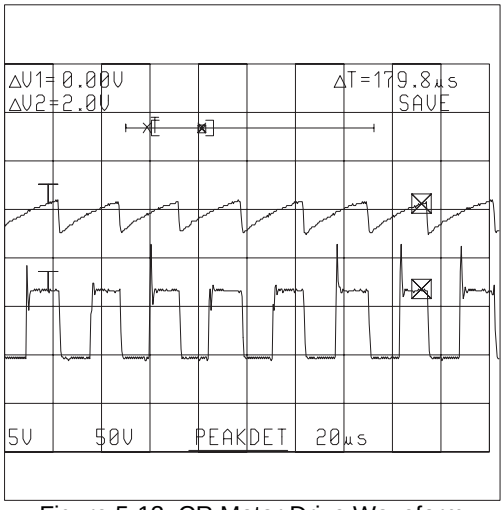
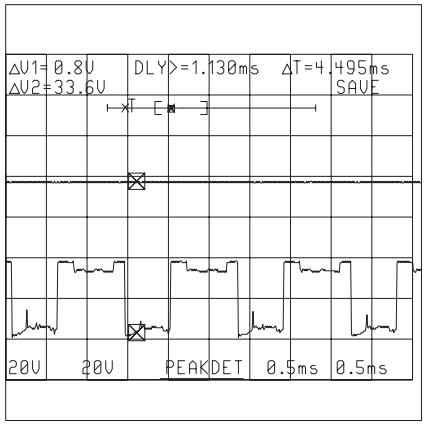
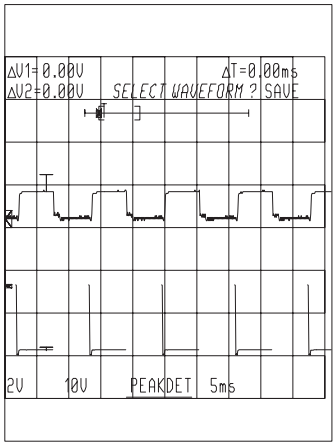
Condition	Cause	Check point	Solution
■ Symptom :An error has occurred.			
"Fatal error"	+35 VDC line monitor circuit is defective.	Check the voltages output from pin 88 and pin 89 of IC16. If the output voltages are correct, CPU is defective.	Replace the main control board or PSB/ PSE board.
	CR control circuit is defective.	Check pins 5, 6, 16 and 17 of IC7 for input signal waveform and pins 1, 8, 11 and 18 for output signal waveform. – If the motor phase signal is not input, gate array IC25 is defective. – If the drive waveform is not output, IC7 is defective.  Figure 5-13. CR Motor Drive Waveform	Replace the main control board or IC7.
Sensors are not functioning properly.	Sensor circuit is defective.	Check pin 85 of IC16 for the correct reference voltage. (+5 V). – If it's normal, CPU is defective. – If it is abnormal, shunt-regulator IC19 and its peripheral parts or the electrical circuit is defective.	Replace the main control board or PSB/ PSE board.

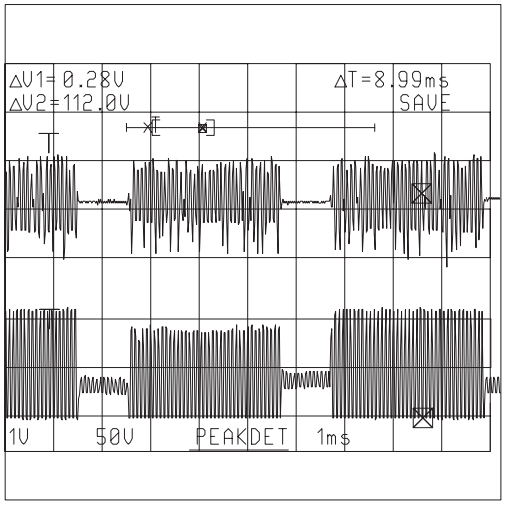
Table 5-13. Repair of C210 MAIN Board (continued)

Condition	Cause	Check point	Solution
■ Symptom : Abnormal printing			
Printhead control circuit operates abnormally.	Printhead control circuit is defective.	If some particular dots are missing or bad, check which head driver is causing the problem, the driver for print pulse A or B. – If any of the drivers is bad, see the circuit diagram and replace the corresponding drive transistors (Q6 to Q33, QM3 to QM10). (See Note 1.) – If both drivers are good, gate array IC25 is defective.  Figure 5-14. Head Drive Signal Waveform	Replace the main control board or associated component.
	Printhead driver circuit is defective.	Check pin 3 of 3-terminal regulator IC17 for the correct output voltage (+12 V). If it's correct, gate array IC25 is defective.	Replace the main control board or any associated part.
PG motor is not functioning properly.	PG motor driver circuit is defective.	Check pins 1,3,5,and 7 of QM1 for the input signal waveform and pins 15/16, 13/14, 11/12 and 9/10 of QM1 for output signal waveform. – If no motor phase input signals is input, gate array IC25 is defective. – If no drive waveforms is output, QM1 is defective.  Figure 5-15. PG Motor Drive waveform	Replace the main control board or any associated parts.

Note:

1. HD-No. shown in the diagram and corresponding dot No. are the same.

Table 5-14. Repair of C210 MAIN Board (continued)

Condition	Cause	Check point	Solution
■ Symptom : Abnormal printing (continued)			
(continued) PG motor is not functioning properly.	Fuse F1 is defective.	Check is the fuse F1 is blown out. If it is, check peripheral parts before replacing the fuse in case they are also shortened due to the fuse problem.	Replace the main control board or any bad parts.
■ Symptom : Paper is fed abnormally.			
PF motor is not functioning properly.	PF motor driver circuit is defective.	Check pin 5,6,16 and 17 of IC6 for input signal waveform and pin 1,8,11 and 18 of IC6 for output signal waveform. – If no motor phase input signals is input, gate array IC25 is defective. – If no drive waveforms is output, IC6 is defective.  Figure 5-16. PF motor Drive Waveform	Replace the main control board or IC6.
■ Symptom :The control panel is not functioning properly.			
Buttons, LEDs or LCD operation is abnormal.	Control panel control circuit is defective.	❑ Check that the harness for the control panel is securely connected to the control circuit board. ❑ Check If the harness is not damaged. IF not, the CPU (IC10) or gate array IC25 is defective.	Replace the control panel or main control board.
■ Symptom : Abnormal data transmission between the host computer and the printer.			
Communication error has occurred or data is garbled.	Any of the interface parts is defective.	Replace the interface cable and run the self-test. If the self-test runs normally, any of the interface parts is defective.	Replace the main control board.
	CPU is defective.	—	
■ Symptom : The default settings are not stored.			
—	EEPROM is defective or abnormal writing operation to the EEPROM.	—	Replace the main control board.

5.5 Repair of the Printer Mechanism

This section consists of tables which contains symptoms, conditions, causes, check points and solutions you need in troubleshooting problems with units in the printer mechanism.

Table 5-15 Repair of the Printer Mechanism

Condition	Cause	Check point Solution
■ Symptom : CR motor does not rotate properly.		
The CR does not move after printer power is turned on.	Foreign matter is lodged in the mechanism.	❑ **Check point:** Move the timing belt manually to check if the motor rotates. ❑ **Solution:** Remove the foreign matter.
	CR motor is defective.	❑ **Check point:** Check the motor coil for correct resistance (approximately 1.1 Ω). (See Table 5-5 and Note.) ❑ **Solution:** Replace the CR motor or the main control board.
■ Symptom : The CR does not move with the printer power on.		
CR motor rotates, but the CR doesn't move.	The drive pulley is defective.	❑ **Check point:** Check if the pulley is worn or damaged. ❑ **Solution:** Replace the drive pulley.
	Timing belt is defective.	❑ **Check point:** Check if the timing belt is properly engaged with the CR or if any of the belt teeth is broken off. ❑ **Solution:** Reinstall or replace the timing belt.
CR moves left a little, then stops.	CR does not move smoothly.	❑ **Check point:** Move the CR manually to check if it moves smoothly. ❑ **Solution:** Clean and lubricate the CR guide shaft surface, or replace the CR motor. (See Chapter 6.)
CR moves to the right or left end, then stops.	HP sensor is defective.	❑ **Check point:** — ❑ **Solution:** Replace the HP sensor.
■ Symptom : Self-test does not run properly.		
CR moves without printing.	Head FFC is not connected properly.	❑ **Check point:** Check the head FFC visually for proper connection, damage and bent. ❑ **Solution:** Replace the head FFC.
	Printhead is defective.	❑ **Check point:** Check the printhead coil for correct resistance (approximately 8.19 Ω). (See Page 5-9.) ❑ **Solution:** Replace the head FFC.
Particular dots are missing.	Printhead is defective.	❑ **Check point:** Check if head wires are bent. ❑ **Solution:** Replace the printhead
Printing color is too light or uneven.	Printhead is defective.	❑ **Check point:** Check if head wires are bent. ❑ **Solution:** Replace the printhead.

Note: *In case the CR motor is shortened, check the driver circuit, since it might be also shortened.*

Table 5-16. Repair of the Printer Mechanism

Condition	Cause	Check point Solution
■ Symptom : Self-test does not run properly. (continued)		
PG adjustment mechanism is not properly functioning.	Platen gap is not adjusted properly.	❑ **Check point:** Check for the proper platen gap. ❑ **Solution:** Adjust the platen gap. (See Chapter 4.)
	PG motor is defective.	❑ **Check point:** Check the PG motor coil for proper resistance (approximately 250 Ω). (See Table 5-5 and Note.) ❑ **Solution]** Replace the PG motor.
	PGHP sensor or PG sensor is defective.	❑ **Check point:** Check PGHP sensor. (Refer to Table 5-7.) ❑ **Solution:** Replace the sensor.
■ Symptom : Paper feeding is abnormal.		
❑ The printer prints, but does not feed paper. ❑ Paper is not fed at a constant speed.	Foreign matter is lodged in the paper path.	❑ **Check point:** Check the paper path visually. ❑ **Solution]** Remove the foreign matter.
	PF motor is not driven properly.	❑ **Check point:** Check if the motor or gear has any foreign matter lodged, or if they are worn or damaged. ❑ **Solution:** Remove the foreign matter or replace the PF motor or the gear.
	PF motor is defective.	❑ **Check point:** Check the PF motor coil for proper resistance (approximately 5.4 Ω). (See Table 5-5 and Note.) ❑ **Solution:** Replace the PF motor. (Replace the driver also, if necessary.
■ Symptom : Ribbon feeding is abnormal.		
Ribbon is not fed.	Ribbon cartridge is defective.	❑ **Check point:** Remove the ribbon cartridge; then turn the ribbon feed knob to check if the ribbon is properly fed. ❑ **Solution:** Replace the ribbon cartridge.
	Foreign matter is lodged in the ribbon feed gear train.	❑ **Check point:** Run the self-test to check if the ribbon is properly fed. ❑ **Solution:** Remove the foreign matter or replace defective parts in the ribbon feed mechanism.
	Ribbon motor is defective.	❑ **Check point:** Check the ribbon motor coil for correct resistance (approximately 76 Ω).(See Table 5-5 and Note.) ❑ **Solution:** Replace the ribbon motor.

Note: *In case the PG/PF/ribbon motor coil is shortened, check the driver circuit, since it might be also shortened.*

Table 5-17. Repair of the Printer Mechanism

Condition	Cause	Check point Solution
■ Symptom :Paper is smudged with ink.		
Ink smudges in the printed area.	Ribbon mask hole is damaged.	❑ **Check point:** Check if the ribbon mask hole is damaged. ❑ **Solution:** Replace the ribbon mask.
	Platen gap is not properly adjusted.	❑ **Check point:** Check for the proper PG. ❑ **Solution:** Adjust the PG. (See Chapter 4.)
	PG motor is defective.	❑ **Check point:** Check the PG motor coil for correct resistance (approximately 250 Ω). (See Table 5-5 and Note.) ❑ **Solution:** Replace the PG motor.
	PGHP sensor or PG sensor is defective.	❑ **Check point:** Check the PGHP sensor for proper condition. (See Table 5-7.) ❑ **Solution:** Replace the PGHP sensor.
■ Symptom :False printing.		
The printer prints with no paper loaded.	Paper sensor is defective.	❑ **Check point:** Check the paper sensor for proper condition. (See Table 5-7.) ❑ **Solution:** Replace the paper sensor.
■ Symptom :Color printing is abnormal.		
Colors mix improperly.	Ribbon motor is defective.	❑ **Check point:** Check the ribbon motor coil for correct resistance (approximately 76 Ω).(See Table 5-5 and Note.) ❑ **Solution:** Replace the ribbon motor.
	Ribbon is caught in the ribbon mask.	❑ **Check point:** Check if the mask surface has any crack or damage. ❑ **Solution:** Replace the ribbon mask.

Note: *In case the PG/ribbon motor coil is shortened, check the driver circuit, since it might be also shortened.*

Chapter 6
Maintenance

6.1 Maintenance

This chapter provides information necessary to keep the printer in optimum condition, as well as to prevent potential troubles. Cleaning the outer cases consists of wiping off dirt using denatured or thinned alcohol. It is also essential to vacuum dust and debris accumulated in the printer when necessary.

⚠ CAUTION

- ***Never apply thinner, trichloroethylene, or ketone-based solvents to any plastic parts. These substances may cause plastic or rubber parts to deform or degenerate.***
- ***Use lubricant or adhesive which are recommended for this printer.***

6.1.1 Lubrication and Adhesion

Application of proper lubricant has a substantial effect on the printer condition and durability. In particular, lubricating at low temperature needs special care. Therefore, be sure to use lubricants specified based on the experiments conducted by EPSON and technical information in wide range.

Table 6-1. Lubricants to be Applied

Type	Product name	Amount	Part code	Availability
Oil	O-8	40 cc	1019753	EPSON-exclusive
Grease	G-26	40 g	B702600001	EPSON-exclusive
Adhesion	Neji-lock	1000 g	B730200200	EPSON-exclusive

Table 6-2. Adhesion Points

Ref. No.	Lubricating points	Application	Lubricant
1	Sliding points for the release lever and the gear (15.5).	5 mm (2 points)	G-26
2	Sliding point for the sub release lever and release lever.	15 mm	G-26
3	Sliding points for the paper guide change lever and sub paper loading shaft.	About 2-mm ball size (2 points)	G-26
4	Gear (30) surface	1/3 of the circle	G-26
5	Gear (18) surface	1/3 of the circle	G-26
6	Inner surface of the parallelism adjust bushing	1 drop	O-8
7	Inner surface of the bushing (10)	1 drop	O-8
8	Upper plain oil pad in the CR assembly.	0.2 cc	O-8
9	Lower plain oil pad in the CR assembly.	0.66 cc	O-8
10	Sliding point for the link release lever and paper eject lever.	3 mm	G-26
11	Right and left sides of the CR on the lower CR guide shaft.	1 drop for each side	O-8

Table 6-3. Adhering Points

Ref. No.	Adhering points
1	The point where the top side of the PGHP sensor assembly and left frame join.
2	2 points in the CR assembly where the timing belt is inserted.
3	2 points where the parallelism adjust bushing and right main frame join.

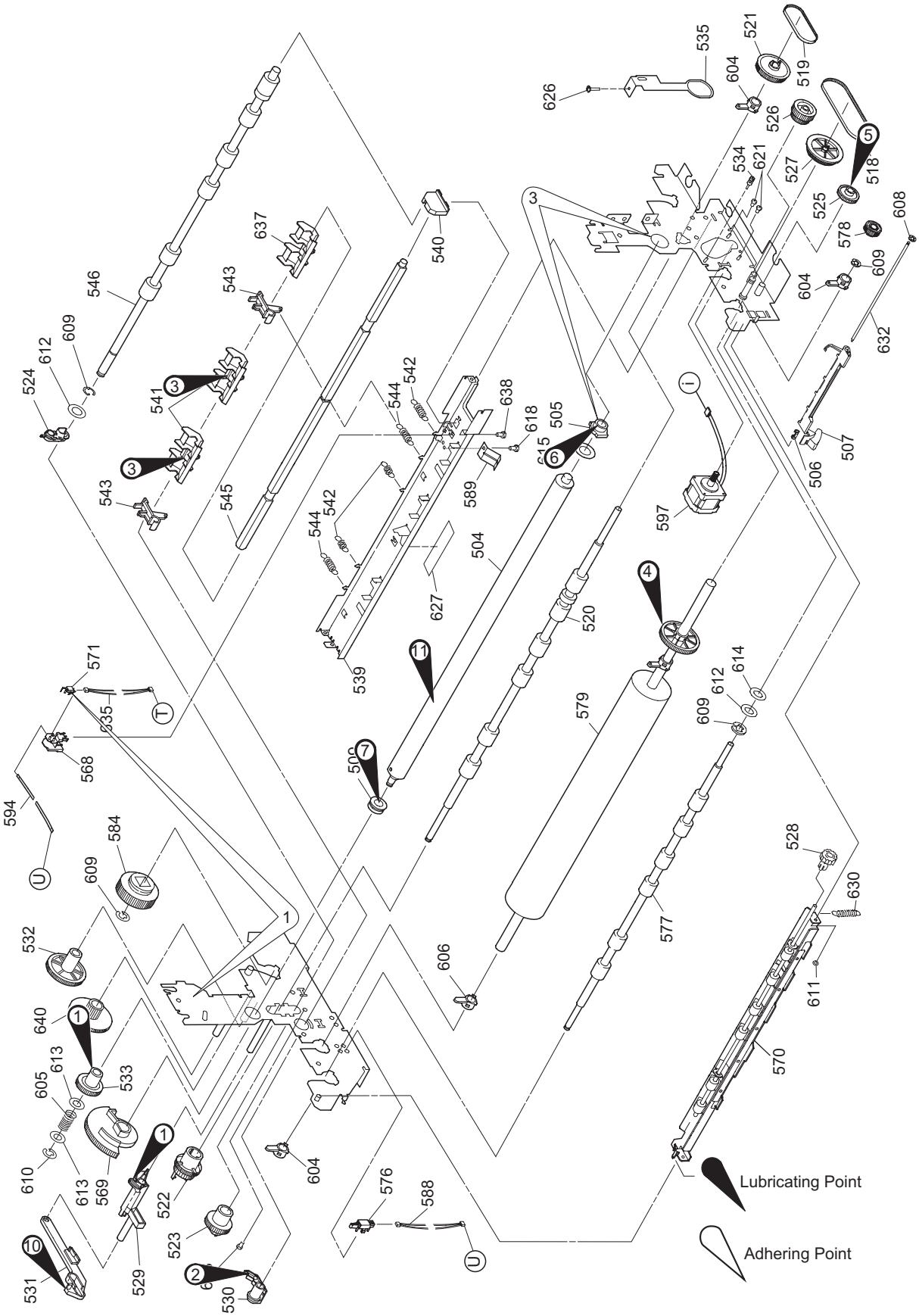
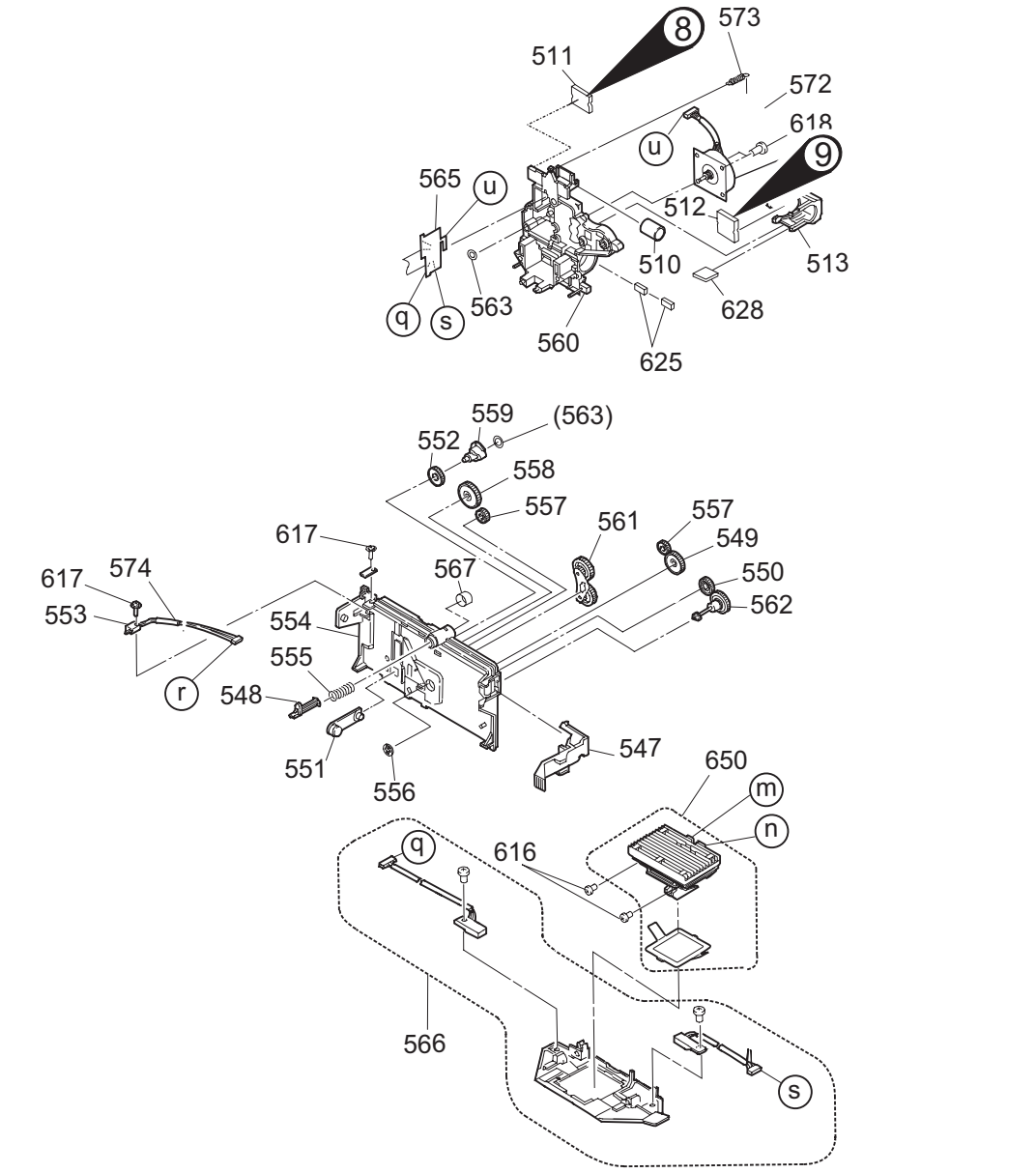


Figure 6-1. Lubricating / Adhering Points (1)



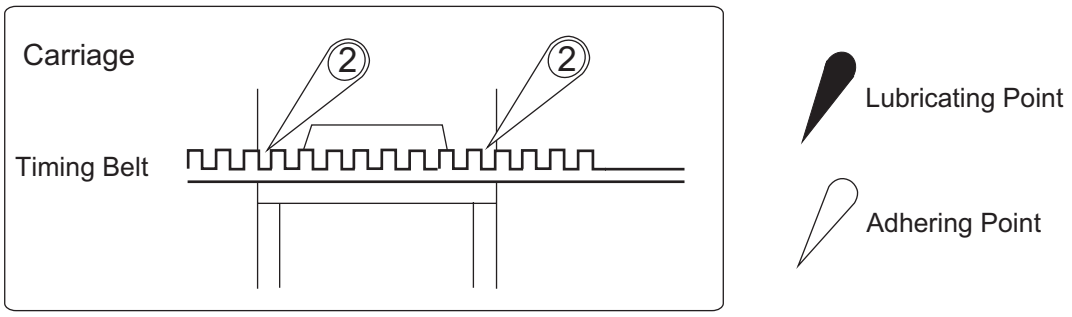


Figure 6-2. Lubricating / Adhering Points (2)

Appendix

A.1 Connector Summary

This section describes the interconnection of the main components and connector pin assignment. Figure A-1 shows the interconnection of the main components.

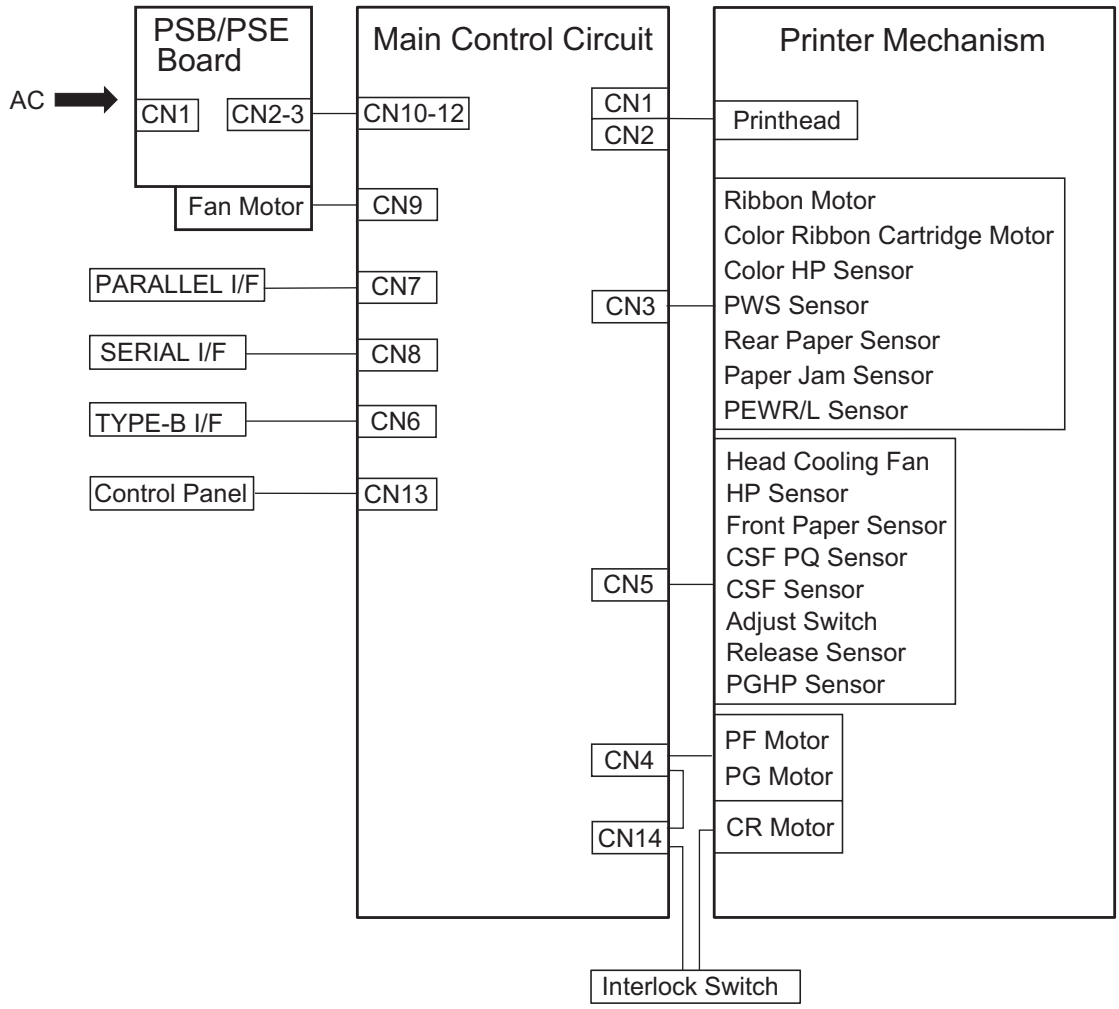


Figure A-1. Interconnection of the Main Components

Table A-1. Connector Assignment for the Main Components

Board	CN No.	Pin No.	Description
C210 MAIN board	CN1	20	Connector for printhead
	CN2	20	Connector for printhead
	CN3	20	Connector for ribbon motor, color ribbon cartridge sensor, color HP sensor, PWS sensor, rear paper sensor, paper jam sensor, PEWR/L sensors
	CN4	18	Connector for CR motor, PF motor, PG motor
	CN5	26	Connector for head cooling fan, HP sensor, front paper sensor, CSF PQ sensor, CSF sensor, Adjust switch, Release sensor, PGHP sensor
	CN6	36	Connector for Type-B interface (See Chapter 1.)
	CN7	36	Connector for parallel interface (See Chapter 1.)
	CN8	7	Connector for serial interface (See Chapter 1.)
	CN9	2	Connector for the electrical circuit board cooling fan motor
	CN10	4	Connector for +5 VDC line
	CN11	6	Connector for +35 VDC line
	CN12	6	Connector for +35 VDC line
	CN13	10	Connector for control panel
	CN14	2	Connector for interlock switch (connected to the common series of the CR motor.)
Sub board	CN21 CN24	–	Printhead drive signal from CN1
	CN22 CN25	–	Printhead drive signal from CN2
	CN23 CN26	–	Ribbon motor drive signal, PEWL/R sensor signal, color ribbon cartridge sensor signal, color HP signal from CN3
	CN23 CN27	–	Rear paper sensor signal to CN3.
	CN23 CN28	–	Paper jam sensor signal to CN3
C124 PSB/PSE board	CN1	2	Connector for AC input
	CN2	10	Connector for DC output (+5 V, CH.B: +35 V)
	CN3	6	Connector for DC output (CH.A: +35 V)

Table A-2. Connector Pin Assignment (CN1)

Pin No.	I/O	Signal name	Description
1	O	HD15	Pin 15 signal
2	–	COM6/22	Pins 6/22 common
3	–	COM11	Pin11 common
4	–	COM3/19	Pins 3/19 common
5	O	HD23	Pin 23 signal
6	–	COM7/15	Pins 7/15 common
7	O	HD22	Pin 22signal
8	O	HD19	Pin 19 signal
9	O	HD9	Pin 9 signal
10	–	HD23	Pin 23 signal
11	O	HD11	Pin 11 signal
12	O	HD14	Pin 14 signal
13	–	COM10/18	Pins 10/18 common
14	–	COM2	Pin 2 common
15	O	HD6	Pin 6 signal
16	O	HD10	Pin 10 signal
17	O	HD2	Pin 2 signal
18	O	HD18	Pin 18 signal
19	O	HD7	Pin 7 signal
20	–	COM14	Pin 14 common

Table A-3. Connector Pin Assignment (CN2)

Pin No.	I/O	Signal name	Description
1	–	COM1/21	Pins 1/21 common
2	–	COM9/13	Pins 9/13 common
3	O	HD5	Pin 5 signal
4	O	HD13	Pin 13 signal
5	O	HD9	Pin 9 signal
6	O	HD17	Pin 17 signal
7	–	COM5/17	Pins 5/17 common
8	O	HD21	Pin 21 signal
9	O	HD20	Pin 20 signal
10	–	COM12/16	Pins 12/16 common
11	–	COM4/24	Pins 4/24 common
12	O	HD12	Pin 12 signal
13	O	HD1	Pin 1 signal
14	O	HD24	Pin 24 signal
15	–	COM8/20	Pins 8/20 common
16	O	HD16	Pin 16 signal
17	O	HD4	Pin 4 signal
18	O	HD8	Pin 8 signal
19	I	TEMP	Thermistor signal
20	I	TEMP	Thermistor signal

Table A-4. Connector Pin Assignment (CN3)

Pin No.	I/O	Signal name	Description
1	–	+5V	+5VDC line
2	–	PEWCOM	PEW sensor common
3	I	CSHOME	CS HP sensor signal
4	–	GND	Ground
5	I	PEWR	Right PEW sensor signal
6	I	PEWL	Left PEW sensor signal
7	–	RFCOM	Ribbon motor common
8	O	RF-B	Ribbon motor phase /B drive signal
9	O	RF-A	Ribbon motor phase /A drive signal
10	O	RFB	Ribbon motor phase B drive signal
11	O	RFA	Ribbon motor phase A drive signal
12	–	GND	Ground
13	I	COLOR	Color ribbon cartridge sensor signal
14	–	NC	(Not connected.)
15	–	GND	Ground
16	I	PEREAR	Rear paper sensor signal
17	I	PJAM	Paper jam sensor signal
18	–	GND	Ground
19	–	+5V	+5 VDC line
20	–	NC	(Not connected.)

Table A-5. Connector Pin Assignment (CN4)

Pin No.	I/O	Signal name	Description
1	O	CRA	CR motor phase A drive signal
2	O	CR-A	CR motor phase /A drive signal
3	O	CRB	CR motor phase B drive signal
4	O	CR-B	CR motor phase /B drive signal
5	–	CRCOM	CR motor common
6	–	CRCOM	CR motor common
7	–	PGCOM	PG motor common
8	–	PGCOM	PG motor common
9	O	PGD	PG motor phase D drive signal
10	O	PGC	PG motor phase C drive signal
11	O	PGB	PG motor phase B drive signal
12	O	PGA	PG motor phase A drive signal
13	O	PFA	PF motor phase A drive signal
14	O	PF-A	PF motor phase /A drive signal
15	O	PFB	PF motor phase B drive signal
16	O	PF-B	PF motor phase /B drive signal
17	–	PFCOM	PF motor common
18	–	NC	(Not connected.)

Table A-6. Connector Pin Assignment (CN5)

Pin No.	I/O	Signal name	Description
1	–	CSFGND	Ground
2	I	CSF	CSF sensor signal
3	I	POS	CSF PQ sensor signal
4	–	CSFVCC	CSF power
5	–	PGENGND	PG encoder ground
6	I	PGENCA	PG encoder phase A signal
7	I	PGENCB	PG encoder phase B signal
8	–	PGENVCC	PG encoder power
9	I	PGW1	Adjust switch 1 signal
10	I	PGSW2	Adjust switch 2 signal
11	I	PGSW3	Adjust switch 3 signal
12	I	PGSW4	Adjust switch 4 signal
13	–	PGSWGND	Adjust switch ground
14	I	PEFRONT	Front paper sensor signal
15	–	PEFGND	Front paper sensor ground
16	–	PEFGND	Front paper sensor power
17	–	CRHPVCC	HP sensor power
18	I	CRHP	CR HP sensor signal
19	–	CRHPGND	CR HP sensor ground
20	I	RELEASE	Release sensor signal
21	–	RLSWGND	Release sensor ground
22	I	PGHP	PG HP sensor signal
23	–	PGHPGND	PG HP sensor ground
24	–	+35 VDC line	+35 VDC for head cooling fan
25	–	GP	Ground
26	–	NC	(Not connected.)

Table A-7. Connector Pin Assignment (CN9)

Pin No.	I/O	Signal name	Description
1	–	+35 VDC	+35 VDC for electrical board cooling fan
2	–	GP	Ground

Table A-8. Connector Pin Assignment (CN10)

Pin No.	I/O	Signal name	Description
1	–	GL	Ground
2	–	GL	Ground
3	–	+5 VDC	+5 VDC
4	–	+5 VDC	+5 VDC

A.2 Circuit Diagrams

Figure A-2. C210 MAIN Board Circuit Diagram (1/2)

Figure A-3. C210 MAIN Board Circuit Diagram (2/2)

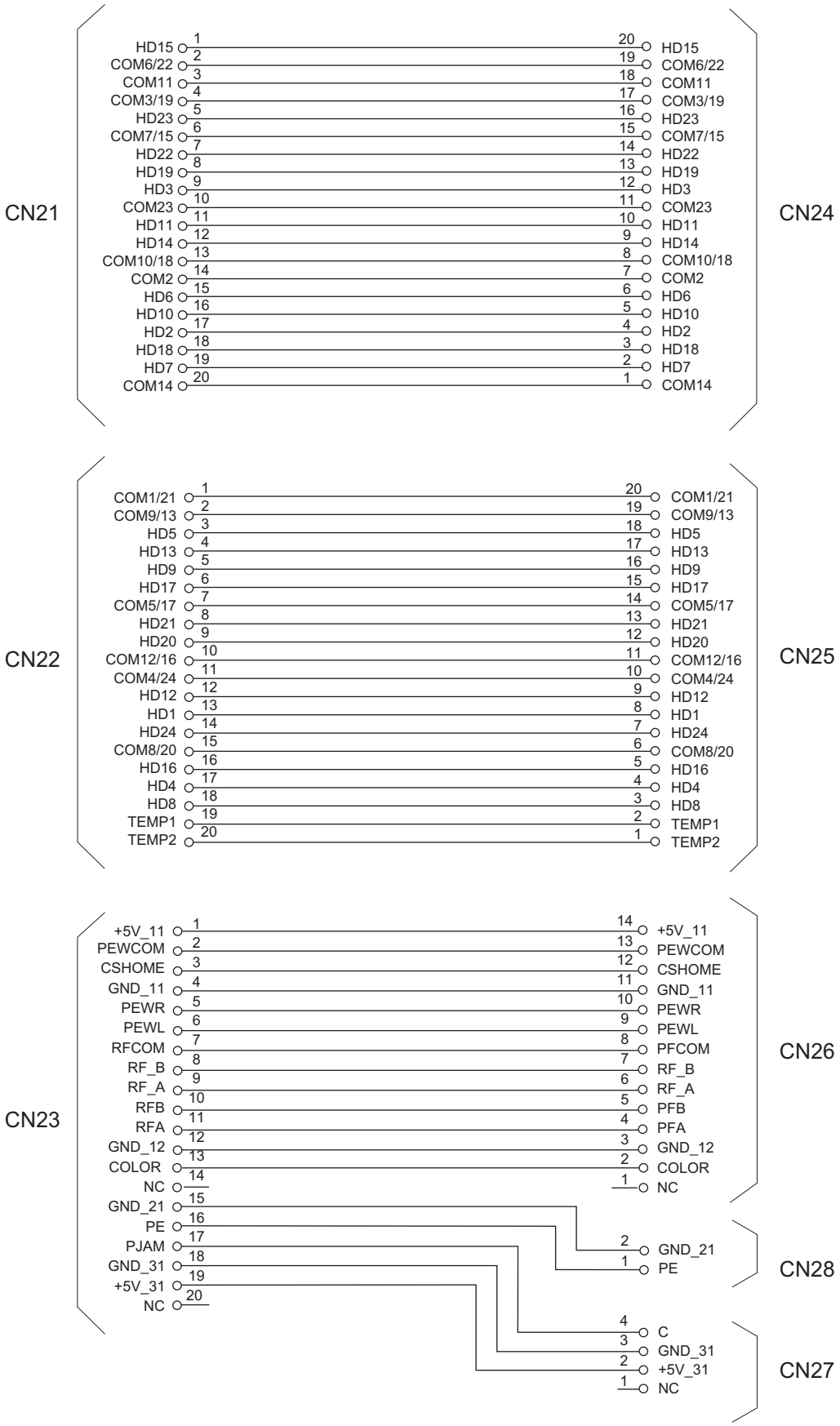


Figure A-4. Sub Board Circuit Diagram

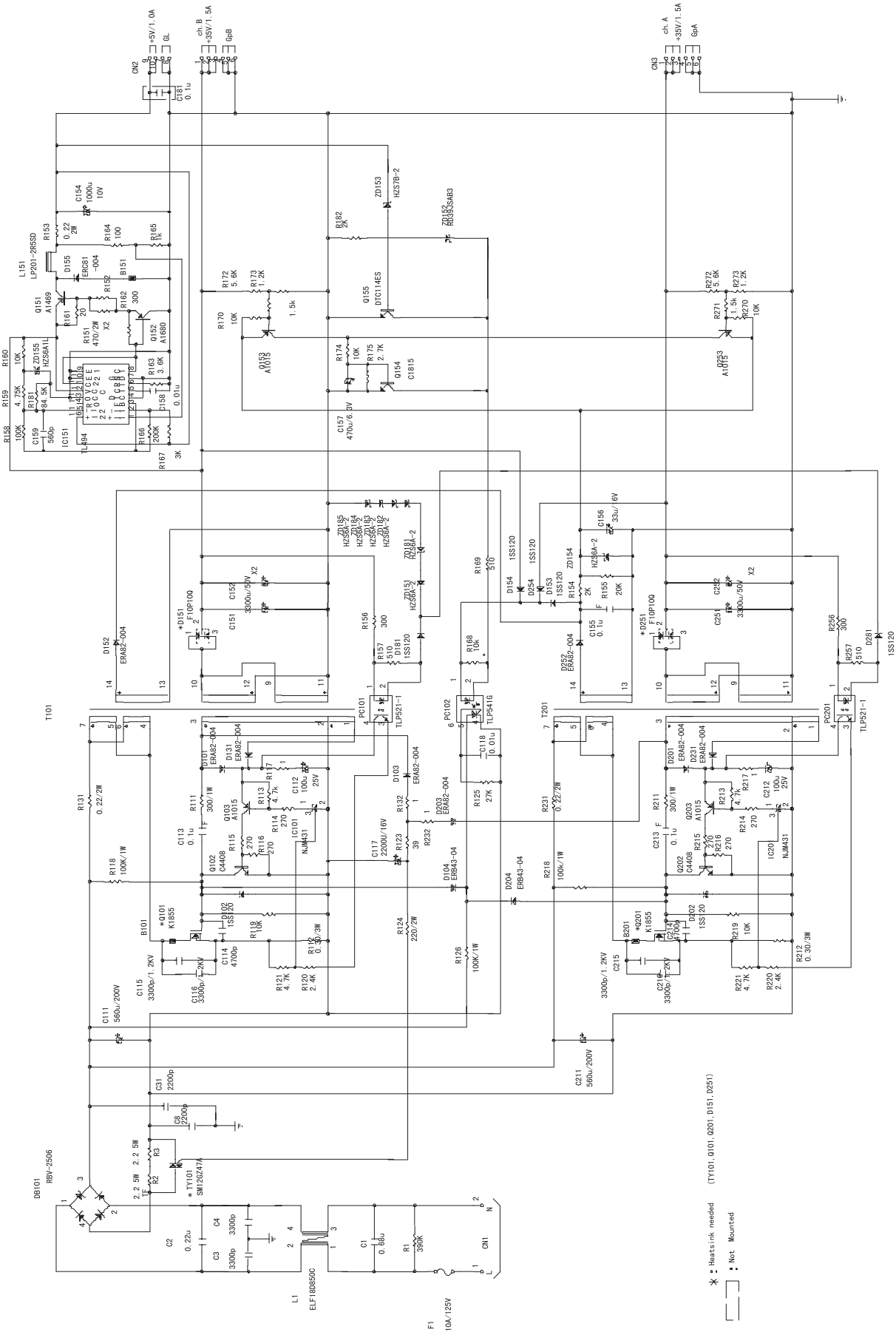


Figure A-5. C124 PSB Board Circuit Diagram

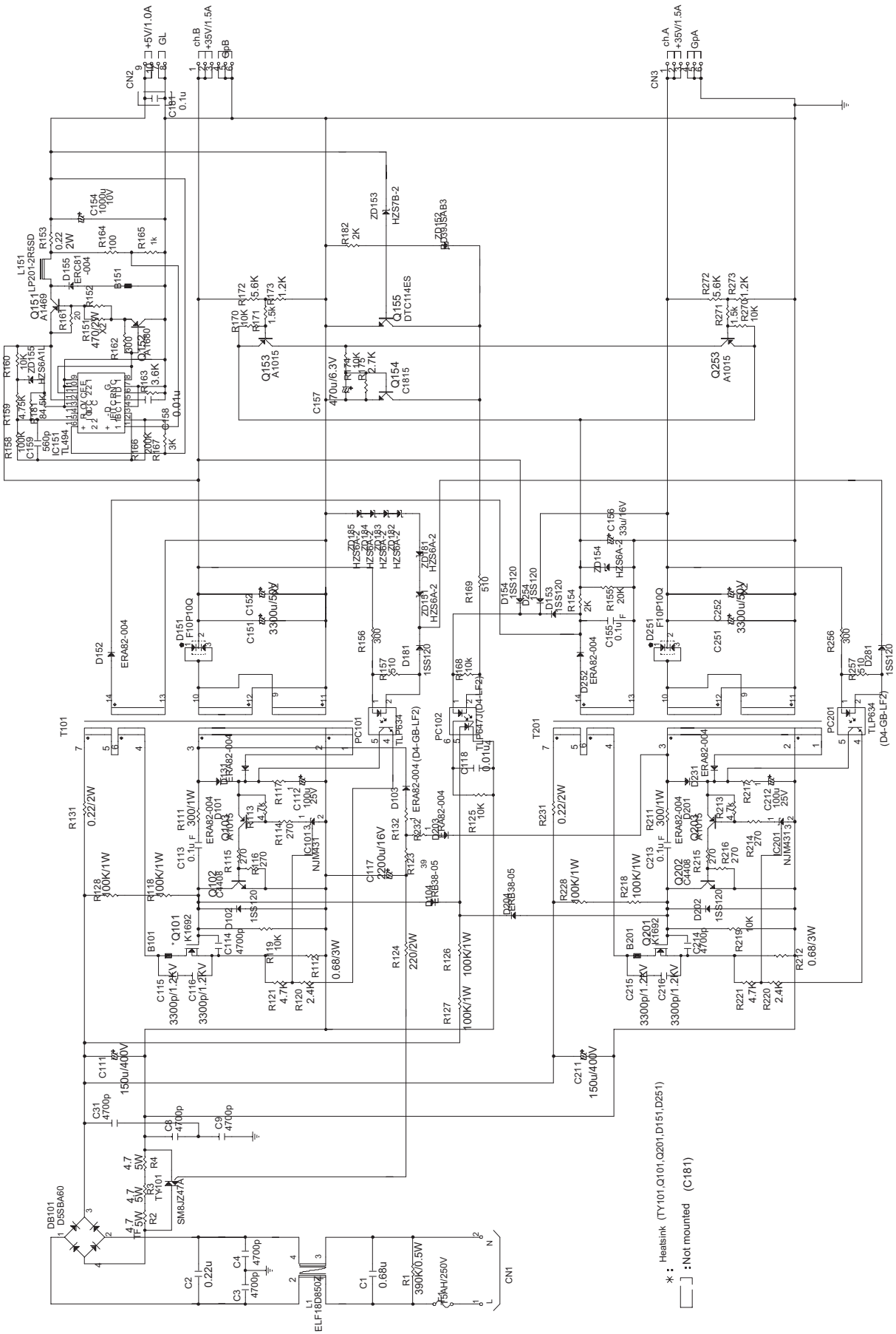


Figure A-6. C124 PSE Board Circuit Diagram

A.3 Circuit Board Component Layout

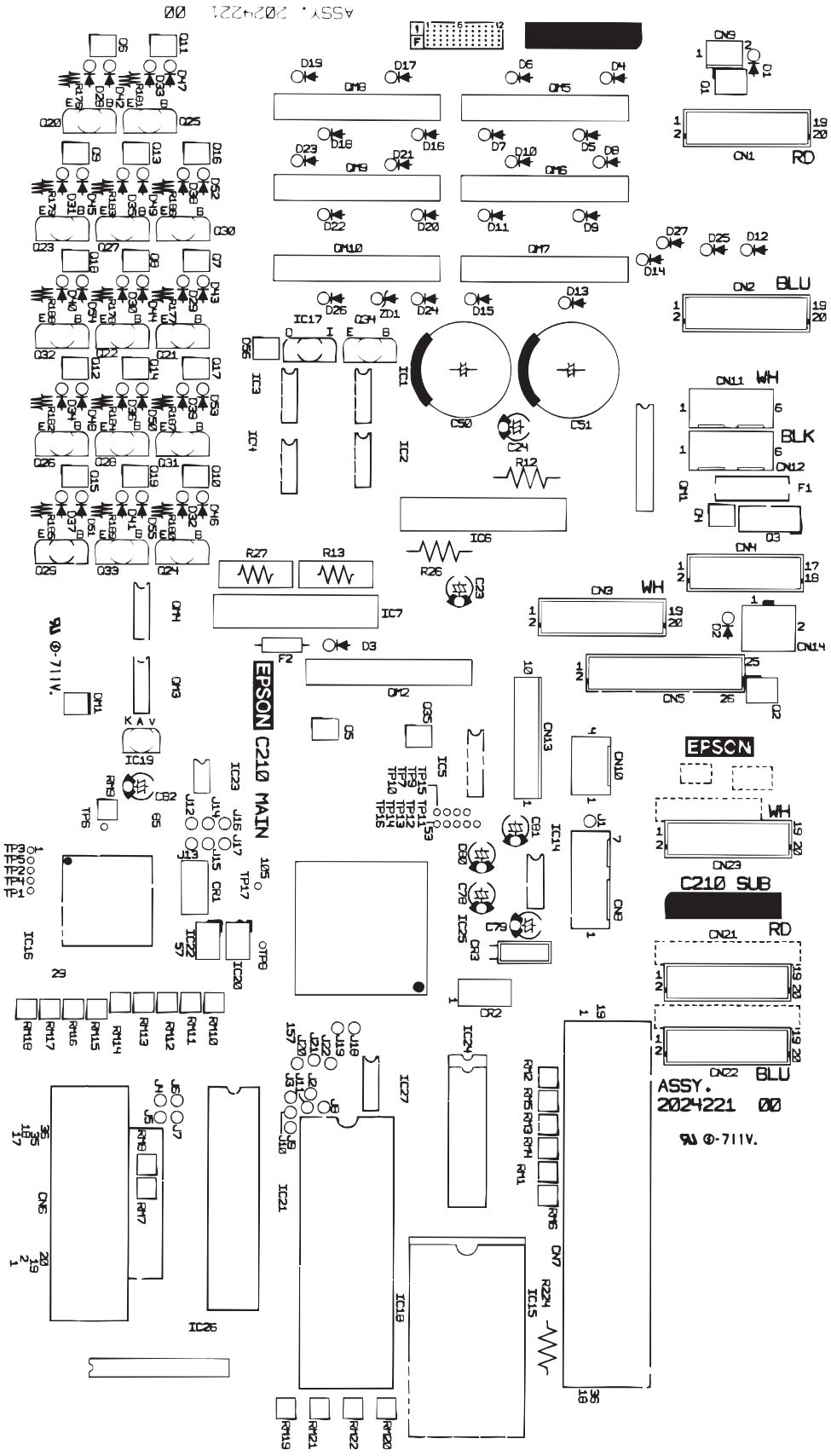


Figure A-7. C210 MAIN Board Component Layout (1/2)

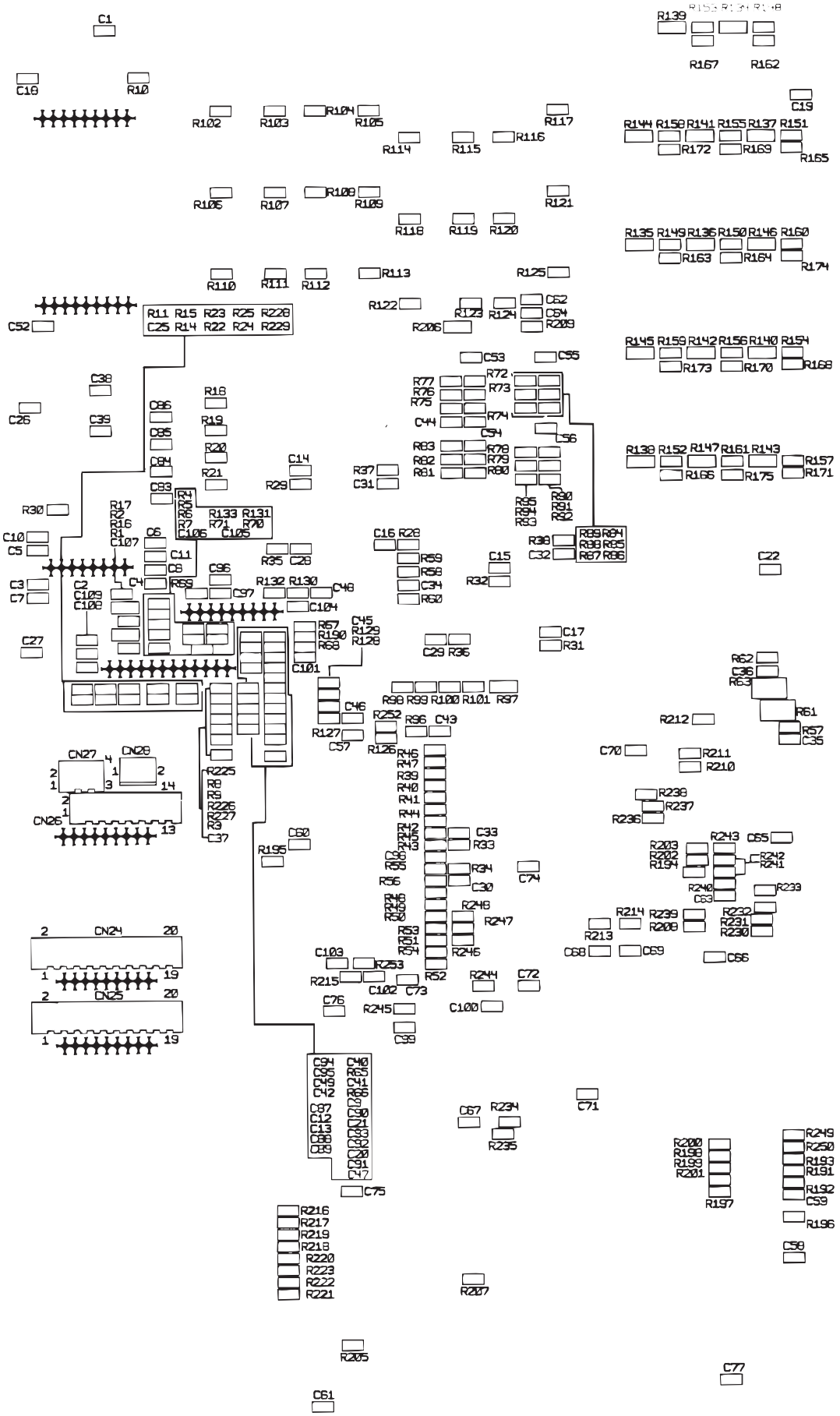


Figure A-8. C210 MAIN Board Component Layout (2/2)

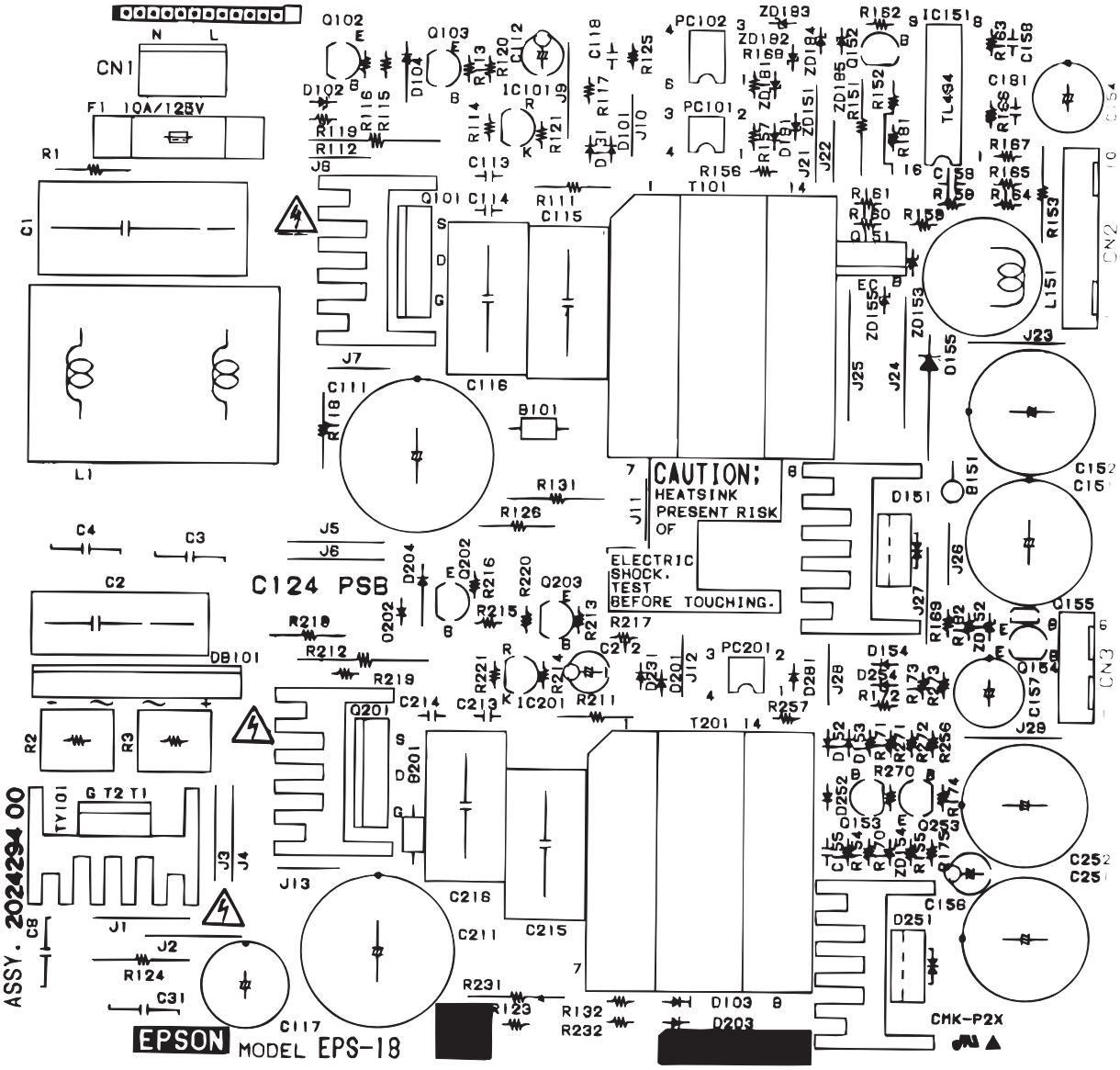


Figure A-9. C124 PSB Board Component Layout

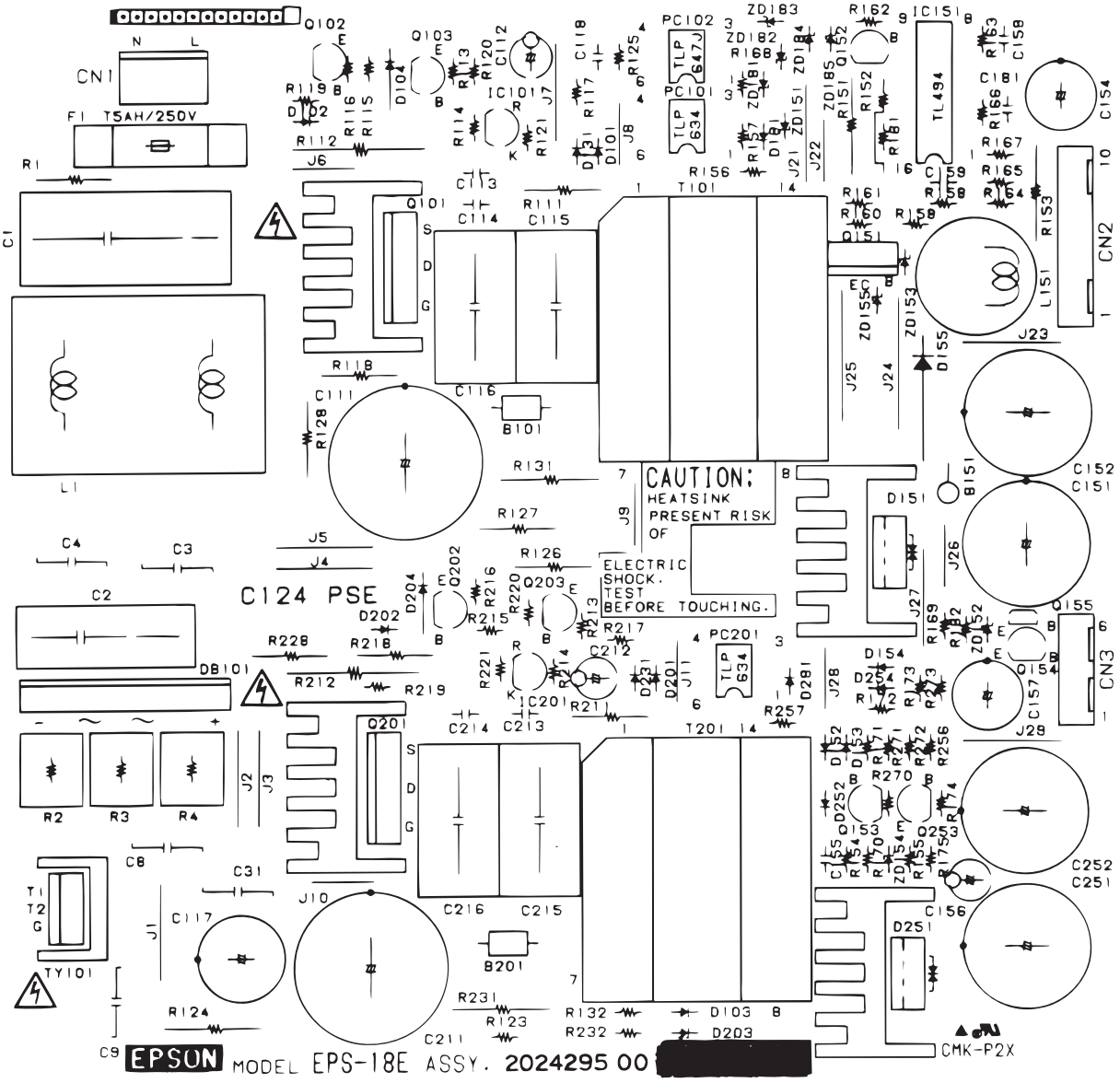


Figure A-10. C124 PSE Board Component Layout

A.4 Exploded Diagram

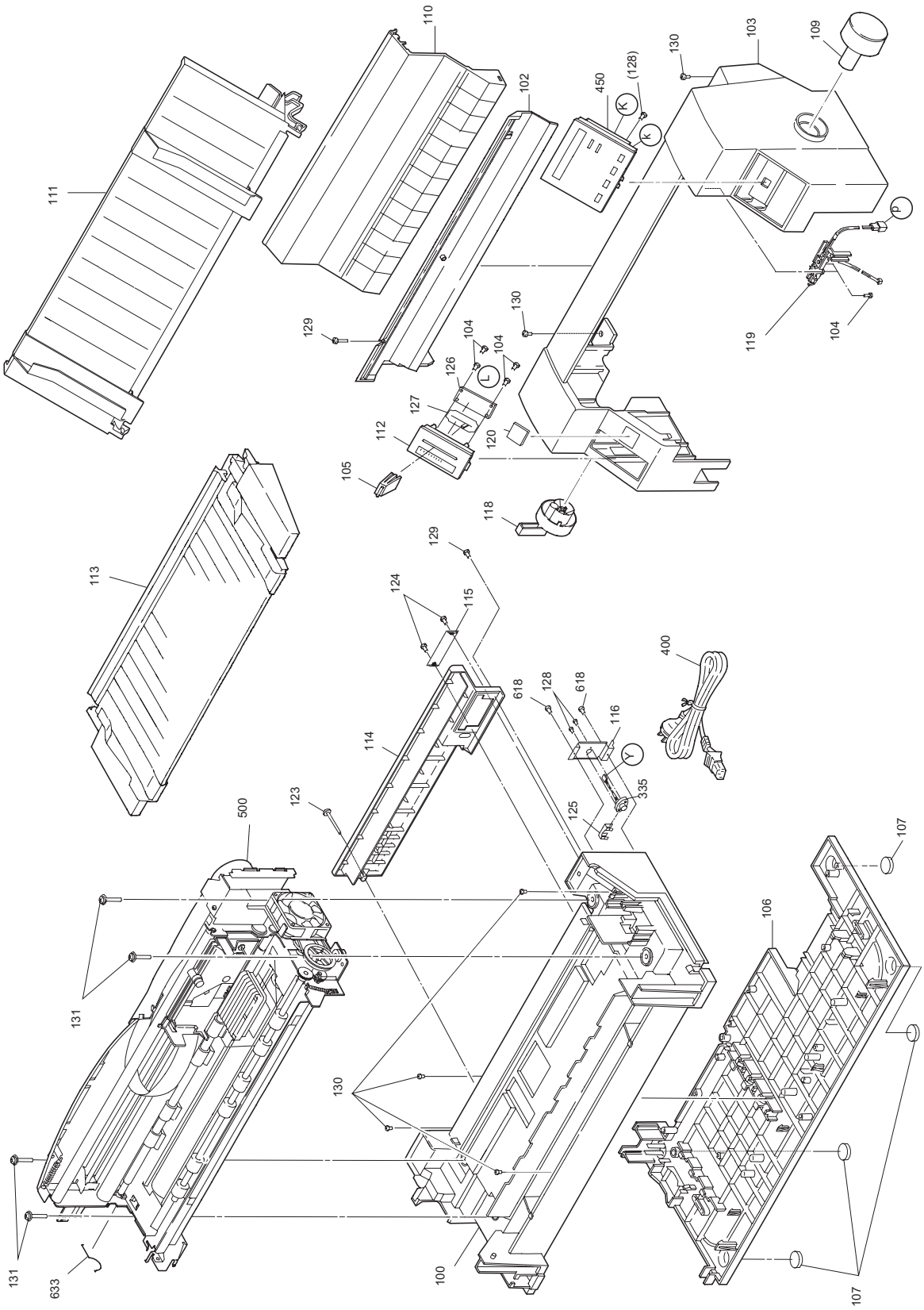


Figure A-11. Exploded Diagram (1)

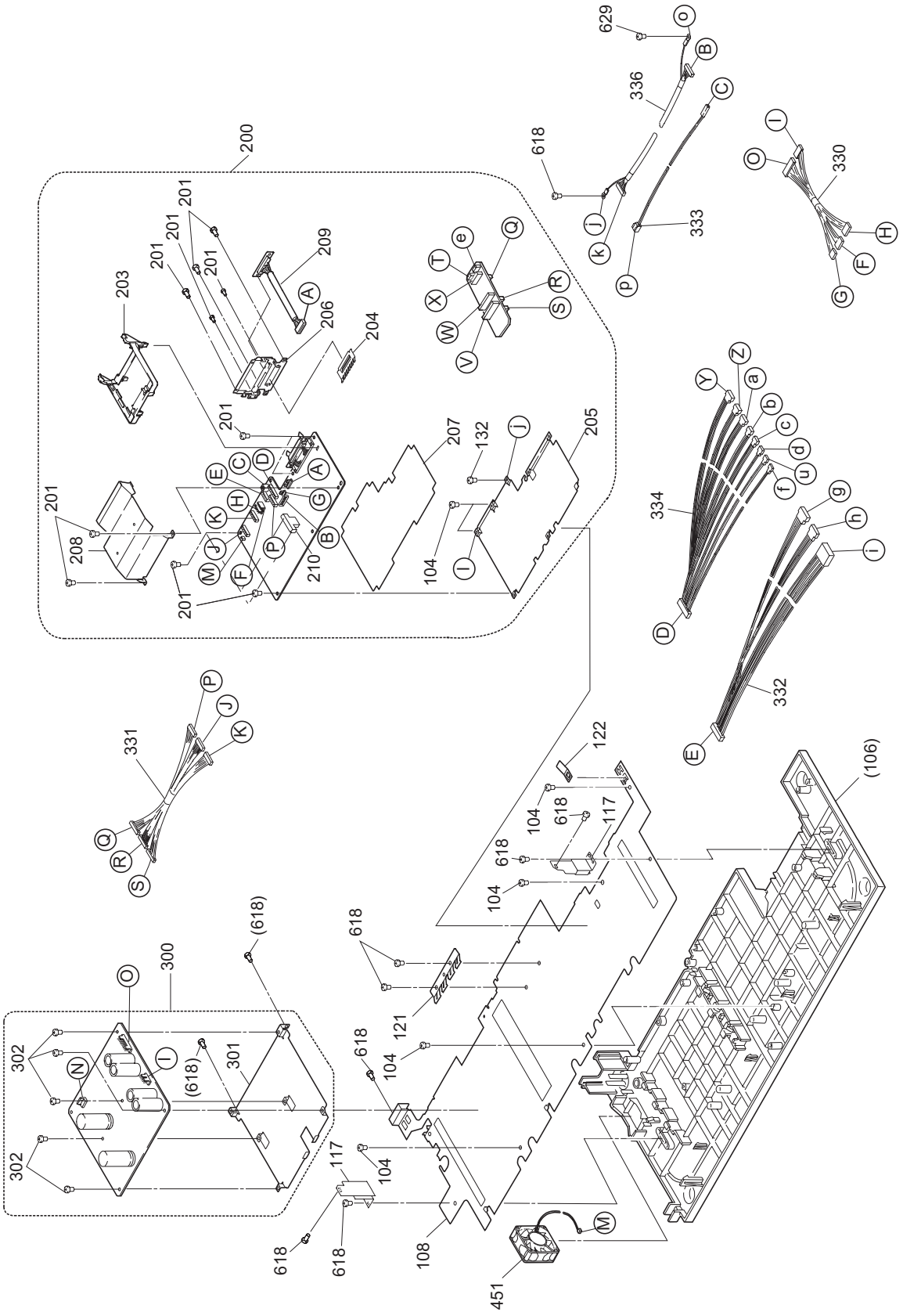


Figure A-12. Exploded Diagram (2)

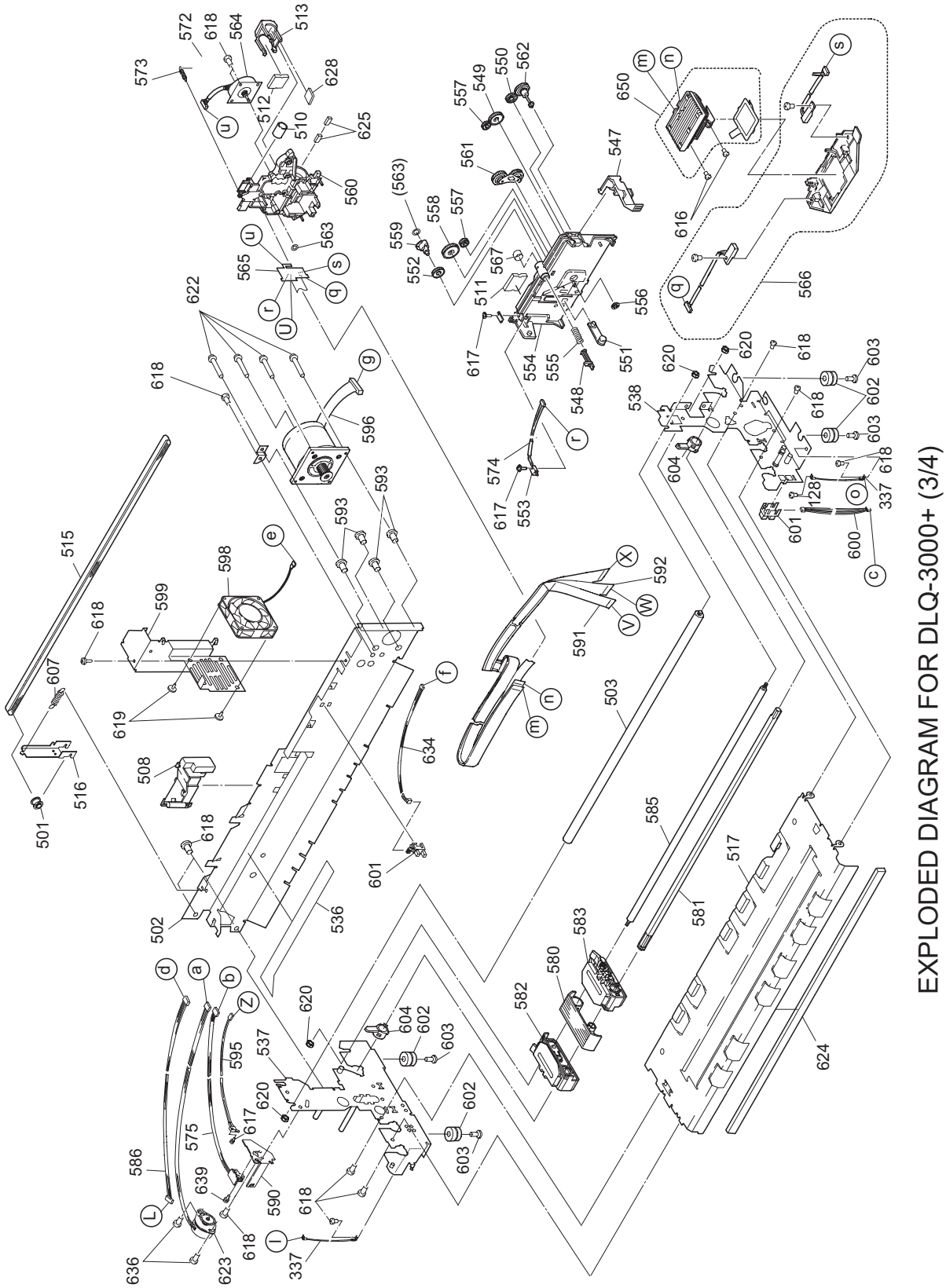


Figure A-13. Exploded Diagram (3)

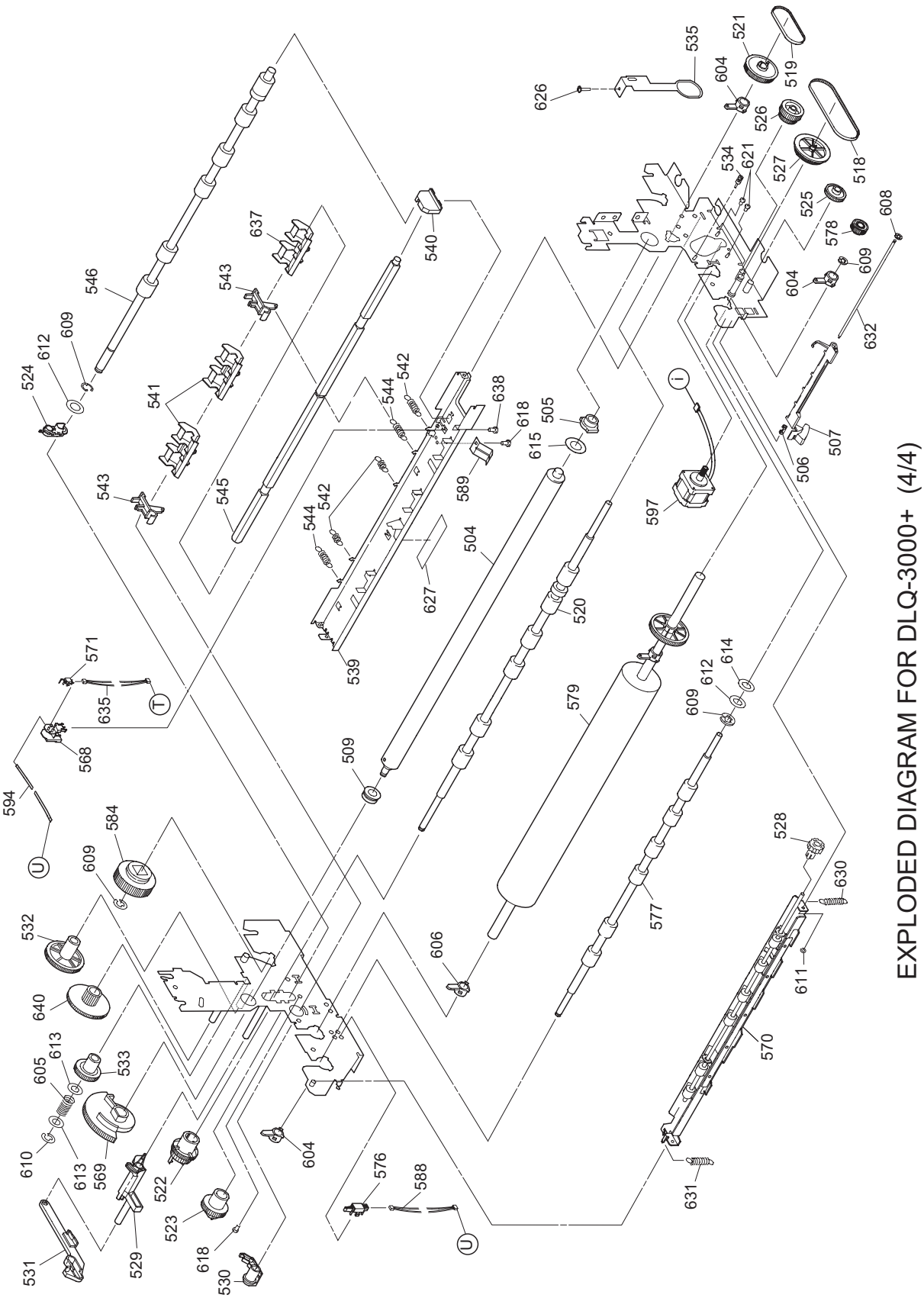


Figure A-14. Exploded Diagram (4)

A.5 Dimensions and Weight

- Physical dimensions (W x H x D): 678 mm x 285 mm x 509 mm (26.7” x 11.2” x 20.0”) (without CSF)
- Weight (without CSF): 16.1 Kg (35.5 lb.)

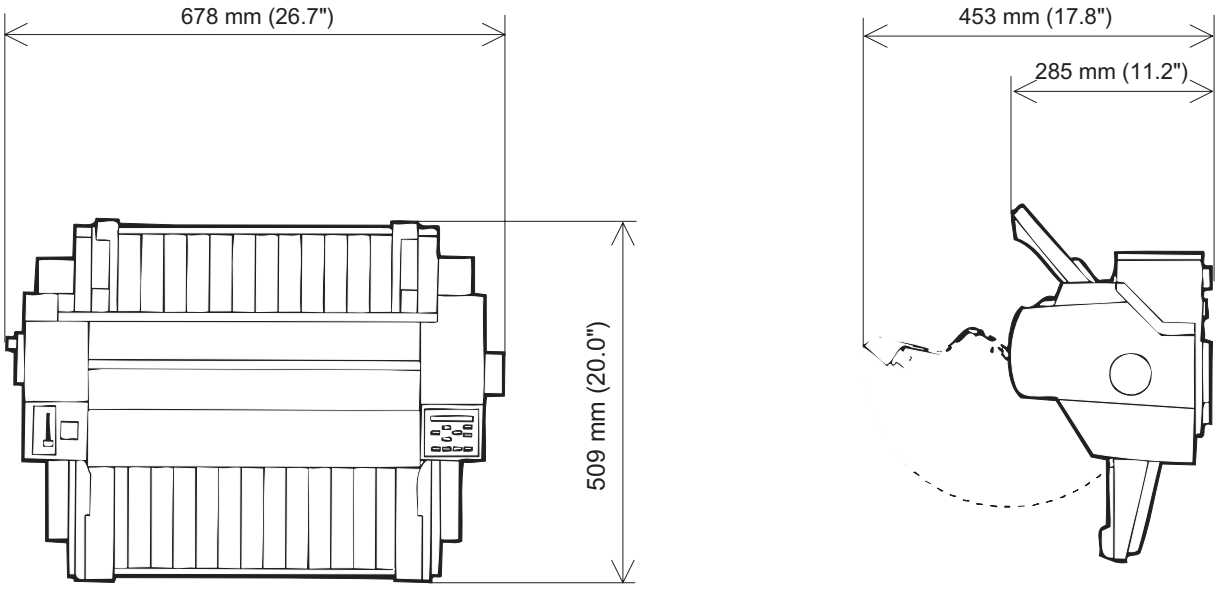


Figure A-15. Physical Dimensions and Weight of DLQ-3000+

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