DL7400
DOT MATRIX PRINTER
MAINTENANCE MANUAL

FUJITSU ISOTEC LIMITED

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PREFACE

This manual is for engineers who operate, install, or maintain the DL7400 printer, and covers:

Chapter 1: Printer specifications, performance, and configuration

Chapter 2: Unpacking, performance check, and connection

Chapter 3: Troubleshooting

Chapter 4: Maintenance

Chapter 5: Principles of operation

Chapter 6: Recommended spare parts

CONTENTS

CHAPTER 1   PRINTER SPECIFICATIONS, PERFORMANCE, AND CONFIGURATION

1.1 Overview

This manual is for maintenance engineers, and covers overall DL7400 printer maintenance, together with detailed information such as troubleshooting and component replacement.

Recommended references are:

    DL7400 Printer Parts Catalogue   (P3KA02038-B001/E)
    DL7400 Printer Schematic Diagrams   (C1KA02038-B001/E)

These three manuals contain all information needed for DL7400 maintenance. This manual covers all models.

The maintenance manual is described by the premise that understands the user's manual.
Please also refer to the following manual if needed.

    DL7400 Printer USER'S MANUAL   (C147-E051-01EN)
    DL7400 Printer Product Description   (A1KA02038-B001/E)

The DL7400 printer has a reliable, simple mechanism requires little maintenance.

1.2 Equipment Structure

1.2.1 Overview

This section outlines printer structure and features.

1.2.2 Model configuration

The DL7400 is a 136-column printer.

Factory options are as follows

    Power Supply type;   100-120VAC input (M33324A)
                         220-240VAC input (M33324B)

    Interface type; Centronics parallel + USB interfaces
                       Centronics parallel + RS232C serial interface

Add-on options are as follows.

    Cut sheet feeder. (The SF940 single-bin feeder)
    Tractor unit. (for a second tractor).
    LAN card. (only for the Centronics parallel + USB interfaces Models.)
    Large paper table.
    Large stacker.

The DL7400 has three emulations as follows.
    Fujitsu DPL24C PLUS
    IBM Proprinter XL24E
    Epson ESC/P2

1.2.3 Structure

Major printer components are organized as shown below. Items in boldface are recommended spare parts (see Chapter 6) that can be replaced in field by maintenance service engineers. Replacement and adjustment are detailed in Chapter 4.

```
DL7400 printer
    ├── LAN CARD
    ├── Cut-sheet feeder
    ├── Tractor unit
    ├── Paper Table assembly
    ├── Stacker plate
    ├── Stacker Unit
    ├── Ribbon cartridge
    └── Print Head
```

Components that operator can install and remove.

```
    ├── Operating panel
    ├── Front Cover assembly
    ├── Upper Cover assembly
    ├── Mecha assembly ──┬── Inter Lock SW
    │                    ├── Carrier Unit ──┬── Carrier Cable
    │                    │                  ├── L/RES sensor
    │                    │                  ├── Tof L/R sensor
    │                    │                  └── Aptc sensor
    │                    ├── Frame
    │                    ├── SP motor
    │                    ├── LF motor
    │                    ├── TR motor
    │                    ├── Connector Board ──┬── APTC motor
    │                    │                     ├── APTCHP SW
    │                    │                     ├── HCPP motor
    │                    │                     ├── HCPPHP SW
    │                    │                     ├── PS Sensors
    │                    │                     ├── FTRPE Sensors
    │                    │                     └── RTRPE Sensors
    │                    ├── Nip Roller assembly
    │                    ├── Dv Roller assembly
    │                    └── Platen Roller assembly
    ├── ROM board
    ├── Power supply
    ├── Reactor
    ├── AC SWITCH assembly
    ├── AC INLET assembly
    └── Lower cover assembly
```

Figure 1.1 Structure of DL7400

Block diagrams
The following figure shows printer functional components and connecting cables.
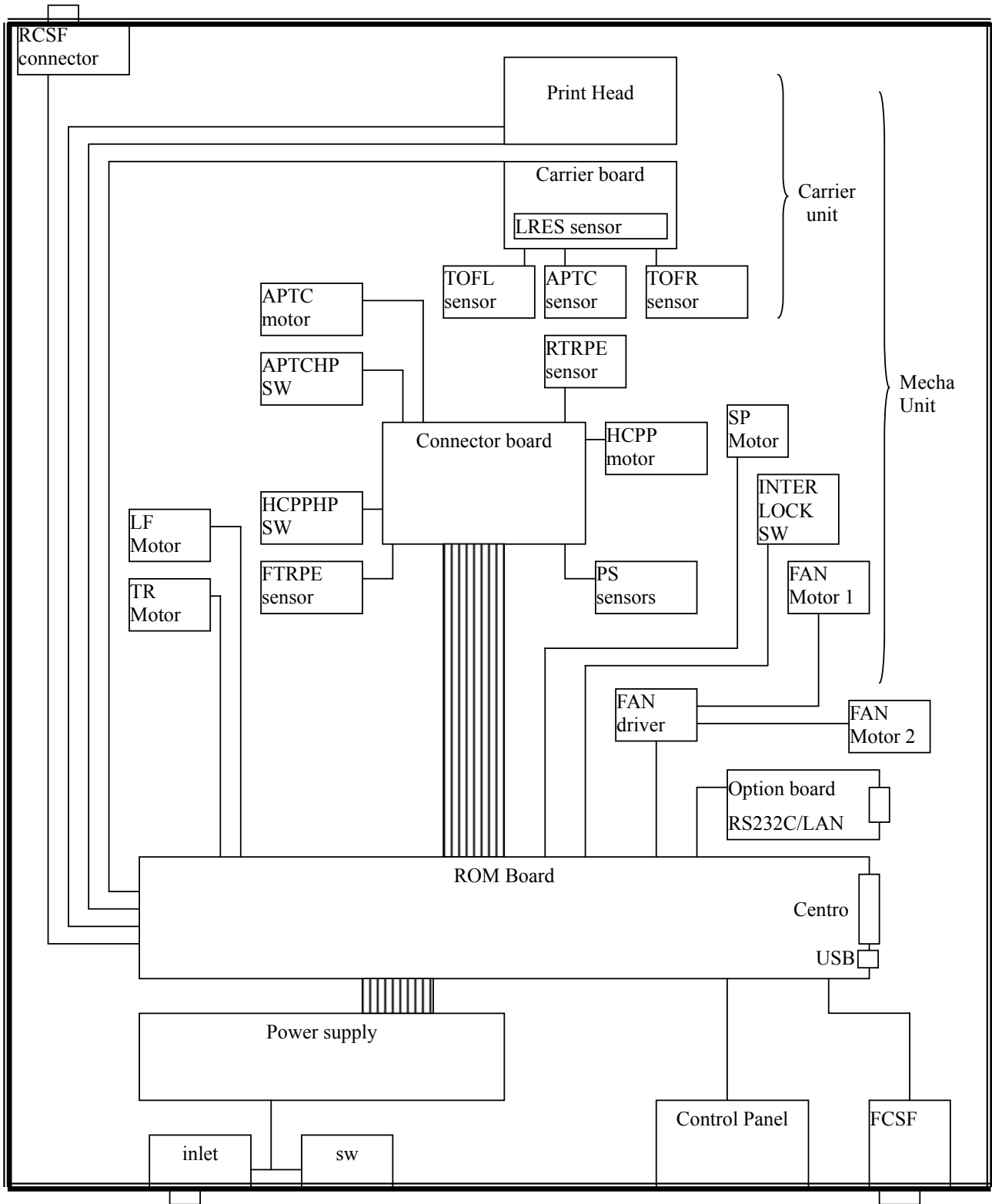
Figure 1.2 Block Diagram of DL7400

(1)Exterior components

This section gives information on exterior components of the printer: covers, removable mechanism units,etc.

Front cover

Print head

Control panel

Paper guide

Power switch

Interface connector

Paper table

Tractor unit

Sub guide

Front CSF connector

Rear stacker

Power connector

Rear CSF connector
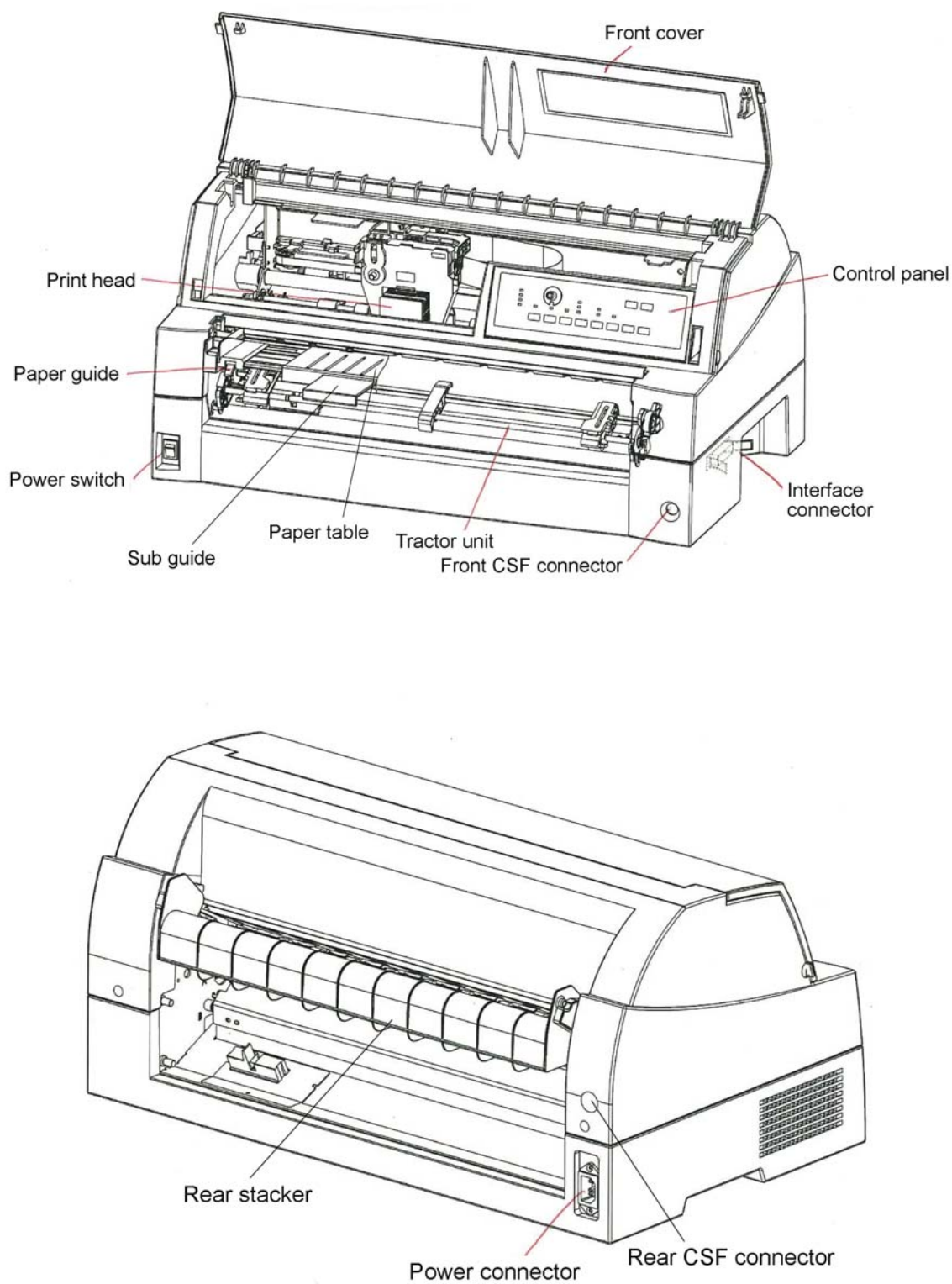
Figure 1.3 Exterior components of DL7400

a. Interface Connector
   The interface cable connector is on the right side of the printer, as seen from the front of the upper cover, so
   the interface cable does not interfere with the paper feed path.
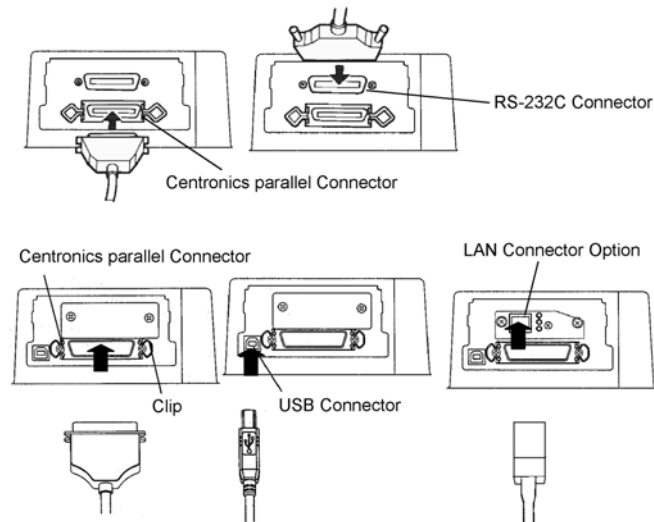
Figure 1.4 Interface type of DL7400

b. Front cover
   The front cover is opened to replace the ribbon cartridge.
   There is an Interlock SW for safety.

c. Paper table
   The paper table guides a cut sheet manually fed by the user. The optional Large Paper Table is necessary to use
   cut sheets exceeding 297 mm in length

d. Rear stacker
   The rear stacker holds printed cut sheets. The optional Large Stacker is necessary to use cut sheets exceeding
   297 mm in length

e. Control panel
   The control panel consists of an LSI, ten push-button switches, one dial, thirteen LEDs, and a buzzer.
   The switches are used for operations such as loading and feeding paper and controlling printing pressure. Some
   switches are also used in setup mode. The LEDs indicate printer basic statuses and paper feed path conditions.
   The buzzer sounds to indicate certain operating and printer statuses.
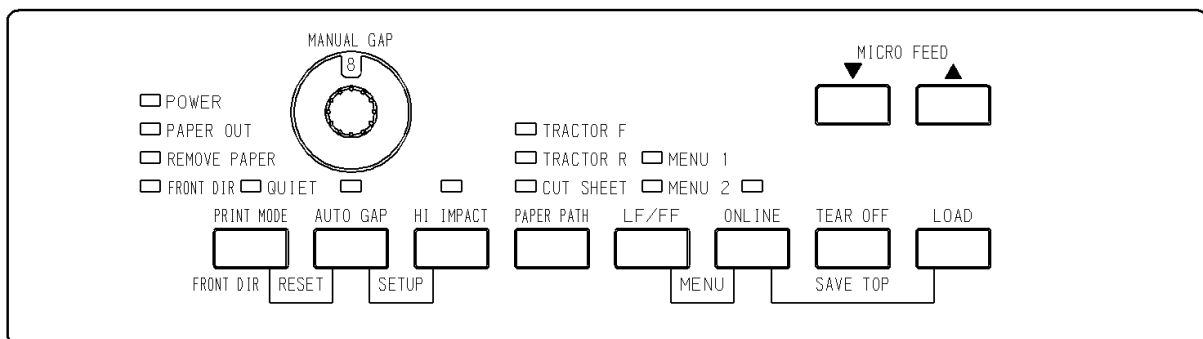
Figure 1.5 Control panel of DL7400

(2)Printing mechanism

Stay shaft

Carriage

Ribbon cartridge

Print head

Stepping motor for
carriage drive mechanism

HCPP motor

APTC mechanism

Paper feed mechanism
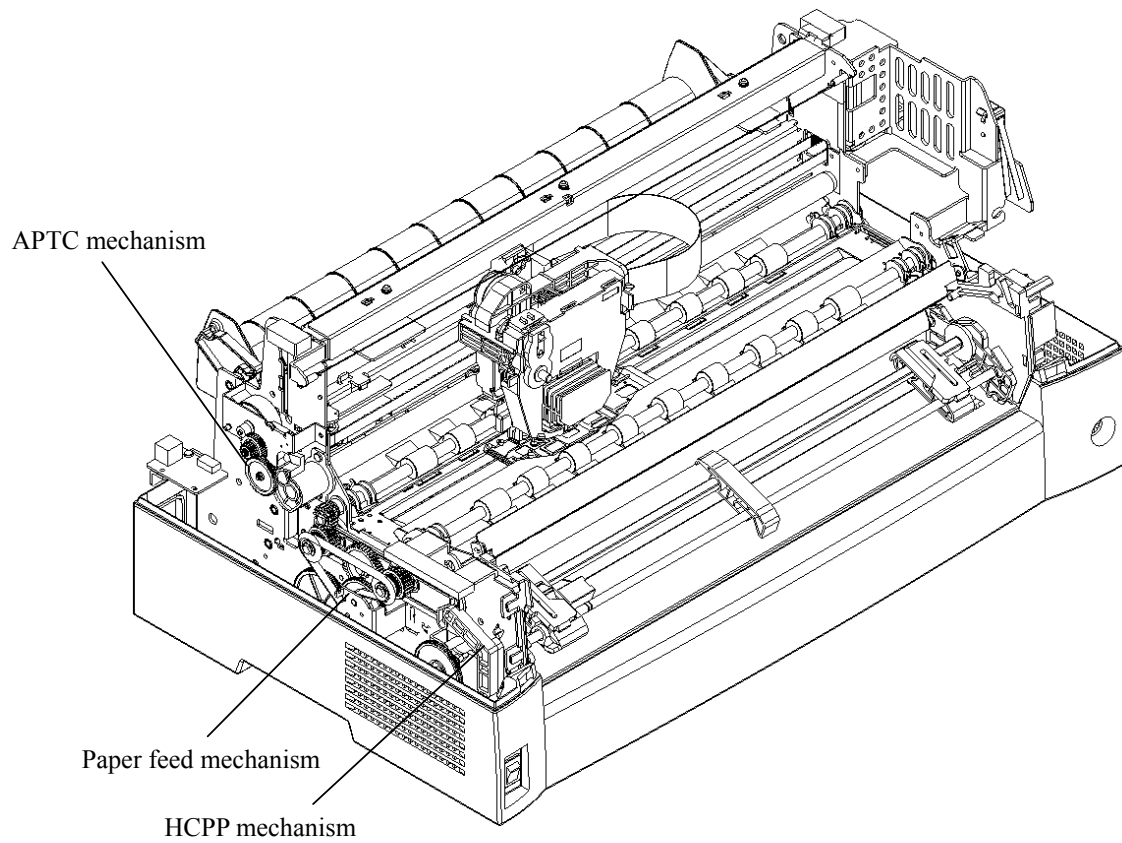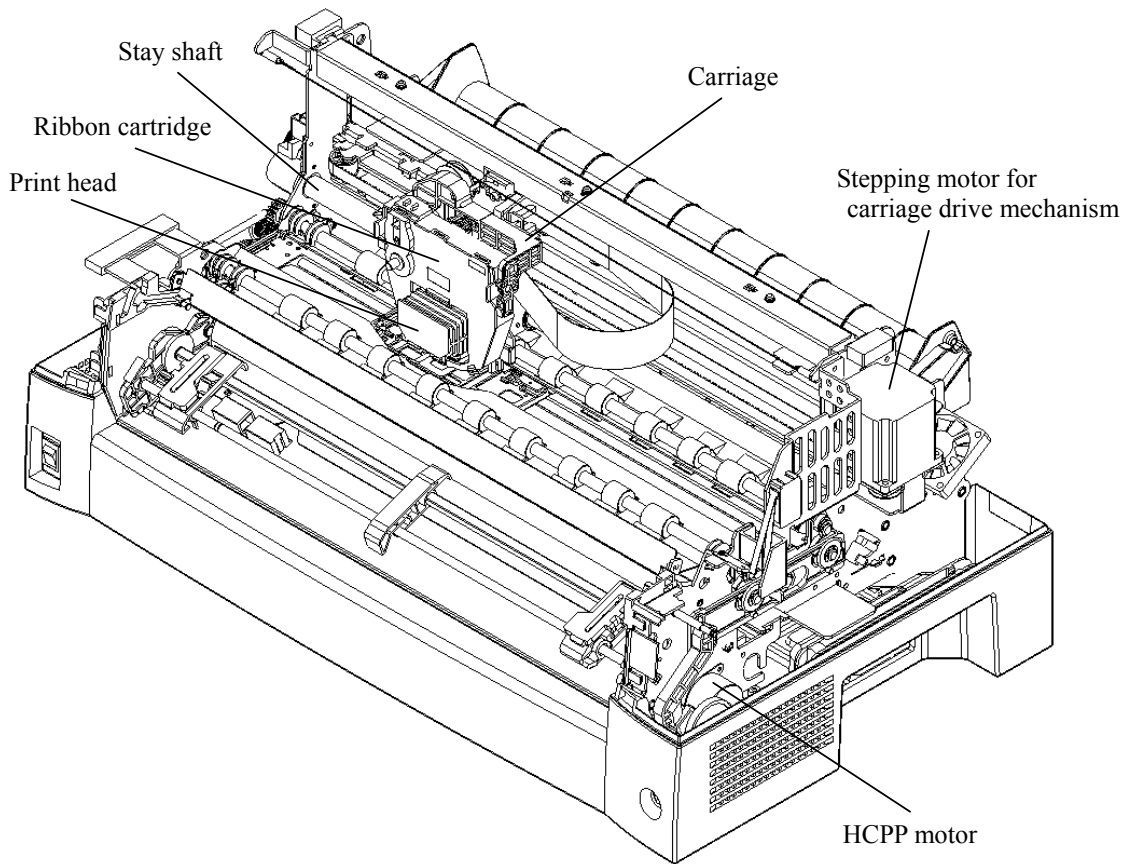
HCPP mechanism

Figure 1.6 Mechanism of DL7400

The printing mechanism fit into the bottom cover. And Upper Cover holds it in position.

a. Carriage
   The carriage supports the removable 24-wire print head and the ribbon cartridge, and slides left and right on the stay shaft. The ribbon feed gear system moves the ribbon in one direction regardless of carriage movement. It has four sensors: LRES, TOFL, TOFR and APTC sensor. The LRES detects both left and right ends of the carriage movement. The TOFL/R detects the edge (top, left, right, bottom) of paper. The APTC sensor detects the surface of paper for control the gap between the print head and the paper.

b. Carriage drive mechanism
   The stay shaft and the stay guide (upper angle) support the carriage; the stepping motor and timing belt move the carriage horizontally.

c. Paper feed mechanism
   There are two stepping motors. One of them drives the rollers and another one drives tractors.

d. Host-controlled paper path (HCPP) mechanism
   The HCPP mechanism switches power transmission to the tractors. Three states are possible: front tractor is selected, rear tractor is selected, and cut sheet is selected. Switching is possible through software or by the control panel. The paper on the platen is unloaded to the park position or ejected, and then the paper feed path is switched. When switching from a cut sheet to continuous forms, the continuous forms are automatically loaded to the print position.

e. Automatic paper thickness control (APTC) mechanism
   The APTC mechanism adjusts the gap between the print head and the paper surface. Before start printing, the print head is approach to the platen until APTC sensor is pressed against the paper surface. And then the print head is returned by a certain distance so that the gap (actually between the print head and the paper) is properly adjusted regardless of the paper thickness.

f. Paper sensors
   There are six paper sensors for controlling paper feeding:

Name	Function	Sensor type
TOFL TOFR	Detect the top edge for paper loading -TOFL is for front loading -TOFR is for rear loading Detect left and right edge for area over control -TOFL is for left and right edge (small width paper) -TOFR is for right edge (large width paper) (Right and left are reversed for rear feed) Detect the bottom edge for detecting paper end. -TOFL is for front loading -TOFR is for rear loading	Photo reflectors
FTRPE RTRPE	Detect the continuous forms at the tractor for as follows. -Control the paper loading sequence. -Detect the paper parking position. -Detect the near paper end of continuous forms.	Photo interrupter
PSS	Detect the cut sheet on the paper table for auto loading. Detect the bottom of the cut sheet for control carriage position to detect the paper end . Detect the leaved paper on the paper table for display remove paper indicator.	Photo reflectors
APTC	Detect the surface of the paper for control the print head gap.	Panel Key Board

(3) Lower cover
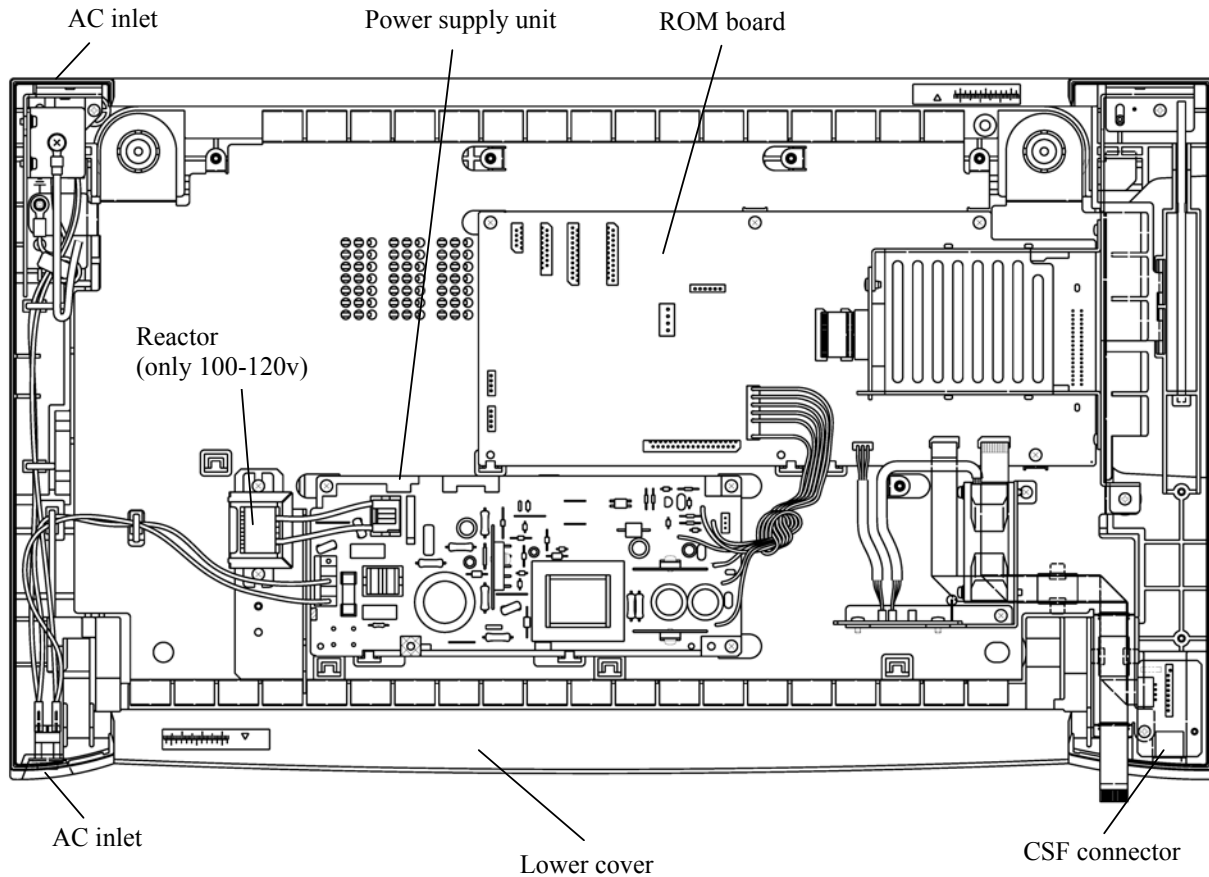
Figure 1.7 Electric components of DL7400

a. Lower cover
  The Lower cover supports the printer mechanism and electric units as follows.

b. ROM board (control board with flash ROM)
  The ROM board controls the host interface, control panel, and printing mechanism using an MPU and an
  LSI circuit. Memory holds the resident character patterns and firmware, including resident emulation programs.
  This board also has drivers and receivers for other components. The sensor receivers convert signals from the
  sensors. The drivers supply power to motors, print head wires, and other components. The separate RS-232C
  serial board or LAN relay board is connected to this board through the cable.

c. Power supply unit
  The power supply unit supplies DC34V and DC5V by one transformer.

d. AC inlet and AC switch.
  The AC inlet has protective earth cable. In order to prevent an electric shock, it must be fixed to frame ground.
  The AC switch has cables to connect the Power supply unit and AC inlet.

e. CSF connector (front CSF)
  The connector board for the front CSF is mounted at the front right of the lower over.

(4) Option and consumables

a. Cut-sheet feeders
  A cut-sheet feeder allows both single-part cut sheets and multi-part cut sheets to be fed automatically.
  The SF94 single-bin feeder is available for DL7400.

b. Tractor unit
  An additional tractor unit can be installed in the printer. Because the standard tractor unit is installed at the front of the printer at shipment, the additional tractor is installed at the rear of the printer. However, both tractor units are the same, and installable at either position.

c. LAN card.
  A LAN card is available as a printer add-on option. A user installable function, the LAN card can be installed only on printer models with the Centronics parallel + USB interfaces.

c. Large paper table
  The large paper table helps to increase operability when large cut sheets are used.
  Also, sheets that are output from the front are easier to keep properly organized.

d. Large stacker.
  The large stacker accommodates sheets output from the rear.   It is used in continuous printing with a cut sheet feeder.

e. Print head
  The 24-wire print head is easily installed on and removed from the print head carriage.

CHAPTER 2   UNPACKING, PERFORMANCE CHECK, AND CONNECTION

2.1 Overview

The DL7400 printer comes packed for transportation.

After unpacking and before installation, the printer must undergo self-test printing. Installation requires minimum time and expense.

2.2 Notes on Installation

For best results, note the following points when installing the paper:

Place the printer on a level, vibration-free surface.
Keep the printer away from sunlight and heaters.
Be sure printer ventilation ports are not blocked.
Do not operate the printer in a humid or dusty environment.
Use an outlet that is separated from noise-generating equipment such as motors.
Use the correct AC voltage unexpected problems.

2.3 Unpacking

Unpacking the printer as follows(Figure 2.1)
1. Open the carton and remove Rear stacker, Ribbon cartridge and Cushion L/R.
2. Lift up the printer using the grip at right and left of the printer.
3. Take out accessories (Power cord, Manual).
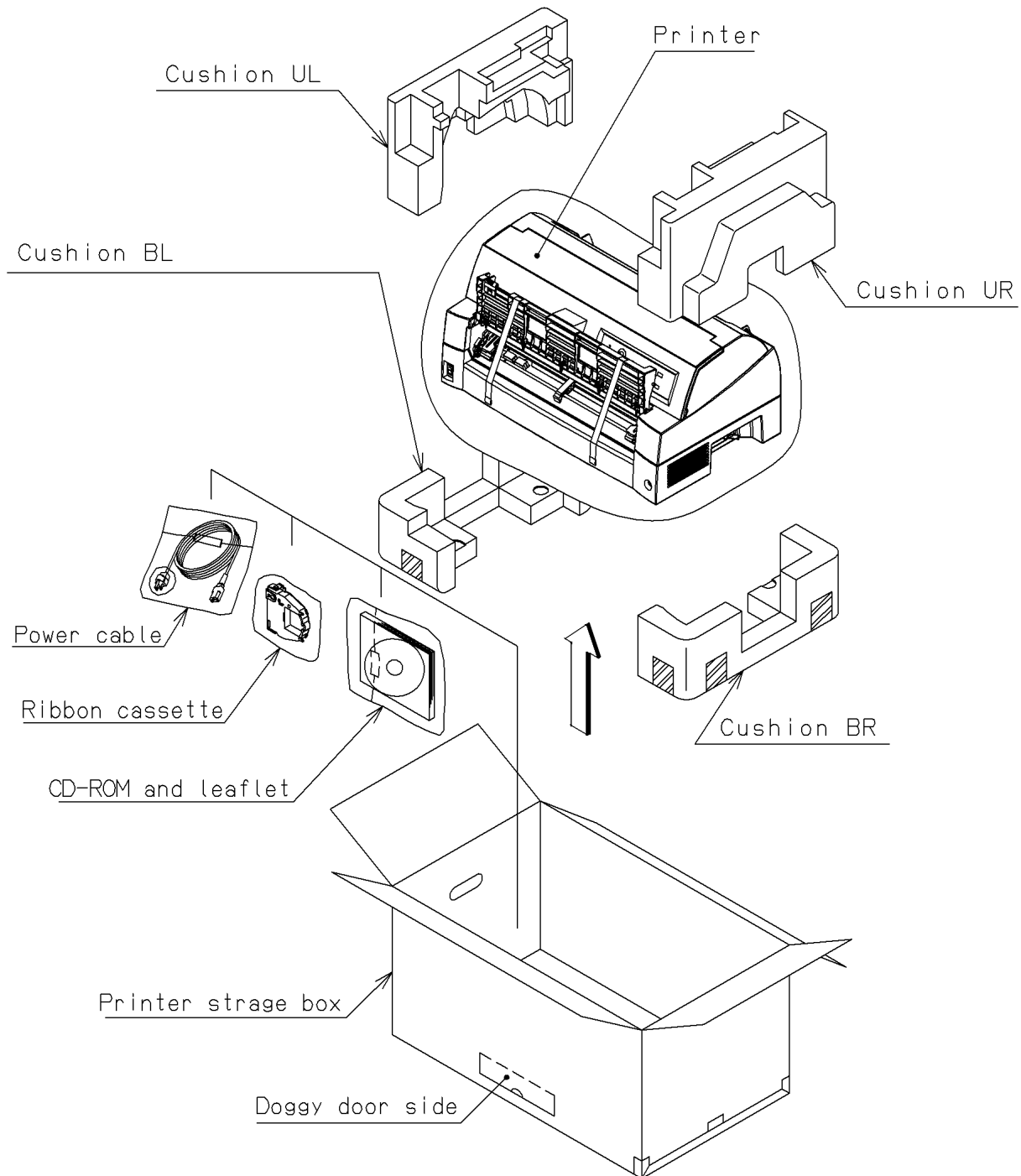
Figure 2.1 Unpacking the printer and accessories

4. Set the paper table as follows.
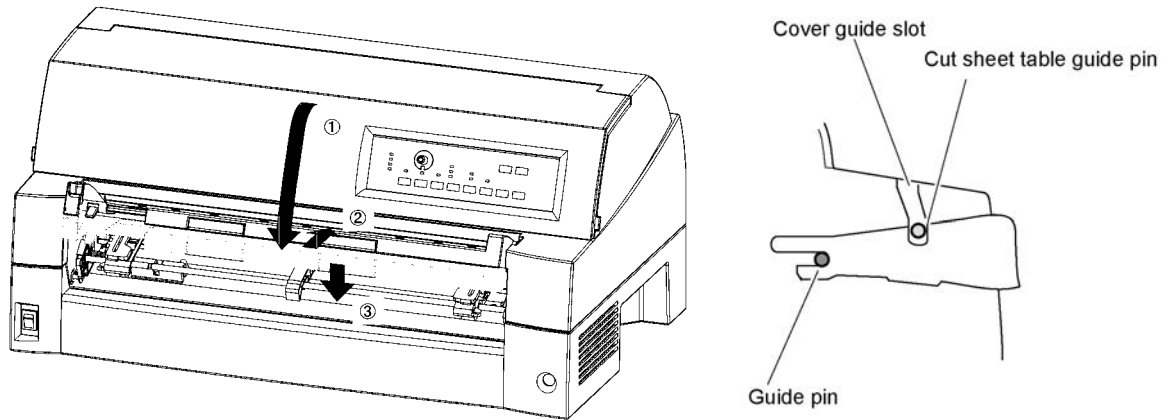
Figure 2.2 Setting the paper table

5. Remove the Block FC.
6.Open the front cover and remove the cardboard shipping restraint holding the carriage in place
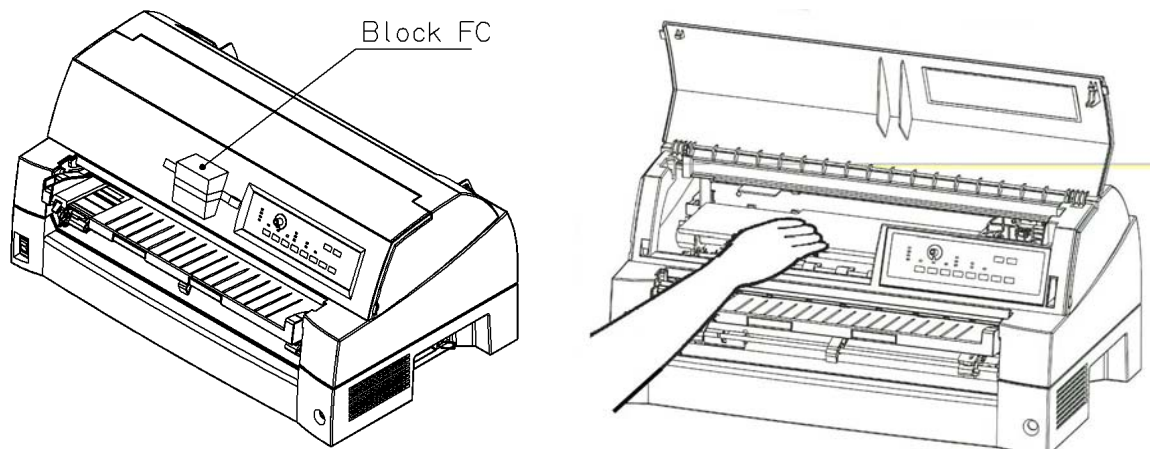
Figure 2.3 Removing the shipping materials

7.Store the original shipping carton and packing materials for future use in moving or shipping the printer.

2.4 Inspection after Unpacking

1. Carefully check assemblies and accessories for visible damage.
2. Install the ribbon cartridge. See the User's Manual for details.
3. Check the rated voltage or the printer and AC power outlet, then connect the AC power cord between the printer and AC power outlet.
5. Close the front cover.
6. Turn on the power switch.
7. Load cut sheet paper or continuous forms paper as explained in the User's Manual.
   Check printing performance and quality using self-test printing, detailed in User's Manual.

CHAPTER 3   TROUBLESHOOTING

This chapter helps pinpoint the causes of problems with the printer.
Section 3.1 is a troubleshooting table. The table shows how to determine what is wrong with the printer and what to do to correct the problem.
Section 3.2 explains error displays on the control panel that help clarify the cause of a problem.
Section 3.3 explains the self-correction functions of the DL9300/9400 printer.
For replacement and adjustment after recovery, see Chapter 4.

3.1 Trouble shooting Table

3.1.1 Problems at power-on initialization (part 001/3)

	Symptom		Cause	Response
1	The POWER lamp does not go on.		The power cord is not connected to the outlet or the printer.	Connect the power cord properly
		The power cord is connected properly.	The power cord is defective.	Replace the power cord.
			The power supply is defective.	Replace the power supply.
			The control board is defective.	Replace and initialize the control board.
			The control panel board is defective.	Replace the control panel board.
			The cable connected to the control panel board is defective.	Check the connection. Check the cable.
2	The POWER lamp comes on momentarily, but goes off. Then, turn the power switch OFF, and turn on the power after 10 to 20 seconds. However, the POWER lamp does not go on.	Turn off the power, then wait for about 10 minutes. Disconnect the space motor connector and turn on the power. Initialization is not done but The POWER lamp comes on.	An SP motor fire check alarm is detected.	• Replace the SP motor. • Replace the control board, then initialize the EEPROM.
		Turn off the power, then wait for about 10 minutes. Disconnect the main LF motor connector and turn on the power. Initialization is done.	A main LF motor fire check alarm is detected.	• Replace the main motor. • Replace the control board, then initialize the EEPROM.
		Turn off the power, then wait for about 10 minutes. Disconnect the tractor LF motor connector and turn on the power. Initialization is done.	A tractor LF motor fire check alarm is detected.	• Replace the tractor LF motor. • Replace the control board, then initialize the EEPROM.

3.1.1 Problems at power-on initialization (part 002/3)

		Symptom	Cause	Response
3	The POWER lamp is on.	After the POWER lamp goes on, simultaneous blinking of all other lamps is not performed. The PAPER OUT lamp does not blink, either.	The control board is defective.	Replace and initialize the control board.
		After the POWER lamp goes on, simultaneous blinking of all other lamps is performed but initialization is not performed normally.	The cover is open.	Close the front cover.
			The cover open switch assembly is defective.	Replace the cover open switch assembly.
		After the POWER lamp goes on, simultaneous blinking of all other lamps is performed but the PAPER OUT lamp does not blink later. If the interface cable is disconnected, initialization is performed normally.	The interface cable is defective.	Replace the interface cable.
			The host is defective.	Check the host.
		The case of as stated above. Initialization is not performed normally even if the interface cable is disconnected.	The control board is defective.	Replace and initialize the control board.
			The control panel board is defective.	Replace the control panel board.
			The cable connected to the control panel board is defective.	Check the connection. Replace the cable.
			The cover is open.	Close the front cover.

3.1.1 Problems at power-on initialization (part 003/3)

		Symptom	Cause	Response
4	The PAPER OUT lamp blinks.	After the POWER lamp goes on, simultaneous blinking of all other lamps is not performed but the PAPER OUT lamp blinks.	A ROM or RAM alarm is detected.	Replace and initialize the driver board.
			Low-voltage alarm is detected.	• Replace the power supply. • Replace the control board, then initialize the EEPROM.
		After APTC initialization, the PAPER OUT lamp blinks.	• APTCHPSW ASY is defective. • The APTC motor is defective. • APTCHPSW ASY is not connected. • The driver board is defective.	• Replace the APTCHPSW ASY. • Replace the APTC motor. • Connect the APTCHPSW ASY cable properly. • Replace the driver board.
		When the power is turned on after the carriage is moved to the center of the side frames, the carriage moves smoothly but hits the left or right side frame.	A LRES alarm is detected. • LES detection is poor. • The carriage cable is defective. • The driver board is defective. • The carriage cable is disconnected.	• Clean or replace the carriage PC board. • Replace the carriage cable. • Replace the driver board. • Connect the carriage cable properly.
		After APTC initialization, the PAPER OUT lamp flashes. • The carriage does not move. • An abnormal sound is made. • Carriage movement is not smooth.	Space alarm is detected. A. The SP motor connector is disconnected. B. The SP motor is defective. C. The stay shaft is rough. D. The SP belt is loose. E. The control board is defective.	A. Connect the Connector correctly. B. Replace the space motor. C. Clean or lubricate the stay shaft. D. Check the tension pulley. E. Replace the control board, then initialize the EEPROM.
		The PAPER OUT lamp blinks immediately after the HCPP starts operation.	• HCPPSW ASY is defective. • The HCPP motor is defective. • HCPPSW ASY is not connected. • The control board is defective.	• Replace the HCPPSW ASY. • Replace the HCPP motor. • Connect the HCPPSW ASY cable properly. • Replace and initialize the control board.

3.1.2 Problems related to printing (part 001/2)

		Symptom	Cause	Response
1	The POWER lamp goes off during printing. Then, turn the power switch OFF, and turn on the power after 10 to 20 seconds. However, the POWER lamp does not go on.	Turn off the power, then wait for about 10 minutes and turn on the power. Initialization is done normally. (If problem occur again in initialization refer to 3.1.1)	The accidental fire check alarm is detected.	• It's difficult to pinpoint a cause. Check the SP/LF/TR motor and HD and there drive circuit on the ROM board and replace them if necessary.
2	The PAPER OUT lamp starts blinking. (Refer to Alarm display function)	Space problem alarm is detected.	Spacing isn't smooth.	Clean any obstacle. Check the paper thickness control.
			SP Motor is defective	Replace SP motor
			ROM board SK is defective	Replace it
		Fan alarm is detected	SP fan is locked by anything.	Clean any obstacle.
			SP fan is defective	Replace it
		Overload alarm detected (+34V isn't restore after 3pass printing.)	The power supply is defective.	Replace it
		APTC Gap Alarm is detected	The paper to be Printed on is too thick.	Replace the paper. (Use paper of a thickness specified in the paper specification.)
			Difference thickness of the paper.	Replace the paper or use manual mode properly.
			Card guide adjustment is incorrect	Adjust card guide correctly.
			APTC sensor is defective	
3	3pass printing is performed.		• Power overload is detected (if more than one character of the solid pattern is printed). • Print head overheat is detected (if print patterns of rather higher density of characters are printed continuously. • The control board is defective. • The power supply is defective. • The print head is defective.	• The print head protection function works normally. Change the print pattern. • The print head protection function works normally. Change the print pattern or stop the printer for a while. • Replace the control board. • Replace the power supply. • Replace the print head.

3.1.2 Problems related to printing(part 002/2)

		Symptom	Cause	Response
4	Data sent from the host is not printed at all. Data cannot be received from the host.	Printing operation is not performed at all.	The interface cable is not connected properly.	Connect the interface cable properly.
			The front cover is open.	Close the front cover.
		Self-test printing is performed normally.	The host interface setting of the printer does not match the host used.	Enter setup mode and change the setting for the host interface.
			The interface is defective.	• Replace and initialize the control board. • Replace the interface cable. • Check the host.
		Even self-test printing is not performed.	The carriage cable is improperly connected to the print head or control board.	Connect the carriage cable properly.
			The control board is defective.	Replace and initialize the control board.
		Paper out condition is detected.	Paper pass select isn't correct. Paper isn't load. CSF is empty.	
		REMOVE PAPER indicator blinks.	Cut sheet leaved on the paper table and printer waiting removing it.	Remove the paper from the paper table.

3.1.3 Problems related to printing result

		Symptom	Cause	Response
1	The data sent from the host does not match the print results.	Self-test printing is performed normally.	The setup mode setting is invalid.	Enter setup mode and change the mode setting properly.
			The interface is defective.	• Replace and initialize the control board. • Replace the interface cable. • Check the host.
		Even self-test printing is abnormal.	The carriage cable is improperly connected to the print head or control board.	Connect the carriage cable properly.
			The control board is defective.	Replace and initialize the control board.
		Printer ignores data that out of print area.	Area over detection works.	
		Area over detection cut the data in the print area.	Printer misread the black printing into the paper edge.	

3.1.4 Problems related to print quality (part 001/2)

	Symptom		Cause	Response
1	A dot is missing or an excess dot is printed. (See other items about blurring of the top or bottom of a character.)		The print head is defective.	Replace the print head.
			The carriage cable is connected improperly.	Connect the carriage cable properly.
			The carriage cable is defective.	Replace the carriage cable.
			The control board is defective.	Replace and initialize the control board.
2	The printing position in the horizontal direction (character spacing direction) is misaligned. Check first that: - Paper thickness is adjusted properly. - The automatic paper thickness control mechanism works normally.		Bi-directional printing position adjustment is poor.	Properly adjust the bi-directional printing position.
			Stay shaft movement is not smooth.	Clean and grease the stay shaft.
			The space belt is defective.	Replace the space belt.
			The space belt tension is inadequate.	Check the tension pulley unit.
			The space motor is defective.	Replace the space motor.
			The control board is defective.	Replace and initialize the control board.
3	Printing smears paper.	Multipart paper or thick paper is used.	The manual paper thickness adjustment dial is set improperly.	Adjust the manual paper thickness adjustment dial.
			Automatic paper thickness control is defective.	Replace and readjust the card guide.
		Paper is smeared by the ribbon. (Haze)	The ribbon is fluffy.	Replace the ribbon cartridge.
		There is a blotch of ink.	Ribbon residue or in adheres the print head.	Remove ink or ribbon residue from the print head.
4	Printing is light or the top or bottom of characters is blurred.		• The manual paper thickness adjustment dial is set improperly. • The ink ribbon has reached the end of its life. • The gap between the print head and platen is inadequate. • The print head is defective. • The control board is defective.	• Adjust the paper thickness adjustment dial according to paper thickness. • Replace the ink ribbon. • Adjust the gap between the print head and platen. • Replace the print head. • Replace the control board.

3.1.4 Problems related to print quality (part 002/2)

	Symptom	Cause	Response
5	Printing is partly blank or the ribbon is out of place. The ribbon is loose. The ribbon is vertically misaligned. The ribbon is twisted.	• The manual paper thickness adjustment dial is set improperly. (Because the paper thickness setting is too narrow, the ribbon is loosened.) • The ribbon is loosened on a locally thick portion of paper. • The ribbon is partly twisted. • Poor card guide adjustment influenced ribbon movement. • The ribbon cartridge is defective. • The ribbon setting is inadequate.	• Adjust the manual paper thickness adjustment dial properly according to paper thickness. • Check the paper specifications. • Check whether the ribbon is twisted. • Adjust the card guide. • Replace the ribbon cartridge. • Set the ribbon properly.

3.1.5 Problems related to paper feed (part 001/2)

	Symptom	Cause	Response
1	Paper selection cannot be performed properly.	• The paper selection HCPP motor does not work • HCPPSW ASY is defective. • The paper selection mechanism is defective. • The control board is defective.	• Replace the HCPP motor. • Replace the HCPPSW ASY. • Replace the printer mechanical unit. • Replace the control board.
2	The paper loading position is inadequate. Or, the PAPER OUT lamp does not go off.	• The setup is inadequate. • TOF adjustment in auto load mode is inadequate. • Paper is defective. • The sensor is defective. For cut sheet paper For front-fed continuous forms For rear-fed continuous forms	• Correct the setup. • Adjust the TOF properly. • Replace paper. (with those conforming to the media specifications) • Replace the sensor. Replace the TOF 1 sensor. Replace the FTRPE sensor. Replace the RTRPE sensor.
3	Front-fed cut sheets are not loaded automatically.	• The setup is inadequate. • The TOF 1 or 2 sensor is defective. • The printer is detecting paper. • The paper detection mechanism is defective.	• Correct the setup. • Replace TOF 1 or 2 sensor. • Eject the paper from the printer. • Replace the printing mechanism unit.
4	Front-fed continuous forms do not move back.	• The front tractor PE sensor is defective.	• Replace the FTRPE sensor. • Replace the tractor unit.
5	Rear-fed continuous forms do not move back.	• The rear tractor PE sensor is defective.	• Replace the RTRPE sensor. • Replace the tractor unit.
6	Paper loading and ejection are abnormal.	• Paper sensor output is abnormal. • Sensor cable connection is defective. • The control board is defective.	• Replace the sensor. • Connect the cable sensor. • Replace the control board.
7	Line spacing is narrowed..	• Paper is defective. • The LF motor is defective. • The LF driver is defective. • Power output is insufficient.	• Replace paper. (with that conforming to the media specifications) • Replace the LF motor. • Replace the control board. • Replace the power supply.
8	The CSF does not load paper automatically.	• The CSF cable is disconnected. • The CSF cable is defective. • The CSF is set improperly.	• Connect the CSF cable properly. • Replace the CSF cable. • Set the CSF properly.

3.1.5 Problems related to paper feed (part 002/2)

	Symptom	Cause	Response
9	Paper skews or a paper jam occurs.	• Paper is set improperly. • Paper is defective. • The manual paper thickness adjustment dial is set improperly. • The card guide is mounted out of place. • The print head gap is invalid. • Paper skews in the CSF.	• Set paper properly. • Replace paper (with that conforming to the media specifications) • Adjust the manual paper thickness adjustment dial properly. • Adjust the card guide position. • Adjust the print head position. • Replace the CSF.

3.1.6 Problems related to the control panel

	Symptom	Cause	Response
1	Switches on the control panel are disabled.	• The printer is online. • The connection between the control panel board and control board is defective. • The printer is in alarm state.	• Turn the printer offline. • Connect the cable properly, or replace the cable. • Check the fault and then turn on the power again. If the fault is an unusual order or smoke emission, eliminate the fault cause before turning on the power again.
		• The control board is defective. • The control panel board is defective.	• Replace the control board. • Replace the control panel board.
2	Lamps on the control panel do not go on properly.	• The connection between the control panel board and control board is defective. • The control board is defective. • The control panel board is defective.	• Connect the cable properly or replace the cable. • Replace the control board. • Replace the control panel board.

3.2 Error Display

This printer indicates errors on the control panel. There are three groups of errors as explained below.

(1) Warning errors

The buzzer sounds and the ONLINE indicator still lights.

For a data transmission error in the interface, only the buzzer indicates the error. The printer continues printing unless placed offline or other groups of errors occur. See Table 3.1.

Table 3.1 Warning errors

Error name	Cause of the error	Recovery
Parity error	An incorrect parity condition is detected in received data in the RS-232C interface. • Besides parity, this error may also occur due to incorrect setting. • The printer prints question marks (?).	• Check the baud rate and data format. • Check the interface cable.
Framing error	An incorrect stop bit condition is detected in received data in the RS-232C interface. • The printer prints a question mark (?) for the first error byte then ignores the succeeding data.	
Overflow error	The host transmits data to the printer although the input buffer is full of data (i.e., while the printer is requesting the host to stop data transmission). • The printer ignores the data (data is lost) and a question mark (?) is stored in the input buffer when the error is recovered.	Check all settings for the RS-232C interface.
Download error	The download buffer overflows. • The printer ignores the data (data is lost).	• Reduce downloaded data. • Reduce the print buffer capacity, i.e., increase the download buffer capacity.
Overrun error	The printer cannot accept data at the rate it is transmitted. That is, while the printer is reading out the input buffer, the host transmits the next data. • The printer ignores the data (data is lost).	Check all settings for the RS-232C interface.
Transmission timeout error	While the printer attempts to transmit data to the host, ten seconds elapse with the output buffer full of data. • The printer ignores the data (data is lost).	

Note:
Incorrect settings on the RS-232C do not always cause parity or framing errors. If the baud rates of the host computer and the printer are multiples of 4800, such as 19200, framing errors are not detectable, and meaningless data indicates a setting error. These errors do not affect the line from the host computer. An error remains if the printer is online and no other warning is displayed until pushbutton operation or an operational error or fatal error is detected.

(2) Operational errors

The PAPER OUT indicator is lighted.

The buzzer sounds, the PAPER OUT indicator lights up, and the printer is placed offline when operation is required.
Refer to Table 3.2.

Table 3.2 Operational errors

Error name	Cause of the error	Recovery
Paper end (PE) error	The printer has run out of continuous forms.	Supply forms and load them into the printer.
Cut-sheet feeder error	The cut-sheet feeder has run out of cut sheets or has detected a paper jam.	• Remove the jammed sheet. Clear any jam. • Supply cut sheets and load a cut sheet.

Notes:
1. The printer cannot be set online until these errors are cleared.
2. The paper end is ignored if setup item PPR-OUT: IGNORE is set.
3. A cut-sheet feeder error is detected during paper loading.

The REMOVE PAPER indicator blinks.

When removing the paper on the paper table is required The REMOVE PAPER indicator blinks.
In this case operator must remove paper for loading new paper.
The PS sensor detects this error by reflecting light form the paper or other obstruction.
It also detected by light that is shining into the photo sensor when the paper table is removed.
Therefore (anyway) paper table must be installed correctly.

(3) Fatal alarms

The power shut down by itself.

The printer cannot display the alarm if it detects one of the following alarms that turn off printer power.

Disconnect components or connectors for related alarms, then check the cause of the alarm.

Table 3.3 Alarms that turn power off

Error name	Cause of the error
SP motor driver alarm	The SP motor driver is faulty. (The motor is driven for an abnormally long time.)
LF motor driver alarm	The LF or CSF motor driver is faulty. (The motor is driven for an abnormally long time.)
Print head alarm	
+34 V over voltage alarm	

The PAPER OUT lamp blinks with other lamps.

For a circuit malfunction detected in the printer:
• The printer stops printing immediately.
• The ONLINE indicator turns off.
• All buttons of the control panel are invalid.

Table 3.4 Fatal alarms displayed on control panel

Alarm name \ Lamp	PAPER OUT	REMOVE PAPER	FRONT DIR	QUIET	AUTO GAP	HI IMPACT	TRACTOR F	TRACTOR R	CUT SHEET	MENU1	MENU2	ONLINE	Condition of occurrence
LES alarm	◎	◎					◎						LES could not be detected during the space initial operation.
Space problem alarm	◎	◎						◎					The shield board could not be detected normally by the LRES sensor.
Fan alarm	◎	◎							◎				The cooling fan for the space motor and the power supply was stopped.
HCPP alarm	◎		◎					◎					Switching between cut sheet paper and continuous forms paper was not possible.
Overload alarm	◎			◎			◎						An overload occurred during printing, and tripartite printing was performed.　However, the power source voltage was not restored.
Low voltage alarm	◎			◎				◎					The power source voltage dropped below the specified level when no printing was in progress.
APTC gap alarm	◎				◎		◎						During the APTC operation, paper was detected immediately after the start of approach motion, or no paper was detected.
APTC hop position sensor alarm	◎				◎			◎					During the APTC operation, no reference position was detected.
ROM/RAM alarm	◎					◎	◎						A sum-check error or read/write error occurred, or no CG-ROM is mounted.
Sector protect alarm	◎					◎		◎					A sector protect check of flash ROM was performed, but no sector protect information was found.

◎ ：Blinking
Blank : Off

CHAPTER 4   MAINTENANCE

This chapter explains the maintenance levels 1 and 2 for cleaning, lubrication, inspection, and adjustment of the DL7400 printer

4.1 Overview

Designed using the latest technology, the DL7400 printer offers high reliability and easy maintenance. Parts requiring lubrication and adjustment have been reduced and the replacement of defective parts made easier than previous models.

The printers has self-diagnostics and indicates the occurrence of errors on the control panel if the printer malfunctions.

The printer also has the self-test print and hex dump functions to indicate whether an error is due to printer or the host and to test operation after error recovery.

4.2 Notes on USE

Note the following:
Do not connect or disconnect connectors or printed circuit boards while power is on.
Use screwdrivers, wrenches, and other tools suited to the parts being replaced. Do not leave screws or parts inside the printer.
Use only the specified type of oil, grease, and cleaning solutions.
Be sure power is turned off before starting to replace parts.

4.3 Maintenance Tools

Table 4.1lists the tools required for maintenance.

Table 4.1 Maintenance tools

No	Tool	Model(part number)	Maintenance level
1	Screwdriver	M2-M2.5(Phillips)(*1)	
2	Screwdriver	M3-M5(Phillips) (*1)	
3	Screwdriver	M2-M2.5(standard)(*1)	
4	Screwdriver	M3-M5(standard) (*1)	
5	Tweezers		
6	Spring hook		
7	Long-nosed pliers		
8	Thickness gage	0.03 to 1 mm	
	Platen gap adjustment gage		
	Floil	D98L-1020-0639	

*1 A magnetized screwdriver is convenient.
 2 For fitting E-ring.

4.4 Maintenance levels

Maintenance for the DL7400 printer is done at two levels.
Level 1 maintenance includes cleaning and lubrication.
Level 2 maintenance includes level 1 items, plus replacement of PC boards, units, and mechanical subassemblies, and adjustment after replacement.

4.5 Preventive Maintenance

No periodic maintenance is required. However keeping the printer clean lengthens its service life and MTBF

4.6 Part Drawings

This section gives basic components and their location.
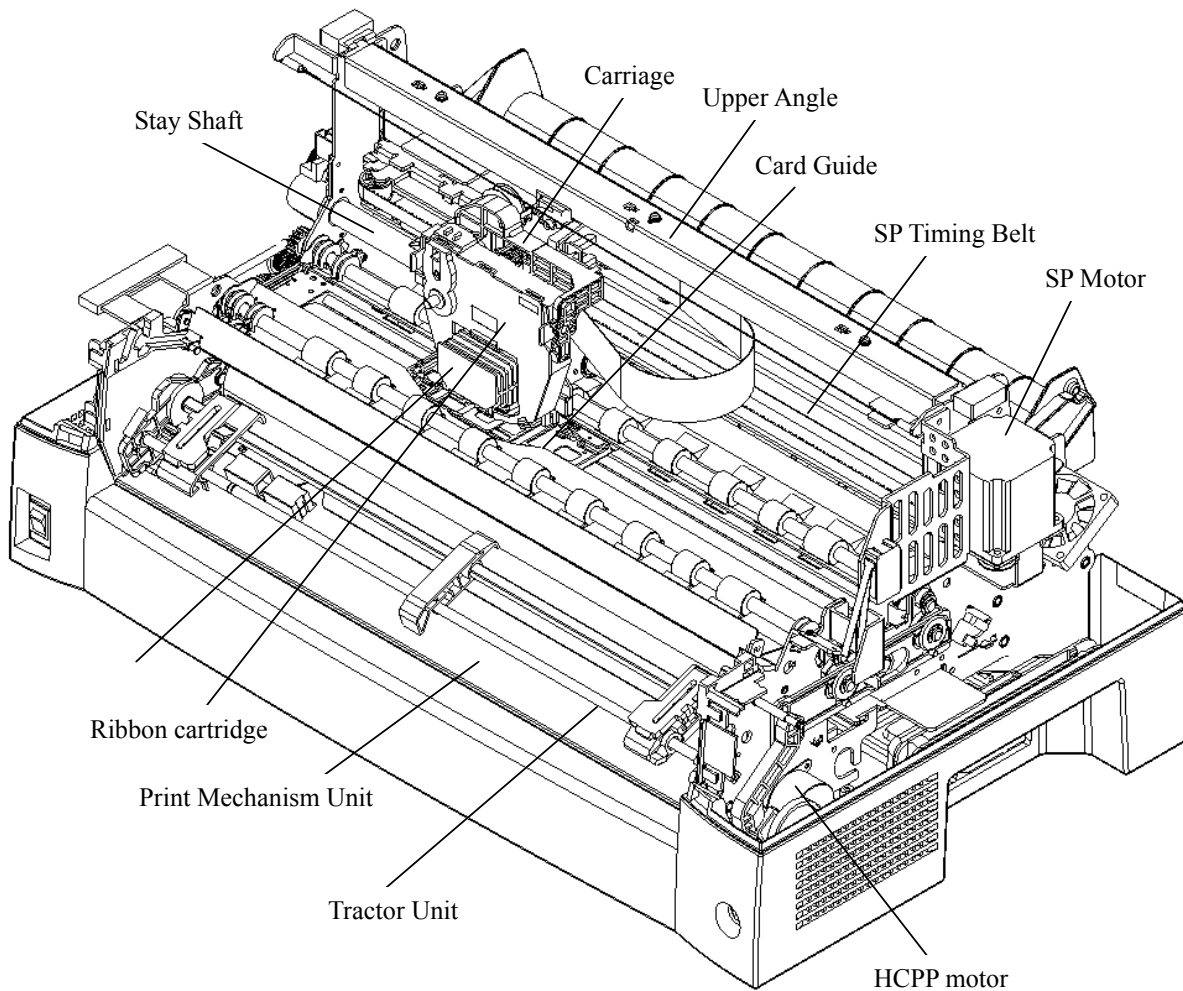
Figure 4.1 Part Drawings

4.7 Parts That must not be Disassembled

This section gives the locations of parts that must not be disassembled. Table 4.2 lists components not to be disassembled and whose mounting screws are not to be loosened or removed.
Parts not to be Disassembled

No.	Components	Parts	Remark
1	Frames (L) and (R)	All screws	
2	Space motor	All screws and pulleys	
3	Print head		
4	Upper Angle	3 screws	Gage for Adjustment
5	Card Guide	2 screws	is necessary
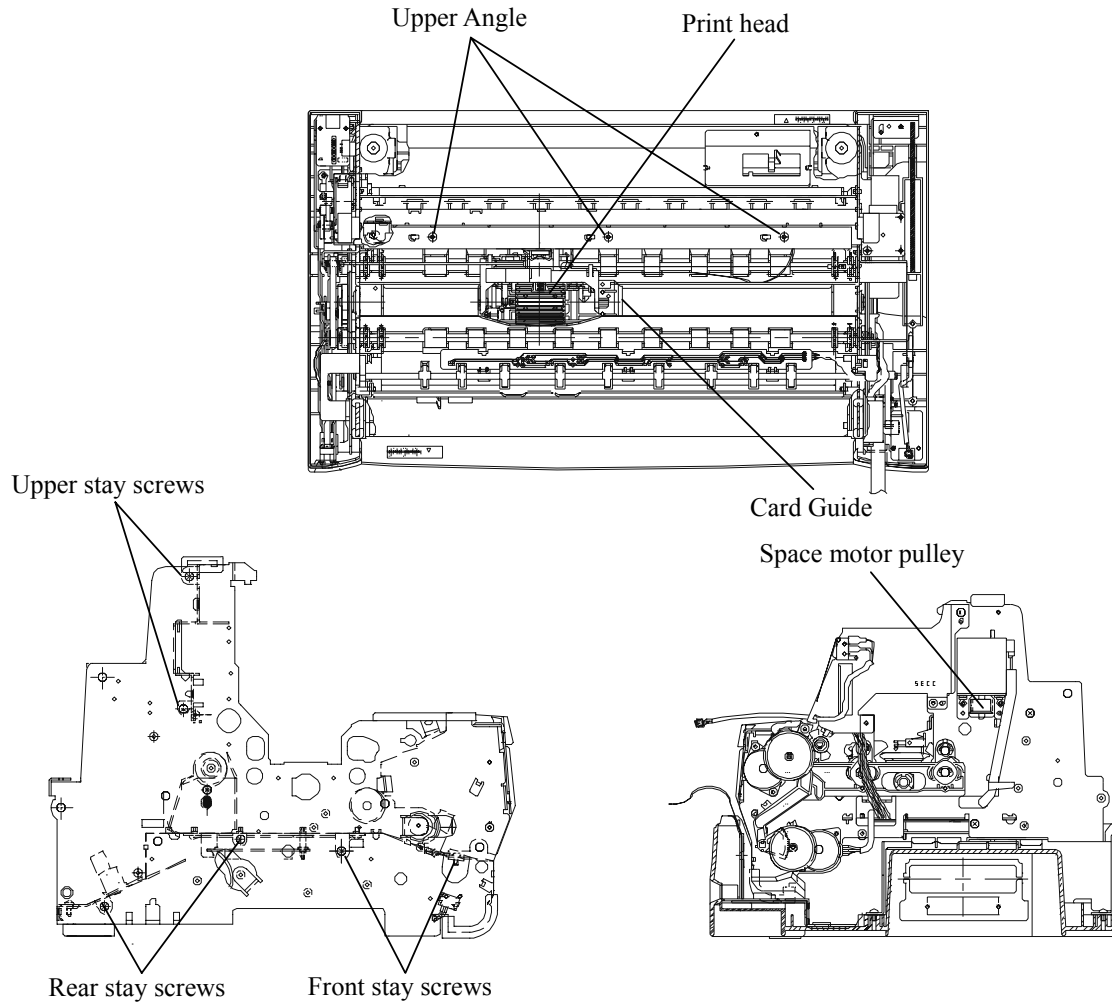
Figure 4.2 Parts That must not be disassembled

4.8 Level 1 Maintenance

Level 1 maintenance includes only cleaning and lubrication and lubrication. These can be performed without removing covers although Figure 4.3 shows the printer with the covers removed.

Check the DL7400   printer inside for paper particles, dust, and dirt, and remove these as explained below. After cleaning, lubricate moving parts.

Location	Cleaning procedure	Remarks
Paper path	Remove paper particles and dirt	
Top of print head	Remove ribbon debris, paper scraps, and other contaminants.	
Card guide	Remove ribbon debris, paper scraps, and other contaminants.	
Platen surface	Clean the surface with soft cloth	*1
Stay shaft	Remove dust from the surface of the shaft and clean it with soft cloth.	Refer to the lubrication specifications.

*1 If paper becomes smeared or dirty, clean the platen. Use a very small amount of alcohol and wipe with clean cloth.
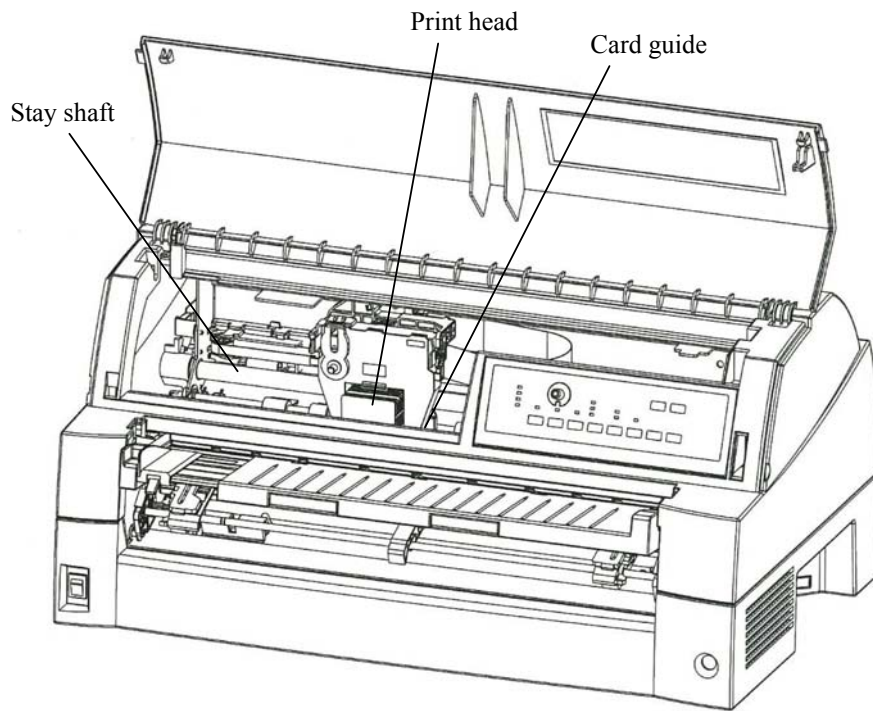
Figure 4.3 Cleaning and lubrication

4.9 Level 2 maintenance

Level 2 maintenance includes lubrication, adjustment, and parts replacement.
Level 1 maintenance should be done at the same time.

4.9.1 Parts replacement

Remember the following notes when replacing any component.
Keep working area clean.
Turn off power to equipment and unplug it before disassembled.
Follow procedures carefully. Do not disassemble the parts that are not to be disassembled.
Store disassembled parts in a clean place where they will not get lost.
Check parts for number and shape after replacement, and adjust them if necessary.
Reassemble the printer, following the steps in reverse order of disassembly.
Confirm that all connectors are connected correctly.

(1) Tractor Unit removal and installation Front feed tractor.

Front feed tractor.

Removal

1. Raise the paper table.
2. During pressing the Rock lever, Lift the left and right sides of the tractor unit, and then remove the tractor unit.
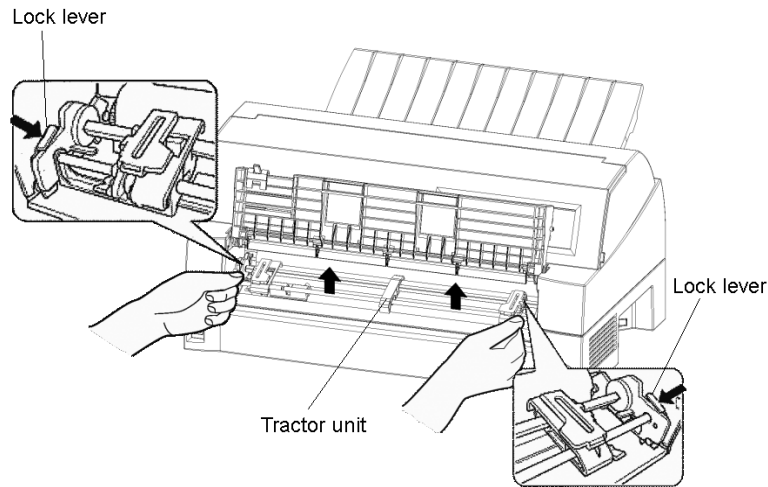
Figure 4.4 Front feed tractor Removal

Installation

1. Engage the U-grooves on the left and right sides of the tractor unit with the counterpart pins on the printer.
   (fit the ditch of left pin, there is any ditch of the right pin)
2. Press down the front shaft of the tractor unit to lock the unit.
3. Make sure that left and right mounting pins 2 have been hooked by lock levers.
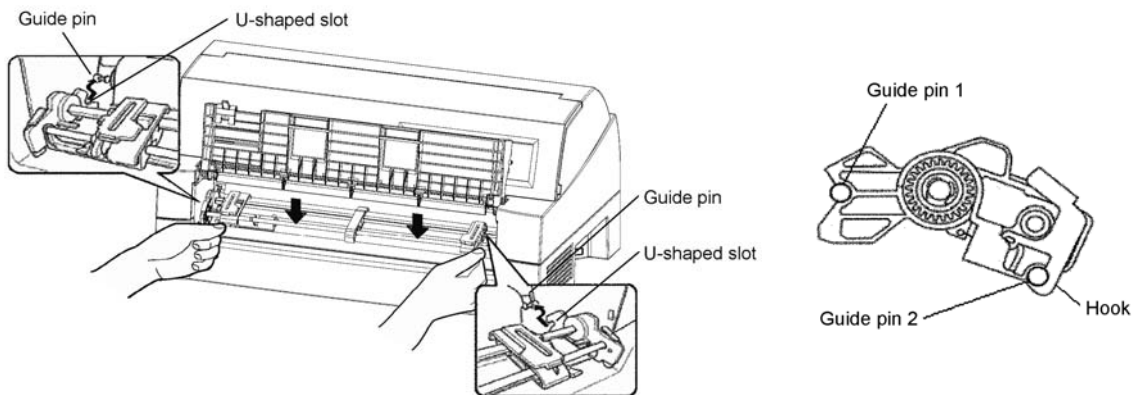
Figure 4.5 Front feed tractor Installation

Rear feed tractor.

Removal

1. During pressing the Rock lever, Lift the left and right sides of the tractor unit, and then remove the tractor unit.
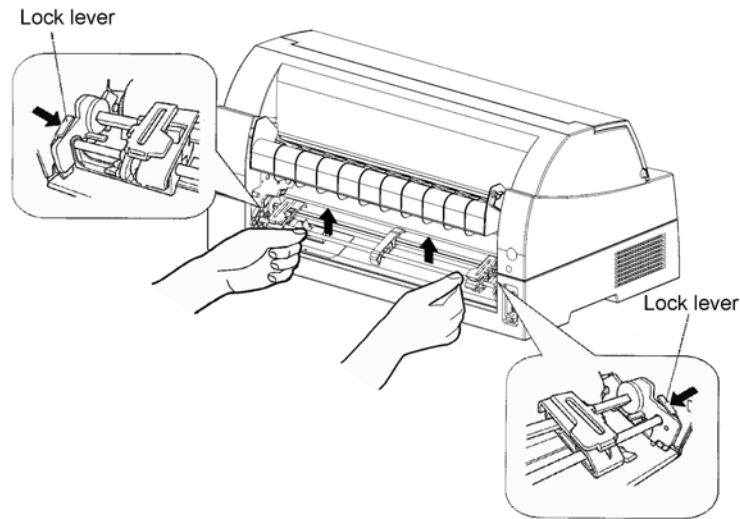
Figure 4.6 Rear feed tractor removal

Installation

1. Engage the U-grooves on the left and right sides of the tractor unit with the counterpart pins on the printer. (fit the ditch of left pin, there is any ditch of the right pin)
2. Press down the front shaft of the tractor unit to lock the unit.
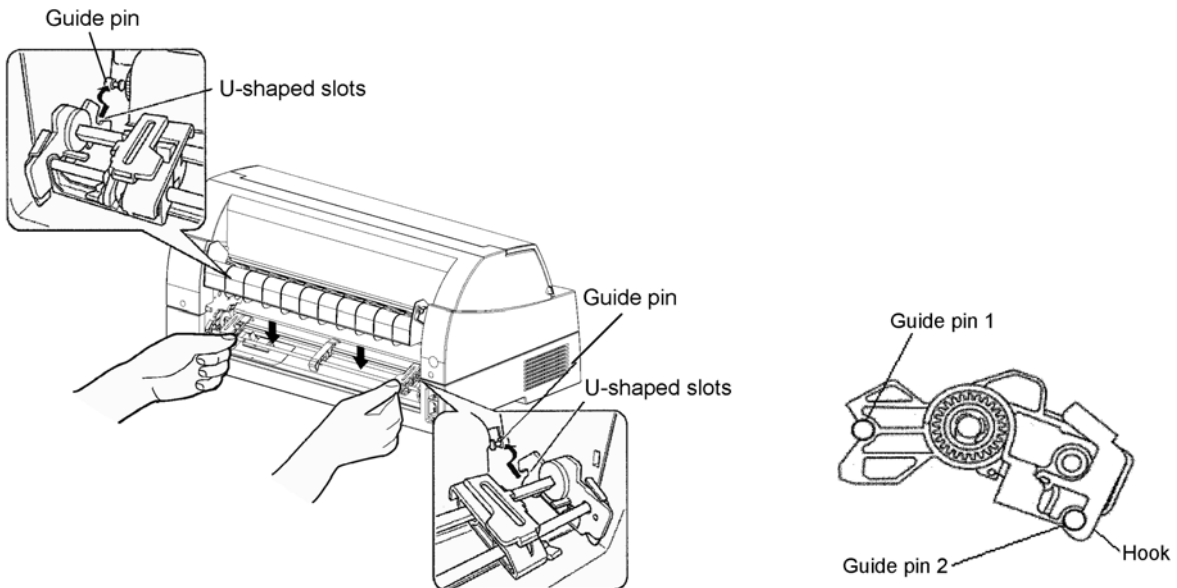
Figure 4.7 Rear feed tractor Installation

(2) Cut Sheet Feeder removal and installation

Front cut sheet feeder

Removal

1. Turn off the printer power.
2. Disconnect the cut sheet feeder cable.
3. Raise the paper table, then hold both ends of the cut sheet feeder and pull it off.

Installation

1. Install the cut sheet feeder by reversing the removal procedure.
2. Turn off the printer power.
3. Raise the paper table, then engage the U-grooves on both ends of the cut sheet feeder with the mounting pins on the printer and lower the cut sheet feeder carefully.
   (Push in the cut sheet feeder while aligning label A on the feeder with label A on the right side of the printer.)
4. Connect the cut sheet feeder cable connector to the connector on the front right of the printer.
5. Insert the connector with the arrow side facing upward.
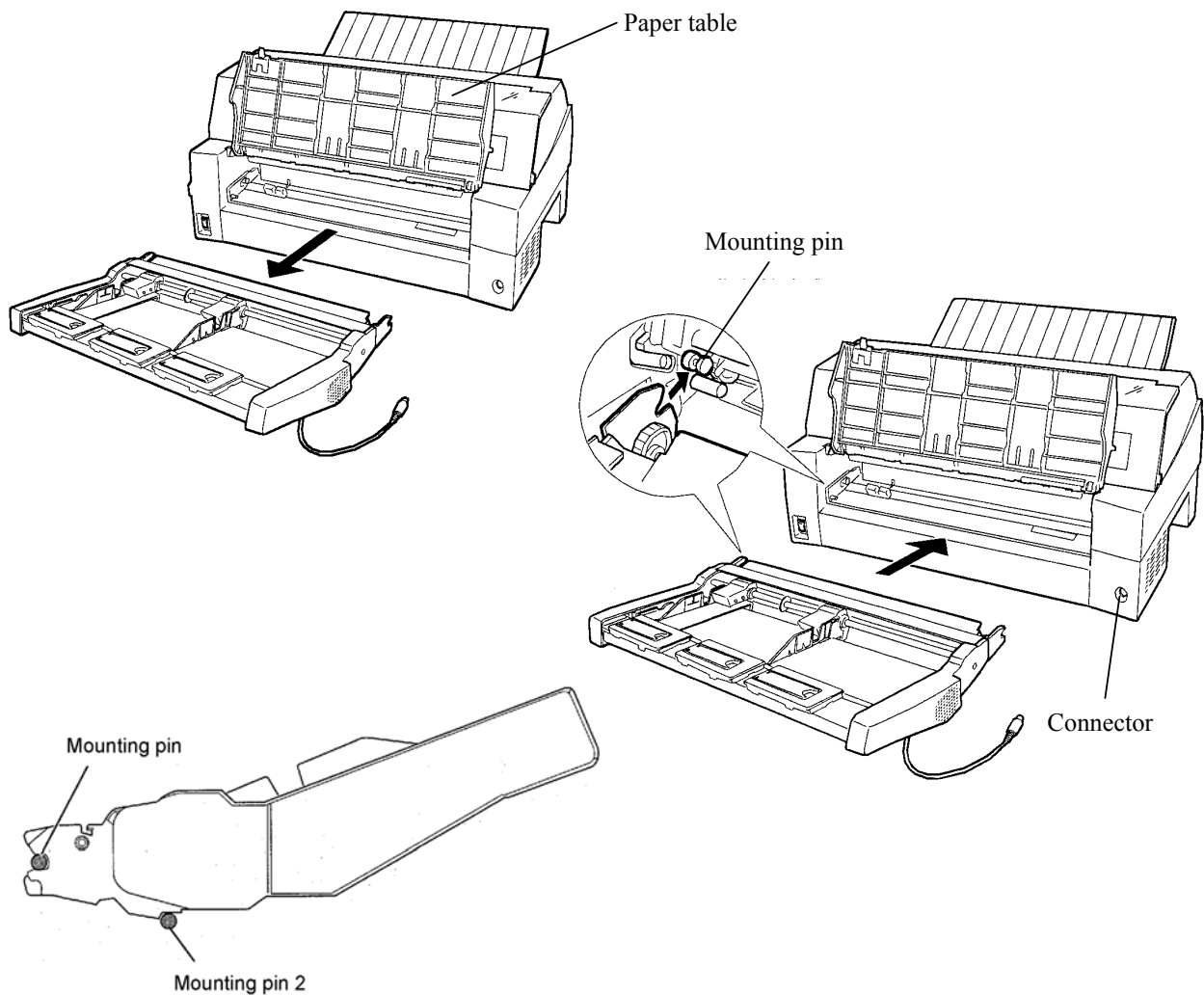
Figure 4.8 Front Cut Sheet Feeder Removal and Installation

Rear cut sheet feeder

Removal

1. Turn off the printer power.
2. Disconnect the cut sheet feeder connector.
3. Raise the stacker table, then hold both ends of the cut sheet feeder and pull it off.

Installation

1. Turn off the printer power.
2. Raise the stacker plate, then engage the U-grooves on both ends of the cut sheet feeder with the mounting pins on the printer and lower the cut sheet feeder carefully.
   (Push in the cut sheet feeder while aligning label A on the feeder with label A on the right side of the printer.)
3. Lower the cut sheet feeder like turning it using the mounting pins as fulcrums.
4. Connect the cut sheet feeder cable connector to the connector on the rear left of the printer.
5. Insert the connector with the arrow side facing upward.

Mounting pin
Stacker plate

Mounting pin 1
Cable
Connector
Mounting pin 2
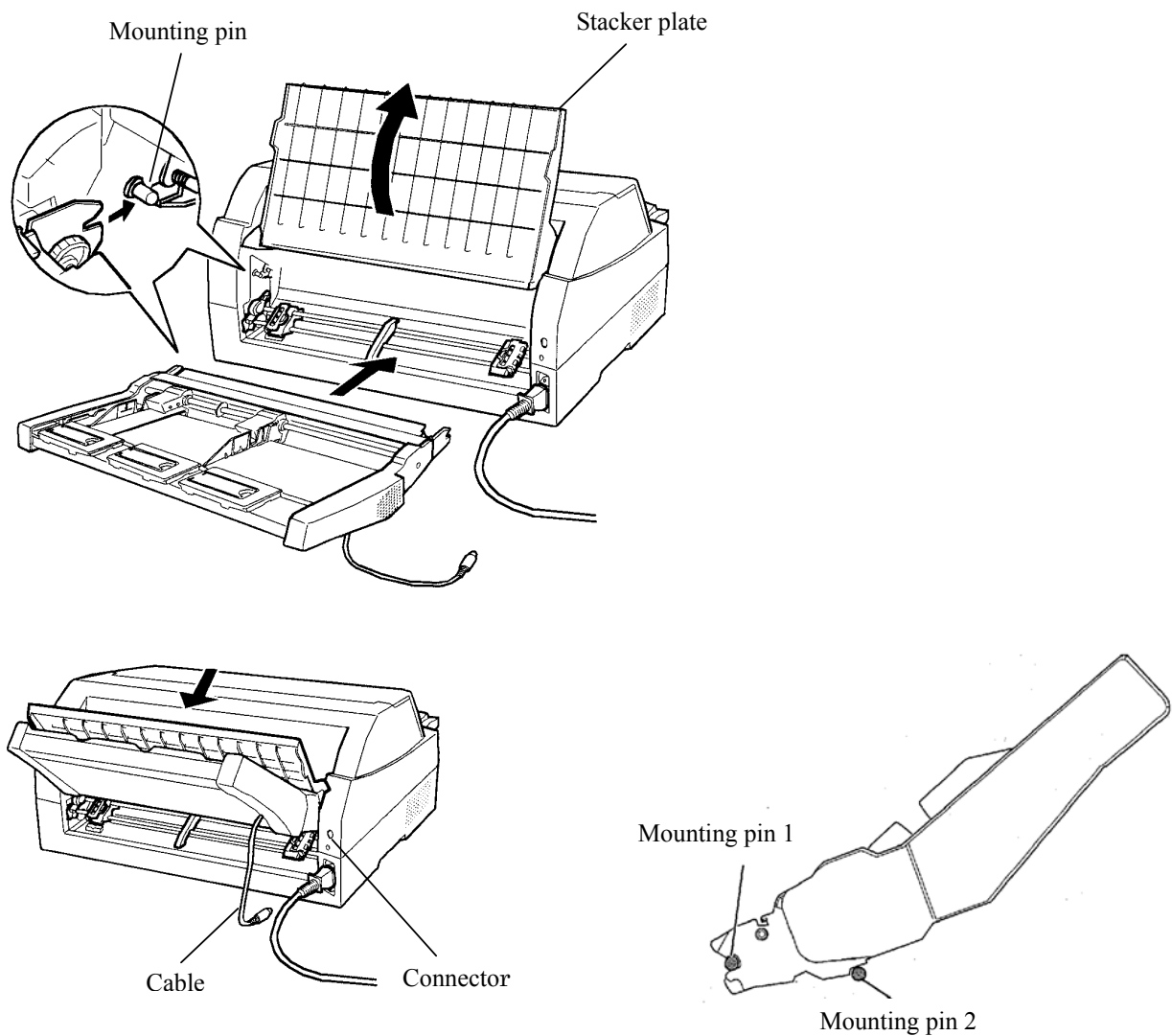
Figure 4.9 Rear Cut Sheet Feeder Removal and Installation

(3) Stacker Plate removal and installation

Removal

1. Raise the stacker plate in the direction indicated by an arrow.
2. Stretch the left and right sides of the stacker frame outward to disengage the stacker plate projections from the frame.

Installation

1. Install the stacker plate by reversing the removal procedure.

Stacker *1

*1
Actually, there are two kinds of stacker as follows.
    Standard stacker; small size
    Large Stacker; large size(option)
(Stacker in Figure is Large Stacker.)

Stacker frame
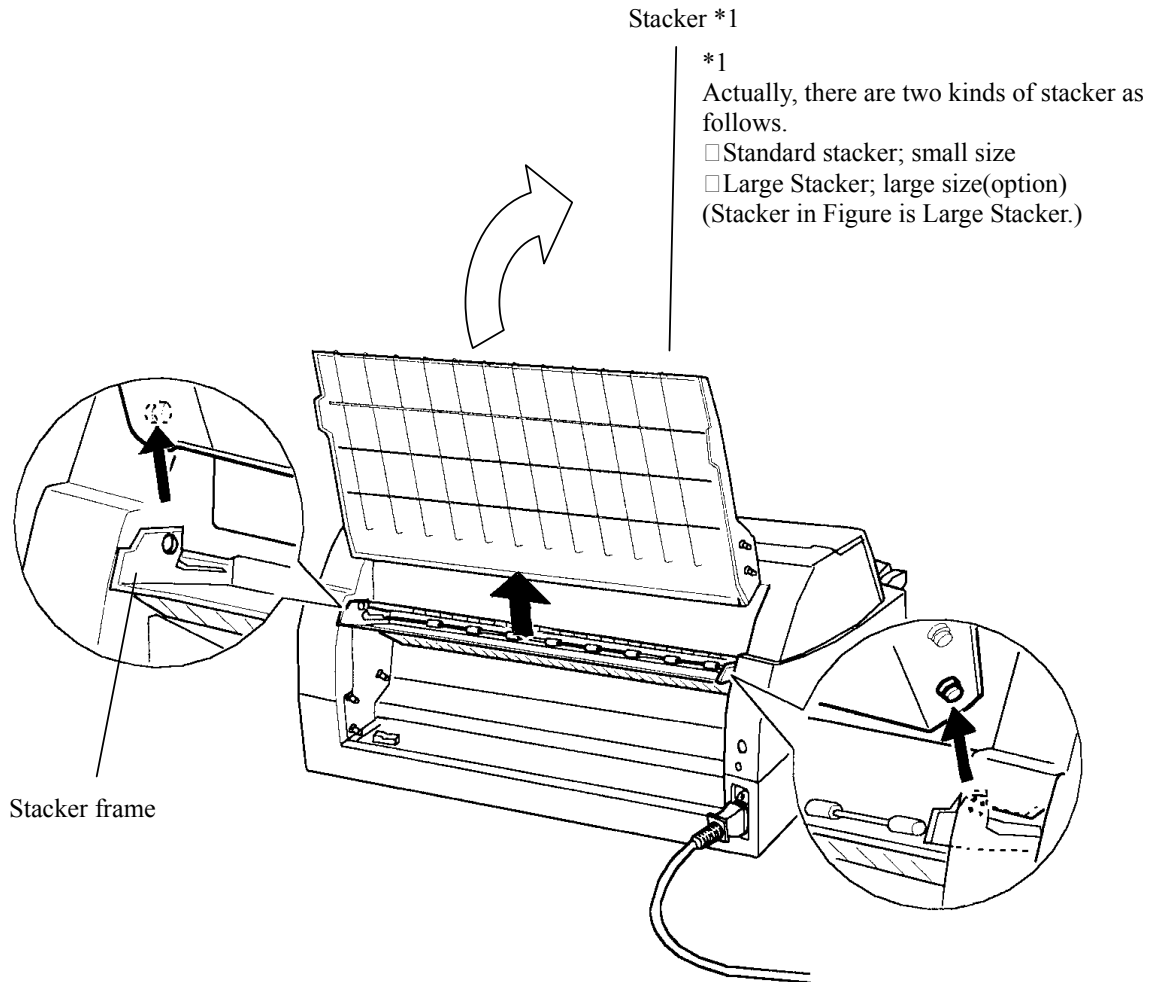
Figure 4.10 Stacker Plate removal and installation

(4) Stacker Unit removal and installation

Removal

1. While pressing down the lock levers on the left and right sides of the stacker unit, pull out the stacker unit to the back of the printer.

Installation

1. Install the stacker unit by reversing the removal procedure.

Lock lever

Stacker unit

Lock lever
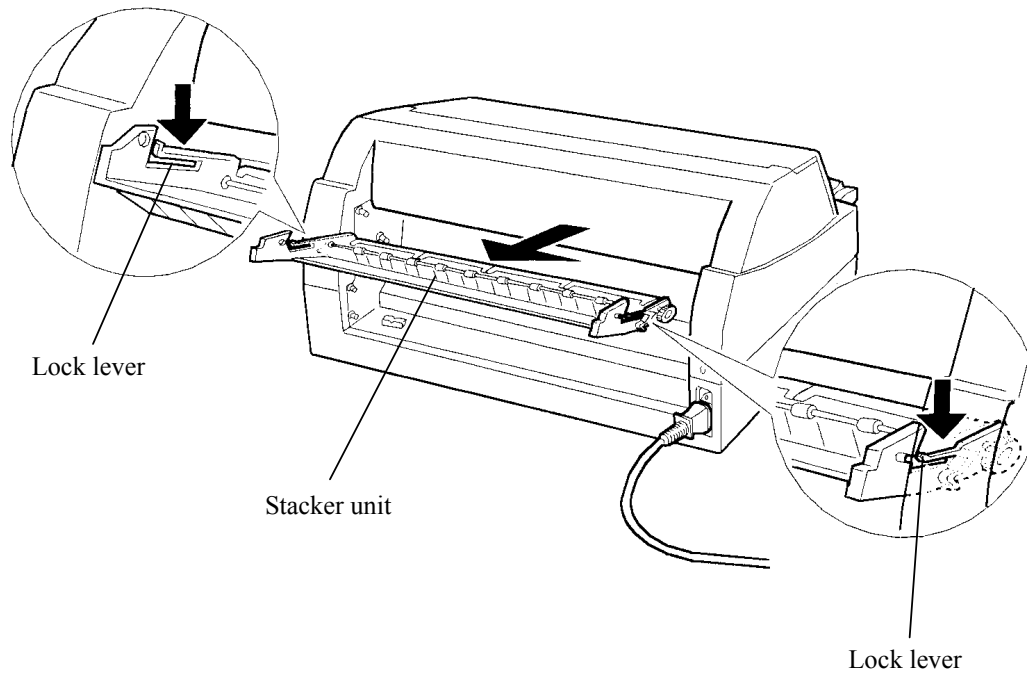
Figure 4.11 Stacker Frame removal and installation

(5) Paper Table removal and installation

Removal

1. After opening the paper table and adjusting it to a tilted position, remove the paper table by lifting it to separate the left and right protrusions on the paper table ends from the grooves on the cover.
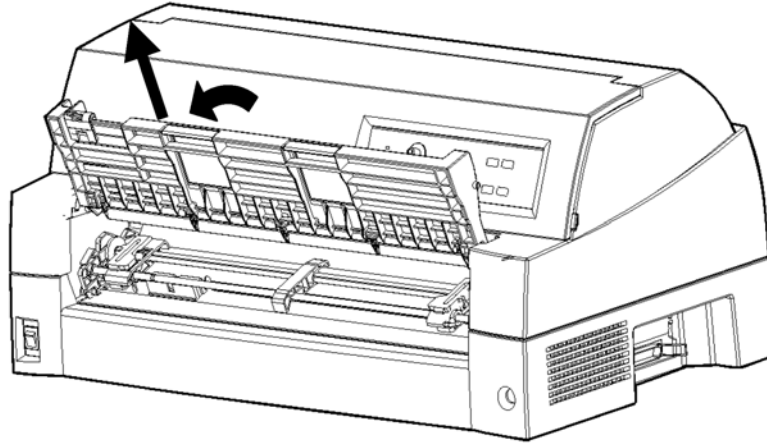
Figure 4.12 Paper Table removal

Installation

1. Insert the left and right protrusions on the paper table ends into the grooves on the cover as shown in the following figure.
2. Set the paper table in the normal position. (Paper table in the following figure is the Large paper table.) Both standard paper table and large paper table can be opened or closed in the same way.
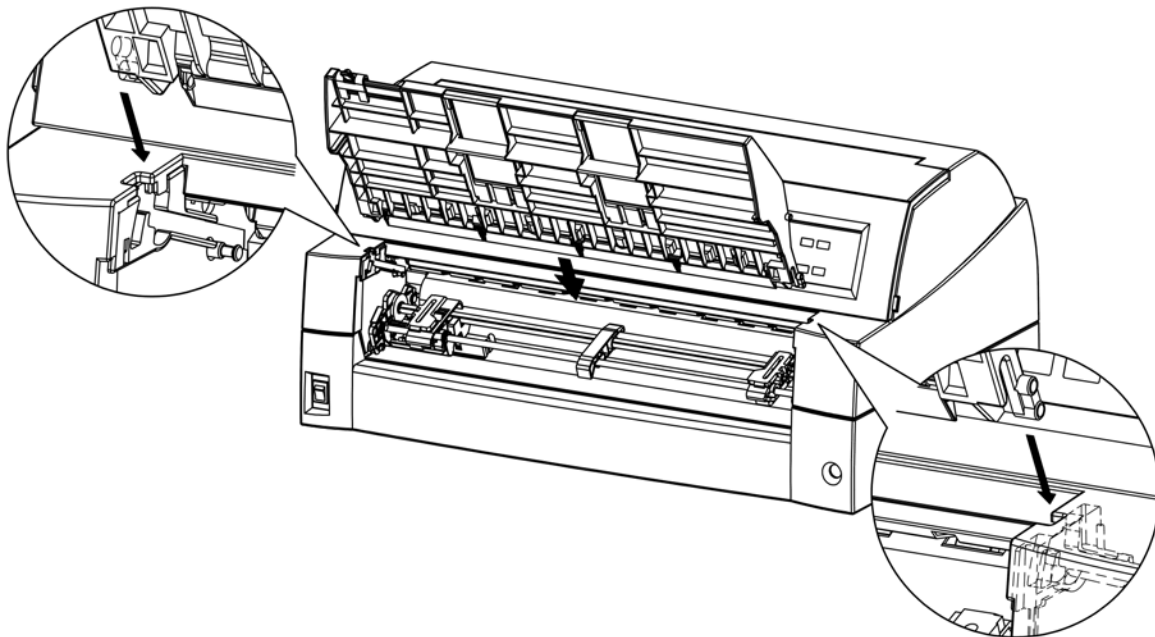
Figure 4.13 Paper Table Instillation

⑹ LAN card removal and installation

Removal

1. Remove the two screws.
2. Remove the LAN card.
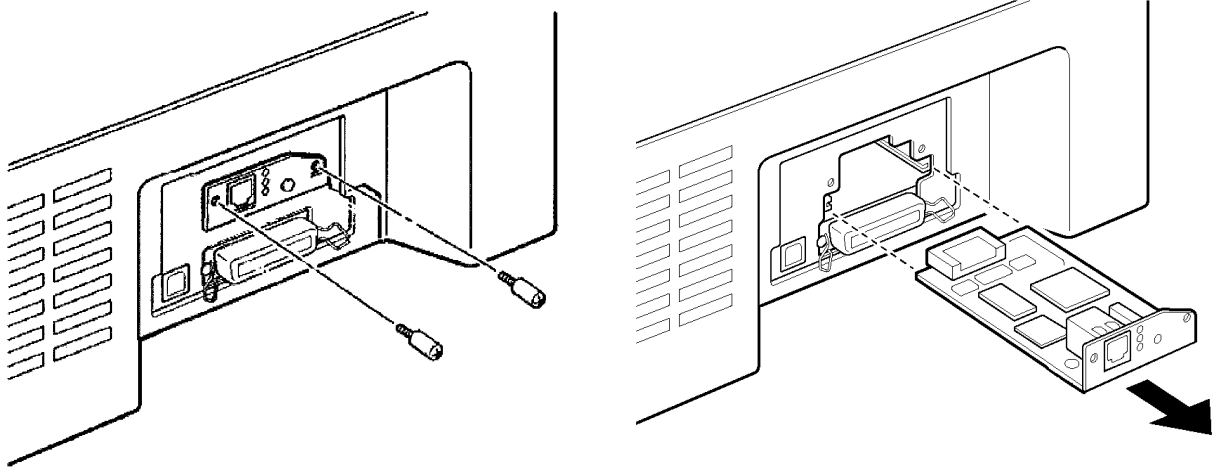
Figure 4.14 LAN card removal

Installation

1. Install the LAN card by reversing the removal procedure.

   Note;   Take care to insert the card into the guide rail correctly.
                 Setup of a LAN card is necessary. See the online manual in the CD of LAN card.
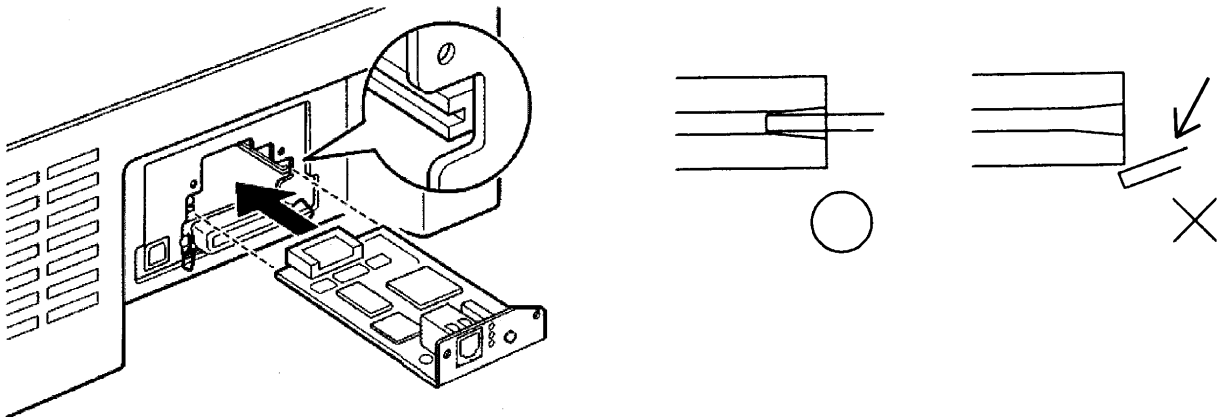
Figure 4.15 LAN card Installation

(7) Flap replacement

Removal

 1. Remove the paper table and stacker unit.
 2. Remove the flap.

Installation

 1. Install the flap by reversing the removal procedure.

Flap

Paper table

Stacker plate

Stacker frame
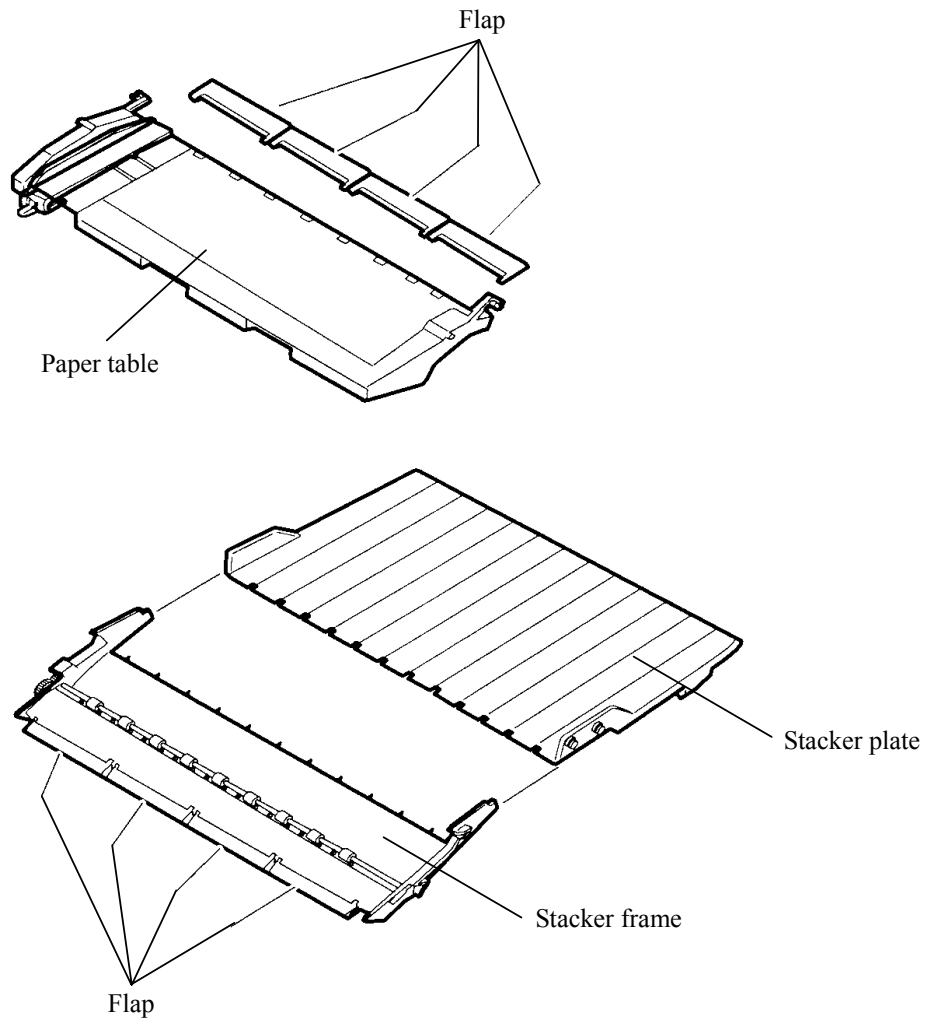
Flap

Figure 4.16 Flap removal and Installation

(8) Ribbon Cassette replacement

Removal

1. Close the front cover, and turn the power on. Then the Print Head move to ribbon replace position.
2. Turn the power off. And Open the front cover.
3. Press the ribbon release levers located on both side of the cartridge and carefully lift the cartridge out of the printer.
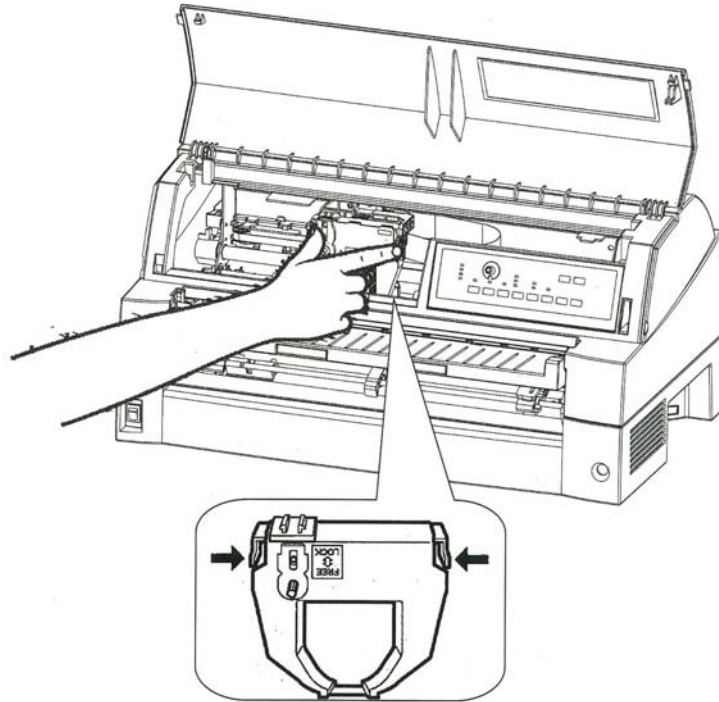
Figure 4.17 Replacing the Ribbon cartridge

Installation

1. Remove the new ribbon cartridge from its package. Push in the sides of the two ribbon release tabs. The tabs will snap into the cartridge and the ribbon feed mechanism will engage.
2. Turn the ribbon feed knob clockwise to be sure that it feeds properly.
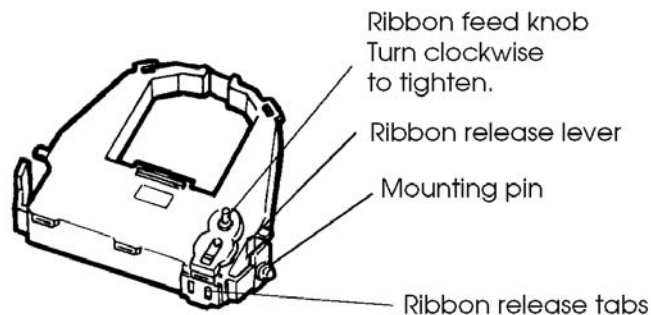
Figure 4.18 Preparing the Ribbon cartridge

3. Place the two mounting pins on the ribbon support brackets of the head cartridge. (The two mounting pins are located on the sides of the ribbon release levers.) Insert the ribbon so that the ribbon falls between the nose of the print head and the plastic print guide.

Print Guide
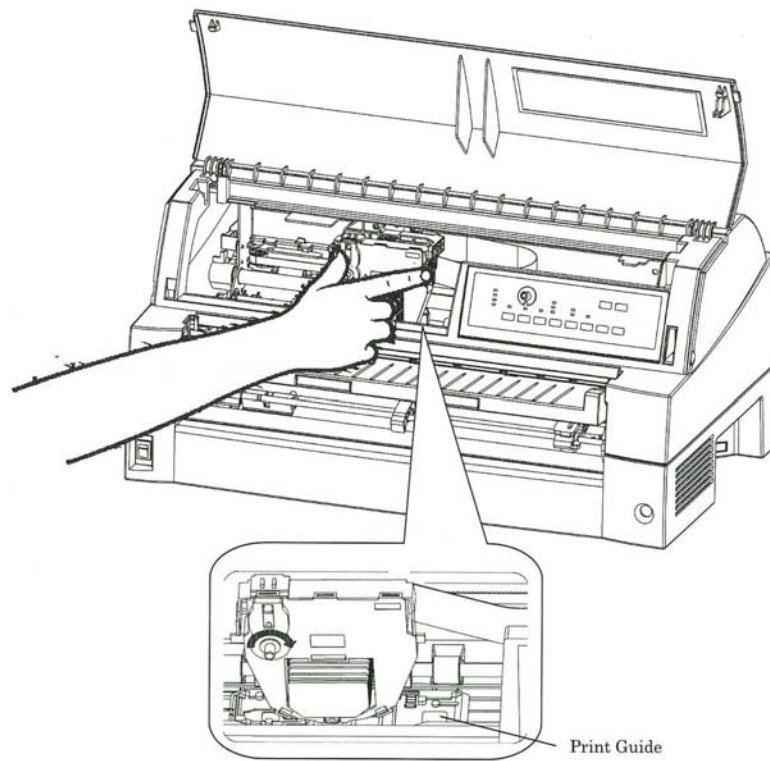
Figure 4.19 Installing the Ribbon cartridge

4. Turn the ribbon feed knob clockwise to tighten the ribbon.
5. Close the front cover of the printer.

Note:
The buzzer may sound if the print head is moved while the power supply is ON.

⑼ Print head replacement

⚠ Caution Hot	At printing or after printing, print head is high temperature. Don't touch the print head still cool.

Removal

1. Turn off the printer.
2. Open the front cover of the printer and remove the ribbon cartridge.
3. Pull the left end of the head lock wire forward to release it from the hook at the left of the print head carriage.
4. Then release the wire from the center hook.
5. Release the wire (under the head) on the left side.
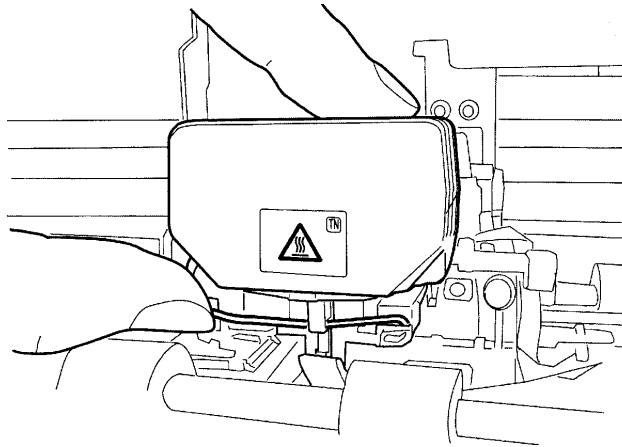
Figure 4.20 Print head removal

6. Remove the print head from the connector on the carriage, as shown in the figure below.

Wire
(Left side releases)
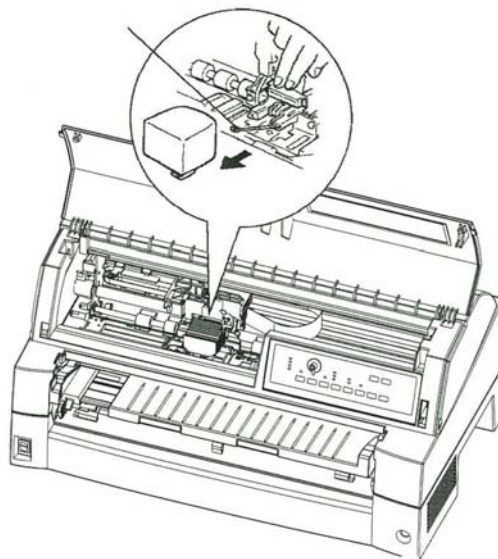
Figure 4.21 Removing the Print head from connector

Installation

1. Install the print head by reversing the removal procedure.

(10) Control Panel Unit removal and installation

Removal

1. Open the front cover.
2. Unhook the control panel case at three positions, then pull out the control panel unit to the front.
3. Disconnect cable from the control panel board.

Installation

1. Install the control panel unit by reversing the removal procedure.

Three hooks
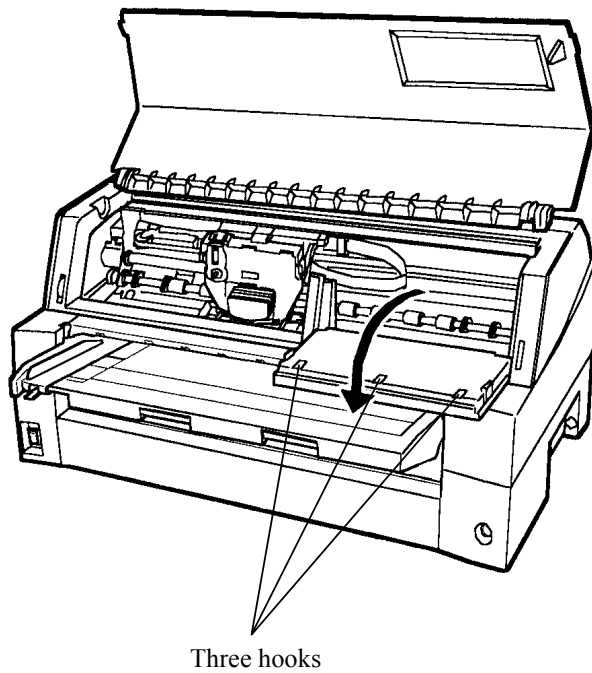
Figure 4.22 Removing the Control panel

(11) Front Cover removal and installation

Removal

1. Open the front cover .
2. Pull The hinge of the Front Cover slantwise then remove the front cover.

Installation

1. Install the front cover by reversing the removal procedure.
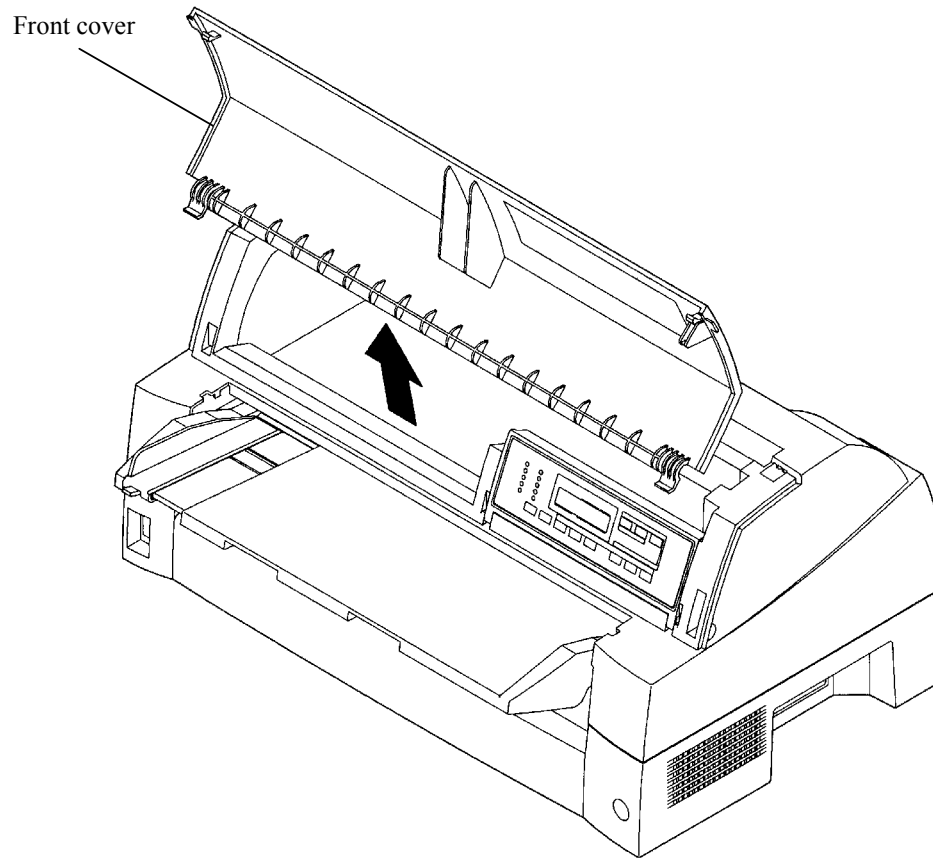
Front cover

Figure 4.23 Removing the Front cover

(12) Upper Cover removal and Installation

Removal

1. Remove the control panel.
2. Remove the two screws securing the upper cover.
3. Raise the paper table.
4. Disengage the hooks on the front left and right of the upper cover, then lift off the upper cover.
5. Remove the paper table.

Installation

1. Install the paper table.
2. When installing the upper cover, pass the control panel cable and cover open switch cable through the openings on the upper cover and control panel holder.
3. Hereafter, follow the removal procedure in reverse order.

Unhooking on the left   Unhooking on the right
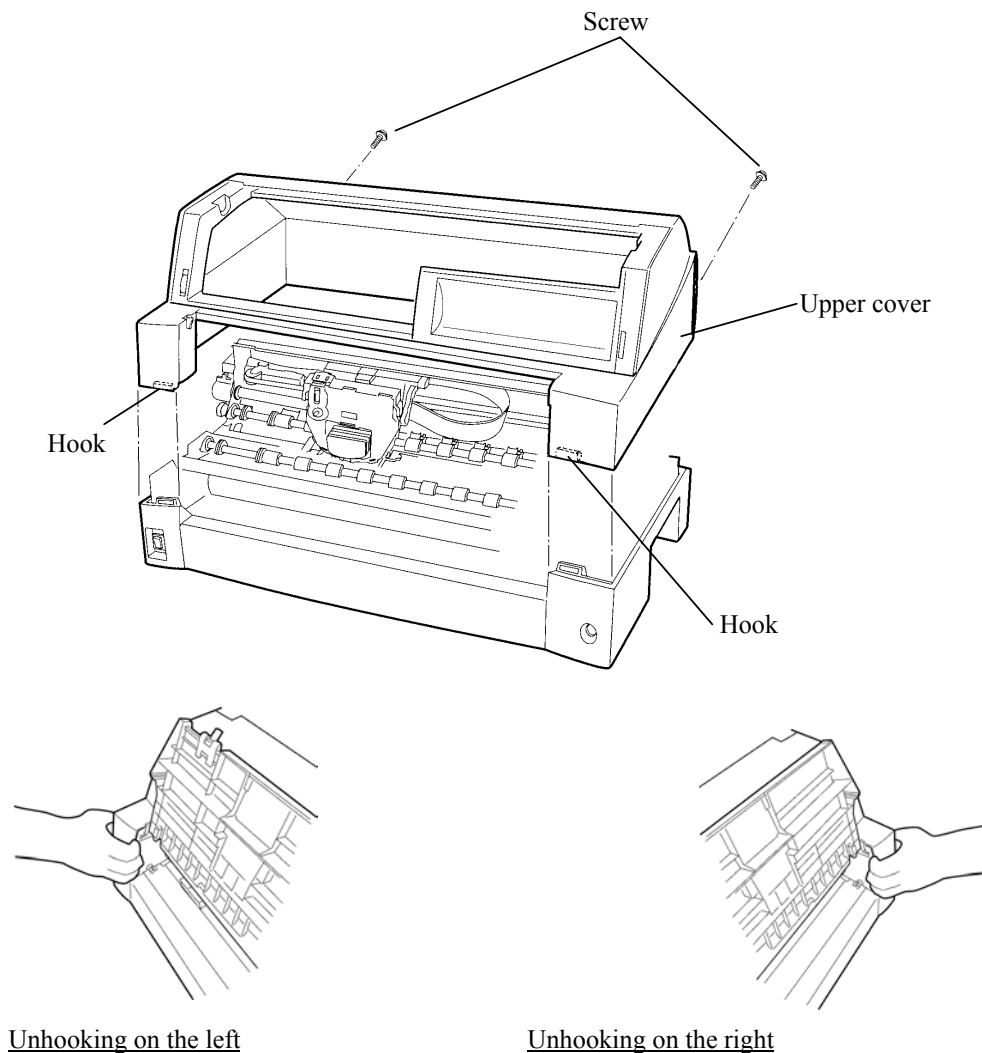
Figure 4.24 Removing the Upper cover

(13) Print Mechanism Unit removal and installation

Removal

* Do this work on a no slippery level bench so that the mechanism can be tilted stably during replacement.
On a slippery surface like paper, the printer may slide when the
mechanism is tilted. It deteriorates the work efficiency.

1. Remove the upper cover.
2. Access the mechanism assembly from the back of the
   printer.
3. Hold the rubber foot and the side plate.
4. Slowly hold up the mechanism unit on the upper
   side.( )
   Note; Too high position cause unplug the
   connector. So be carefully.
5. Move the mechanism unit about 2cm to the right (when
   looking form back of the printer) and then put the rubber
   foots of the front of mechanism unit above the mounting
   projection of lower cover(2).
6. Keep the left hand holding side plate. and then move the right
   hand to the rear of the mechanism unit(3).
7. Lift up the rear of the mechanism unit(4).and then place the tilt
   bar hole of the rubber foot(5)and hole of the lower cover to
   support mechanism unit.

Side plate

Rubber foot

Tilt bar

Tilt bar storing
position

Mounting projection

Tilt bar standing
position
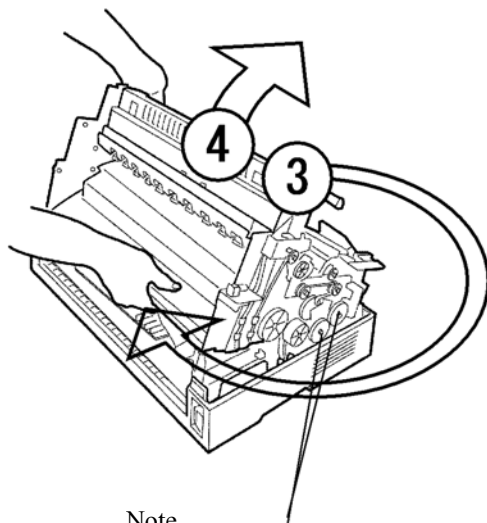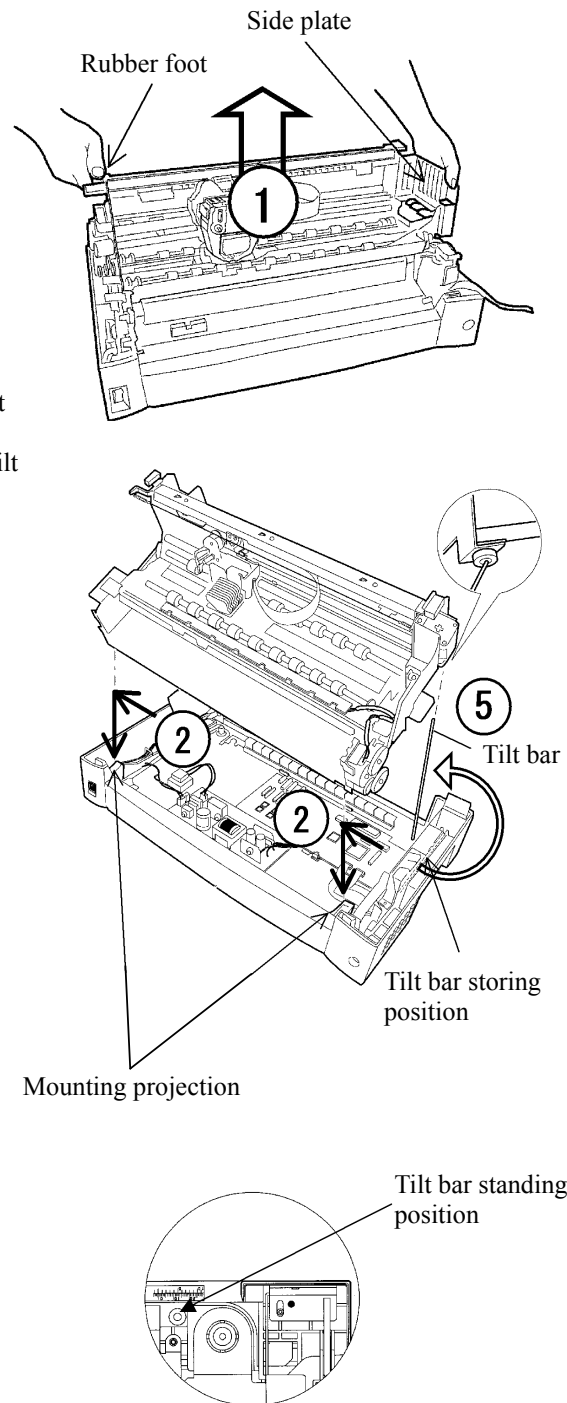
Note
Be careful not to catch studs in a
lower cover.

Figure 4.25 Print Mechanism Unit removal and installation

8. Unplug cables from mechanism unit.
   (SP motor ,LF motor, TR motor, Carrier cable (3 flat cables),RCSF cable, Relay cable. Total 8 cables)
9. Lift the mechanism unit higher and remove it.

Relay cable

LF Motor cable

TR Motor cable

SP motor cables

Carrier cable
(3 FFC Cables)

R-CSF
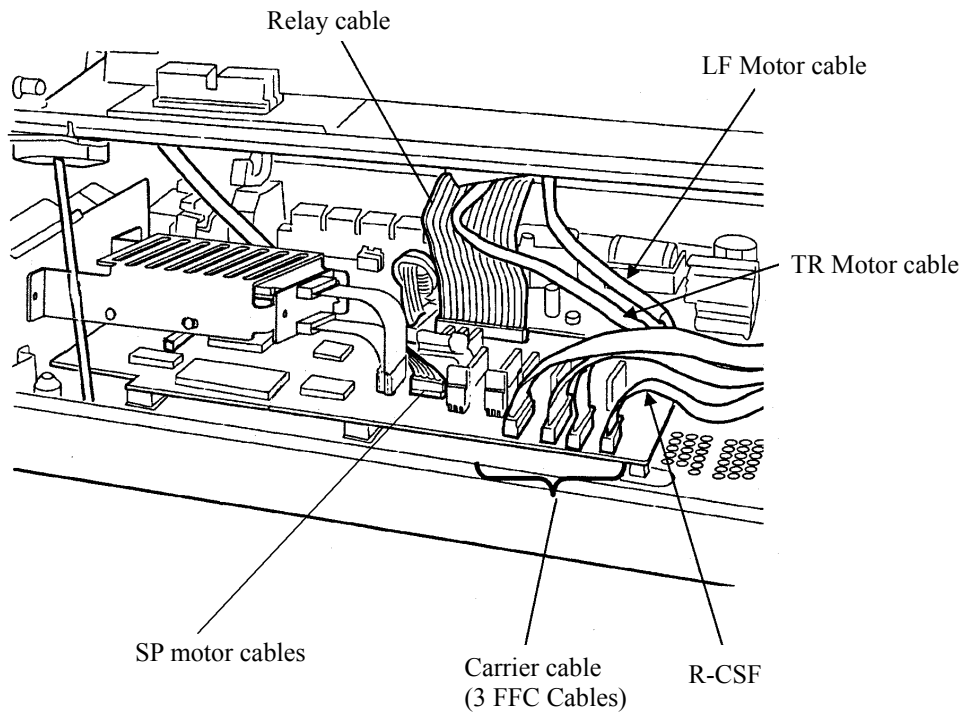
Although not drawn a picture, there is also
the following cables in fact.
 SP FAN cable
 INLOK cable

Figure 4.26 Print Mechanism Unit removal and installation

Installation

1. Install the mechanism assembly by reversing the removal procedure.

Note: The following adjustments are required after installation:
- Bi-directional printing positions
- Auto loading positions
- Skew detection

(14) Power Supply Unit removal and installation

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the 3 screws securing the power supply unit.
4. Disconnect the AC switch assembly connector, reactor connector, and power supply unit connector, then remove the power supply unit.

Installation

1. Install the power supply unit by reversing the removal procedure.
2. Counter reset should be done after Power Supply Unit replacement.

Screws

Power supply unit connector

Power supply unit

Reactor connector
(Only 100-120V models)

AC switch assembly

Figure 4.27 Power Supply Unit removal and installation

(15) ROM Board (Main Board) replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the LAN cables. Remove the bracket (2 screws).
4. Remove the 6 screws securing the ROM board (4 on the top and 2 on the side), and remove the ROM board.
5. The memory chip on the ROM board contains printer information (setup and counter data).   Remove it from the old ROM board and mount it on the ROM board to be installed.

Installation

1. Replace the NVRAM (memory chip) to put adjustment and set up information from old board into the new board.
2. Install the ROM board by reversing the removal procedure.
   Mount the memory chip on the IC socket with the dent facing the printer cable connector.

To reset the NVRAM see the procedure as follows.
(Note, Resetting NVRAM requires adjustment and setting up. If you don't know set up value don't reset NVRAM)
To all clear NVRAM ;
To reset SET-UP ;
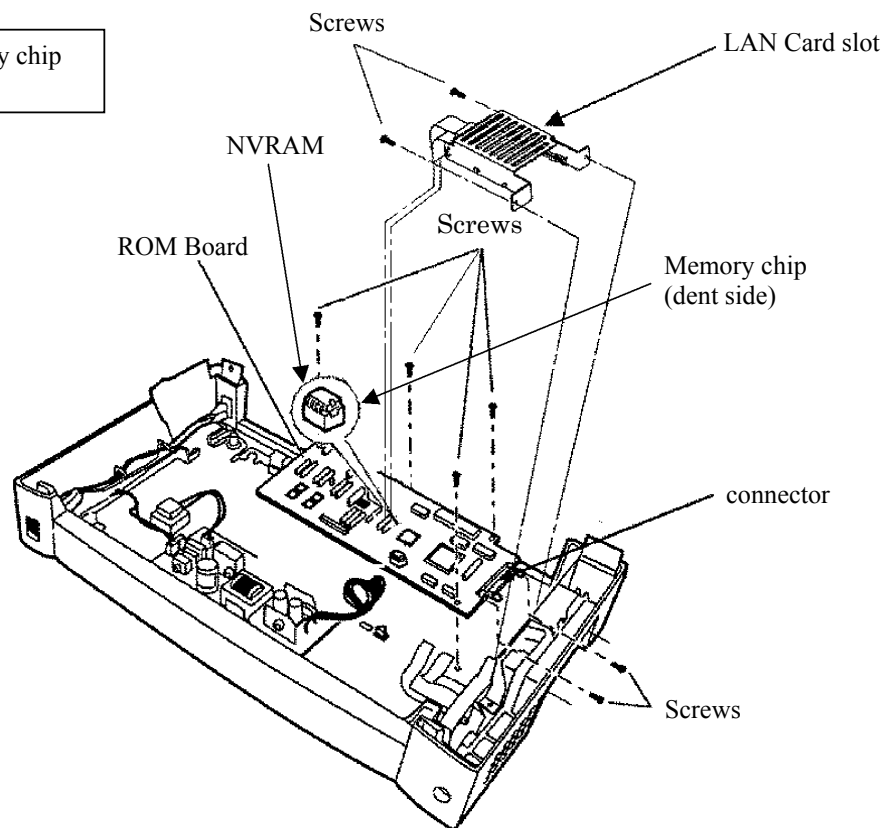
Figure 4.28 Rom board removal and installation

59

(16) LAN RELAY PCA / LAN cable 17P replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the two LAN cables. Remove the bracket (2 screws).
4. Remove the screws securing the LAN RELAY PCA.
5. Remove the LAN cable 17P.

Installation

1. Install the LAN RELAY PCA / LAN cable 17P by reversing the removal procedure.
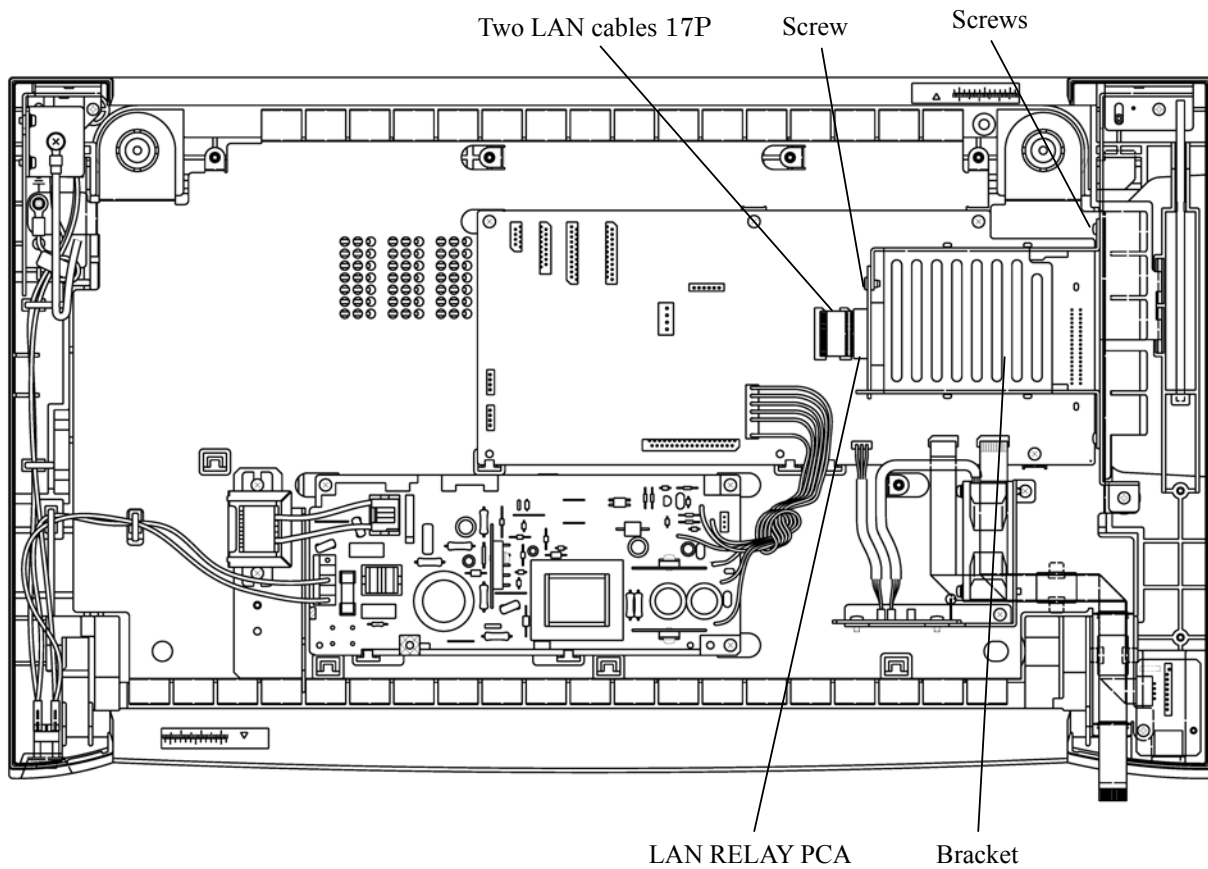
Figure 4.29 LAN RELAY PCA / LAN CABLE 17P removal and installation

(17) RS232C BOARD replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the two exclusive screws and RS232C BOARD.

Installation

1. Install the RS232C BOARD and two exclusive screws by reversing the removal procedure.

LAN RELAY PCA
With two exclusive screws
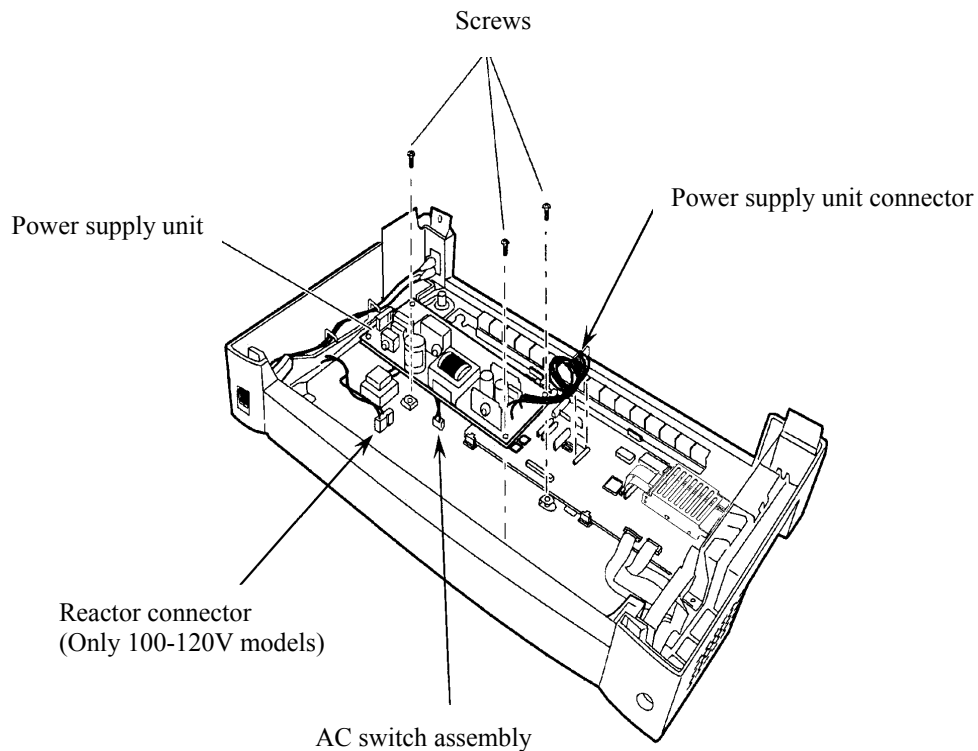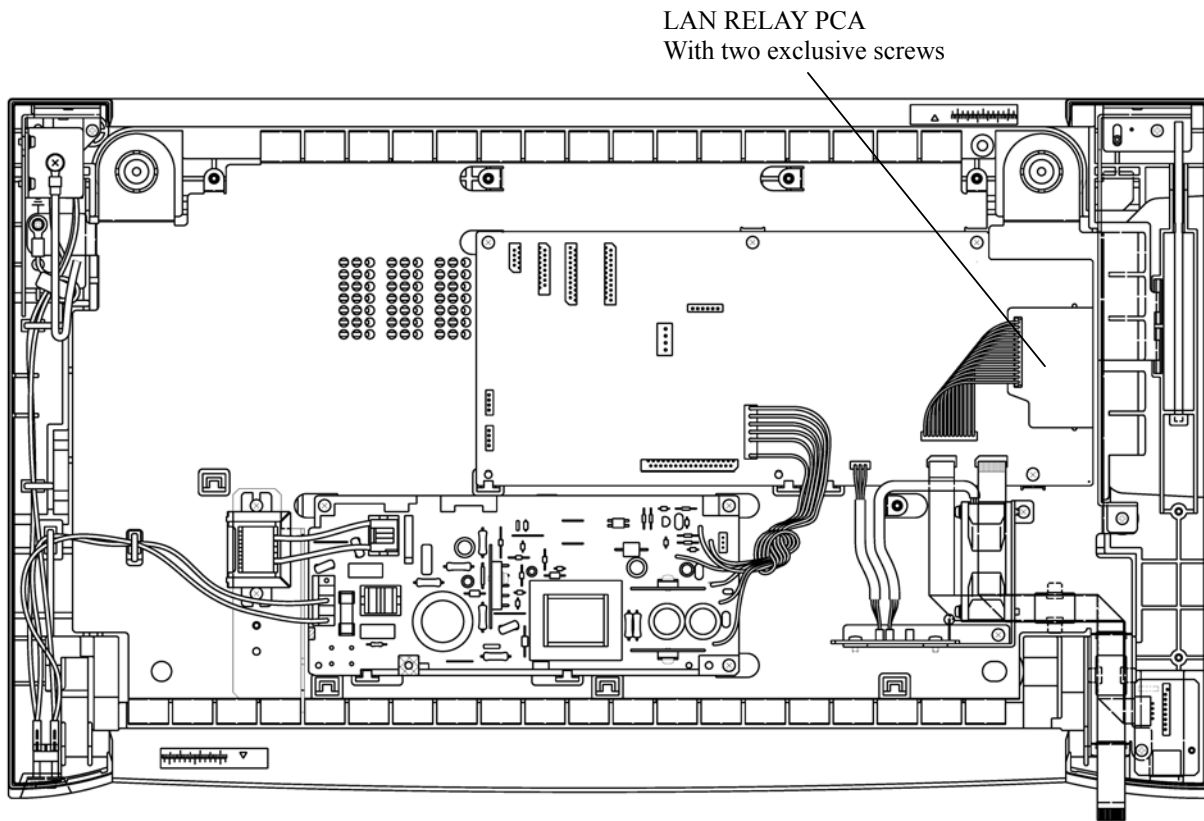
Figure 4.30 RS232C Board removal and installation

(18) AC Switch ASY removal and installation

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the AC switch assembly from the lower cover.

Installation

1. Install the AC switch assembly by reversing the removal procedure.

AC switch assembly

Red(upper side)

White(lower side)
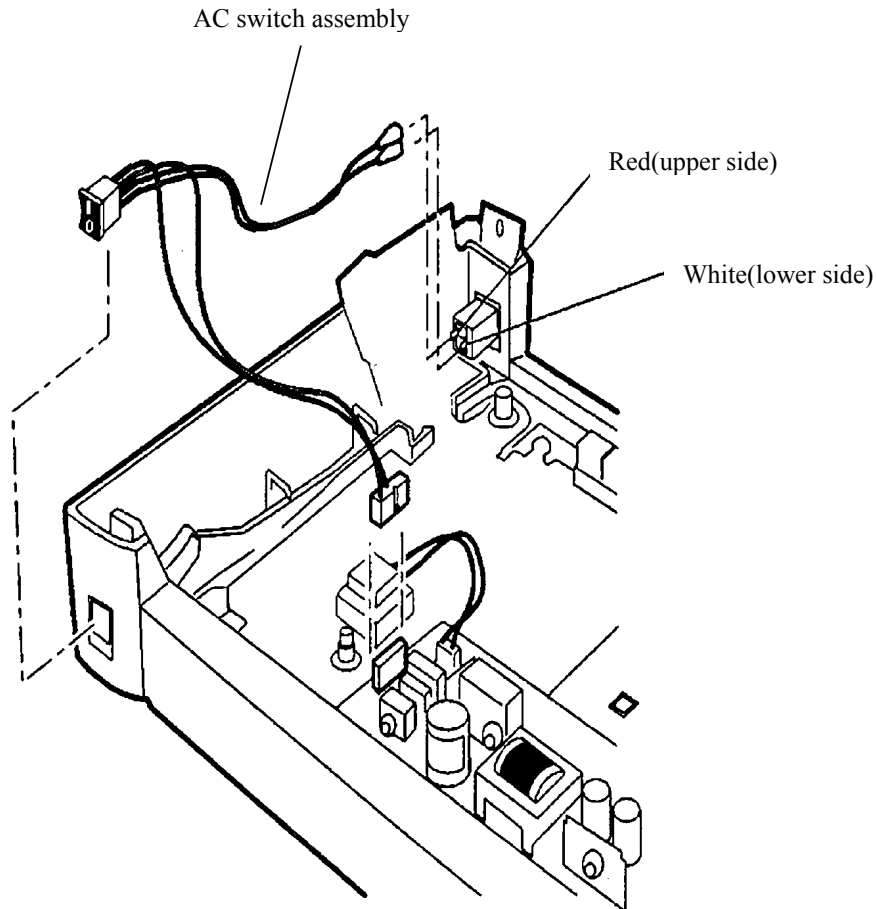
Figure 4.31 AC Switch ASY removal and installation

(19) Inlet ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the two screws securing the inlet and one screw securing the frame ground wire, and 4. remove the inlet assembly.

Installation

1. Install the inlet assembly by reversing the removal procedure.
2. Regarding the connecting cables, refer to the front page.

Figure 4.32 Inlet ASY removal and installation

(20) Reactor replacement

Note Reactor used only 100-120V models.

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the two screws securing the reactor.   Disconnect the cable from the power supply and remove the reactor.

Installation

1. Install the reactor by reversing the removal procedure.
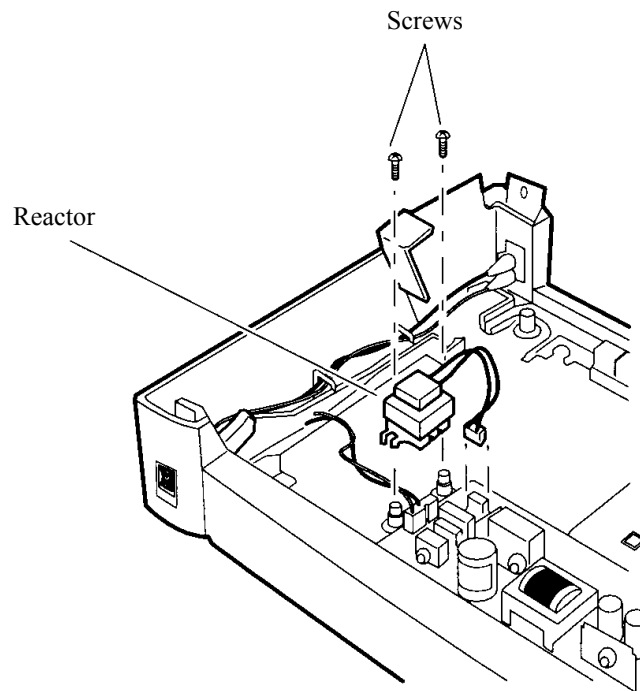
Figure 4.33 Reactor removal and installation

(21) FAN UNIT 2 replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the FAN UNIT 2 cable from ROM BOARD.
4. Remove the two screws securing the FAN UNIT 2.

Installation

1. Install the FAN UNIT 2 by reversing the removal procedure.

FAN UNIT 2 CABLE   FAN UNIT 2   Screws
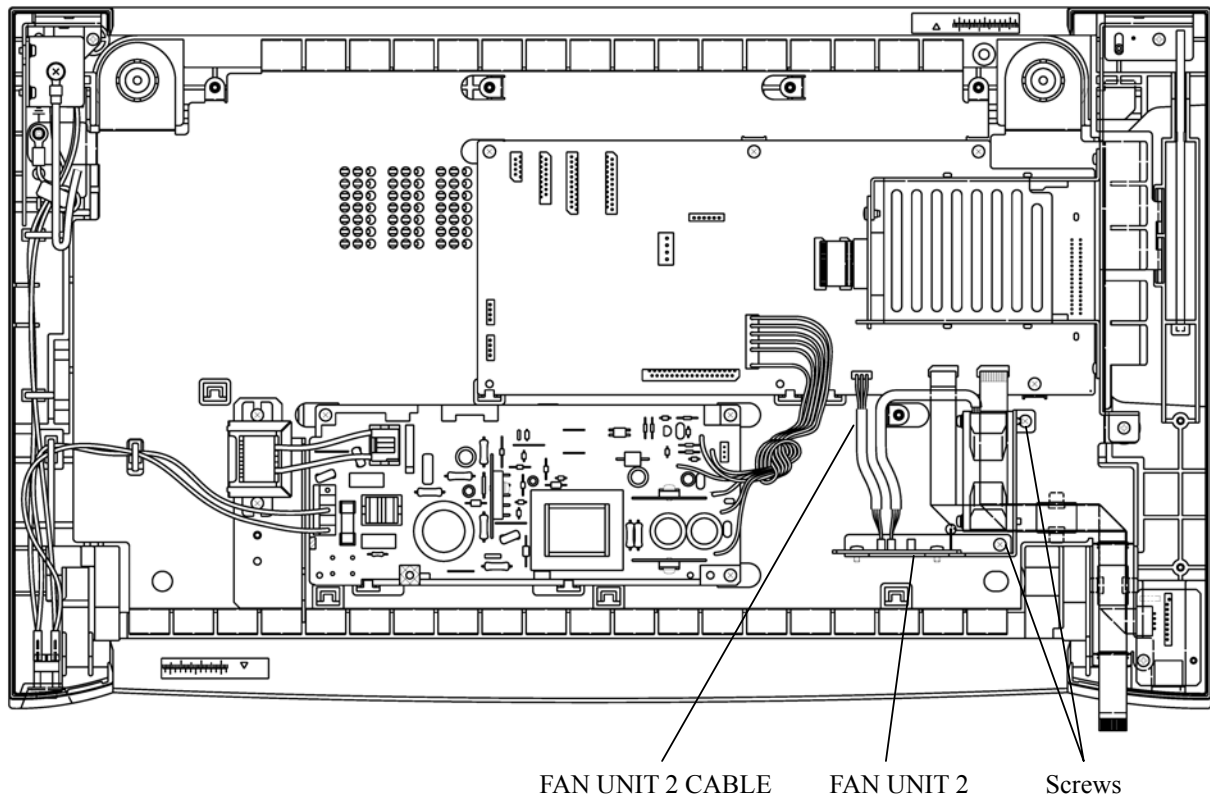
Figure 4.34 FAN UNIT 2 replacement

(22) Control Panel Cable replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the FAN UNIT 2.
4. Remove the 4 operator cable covers and then disconnect the operator cable from the ROM board.

Installation

1. Install the control panel cable by reversing the removal procedure.

ROM board

Control Panel cable
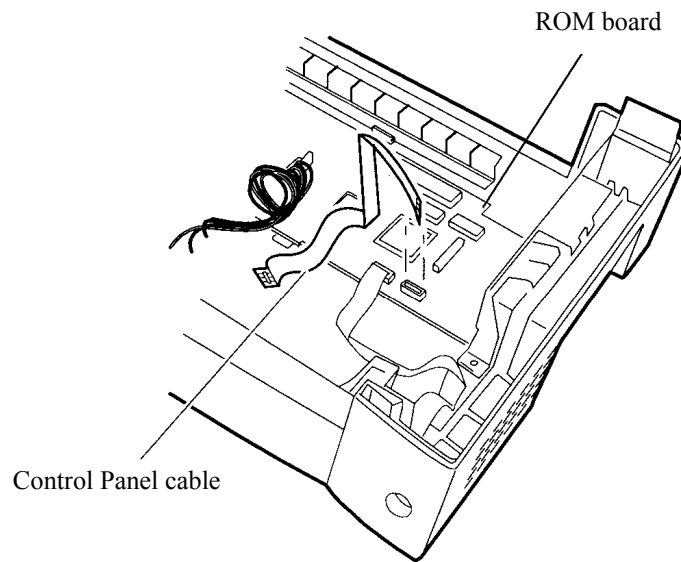
Figure 4.35 Control Panel Cable replacement
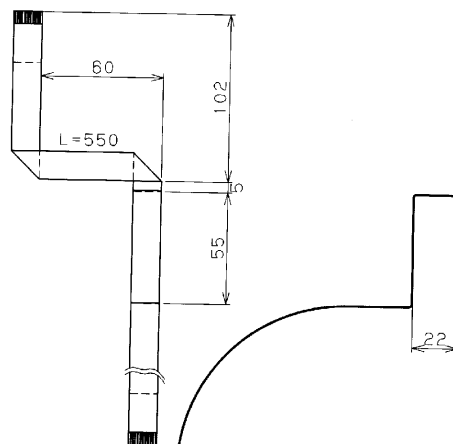
Figure 4.36 bending size of control panel cable

(23) F-CSF Cable/CSF Connector PCA replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the FAN UNIT 2.
4. Disconnect the cable from the front CSF PCA connector.
5. Remove the two screws securing the front CSF PCA to remove the PCA.

Installation

1. Install the front CSF PCA by reversing the removal procedure.
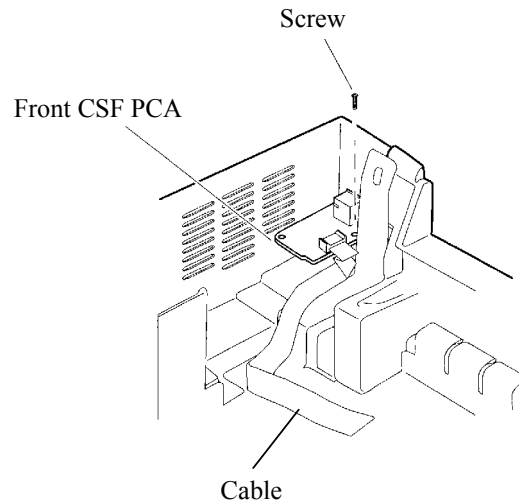
Figure 4.37 bending size of control panel cable

Bending the front CSF cable (KA02027-Y192)
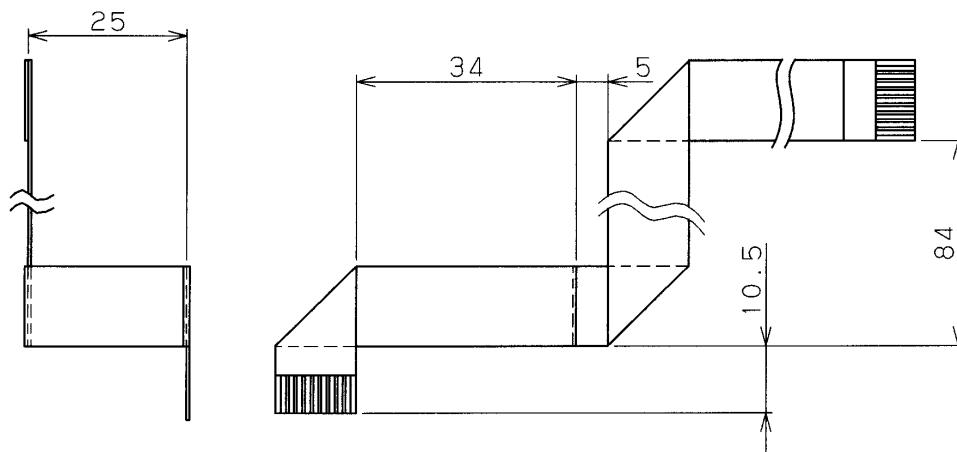
Figure 4.38 bending size of Front csf cable

(24) R-CSF Cable/CSF Connector replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the screw securing the rear CSF PCA and remove
   the PCA.

Installation

1. Install the rear CSF PCA by reversing the remov
      procedure.

Screw

CSF CONNECTOR

R-CSF CABLE

Figure 4.39 R-CSF Cable/CSF Connector replacement

Bending the rear CSF cable (KA02022-Y191)

22

87.5

20

11
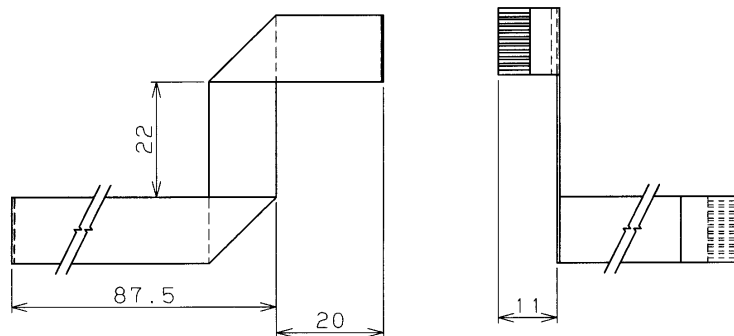
Figure 4.40 bending size of Rear csf cable

(25) Relay Cable replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Disconnect the relay cable from the sensor PCA connector.

Installation

1. Install the relay cable by reversing the removal procedure.

Sensor PCA
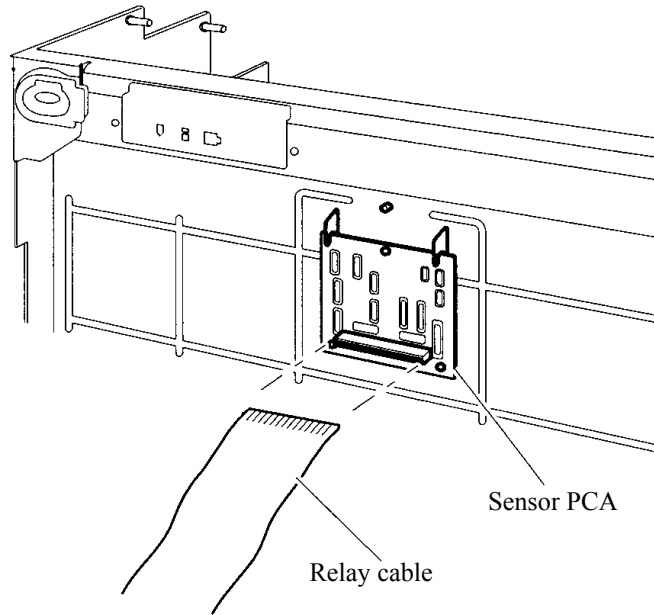
Relay cable

Figure 4.41 Relay cable replacement

(26) Sensor PCA replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Disconnect the mechanism cable and flat cable from the sensor PCA connectors.
4. Separate and remove the sensor PCA from the two saddles by using long-nosed pliers.

Installation

1. Install the sensor PCA by reversing the removal procedure.
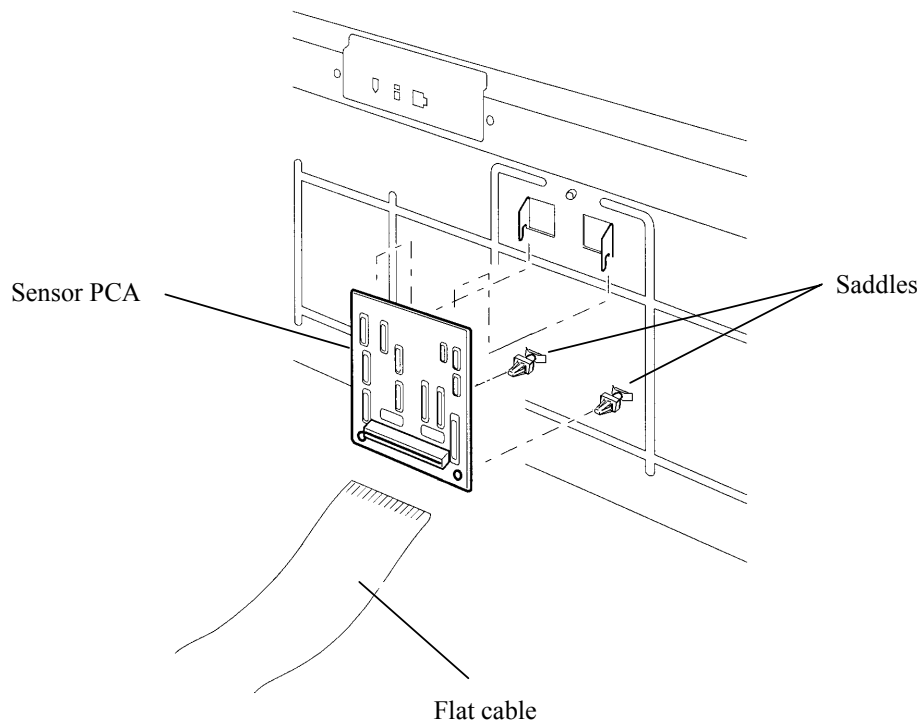
Figure 4.42 Sensor PCA replacement

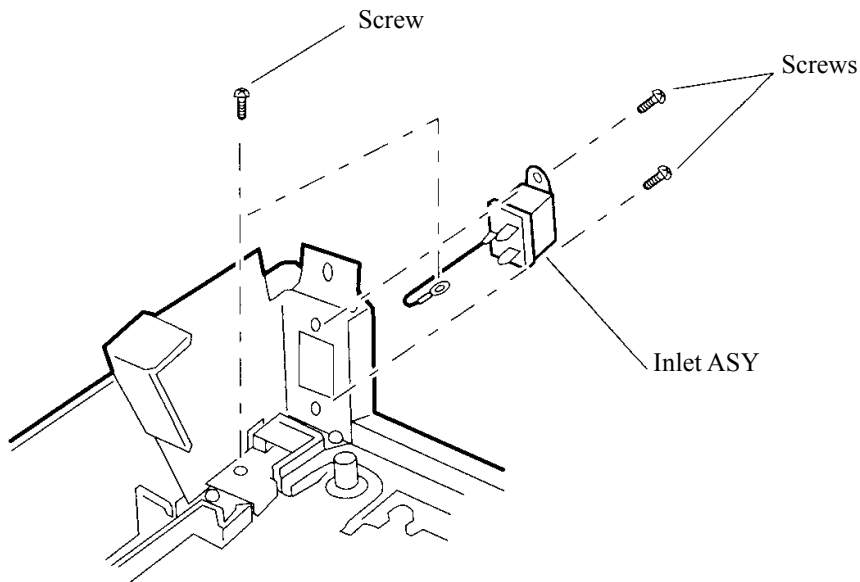# (27) SP Motor ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Loosen a screw securing the fan unit and turn the fan unit so that the screws securing SP motor may be removed
4. Remove the screws securing SP motor.
5. Remove the SP motor while loosen the tension pulley by (-) driver.

Installation

1. Install the SP motor assembly by reversing the removal procedure.

  Note:
  After installation, the following adjustment is required:
  Bi-directional printing position
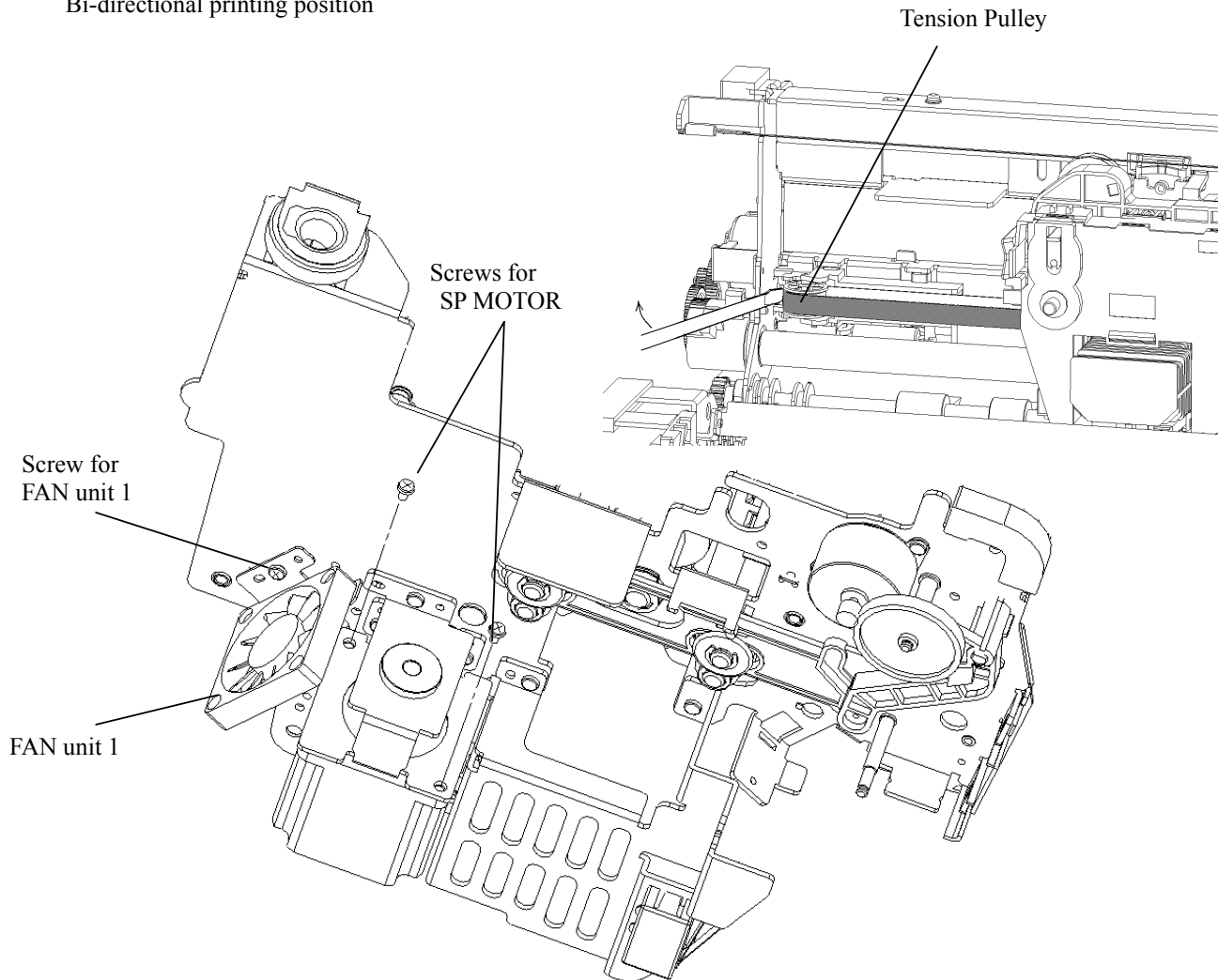
Figure 4.43 Sp motor removal and installation

(28) LF Motor removal and installation

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the idle gear
4. Remove the screws fixing lf motor
5. Remove the LF motor from inside of side frame.

Note
LF bracket needs adjustment. Putting the mark before disassembly is gives aim to adjustment for assembly.

Installation

1. Install the LF motor by reversing the removal procedure.

LF Motor

Screws

Idle Gear
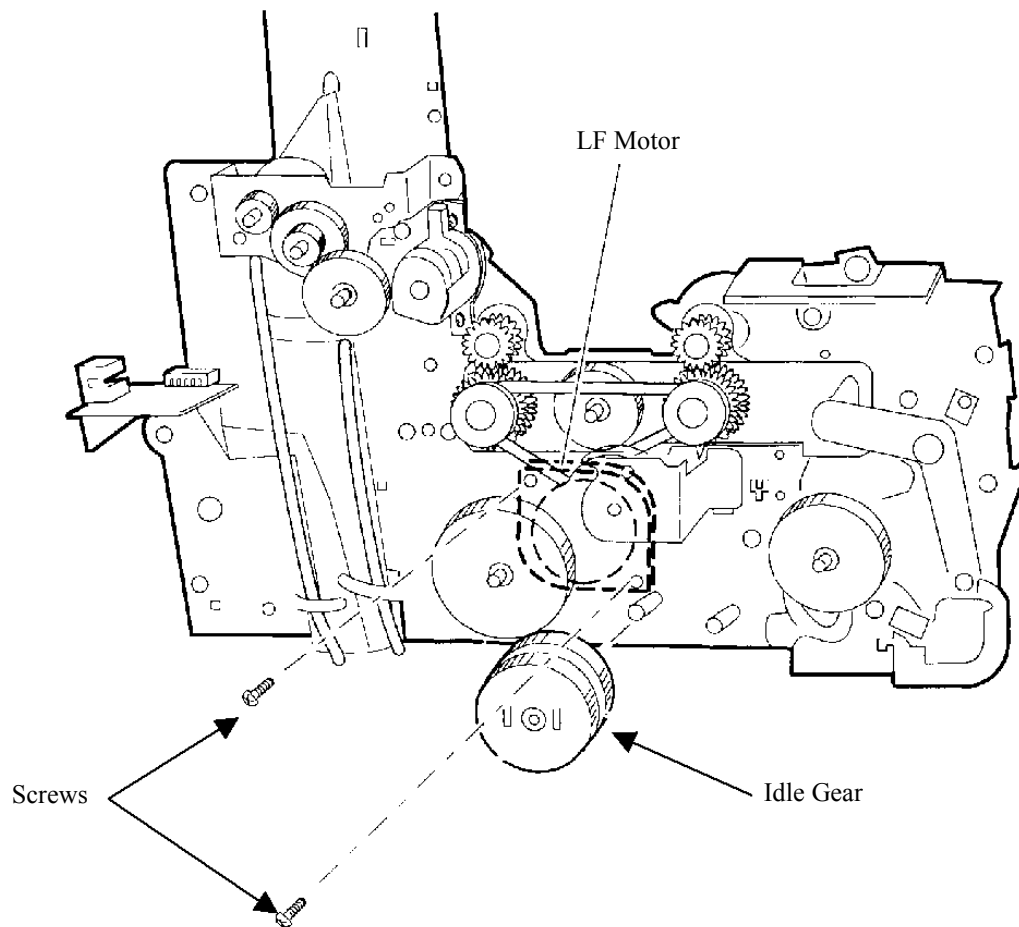
Figure 4.44 LF motor removal and installation

(29) TR Motor removal and installation

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the shift gear and shift spring.
4. Remove the two screws securing the TR motor.
5. Remove the TR motor from the side frame.

Installation

1. Install the TR motor by reversing the removal procedure.

TR motor

Screws

Shift gear

Shift spring
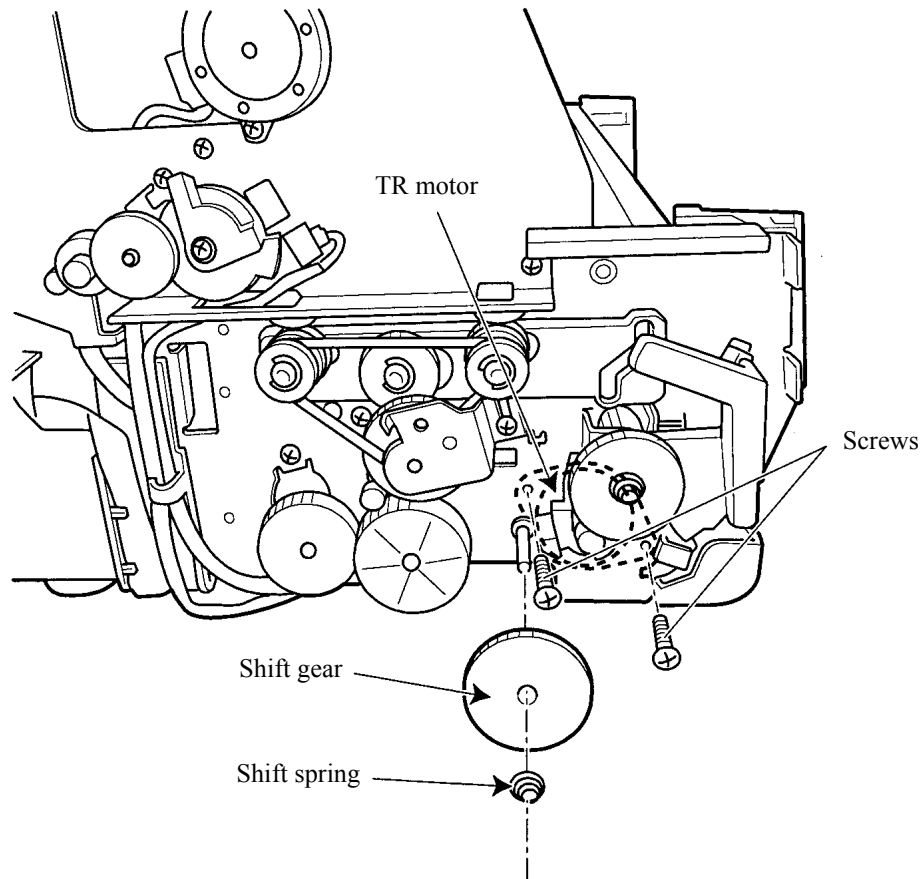
Figure 4.45 TR motor removal and installation

(30) APTC Unit replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the two screws and APTC bracket.

Installation

1. Install the APTC unit by reversing the removal procedure.

APTC motor

APTC bracket

Screw (APTC motor)
backside

Screws (APTC bracket)

Push against the bracket to the stud in
the direction of right and lower side.
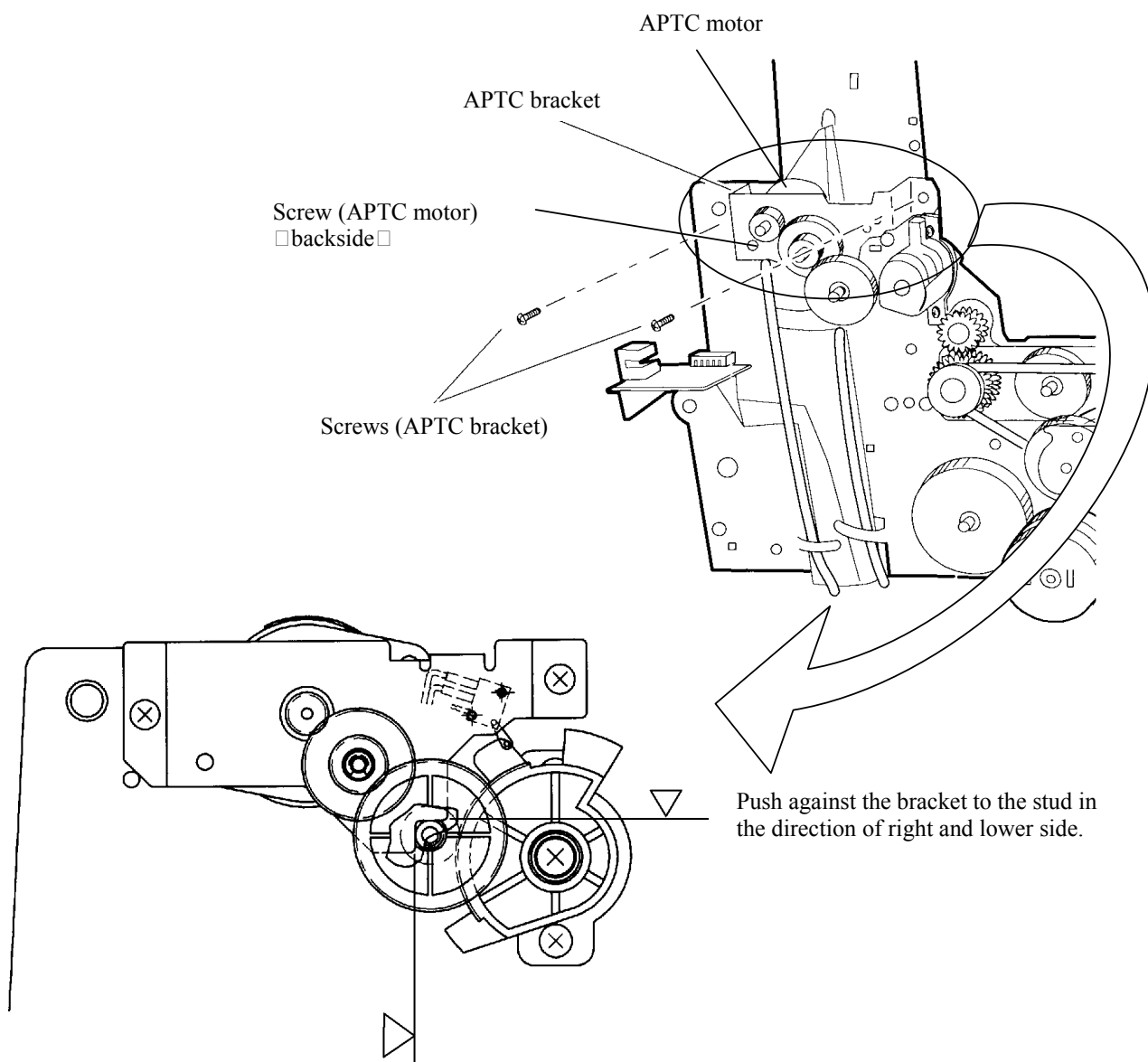
Figure 4.46 APTC Unit removal and installation

(31) HCPP Motor replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the HCPP gear.
4. Remove the two screws securing the HCPP motor.
5. Disconnect cable from the sensor PCA connector, then remove the HCPP motor from the side frame.

Installation

1. Install the HCPP motor assembly by reversing the removal procedure.

HCPP Motor

HCPP Gear
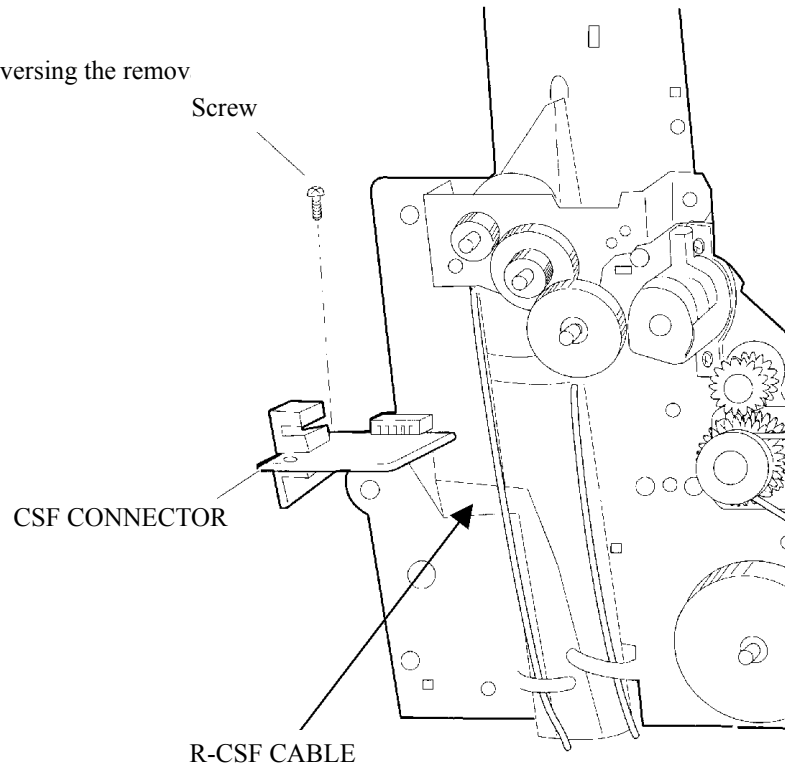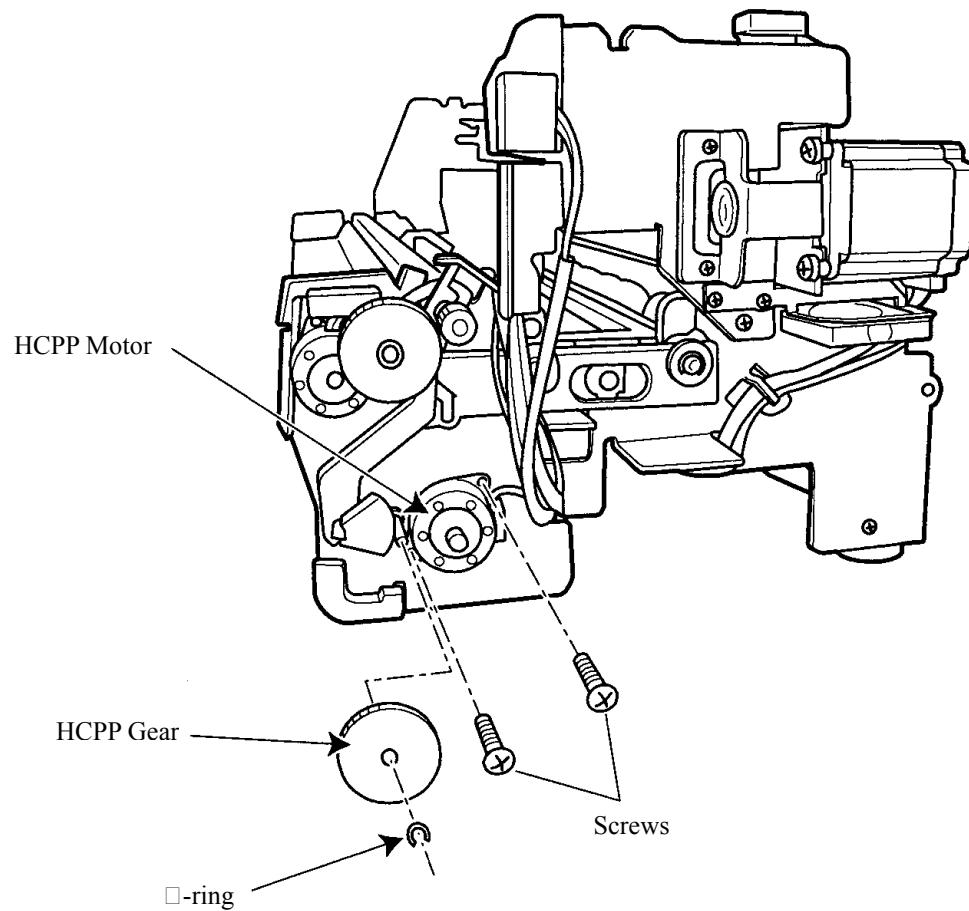
Screws

-ring

Figure 4.47 HCPP Motor removal and installation

（32）SP FAN motor replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the screw securing the bracket , then remove fan unit.

Installation

1. Install the fan unit by reversing the removal procedure.

FAN UNIT 1

Screws
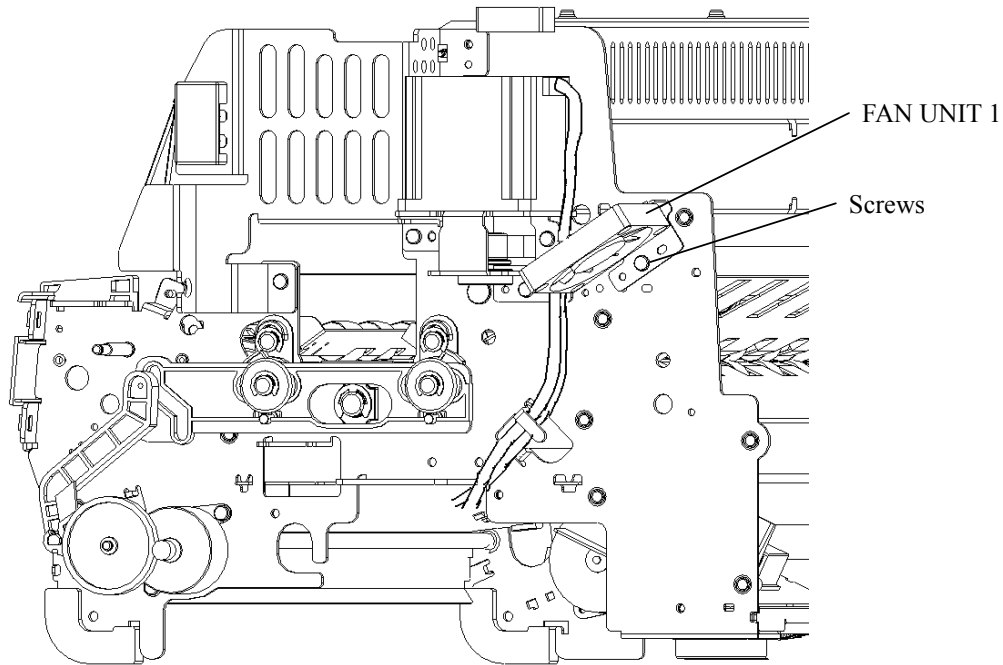
Figure 4.48 SP fan removal and installation

(33) INLK SW ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the SW holder and INLK SW ASY.

Installation

1. Install the INLK SW ASY by reversing the removal procedure.

INLK SW ASY

SW holder

SW holder
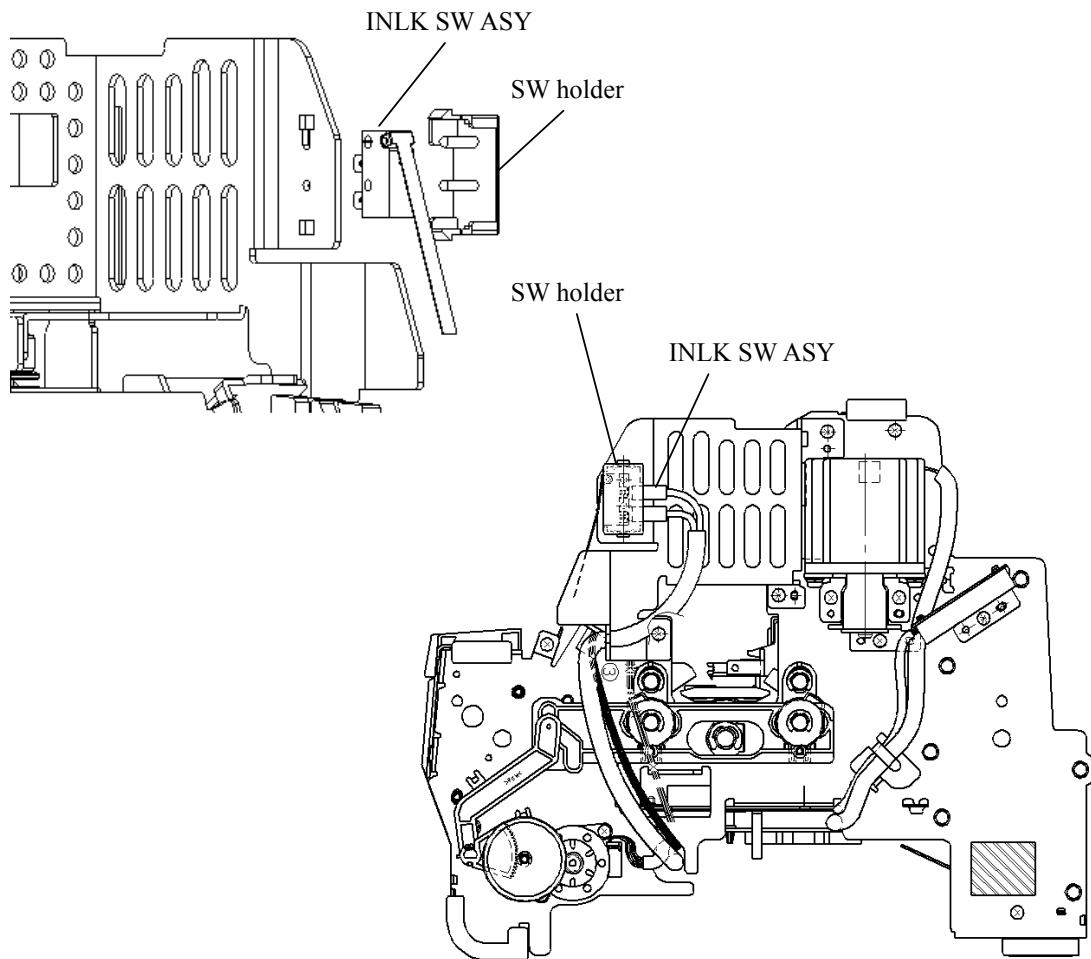
INLK SW ASY

Figure 4.49 INLK SW ASY removal and installation

(34) PS PCA replacement

Removal

1. Remove the upper cover.
2. Release the PS PCA from the three hooks on the PS holder.
3. Disconnect the cable from the connector and remove the PS PCA.

Installation

1. Install the reactor by reversing the removal procedure.

PS PCA

PS holder

Cable
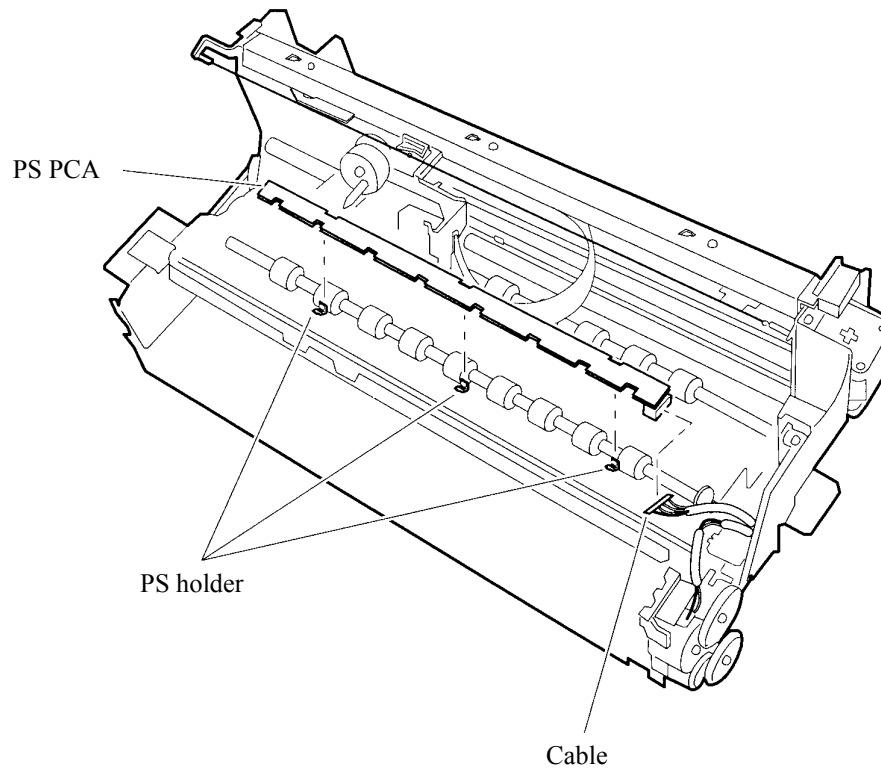
Figure 4.50 PS PCA removal and installation

(35) HCPP switch ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the rubber foot from side frame L, then unhook the holder at two locations.
4. Disconnect the cable from the sensor PCA connector, and remove the HCPP switch assemble.

Installation

1. Install the HCPP switch assembly by reversing the removal procedure.

Side frame L

Holder

HCPP SW ASY

Rubber foot
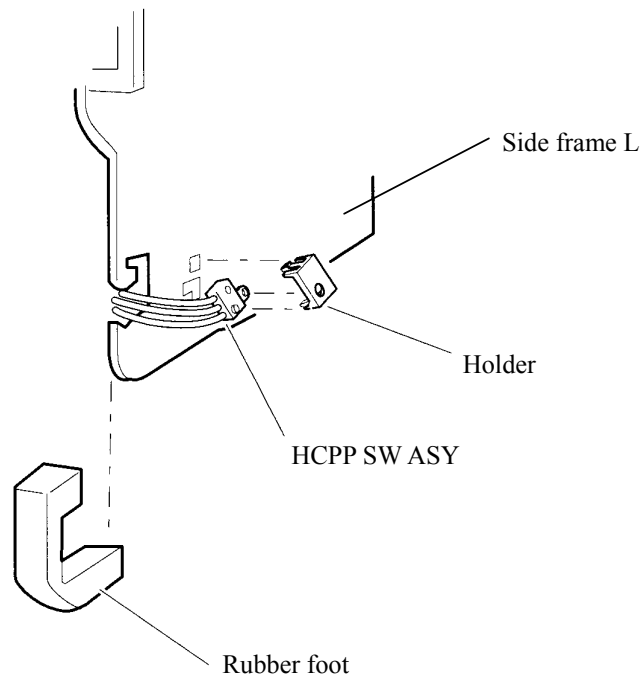
Figure 4.51 HCPP switch ASY removal and installation

(36) Sensor cover TR/TR PES ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Unhook the sensor cover TR and remove the sensor cover TR.
4. Unhook the TRPES ASY and remove the TRPES ASY.
5. Disconnect the TRPES ASY connector.

Installation

1. Install the TRPES assembly and sensor cover TR by reversing the removal procedure.

sensor cover TR
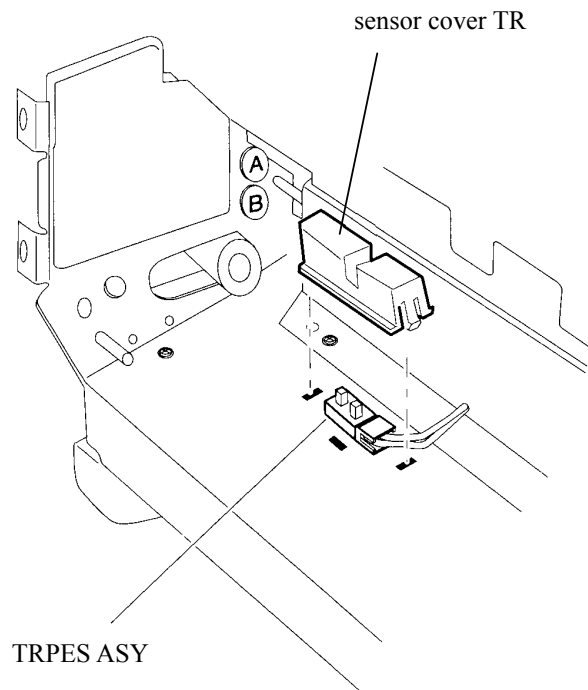
TRPES ASY

Figure 4.52 Sensor cover TR/TR PES ASY replacement

(37) Ribbon Rope ASY replacement

Removal

1. Remove the upper cover.
2. Remove the springs on the left and right side of ribbon rope.
3. Remove the ribbon rope.

Installation

1. Install the ribbon rope. If necessary, remove the ribbon bracket to lead the ribbon rope under the ribbon pulley.
   (To remove the ribbon bracket release the craws of the ribbon bracket hooking the carriage.)
2. Check the direction of turning.
3. Hook two springs left and right side of ribbon rope.
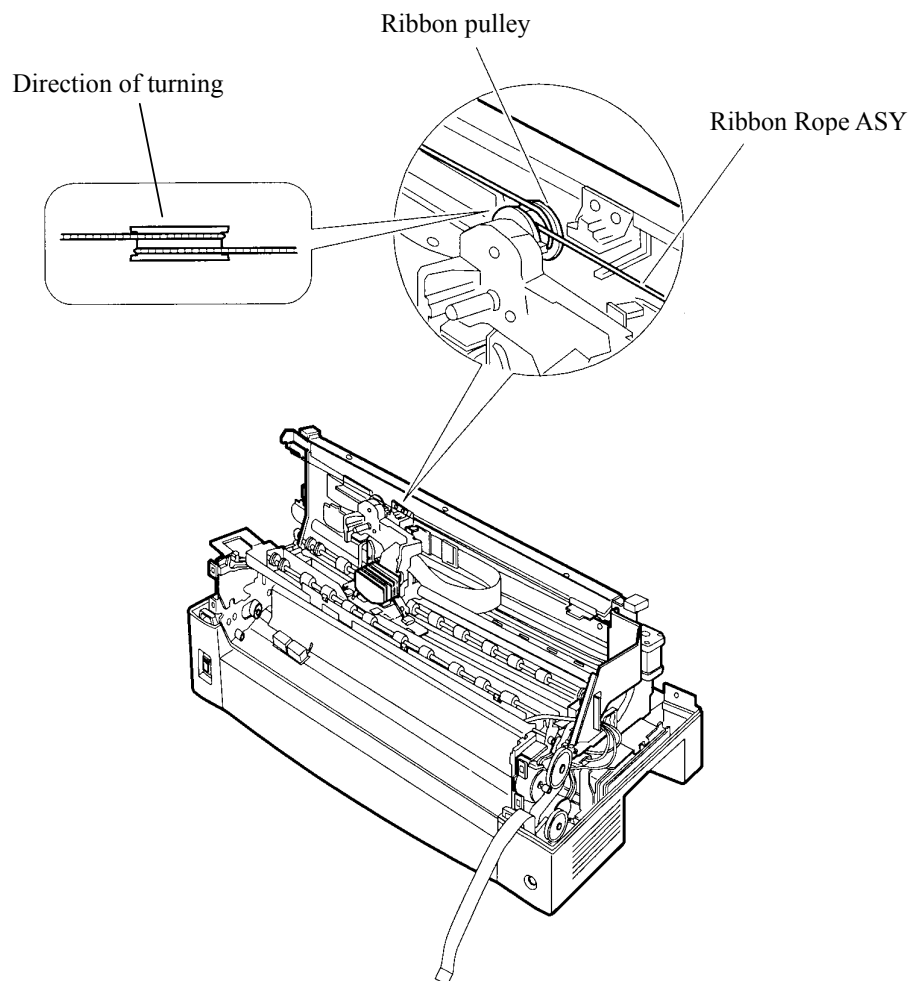
Figure 4.53 Ribbon Rope ASY replacement

(38) Card Guide ASY replacement

Removal

1. Remove the upper cover.
2. Remove the screws securing the upper guide F on its left and right, and release it to the front.
3. Remove the print head.
4. Disconnect the TOF1, TOF2, and panel keyboard cables from the carriage PC board.
5. Remove the two retaining screws, and remove the card guide assembly while turning it.

Installation

1. Install the card guide assembly by reversing the removal procedure.
2. Improper cable forming may cause the breaking of wire. See next page to form the wire appropriately.
3. After installation, the following adjustments are required:

- Card guide attaching position
- TOF sensor output
- Auto loading position
- Printing positions at paper end
- Left printing start position
- Skew detection
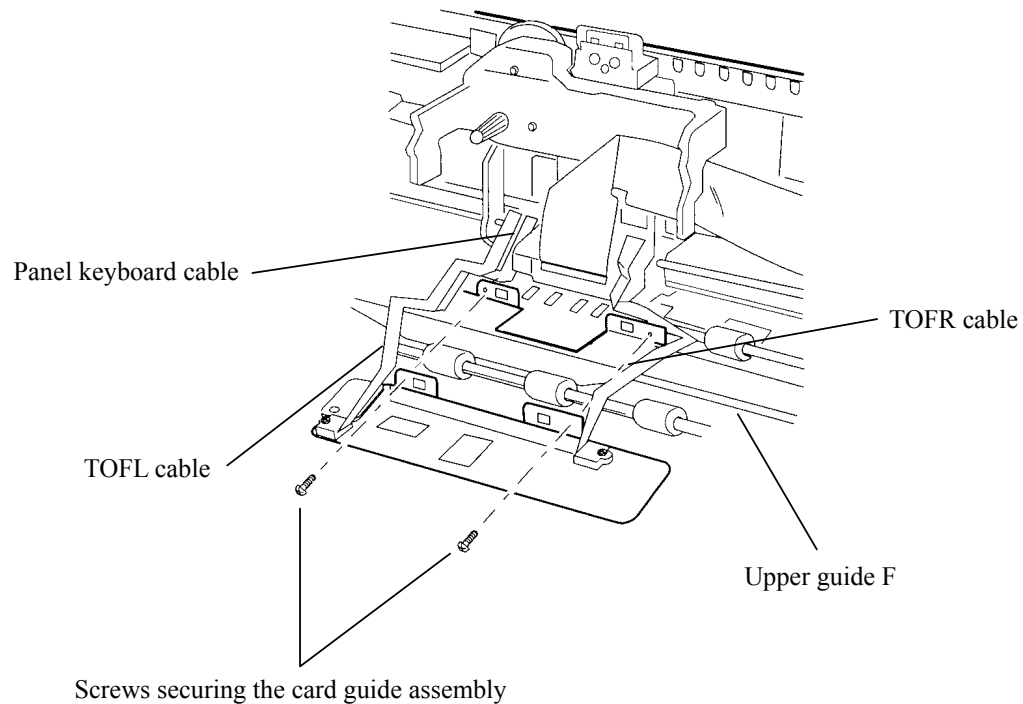
Figure 4.54 Card Guide ASY replacement

Proper cable forming of card guide.

1. Lead the cables in front of the guide part of the carrier frame (aluminum die-cast parts).
   Don't lead wires between the guide part and upper guide R or breaking wire may cause because of cables get into touch with upper guide F.

Guide part of the carrier frame

Upper guide
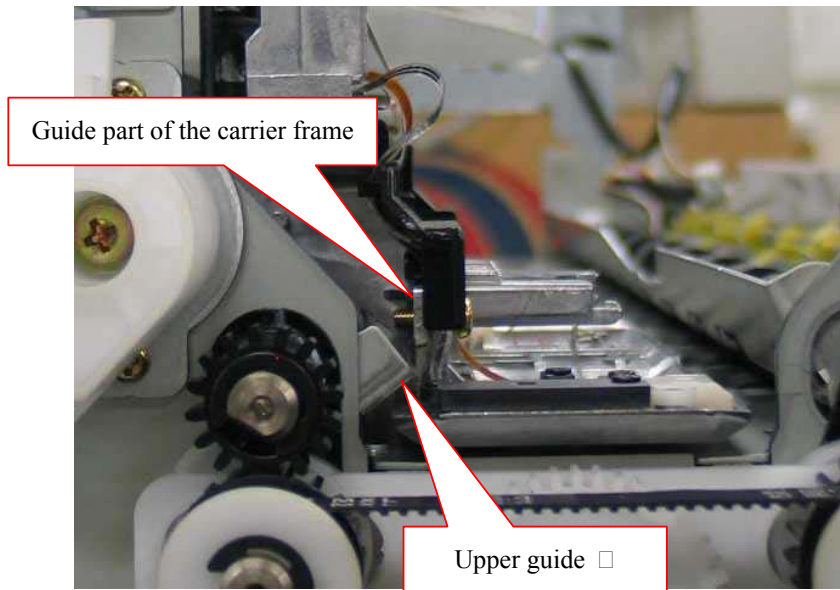
2. Lead TOF L and APTC cables inside a rib behind the ▲mark.
3. Insert the extra length of TOFL cable into the place of "A".
4. Insert the extra length of TOFR cable into place of "B".

Place "B" for extra length

Place "A" for extra length

▲mark
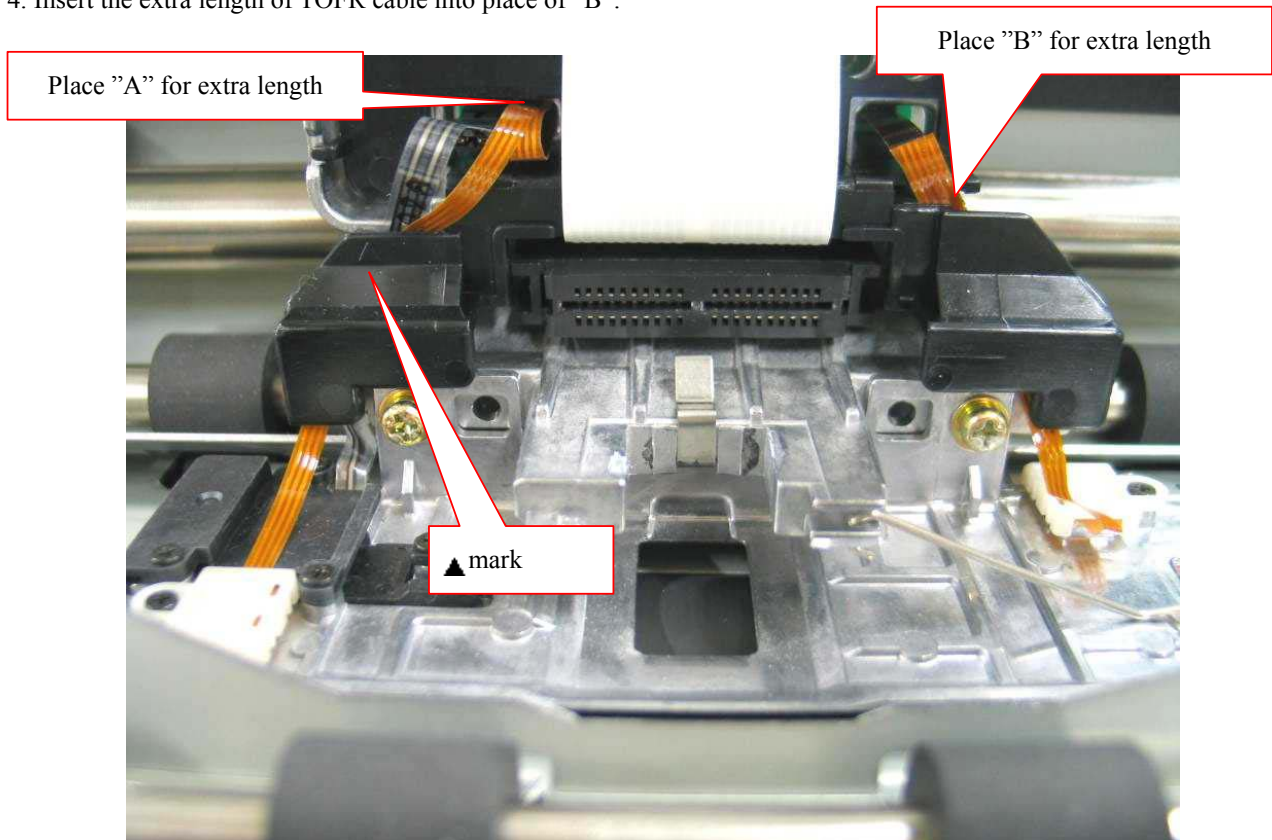
Figure 4.55 Card Guide cable forming

(39) TOFL/R sensor ASY replacement

Removal

1. Remove the upper cover.
2. Remove the screws securing the upper guide F on its left and right, and release it to the front.
3. Remove the print head.
4. Disconnect the TOFL/R cable from the carriage PC board.
5. Remove the small screws by precision driver, and remove the TOFL/R sensor.

Installation

1. Install the TOFL/R sensor assembly by reversing the removal procedure.
2. After installation, the following adjustments are required:

- TOF sensor's voltage adjustment
- Top-of-forms adjustment (factory use)
- Skew detection value adjustment

TOFL sensor ASY
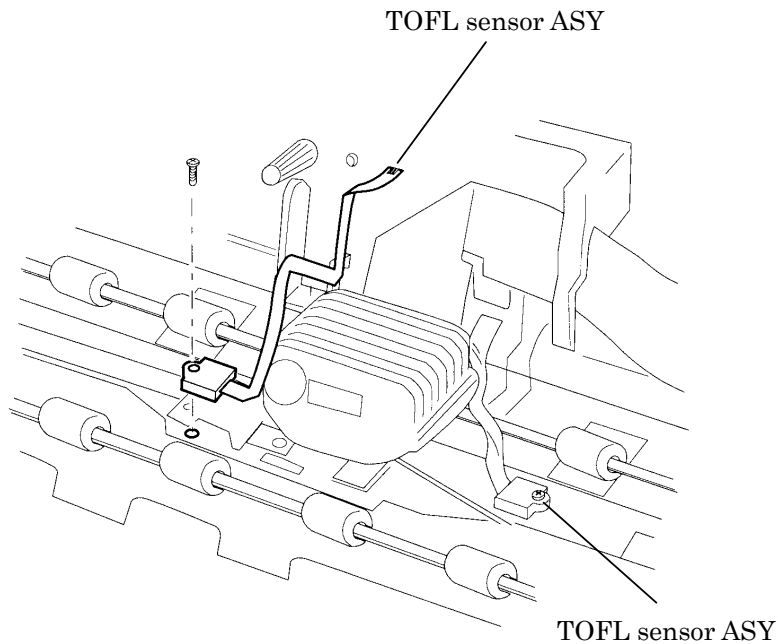
TOFL sensor ASY

Figure 4.56 TOFL/R sensor ASY replacement

（40）Carriage Unit and Stay Shaft replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Release the upper guide F to the front.
4. Remove the SS gear, gear B.
5. Remove the stay bearing and the stay shaft.
7. Remove the SP belt while pressing the tension bracket.
8. Remove the carrier cable holder.
9. Remove the card guide from the carrier.
   (If you don't have head gap jig don't remove
10. Remove the carrier unit

Note.
Don't remove the screws for upper angle. Head gap jig is necessary to fasten them.

Screws for upper angle

Removing print head and card guide is necessary to remove carrier unit without removing upper angle.

Carrier cable holder is behind the carriage. Slide it to remove it.

Carrier cable holder
Slide it to remove it.
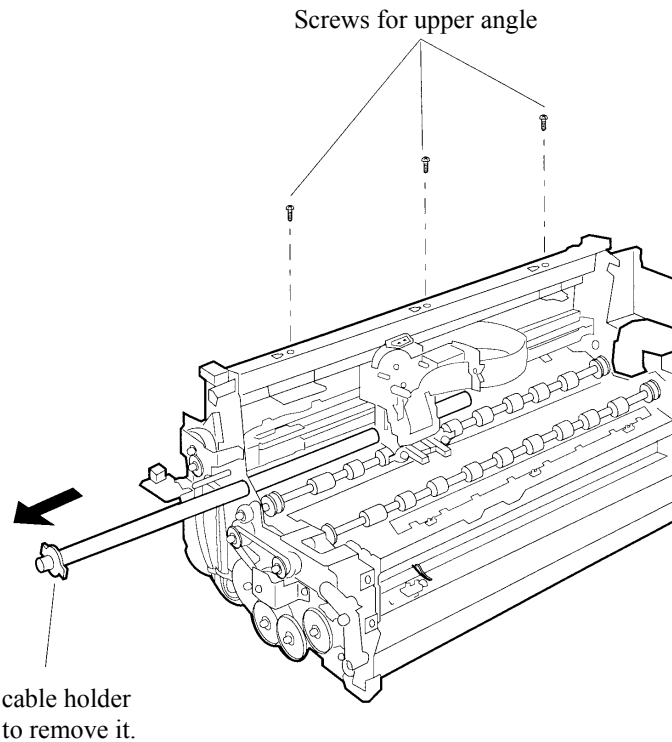
Figure 4.57 Carriage Unit and Stay Shaft replacement

Installation

1. Install the Carriage Unit and Stay Shaft by reversing the removal procedure.
2. When insert the stay shaft, take care of the oil felt inside the carrier hole.
   Refer to lubrication inspection.
   The following adjustments are required:

- Print head gap adjustment (for upper angle).
   (You may omit, when having not loosened the screw.)
- Card guide position adjustment
- TOF sensor's voltage adjustment
- Vertical Alignment (V-ALMNT) adjustment
- Top-of-forms adjustment (factory use)
- Skew detection value adjustment

(41) SP Timing Belt replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the carriage unit.
4. Remove the belt clamp.
5. Remove the timing belt.

Installation

1. Install by reverse order
2. The following adjustments are required:

- Print head gap adjustment (for upper angle)
- Card guide position adjustment
- TOF sensor's voltage adjustment
- Vertical Alignment (V-ALMNT) adjustment
- Top-of-forms adjustment (factory use)
- Skew detection value adjustment

Difference of teeth position shall be less than 1 teeth.

Belt Clamp

Belt

Belt Clamp
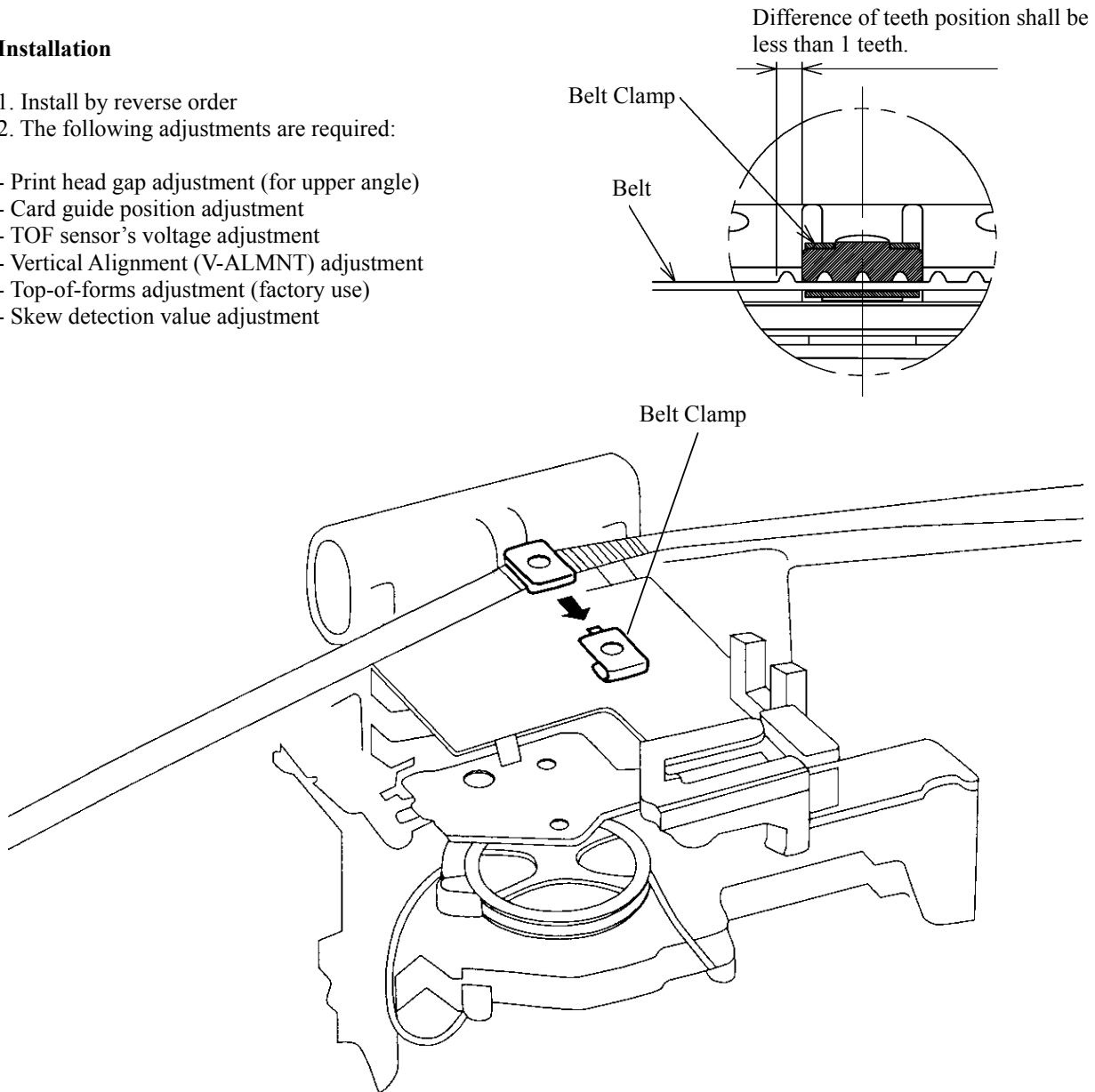
Figure 4.58 SP Timing Belt replacement

(42) SP Tension bracket replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the SP motor.
4. Remove the stay bearing so that stay shaft falls downward.
   (Therefore the purpose of this work is for increasing space for the work which removes a spring, it is omissible.)
5. Remove the tension pulley.
6. Remove the tension spring.
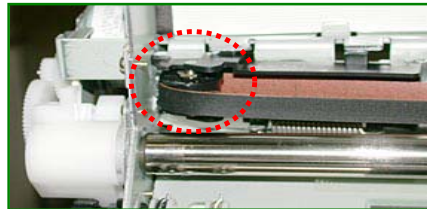
Removing tension pulley

Tension bracket

Tension Pulley
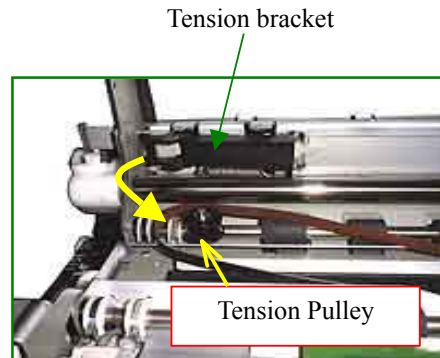
(1) Please hold firmly the hook part on the left side of a tension spring (~~~~ on long nose pliers.
(2) Attach thumb of left hand to a frame and attach index finger to a ~~~~ And pull the pliers left by gripping force of left hand, so that spring ~~~~ removed form tension bracket.
(3) Remove a tension bracket from a frame portion.

Be careful not to give a crack to a shaft.

Figure 4.59 Removing SP Tension spring and SP tension bracket

Installation

As shown in the right figure, build a tension spring into a new tension bracket.

Please attach a new tension bracket and a new spring in a frame.

Attach the tension spring

(1)Hold firmly the root of a spring hook by long nose prier..

  Be careful not to give a crack to a shaft.
  It is desirable to work carrying a paper on a stay shaft and
  protecting.

(2) Attach thumb of left hand to a frame and attach index finger to a pliers. And pull the pliers left by gripping force of left hand, so that spring hook is installed hook part of upper stay..

Install subsequent process by reverse order
The following adjustments are required:
- Vertical Alignment (V-ALMNT) adjustment

Figure 4.60 Installing SP Tension spring and SP tension bracket

(43) LF Timing Belt replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Put the mark to memory the LF tension bracket position. .
4. Remove the LF tension bracket and remove the LF belt.

Installation

1. Install the LF timing belt by reversing the removal procedure.
2. Install the LF tension bracket while aligning it with the marking and secure it with a screw.

Note:
After installation is finished, the following adjustment is required:
LF belt tension

Put the mark before disassembly

LF belt

Lf tension bracket

screw
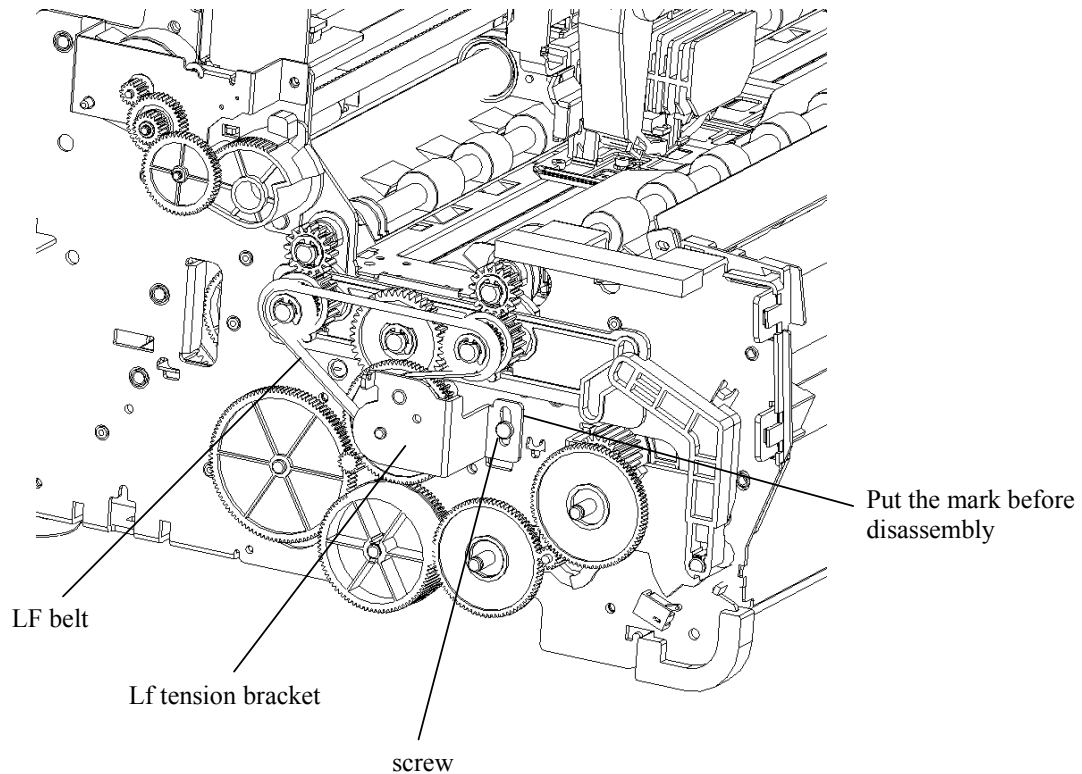
Figure 4.61 Replacing the LF timing belt

(44) Platen Roll replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Before remove the LF tension pulley ASY put the mark to memory its adjusted position.
4. Remove the LF tension pulley ASY and LF belt and Pulley gear.
5. Remove the Platen gear, Flanges, DV gears.
6. Remove the slide cam.
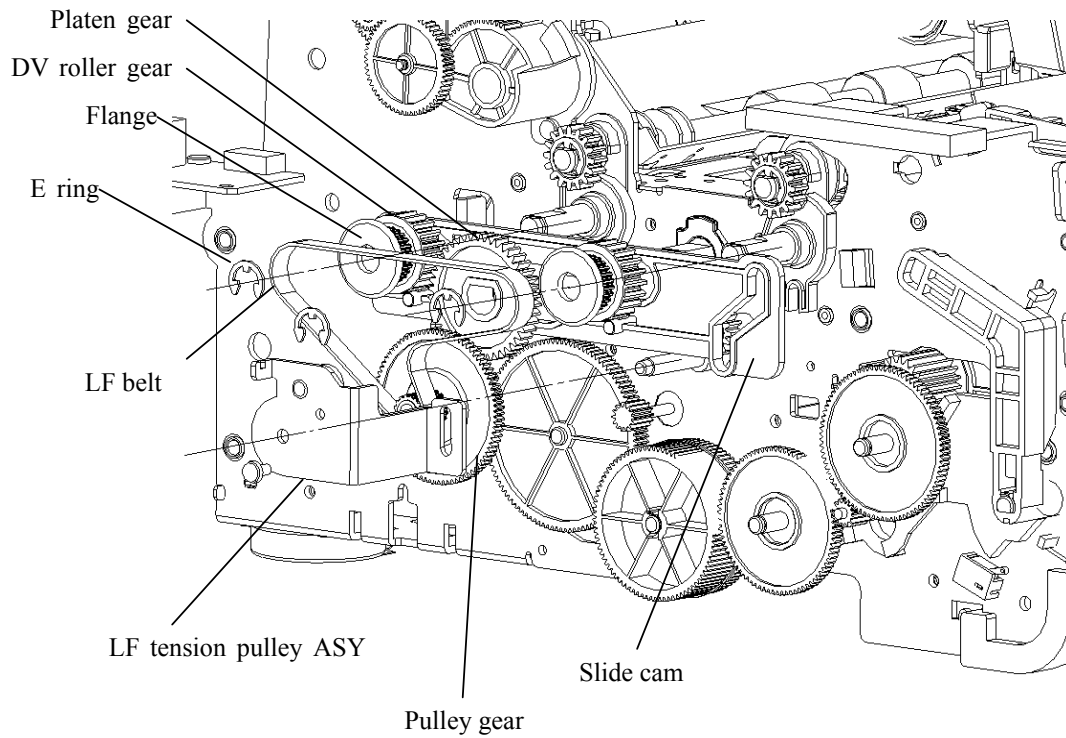
Figure 4.62 Removing the Platen roll

7. Turn down the mechanism assembly.
8. Disconnect cables backside of printer mechanism unit, remove 6 screws of lower plate.
9. Remove the bearings and slide in the direction of allow then remove it.

Platen roll

Screws for lower plate
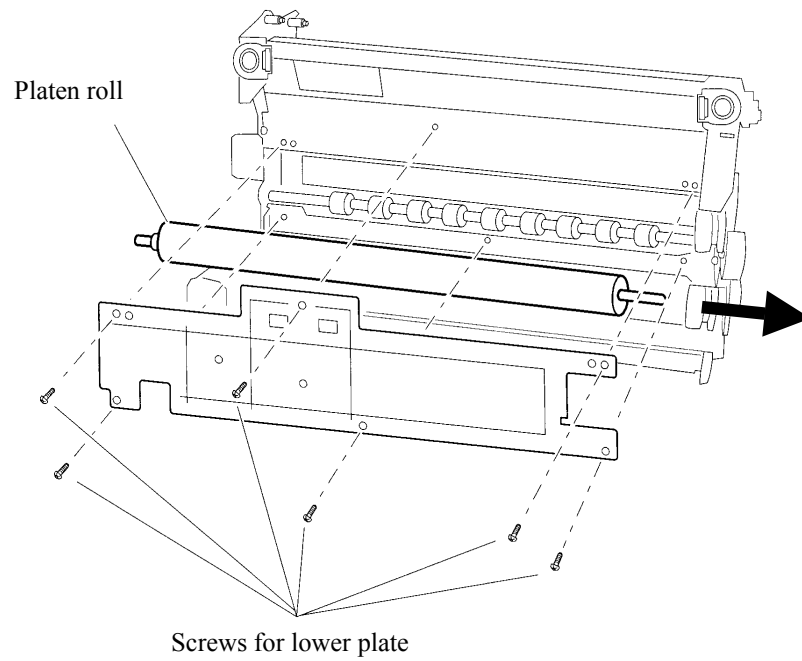
Note:
Take care of jamming cables together when install platen cover.

Figure 4.63 Removing the Platen roll

Installation

1. Assembly by reverse order the removal.

Note Lubrication is necessary to right and left shaft of Platen roll.
(Refer to lubrication tables)

（45）Nip Spring 1/2 replacement

Removal

1. Remove the upper cover.
2. Unhook four nip springs 1 (two on each end) and four nip springs 2 (two on each end), and remove the springs.

Installation

1. Install nip springs 1 and 2 by reversing the removal procedure.

NIP spring1(silver

NIP spring2(black)
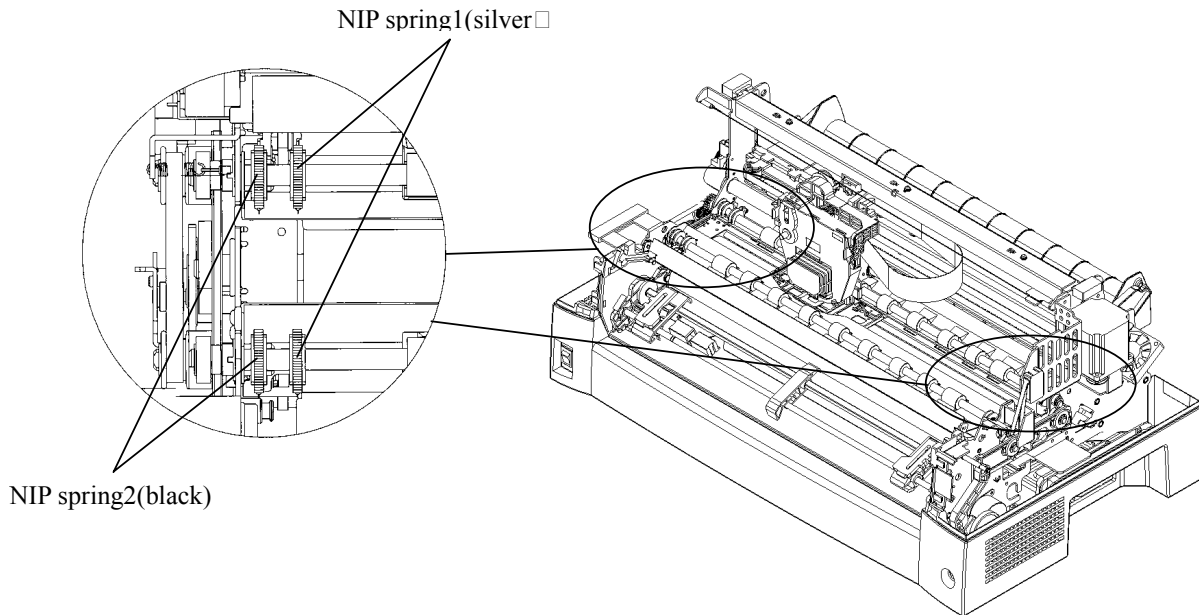
Figure 4.64 Nip Spring 1/2 replacement

(46) Nip Roller replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
2. Unhook one sides of 4 nip springs and remove 4 spring holders.
3. Remove the E ring of both side and Nip gear on the left side.
4. Remove the flanges, slide cam, OC cam and bearings..
5. Lift and slide the Nip roller to the right. And remove it from its left end.
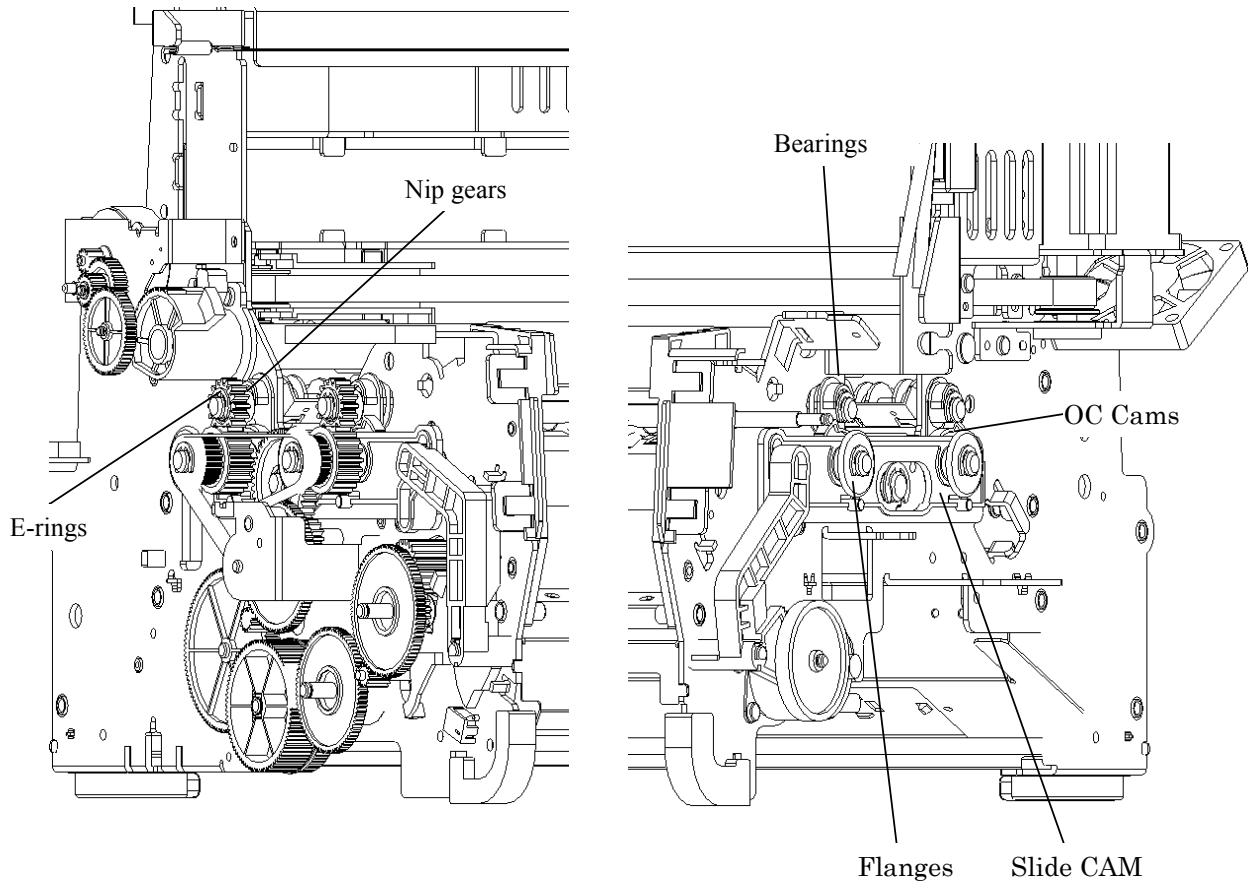
Figure 4.65 Nip Roller replacement

Installation

1. Assembly by reveres order.
   Lubrication is necessary refer to lubrication table

(47) DV Roller ASY replacement

Removal

1. Remove the upper cover.
2. Remove the printer mechanism assembly.
3. Remove the LF bracket (one screw) and LF belt.
4. Remove the two flanges (two E-rings), two DV gears, two nip gears (two E-rings), and one platen gear (one E-ring) from the left of the mechanism assembly.
5. Remove the slide cam and OC cam from the left side of the mechanism assembly.
6. Remove the bearings from the left side of the mechanism assembly.
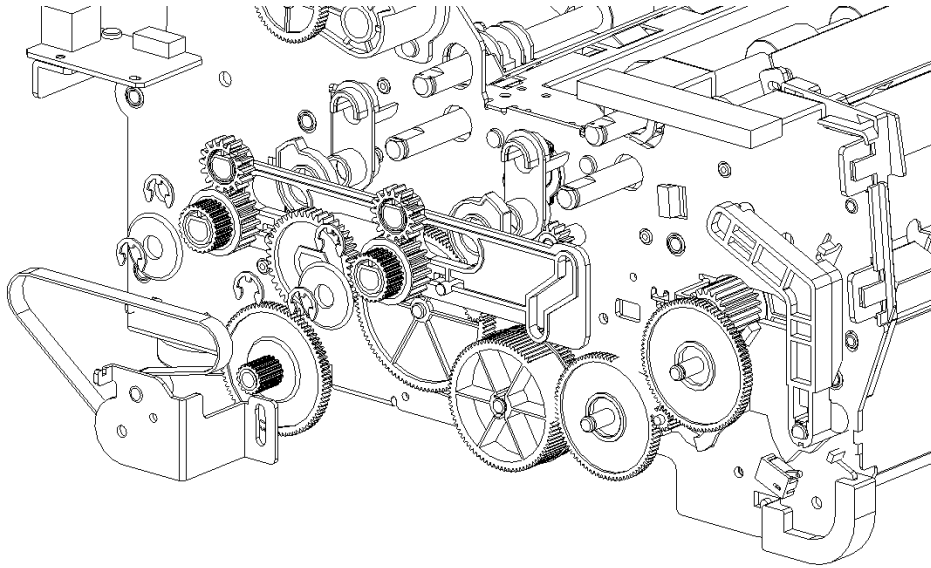
7. Remove 3 e-rings, 2 flanges and slide cam at right side of printer mechanism.
8. Remove the OC cam and bearing at right side of printer mechanism.
9. Remove 4 screws fixing lower guide at left and right side.
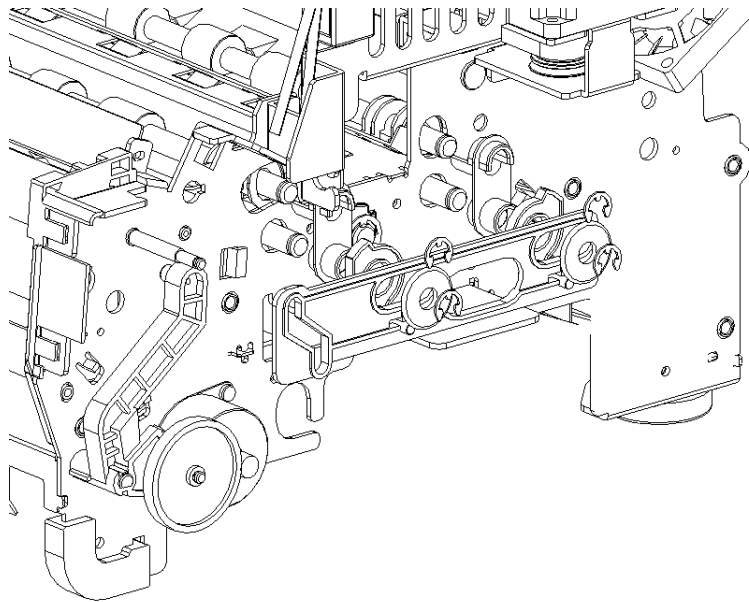
Figure 4.67 Removing DV Roller

10. Remove 8 screws fixing lower guide at base side and front and rear side.
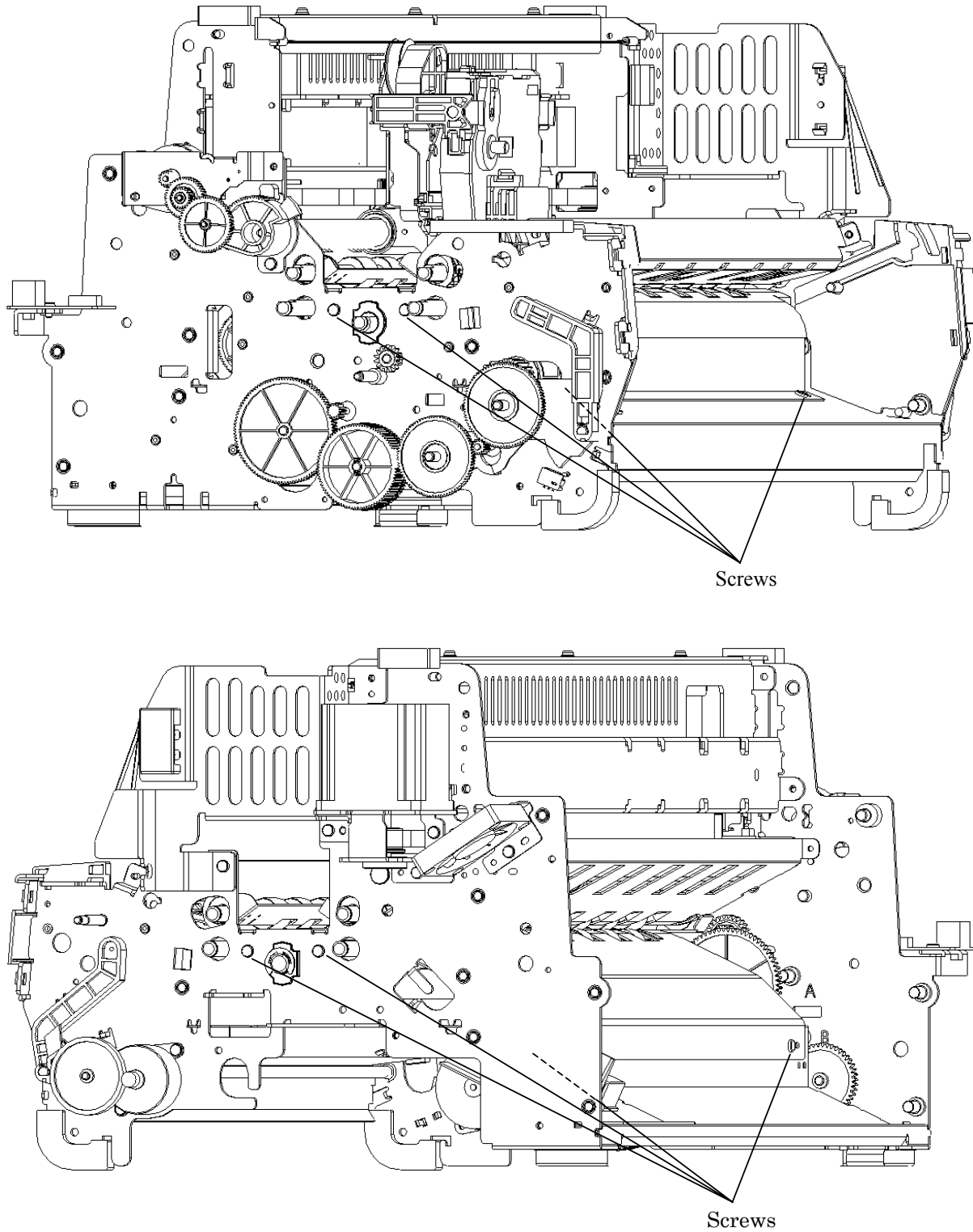
Screws

Screws

Figure 4.68 Removing Lower Guide

11. Shift the lower guide a little upward.

12. Remove the lower plate.
    Disconnect cables backside of printer mechanism unit, remove 6 screws of lower plate.
13. Slide the DV rollerr assembly direction of arrow, then remove it.

Screws for lower plate
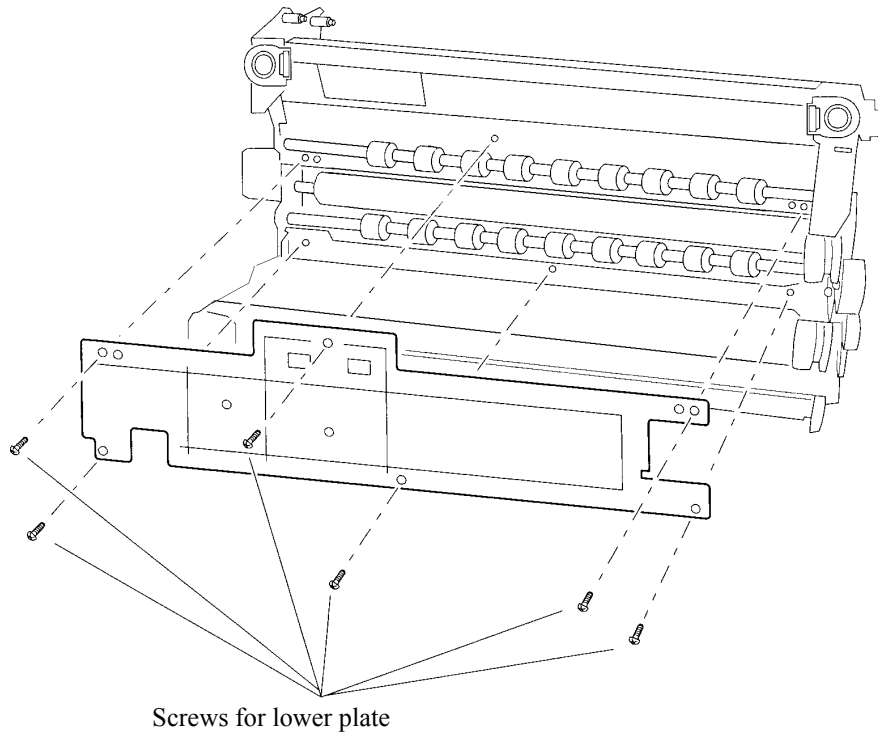
Figure 4.69 Removing DV Roller

14. Replace assembled parts on the DV roller.

Installation

1. Assembly by reverse order the removal.

Note Lubrication is necessary to right and left shaft of Platen roll.
(Refer to lubrication tables)

NOTE   after installation, the following adjustment are required.
(1)LF belt tension Note Lubrication is necessary to right and left shaft of Platen roll.
(Refer to lubrication tables)

4.9.2 Adjustment

(1) Print head gap adjustment

Note:
This adjustment needs the head gap adjustment jig (special dial gage), so this part is parts that must not be disassembled. If you don't have head gap adjustment jig, don't adjust this portion as much as possible.

Procedure

1. Attach the head gap adjustment jig on the carriage.
2. If necessary open the upper guide F open.
3. Move the card guide upper side.

Head gap adjustment jig

Upper guide F

Direction of moving card guide.
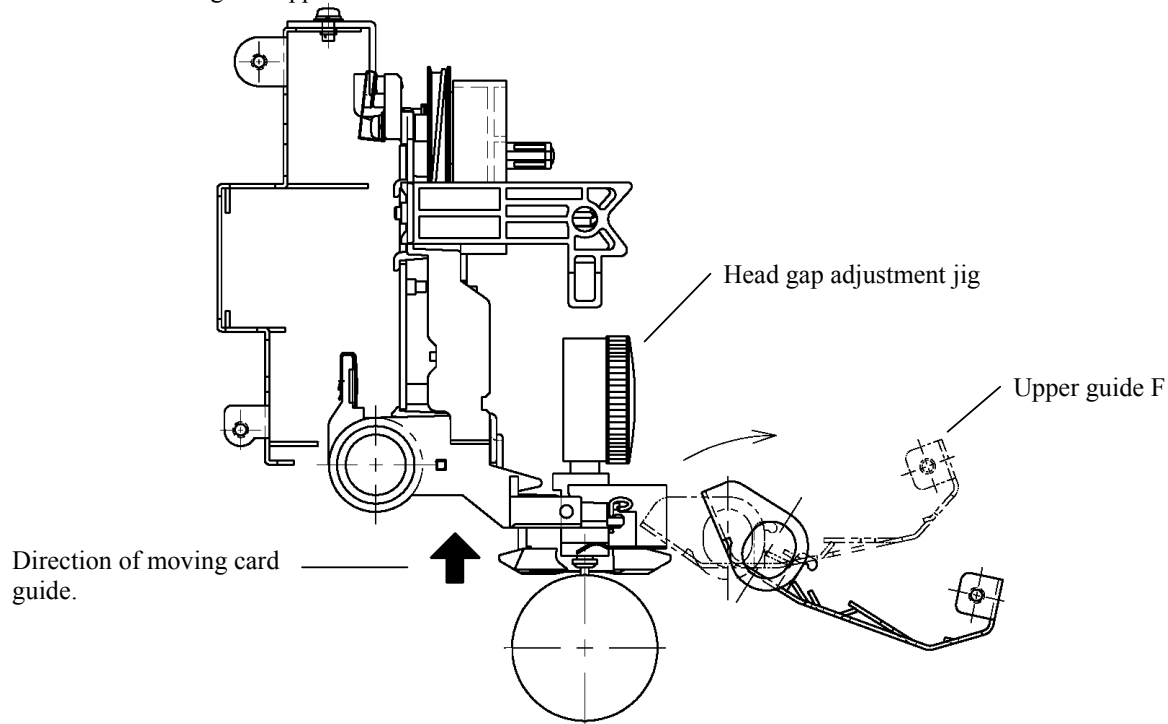
Figure 4.70 Attach the print head gap jig

4. Rotate the SS gear (located at the left side of the stay shaft) clockwise (this direction makes the head gap narrow) until its stopper touches the stopper (studs) of the side frame.

Stopper stud

SS gear

Stopper of SS gear
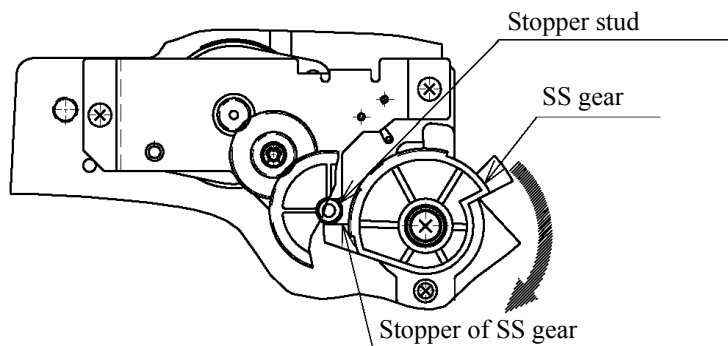
Figure 4.71 Rotate SS gear

5. Slightly loosen the three screws(a),(b) and (c) on the upper angle.
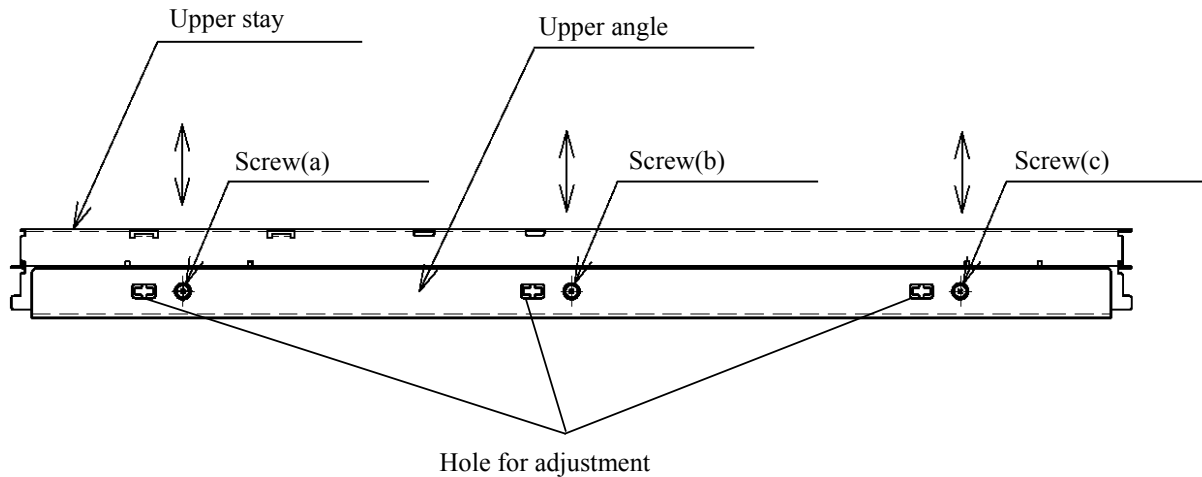
Figure 4.72 Adjustment head gap

A=0.00mm±0.01mm

6. Slide the carriage unit to the left end (1st column side)
7. Move the upper angle back and forth so that the head gap may have value A, then fasten the screw(a).
8. Slide the carriage to the right end (136 column side) and move the upper angle back and forth so that the head gap may have value A, then fasten the screw(c).
9. Center the carriage unit and move the upper angle back and forth so that the head gap may have value A, then fasten the screw(b).
10. Slide the carriage unit to the left, center and right, and the check the value A at each position.
11. If the head gap doesn't have value A, loosen the screw at that position and move the upper angle back and forth again so that the head gap may have value A, and then fasten the screw.
12. If the head gap has value A at the left, center, and right positions, that's all for this adjustment.

(2) Card guide position adjustment

Note:
For improve the precision using the head gap adjustment jig is better.
If you don't have the head gap adjustment jig refer to the another procedure which comes out behind

[Using the head gap adjustment jig]
This adjustment should be done after print head gap adjustment is finished.
1. Attach the head gap adjustment jig on the carriage.
2. Open the upper guide F open.
3. Place the carriage to the ribbon replace position.
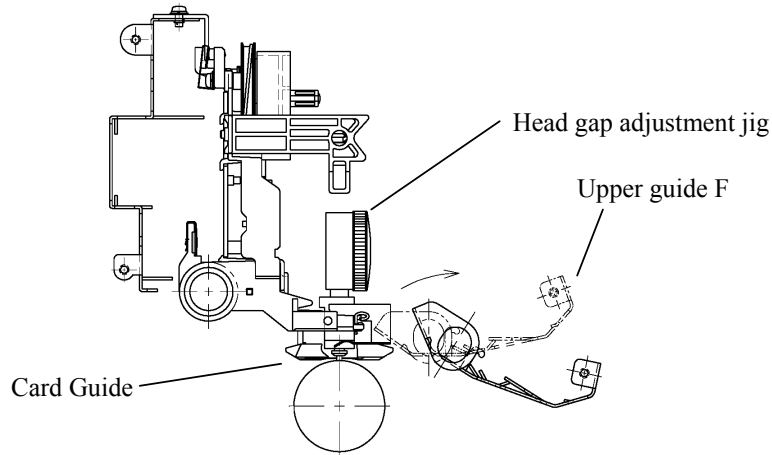
Figure 4.73 Attach the head gap adjustment jig

3. Enter adjustment mode
   Turn the power on while pushing "▲"SW and "▼"SW of operation panel. Then printer enters the adjustment mode. Any motors don't move in this mode.
4. Loosen the card guide mounting screws slightly (to an extent where the card guide doesn't drop towards the platen).
5. Place one sheet of 1p-55kg paper between the card guide and platen at the APTC switch side.
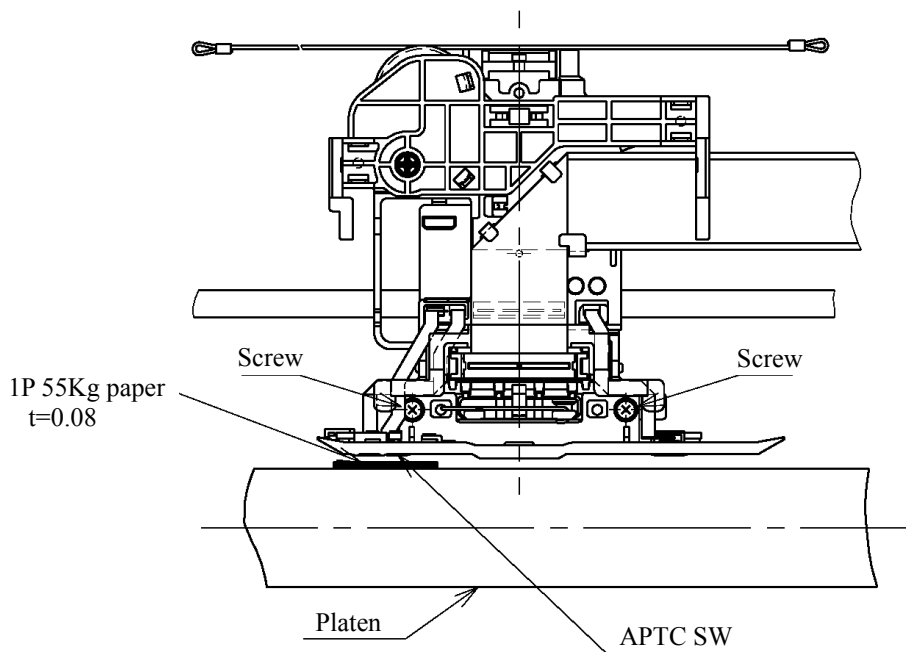
Figure 4.74 Insert paper for adjustment

6. Adjust the head gap to value A, by turning the SS gear.
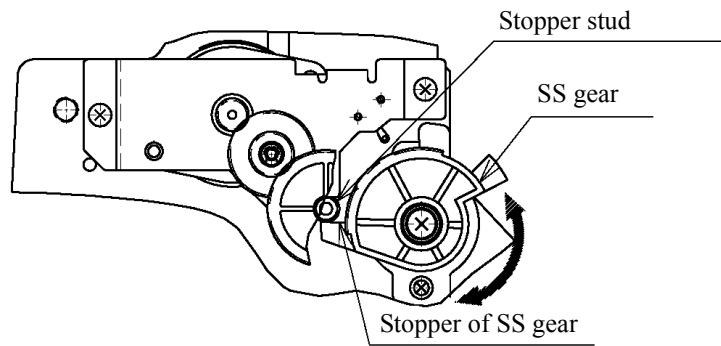
Figure 4.75 Rotate SS gear

A=0.25mm±0.01mm

7. Move the card guide up and down so that APTC SW should be switched into conducting state at the head gap is value A. (The value A should be checked during the SS gear is rotating in the direction of clockwise.)
8. Slope of card guide should be as follows.
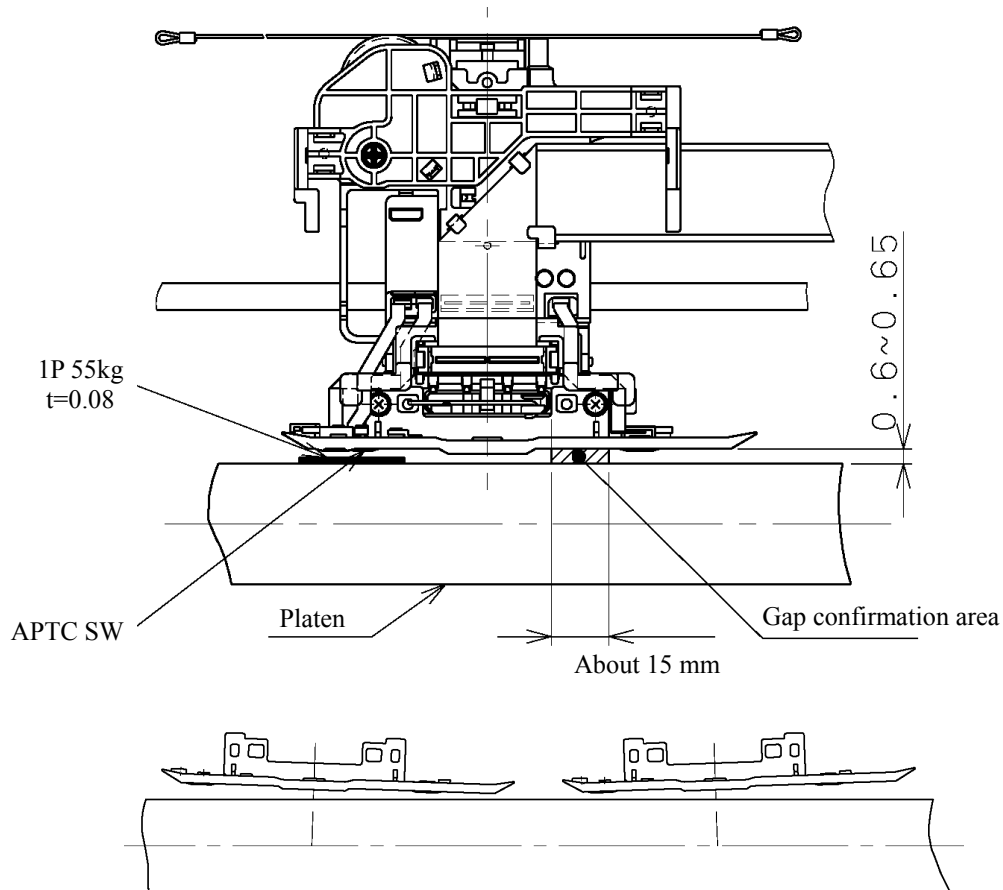
Figure 4.76 Adjustment and check inclination of card guide

9. Check the gap between the print head and paper after APTC function is operated.

Turn the printer off immediately after printing is started. Check the value B by head gap adjustment jig. If the Value B is as follows adjustment is finished.

B=0.29mm±0.03mm
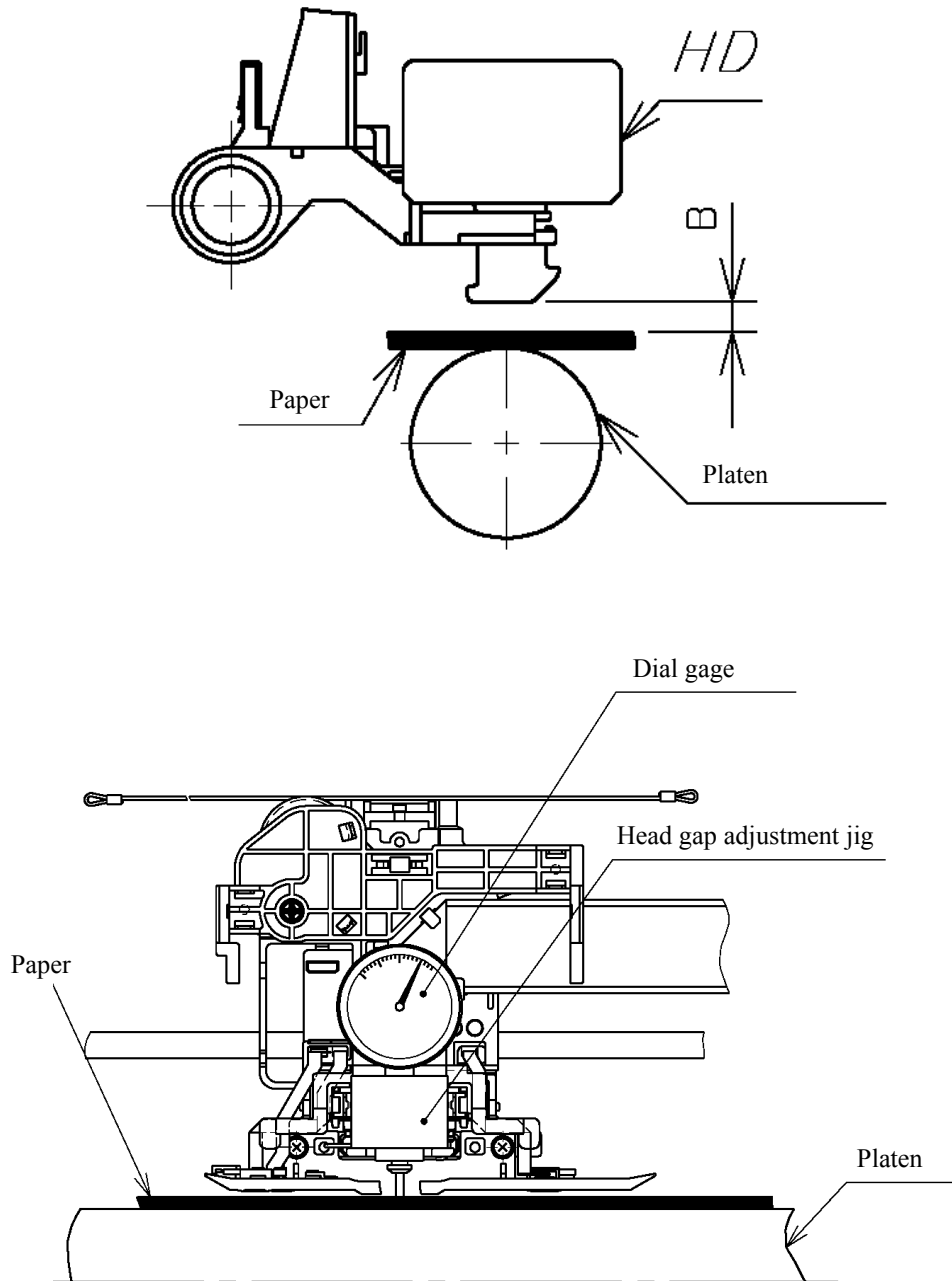
Figure 4.77 Check the gap after APTC operate

(3) Card guide position adjustment (another way)

[Without the head gap adjustment jig]
This method uses the gear that is next to the motor pinion instead of head gap adjustment jig.
This adjustment should be done after print head gap adjustment is finished.

1. Remove the print head.
2. Open the upper guide F open.
3. Rotate the motor pinion counterclockwise until stopper of SS gear touch against the stopper stud.

   Note Please make sure to rotate gears by motor pinion.
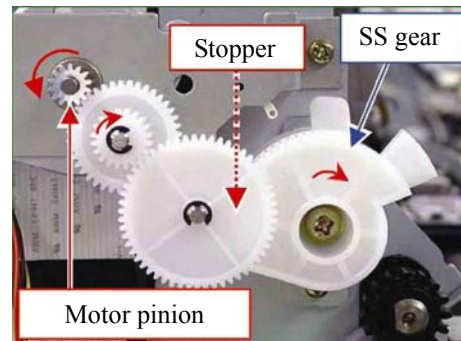
4. Put the "MARK 1" as the base position.
   Put the "MARK 1" on the tooth of the gear's, and put the mark bracket at same position.
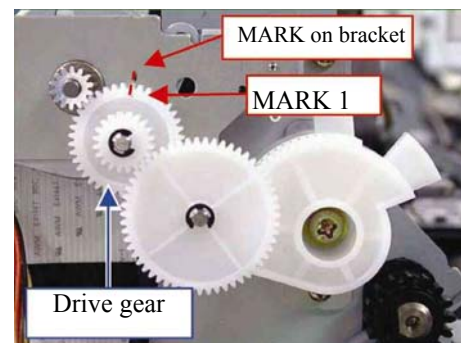
5. Put the "MARK 2" as the aim for adjustment.
   Rotate the motor pinion clockwise to rotate drive gear by 10 teeth. Then put the "MARK 2" to the tooth, which becomes ten pieces from the "MARK 1".
   And then rotate the motor pinion clockwise to rotate drive gear by 2 teeth.
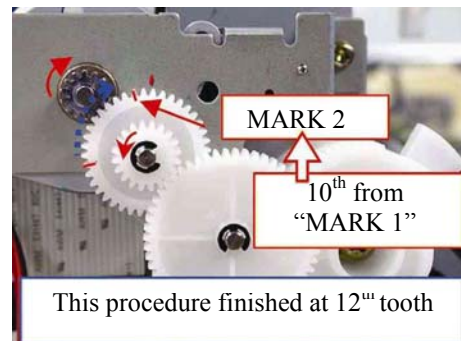
6. Insert the 8 parts of paper into the right of card guide and platen.
   This spacer should be made as follows.
   Fold the A4 size paper 3 times.
   Total thickness of papers should be 0.65±0.1mm
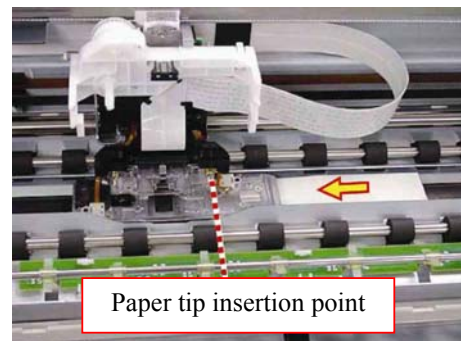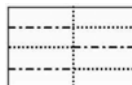
Figure 4.78 other way to adjust the card guide

7. Fasten the rightside screw temporly
   Fasten the right side screw during pushing right potion of curd guide by light force.

8. Remove the inserted paper.
9. Enter the adjustment mode.
   During pushing the "▲","▼"SW, turn the power on.

Fix temporary
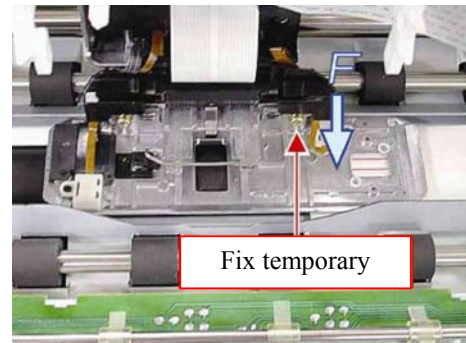
10. Adjust the position of the card guide
    Lower the left side of a card guide little by little until the buzzer s
    and then fasten the screw temporally.
The buzzer sounds during the APTC detect SW is pushed. To stop the
    rotate motor pinion clockwise.

Fix temporary
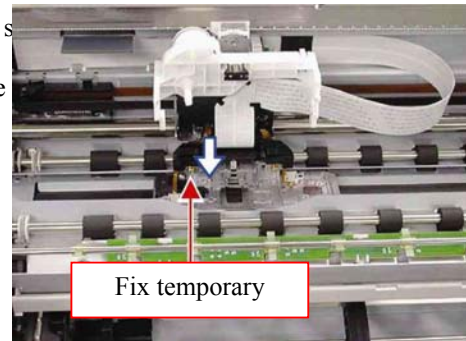
11. Check the drive gear position when the buzzer sound.
    Once turn clockwise until buzzer is stop, and then turn the
    motor pinion gear counterclockwise until buzzer sounds.
    On an ideal target "MARK 2"agree the mark on the bracket.
    ±2 tooth is a permission level.
    When the buzzer start souding, "MARK 2"is on the righte of
    the mark on the bracket, upper the card guide.
    When the buzzer start souding, "MARK 2"is on the left of the
    mark on the bracket ,lower the card guide.

Frame mark

Mark 2

Displacement should be less than 2

12. Fasten the screws.
    Check result is ±2 teeth, and then fasten the screws.
    After fasten the screws.   Check again and check result is less
    than two teeth it can finishe adjutment.
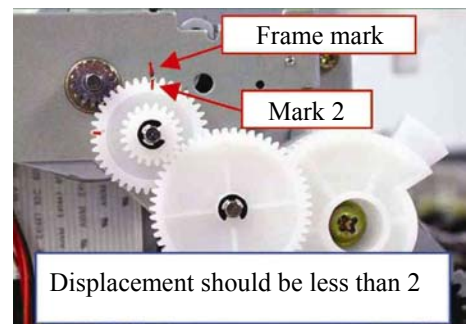
Figure 4.79 other way to adjust the card guide

(4) TOF sensor's voltage adjustment

Note This adjustment should be done after card guide adjustment is finished.
     Please make sure any dust has cleaned under the TOF sensors.

1. Turn the printer power on, then the carriage escape to the maximum gap and move and stop the ribbon
   replacing position.

2. Enter adjustment mode.
   Turn the power on while pushing "▲"SW and "▼"SW of operation panel. Then printer enters the adjustment
   mode. Any motors don't move in this mode.

3. Adjust the volume resistance shown below, so that states on the table is satisfied
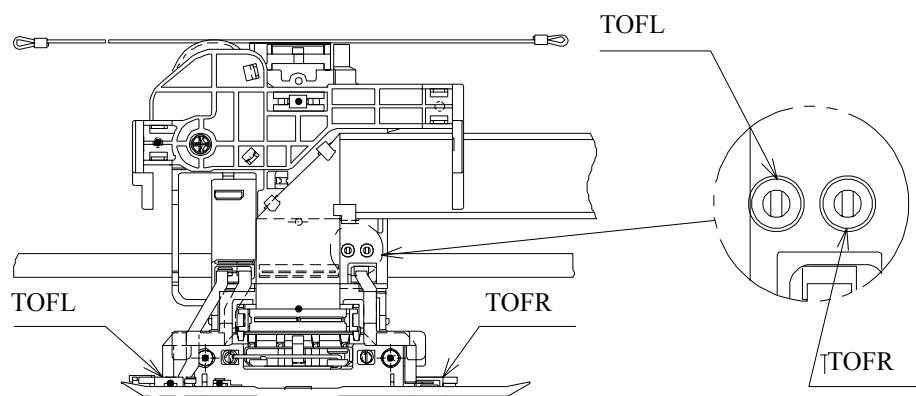
Figure 4.80 adjusting TOFL/R output level

Name of sensor	Name of LED	Remark
TOFL	HI IMPACT	When paper is out of the printer, LED should
TOFR	ONLINE	light steadily.

4. Adjustment has finished. Then turn the power off.

For reference
Output voltage when LED lights steadily is 0.65   0.75V.
If the paper exists, LED is blinking.

⑸ LF belt's tension adjustment

1. Adjust the tension using tension bracket position, so that reaction force is value A when LF belt is lowered 2mm.

LF belt

Screw

Tension bracket
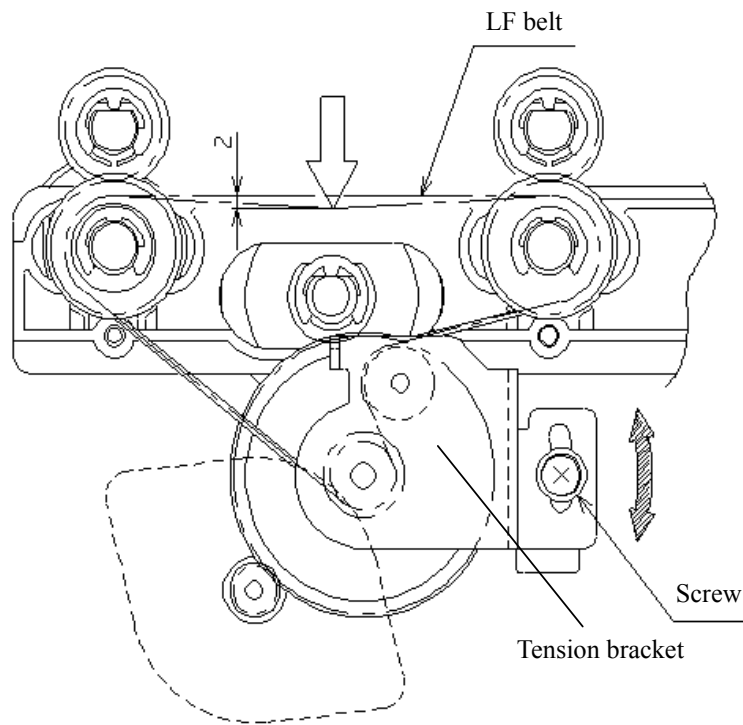
Value A = 250gf±20gf
(2.45N±0.2N)

Figure 4.81 adjusting LF belt tension

⑹ Vertical Alignment (V-ALMNT) adjustment

1. Load the continuous forms paper wider than 356mm (14 inches) from front tractor.
2. Enter adjustment mode.
   "ONLINE"SW + POW ON ,then printing start at "LQ"speed.
3. Check the direction of displacement and adjust the alignment using ▲▼ SW as follows.

```
Letter quality          Letter quality
→|          |            →|          |
←|          |            ←|          |
→|          |            →|          |
←|          |            ←|          |
→|          |            →|          |
←|          |            ←|          |
→|          |            →|          |

  Printing is early        P Printing is late
        ↓                          ↓
    Push "▼" SW              Push "▲" SW
```
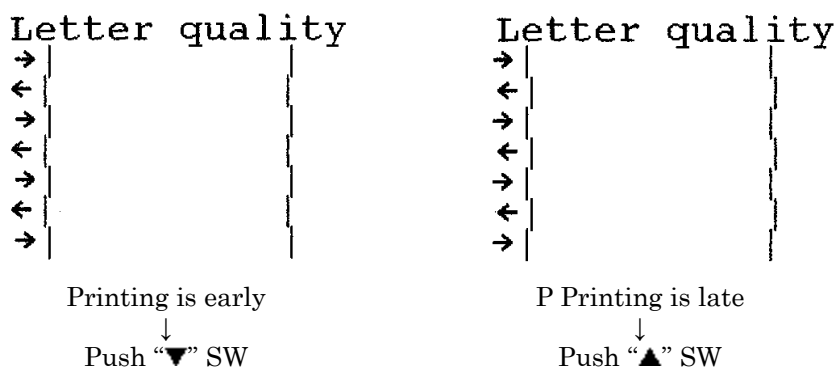
Figure 4.82 adjusting Vertical Alignment

Note
   SW is detected when the cartridge turns each side of printing.
   So you must start pushing the SW before carriage turning and release the SW after carriage turning.
   If the carriage turns two times while pushing SW, adjustment value is added two steps.
   Check all lines (left, center, right) and correct adjustment if necessary.

4. Change the printing mode and adjust individually.
   All printing mode is as follows.
   For change the printing speed press "TEAR OFF" button.
   To enter Hi-impact mode press "Hi-impact" button.

		Speed mode			
		LQ	CQ	DQ	HDQ
Impact mode	(Normal)	120cps	240cps	360cps	505cps
	Hi-impact	84cps	169cps	254cps	353cps

5. Save and exit the adjustment mode.
   Press "ONLINE" button to exit adjustment mode and save new values.

(7) Top-of-forms adjustment (factory use)

Note . Other adjustment methods are in setup mode.
Each adjustment value exists independently in each adjustment mode.
Anyway vertical printing position effected by both adjustment value.
If vertical printing position is adjusted by set up mode. Don't adjust this value.
Ideally set up mode should be done after this adjustment is satisfied.

1. Enter set up mode
   Turn the power on while pressing the "▲" SW.
2. Select the paper pass
   Push the "PAPER PATH" SW to select the paper pass
3. Load the paper.
   Push the "LOAD" SW to load the paper.
      Paper thickness should be 1P 55kg (about 0.08mm)
      Paper width should be wider than A4 size(210mm)
4. Print the marks at the load position.   ⋈
   Push the "TEAR OFF" SW to print marks.
5. Unload the paper to measure the value of top margin.
   Push the "LOAD" SW to unload the paper.
   Then measure the top margin. And calculate the adjust values.
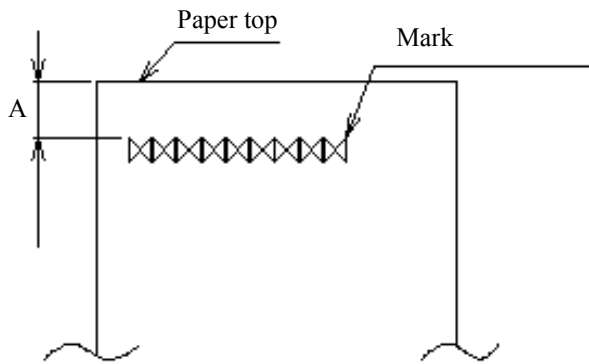
Spec is 22±0.5
Required adjustment value is as follows
$D=A-22$
No. of adjustment is as follows
$S=D÷(1/180")=D÷0.14$

Figure 4.83 adjusting top of form position

6. Load the paper again to adjustment.
   Push the "LOAD" SW to load the paper.
7. Adjust the load position
   Paper moves in the direction of the ▲,▼ SW shape(push the ▲ to advance front pass paper
   Amount of move is 1/180 inch for one push.

(8) Skew detection value adjustment

Note. To correct the vertical span between TOFL and TOFR for correct skew detection.

1. Enter adjustment mode.
   Turn the power on while pressing the "LOAD" and "▲"SW .
2. Select the cut sheet position.
   Press the "PAPER PASS" SW to select the paper pass.
3. Perform the sequence of adjustment.
   1) Advance the paper until TOFL sensor detects the paper top end.
   2) Move the carriage, so that TOFR sensor detects the paper top end at the same position.
   3) Advance the paper until TOFR sensor detects the paper top end.
   4) Write the distance between the TOFL and TOFR to the NVRAM.
   5) Eject the paper. And perform the initialization.

4.9.3 Lubrication

Lubrication is required only when the printer is overhauled or mechanical components are replaced.
Lubrication codes are as follows:

2 – GD – D – O
  Cycle
  Amount (1 drop)
  Type (Mobil oil)
  No.
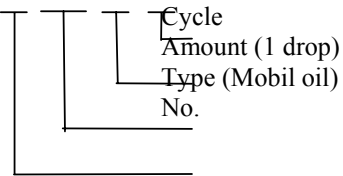
1. No.
    Sequential number for the location to be lubricated

2. Type
    A: Alvania EP grease 2
    FL: Floil
    KF: Silicone (KF96SP manufactured by Shinetsu))
    SG: Silicone grease

3. Amount
    C: Thin uniform film
    D: 1 drop
    F: Fill the case or oil wick.
    S: Several drops

4. Cycle
    O: At overhaul

(1) Upper angle

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	SG	C	O	Front and rear surface of the upper angle	Area of phantom line
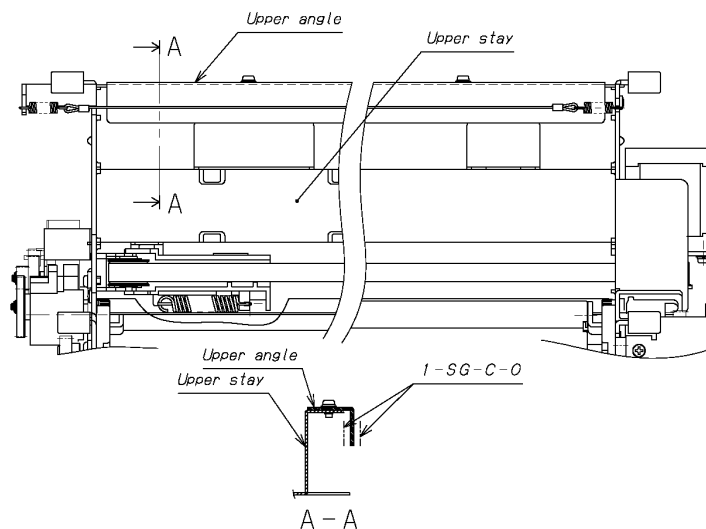
Figure 4.84 upper angle lubrication

(2) HCPP mechanism, Stud for gear

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	SG	C	O	Hole of slide cam	
2	SG	C	O	Cam surface	
3	SG	C	O	OC lever L sliding section	
4	SG	C	O	Axis of OC lever L/R	
5	SG	C	O	Studs for shift gears	2 points (stud)
6	SG	C	O	Studs for LF gears	
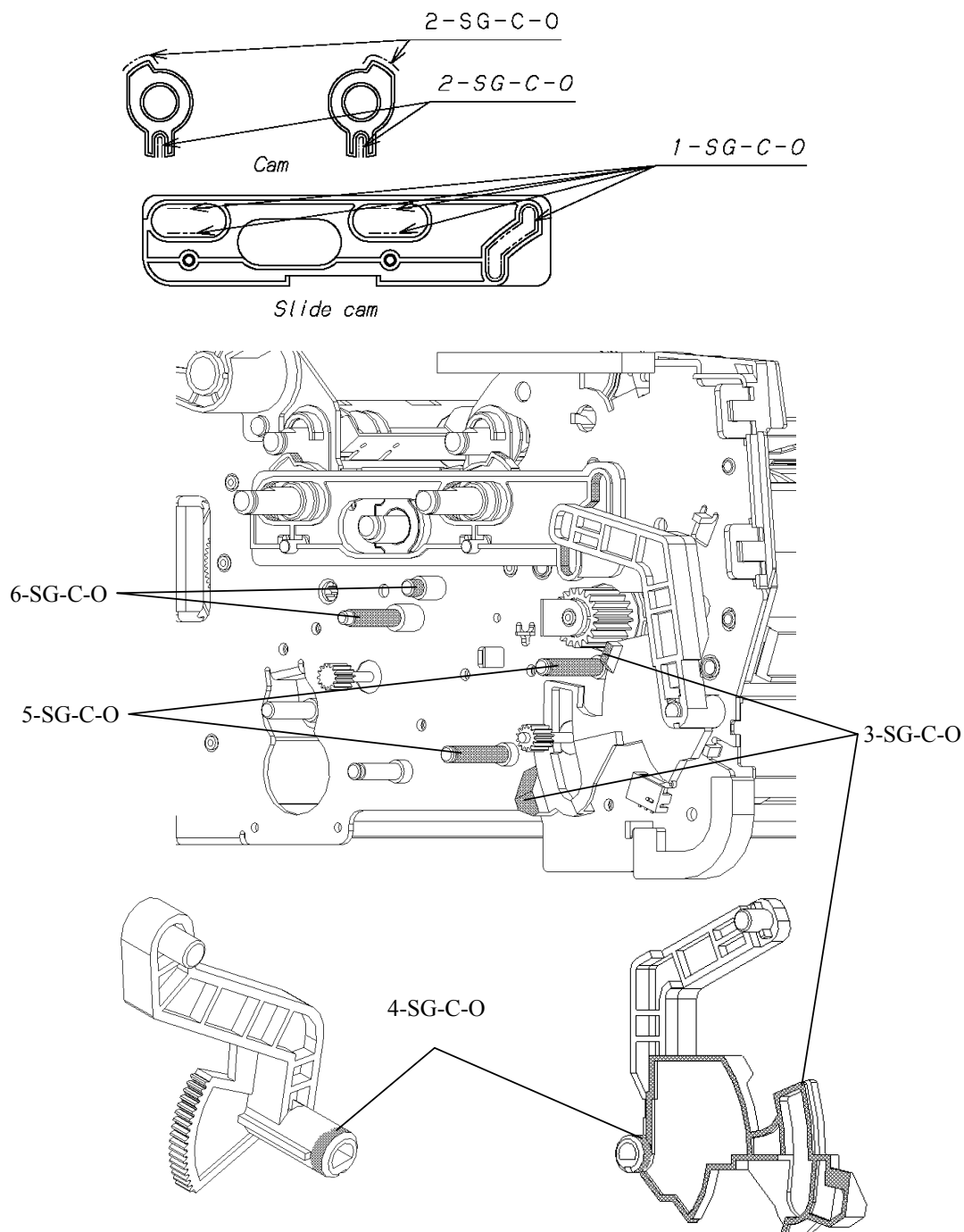
Figure 4.85 HCPP mechanism lubrication

(3) Detent for DV roller

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	SG	C	O	Spacer	
2	SG	C	O	Collar	
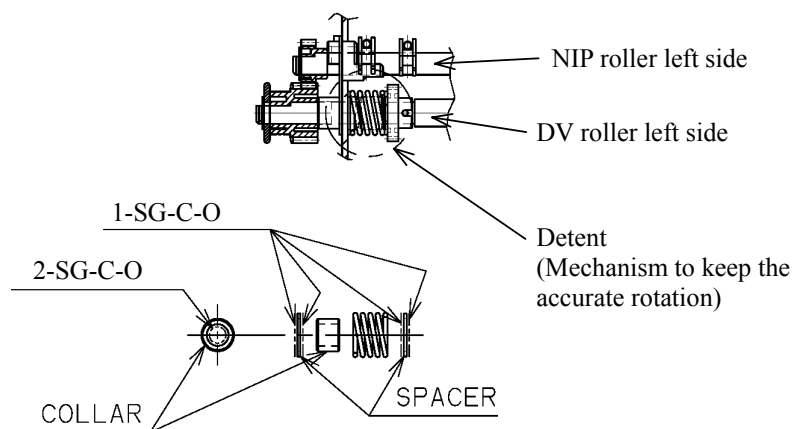
Figure 4.86 Detent lubrication

(4) Bearings

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	SG	C	O	Bearings of stay shaft	Same as side frame R
2	SG	C	O	Bearings Nip and DV roller shaft	Same as side frame R
3	SG	C	O	Bearings platen roller shaft	Same as side frame R
4	SG	C	O	Side of bearing	Gear is sliding on the surface
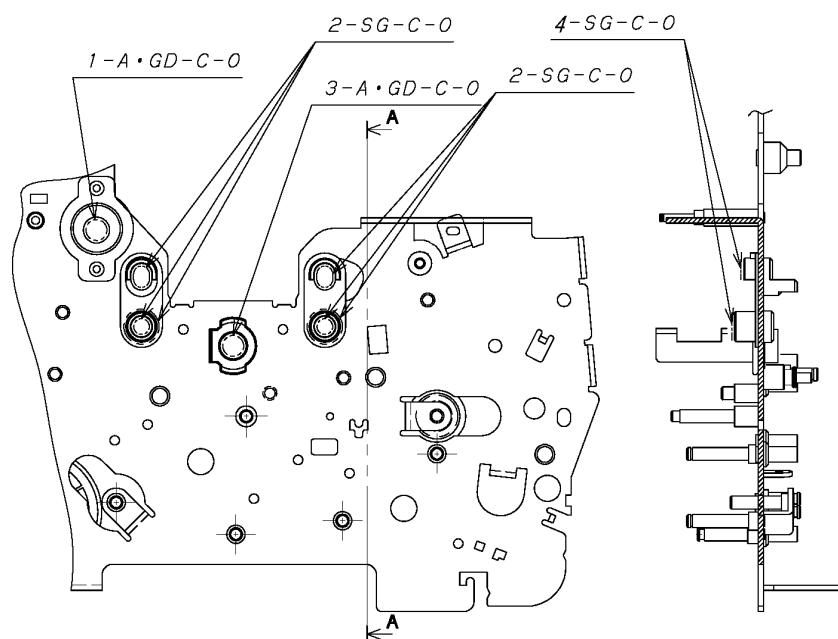
Figure 4.87 Bearing lubrication

⑸ Guide to slide the paper table

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	KF	C	O	Guide rails of paper table.	
2	SG	C	O	Studs for gears	

1-KF-C-O

2-SG-C-O

1-KF-C-O
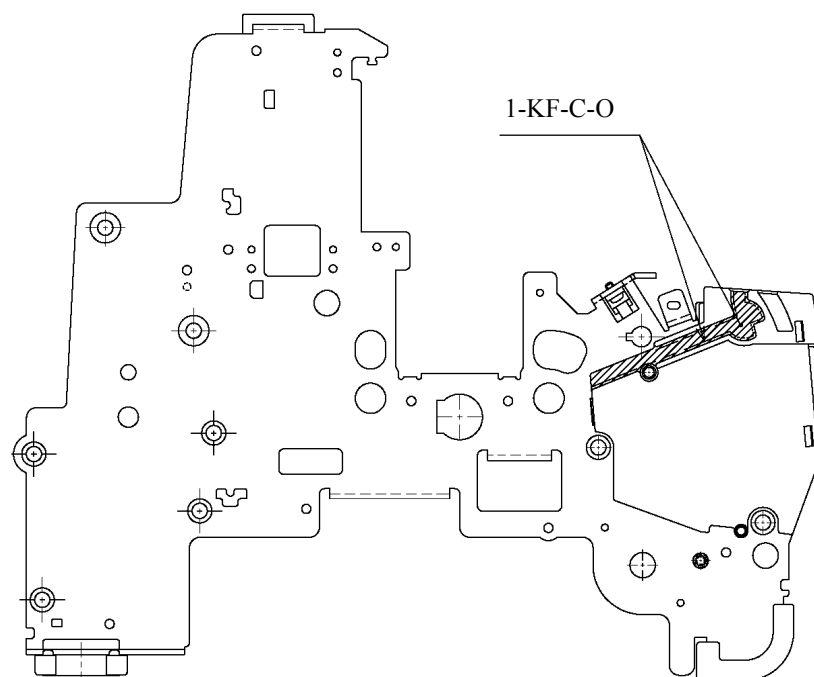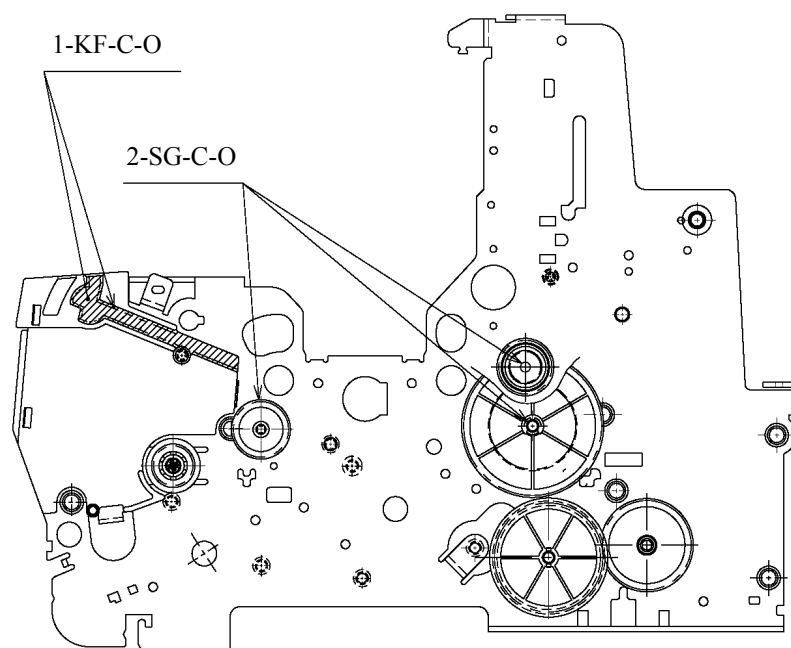
Figure 4.88 paper table slide guide lubrication

(6) Carrier unit (Ribbon drive mechanism)

No.	Oil	Amount	Lubrication cycle	Location	Remarks
1	FL	F	O	Oil felt section	0.6 0.7CC
2	SG	C	O	Surface that RF shaft slides (Carrier)	
3	SG	C	O	Teeth of RF shaft etc.	
4	SG	C	O	Axis of pulley and gear	
5	SG	C	O	Surface that RF shaft slides (Ribbon bracket)	
6	SG	C	O	Surface that RF shaft slides (Ribbon bracket)	

3-SG-C-O

2-SG-C-O

3-SG-C-O

1-FL-F-O

6-SG-C-O

3-SG-C-O

4-SG-C-O

RIBBON PULLY

4-SG-C-O

Ø13

RF LEVER

5-SG-C-O

3-SG-C-O

Note
Don't apply grease too much to the teeth. If excessive grease disperses, the slide of a pulley and a rope will occur and It will be breaking down early.

Note
Don't apply grease to the pulley. It causes the slide of a pulley and a rope and mechanism will be breaking down early.

Note
Don't apply grease to the axis of planet gear. If friction of axis is decrease, the movement of RF lever becomes slow. It will be cause of defect of ribbon feed.

Figure 4.89 Ribbon drive lubrication

4.10 Diagnostics

This section describes how to use the following diagnostic functions:
- SELF-TST
- HEX-DUMP

These functions are used for checking print quality and diagnosing printer problems. HEX-DUMP also provides useful information for programmers.

4.10.1 Printing the Self-Test

The SELF-TST function prints test pages to check how the printer operates independently of your computer. The self-test does not check the interface between the computer and the printer.
The self-test prints the printer's firmware version, its resident emulations, and all of the characters available in the currently selected character set.
If the DPL24C PLUS emulation is selected for MENU1, the self-test is printed using the settings currently assigned to MENU1.

Procedure

This procedure assumes that you are in setup mode. To print the self-test, make sure that continuous forms paper is loaded into the printer. Then proceed as follows:

1. Print the <<FUNCTION>> menu.

The <<FUNCTION>> menu should be the last printed line on the page. If the menu is not printed, press the ONLINE button to print the menu.   If you are using the HEX-DUMP function, press the "TEAR OFF" or "LOAD" button instead of the ONLINE button to print the menu.   The following <<FUNCTION>> menu is printed: The following <<FUNCTION>> menu is printed:

```
<< FUNCTION >>
SAVE&END MENU1   MENU2   HARDWRE ADJUST  CONFIG  GAP-ADJ DEFAULT LIST    SELF-TST
HEX-DUMP V-ALMNT  INITIAL
```

2. Select the SELF-TST function.

Repeatedly press the "TEAR OFF" or "LOAD" button to position the cursor on the left edge of the aluminum print guide on SELF-TST, and then press the "▲" button or the "▼" button. The printer selects SELF-TST and starts printing. A short help menu is printed at the top of the page, followed by the self test.   Note that the printer is not online during self-test printing.

3. Examine the self-test page.

A sample self-test page is shown in next page.. To pause during self-test printing, press the "LOAD" button.

To resume self-test printing, press the "LOAD" button again.

4. Exit the SELF-TST function.

Exit the SELF-TST function in either of the following ways:
• To exit SELF-TST and remain in setup mode, press the LF/FF button. The <<FUNCTION>> menu is then reprinted.
• To exit SELF-TST and return online, press the ONLINE button.
The printer permanently saves any changes made while in setup mode and returns online.

The self-test can also be started by turning off the printer, and then pressing the LF/FF button while turning the printer back on.

```
=== Self test printing ===

BUTTON      ACTION
<ONLINE>    Exit to normal mode
<LF/FF >    Return to <<FUNCTION>> mode
<PRINT >    Change print mode
<IMPACT>    Change high impact
<LOAD  >    Pause/resume printing

1. Software specification

   40100-4033 (01A) 035103

2. Emulations

   DPL24C+   --- FUJITSU DPL24C PLUS      Ver. 2.02
   IBMXL24E  --- IBM Proprinter XL24E     Ver. 1.02
   ESC/P-2   --- EPSON ESC/P-2            Ver. 1.02

3. Repeat printing

LOG ; 00 00 00 00 00 00 00
```

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
qrstuvwxyz{|}~áíóúñÑªº¿⌐¬½¼¡«» ‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖ ␣␣␣αßΓπΣσµτΦΘΩδ∞φε∩≡±≥≤⌠⌡÷≈°∙·√ⁿ²■!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
TUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~áíóúñÑªº¿⌐¬½¼¡«»...

4.10.2 Hex dump

The HEX-DUMP function prints data and commands in hexadecimal characters and abbreviated control codes. The IBM character set 2 is used for printing (see Appendix E).
The HEX-DUMP function is useful for checking whether your computer is sending the correct commands to the printer and whether the printer is executing the commands correctly.
It is also useful for debugging software programs.

Procedure

To print hex dumps, make sure that continuous forms paper is loaded into the printer. Then proceed as follows:

1. Enter setup mode.

Press the "AUTO GAP" button and the "HI IMPACT" button simultaneously until the printer beeps. Wait for the printer to stop printing and check that the following <<FUNCTION>> menu is printed:

2. Select the HEX-DUMP function.

```
<< FUNCTION >>
SAVE&END MENU1   MENU2   HARDWRE ADJUST  CONFIG  GAP-ADJ DEFAULT LIST    SELF-TST
HEX-DUMP V-ALMNT  INITIAL
```

Repeatedly press the "TEAR OFF" or "LOAD" button to position the cursor on the left edge of the aluminum print guide on HEX-DUMP, then press the ▲ button or the ▼ button to select the HEX-DUMP function. The printer goes online and prints a header and a short help menu

3. Print the hex dump.

To start hex dump printing, send your file or program to the printer. The printer goes online and prints the hex dump.
Press the "LOAD" button to pause during hex dump printing. To resume hex dump printing, press the button again.

NOTE

When hex dump printing stops, the printer remains online in setup mode (the ONLINE indicator is green).
To print another hex dump, send another file to the printer.

```
*** Hex dump printing ***

BUTTON        ACTION
<ONLINE>      Exit to normal mode
<LF/FF >      Return to <<FUNCTION>> mode
<PRINT >      Change print mode
<IMPACT>      Change high impact
<LOAD  >      Pause/resume printing


0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F      0123456789ABCDEF
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F      !"#$%&'()*+,-./
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F     0123456789:;<=>?
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F     @ABCDEFGHIJKLMNO
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F     PQRSTUVWXYZ[\]^_
60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F     `abcdefghijklmno
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 0D     pqrstuvwxyz{|}~⌂
0A 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E     ⌐ÇüéâäàåçêëèïîìÄ
8F 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E     ÅÉæÆôöòûùÿÖÜ¢£¥₧
9F A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE     ƒáíóúñÑªº¿⌐¬½¼¡«
AF B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE     »▒▓│┤╡╢╖╕╣║╗╝╜╛
BF C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE     ┐└┴┬├─┼╞╟╚╔╩╦╠═╬
CF D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE     ╧╨╤╥╙╘╒╓╫╪┘┌█▄▌▐
DF E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE     ▀αßΓπΣσµτΦΘΩδ∞φε
EF F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE     ∩≡±≥≤⌠⌡÷≈°∙·√ⁿ²■
FF 0D 0A                                            ⍺Ⱡ
```

Sample HEX-DUMP

4. Exit the HEX-DUMP function.

Exit the HEX-DUMP function in either of the following ways:
• To remain in setup mode, press the LF/FF button. The <<FUNCTION>> menu is then reprinted.
For details on other functions, see other sections in this chapter.
• To return to online normal mode, press the ONLINE button. If you press the ONLINE button while the hex dump is printing, The printer immediately switches to normal online mode. Any data that was sent to the printer but not printed is discarded (cleared).
You can also enter hex dump mode, by turning off the printer, and then turning the printer back on while simultaneously pressing the ONLINE button and the LF/FF button until the printer beeps.

4.10.3 Power-on Features for DL7400

There are several special tests and setup modes built into the DL7400 printers. Holding down certain control panel buttons, while turning on the printer, activates these special printer modes.

After the printer beeps, the buttons are released.

Please do not open these features to end-users, just use for CE check.

The chart below shows the relationship between the control panel buttons and the various power on modes.

Special Power-on Features										
Button Name										Function Description
PRINT	AUTO GAP	HI IMPACT	PAPER	LF/FF	ONLINE	TEAR OFF	LOAD	▼	▲	
								●	●	Sensor adjustment Mode
									●	TOF adjustment Mode
								●		PE adjustment Mode
							●	●		Left start position adjustment mode.
							●		●	Skew detect adjustment mode.
				●						Self Test Print Mode
	●			●						No Print Mode
					●					Vertical Alignment Mode
				●	●					Enter HEX Dump Mode
●										Demonstration Print Mode
	●	●								Enter Offline Setup Mode
		●								List Setup Parameters
						●	●	●	●	Flash ROM Update Mode
						●				Online Setup Mode
					●		●			EEPROM DATA Print Mode
			●	●	●					Error Log Clear
					●	●	●			All EEPROM Reset (Note 1, a)
				●	●		●			EEPROM All Settings Reset (Note 1, b)
						●	●			Reset set up value. (Note 1, c)

Denotes a button that is pressed down to activate a test mode.

Note 1: Print a listing of the printer setup before resetting the EEPROM. Then reprogram the printer to the required

settings. Reset items are as follows:

(1)Settings of Setup

(2)Mechanical settings

(3)Error Log

a) All EEPROM Reset: ONLINE + TEAR OFF + LOAD: Reset (1), (2), (3)

b) EEPROM All Settings Reset : LF/FF + ONLINE + LOAD: Reset (1) and (2)

c) EEPROM Reset : TEAR OFF + LOAD: Reset (1) only

CHAPTER 5   PRINCIPLES OF OPERATION

5.1 Overview

This section explains the principles of DL7400 operation. A microprocessor controls the following basic functions:

Carriage drive
Print head drive
Paper feed

Carriage drive

Print head drive

Paper feed
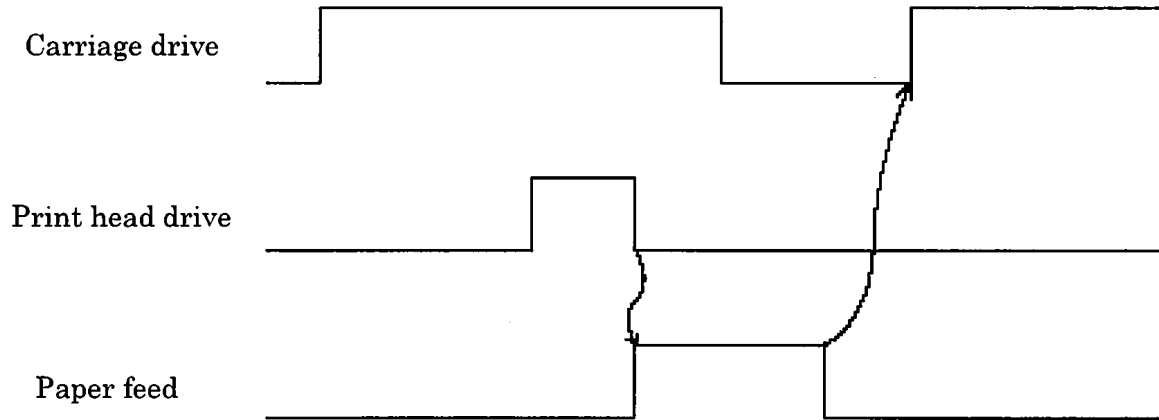
Figure 5.1 Function sequence

5.2 Mechanical Operation

5.2.1 Printing Operation

5.2.1.1 Print head

The print head consists of 24 wires in six rows.
The print head has 24 electromagnets that drive armatures with wires.
The print head is fastened to the carriage by the lock wire.
When not printing, the armature is parked against the stopper by the elasticity of the coil spring.
During printing, the coil is excited to generate a driving force, which attracts the armature and accordingly moves the wire in the direction indicate by an arrow.
The wire is guided by the ceramic wire guide and other four plastic guides.
When attracted by the magnet, the armature pushes the wire against the ribbon to print a dot.
When coil excitation is interrupted, the armature returns to the stopper again by the elasticity of the coil spring.
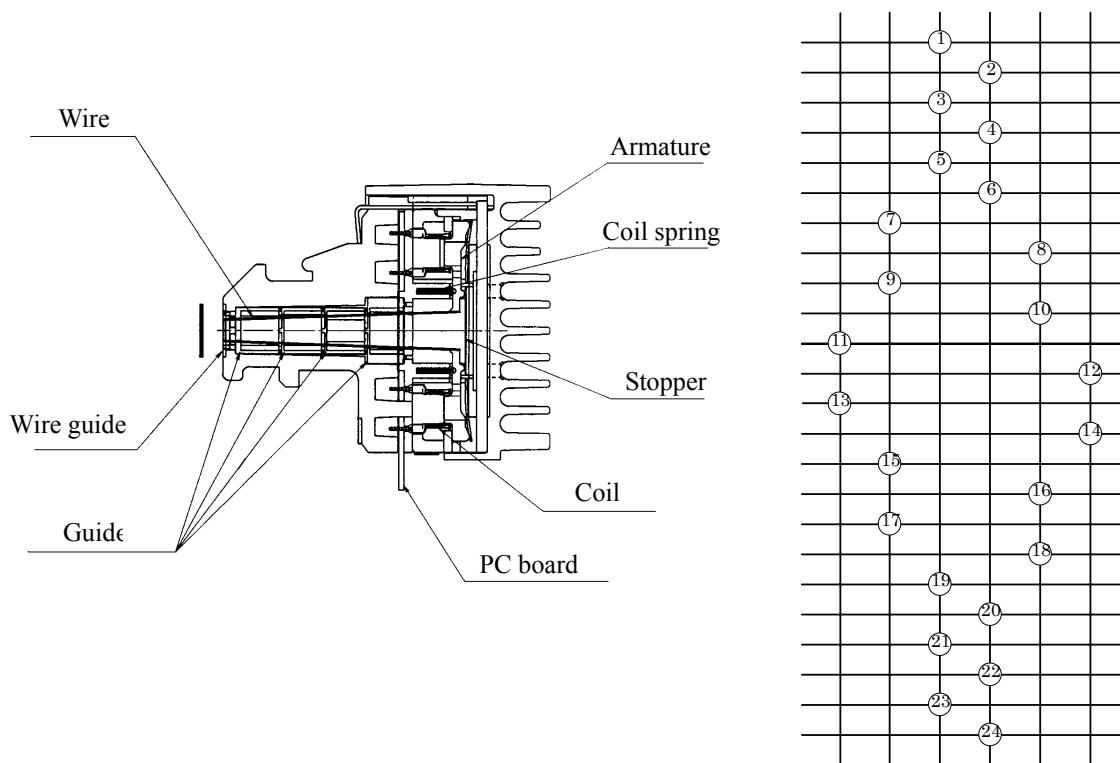
Positions of wire dots
viewed from the printing side

Figure 5.2 Print head structure

5.2.1.2 Spacing operation

Figure 5.3 shows spacing mechanism.
Spacing operation is performed by the space motor (4-phase pulse motor) mounted on the right side of the side frame.
The drive pulley used to move the carriage is mounted on the top of the space motor, and the timing belt is put on the drive pulley.
The carriage with the print head is guided by the stay shaft parallel to the platen and the upper angle secured to the frame so that the carriage can move parallel to the platen.
The timing belt is connected to the carriage by the belt clamper, and the carriage moves in parallel to the platen to the left and right in accordance with the space motor rotation.
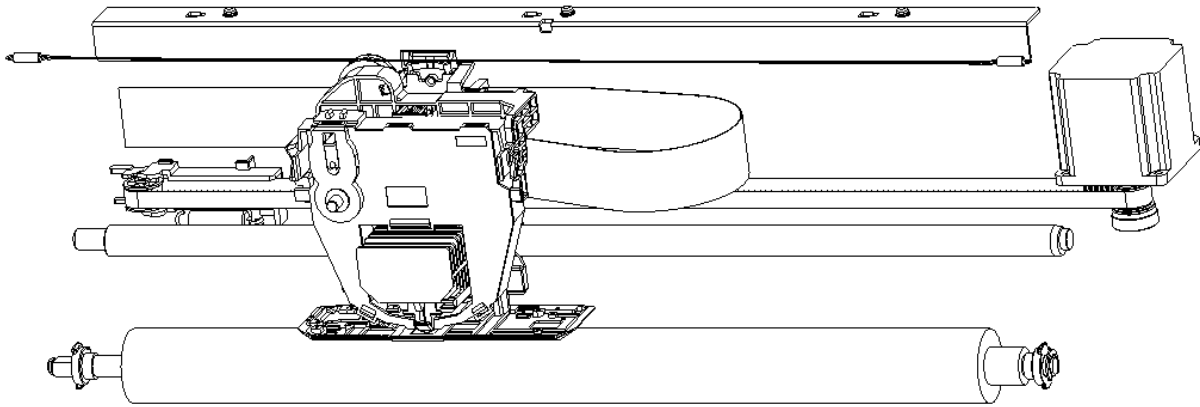
Figure 5.3 Spacing mechanisms

5.2.1.3 LRES (Carriage position) detection

The left and right carriage positions are detected using one LRES sensor provided on the back of the carriage and the left and right shield plates provided on the upper stay.   The shield plates are different in length in the direction in which the carriage moves.
The LRES uses a photo interloper (packaged device include LED and photo transistor) and detects the presence of the shield plate, i.e., the interrupted state and the transparent state.
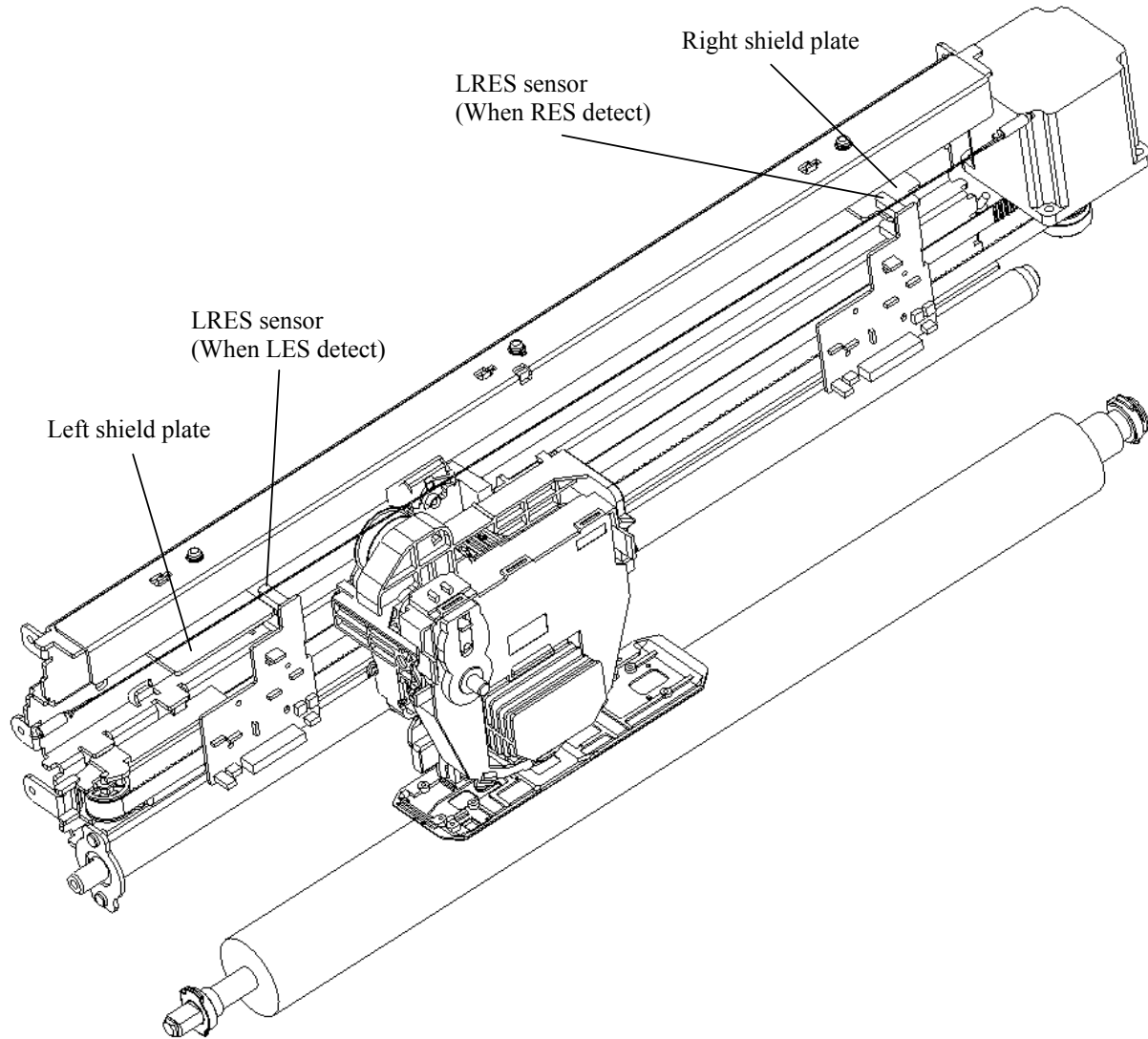
Figure 5.4 LRES detection

5.2.1.4 Ribbon feed mechanism

Figure 5.5 shows the ribbon feed mechanism.
The ribbon is fed by the rotation of the ribbon feed shaft.
The ribbon shaft always rotates in the same direction regardless of whether the carriage moves in direction A or B (left or right).
The ribbon rope winds around the ribbon pulley.   The driving force is obtained by the rotation of the ribbon pulley driven when the carriage is moved in direction A or B (left or right).   It is then transmitted to the ribbon feed shaft via planet gear and idle gear.

Ribbon pulley

Planet gear

Ribbon rope

Idle gear

Ribbon drive shaft
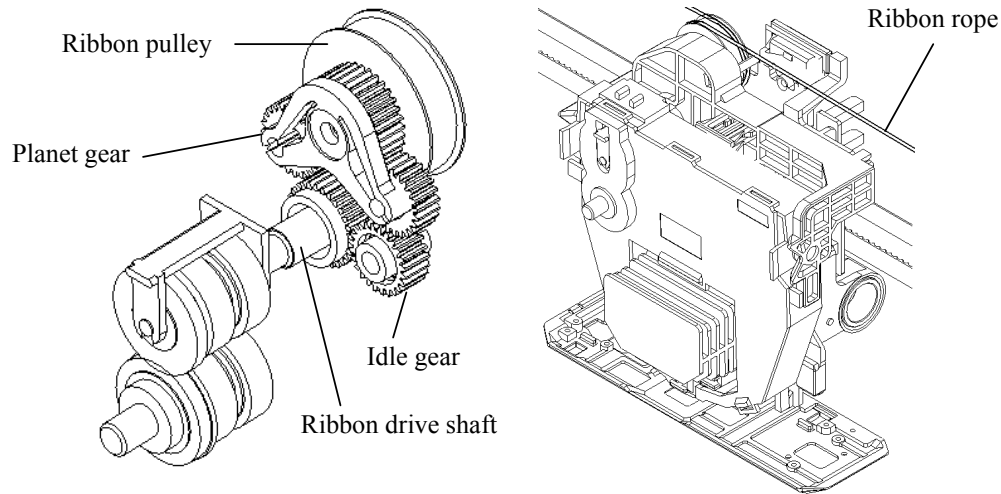
Figure 5.5 Ribbon feed mechanism

Operation when the carriage moves in direction A
Ribbon pulley ⇧rotation   →   planet gear   →   ribbon feed shaft

Operation when the carriage moves in direction B
Ribbon pulley ⬆rotation   →   planet gear   →   idle gear   →   ribbon feed shaft

Planet gear

Ribbon pulley

Ribbon rope

Direction A

Direction B

Idle gear

Ribbon drive shaft
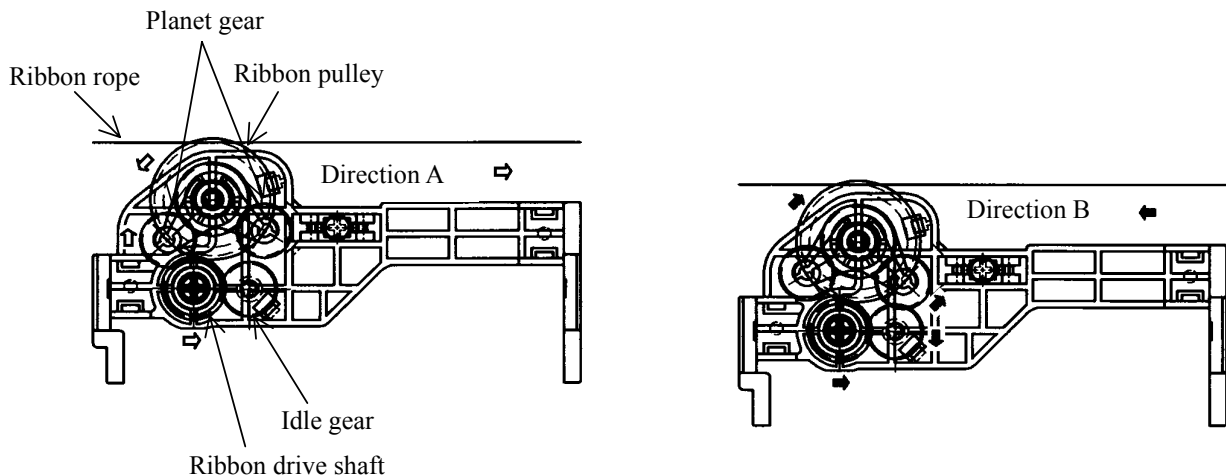
Figure 5.6 Ribbon feed mechanism

5.2.1.4 Automatic paper thickness control mechanism

The automatic paper thickness control mechanism consists of and the paper surface detection switch on the left side of the card guide.

< The head approach mechanism>
The mechanism consists of the pulse motor, stay shaft, and gear transmission mechanism.
Because stay shaft is designed to work as eccentric cam, the print head is moved up and down by the angle of the stay shaft.
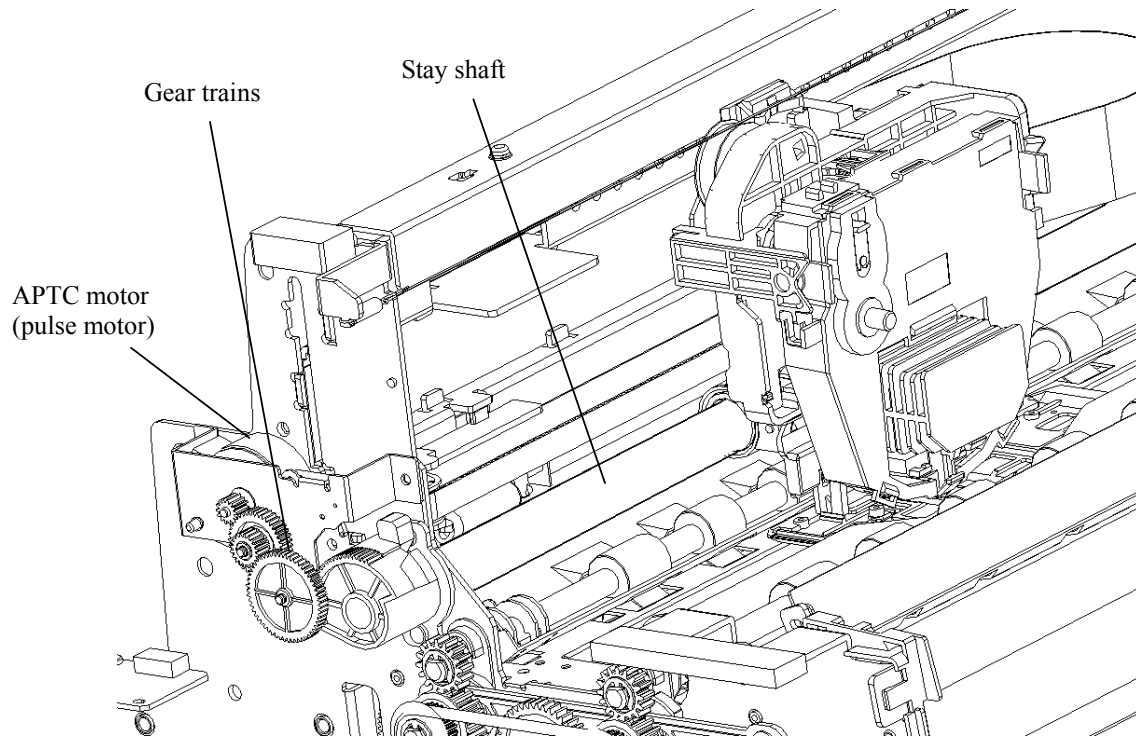
Figure 5.7 APTC approach and escape mechanism

<The paper surface detection switch on the left side of the card guide>
The ceramic chip is pressed by the paper surface during print head approaches. And then panel keyboard SW is pressed by lever. The spring is mounted in order to acquire the proper load to detect the paper surface.
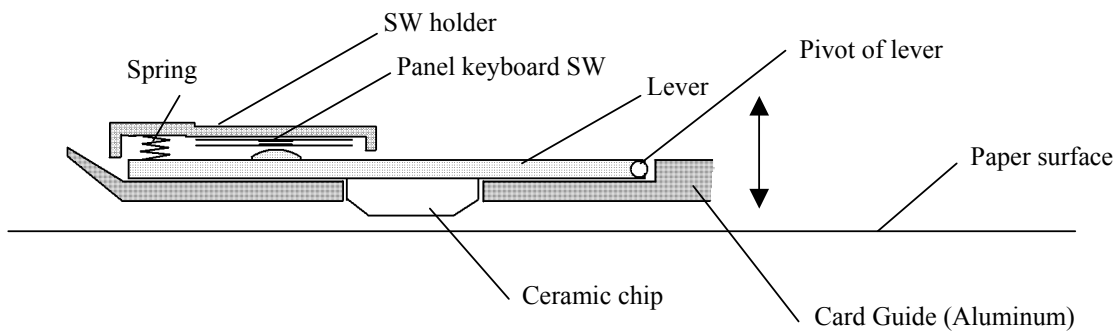
Figure 5.8 APTC sensor structure

5.2.1.5 Skew detection

Skew is detected by two sensors provided on the card guide in the carriage unit when a cut sheet is loaded.

The card guide has two sensors: TOFL and TOFR.   If a detection difference between the two sensors when the top end of paper passes them is too large, paper is ejected to the front.

Skew detection is valid only when a cut sheet is fed manually.   It is invalid when a cut sheet is fed from the CSF (front or rear) or continuous forms are fed.

TOFL

TOFR

Card guide ASY
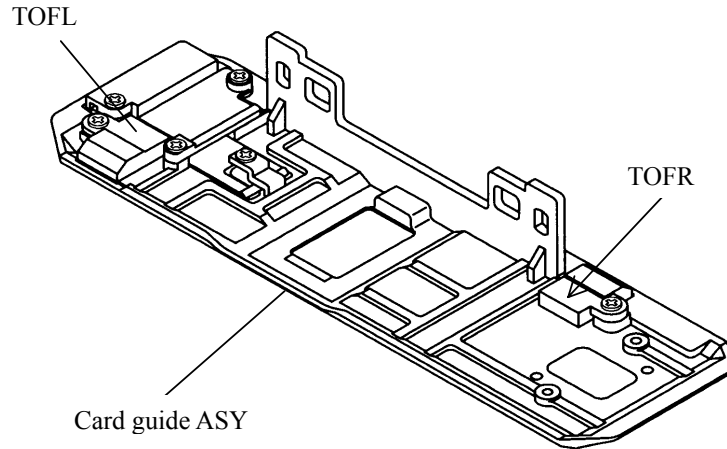
Figure 5.9 APTC sensor structure

5.2.2　Paper Feed Operation

5.2.2.1 Paper path selection mechanism (HCPP)
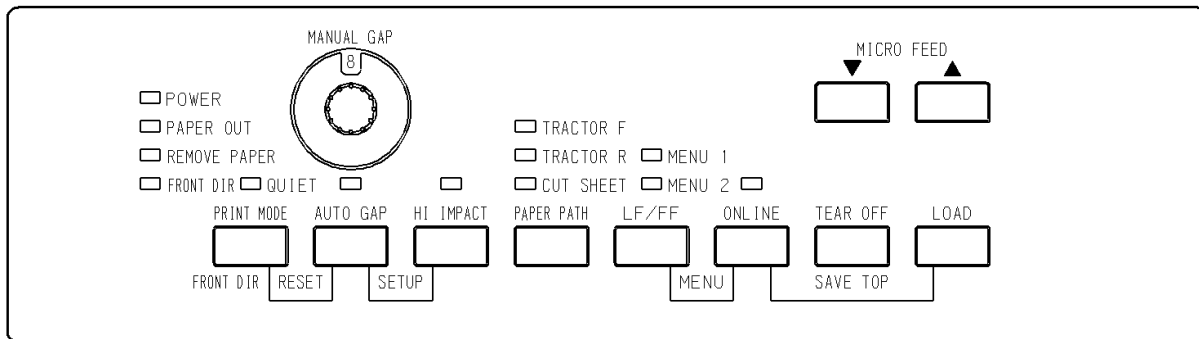
Figure 5.10 Control panel

The "PAPER PATH" button on the control panel is used to select cut sheet paper, front-fed continuous forms, and rear-fed continuous forms.　The button lights a lamp indicating the type of paper to be used.　When the PAPER PATH button is pressed to select the type of paper, the printer automatically operates the applicable components by using power of HCPP motor rotation.

The opening and closing of a roller and the state of a motor connection place in each paper path are as follows.

Table Condition of Each PAPER PATH

	PAPER PATH	"TRACTOR F"		"CUT SHEET"	"TRACTOR R"	
	STATE OF ROLLER	1	2 *		2 *	1
1	Nip ROLLER F	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
2	Nip ROLLER R	CLOSE	CLOSE	CLOSE	CLOSE	OPEN
3	What TR motor drives	FRONT TRACTOR		Nothing	REAR TRACTOR	
4	What LF motor drives	ROLLERS		ROLLERS	ROLLERS	

Note * ; In each tractor mode, both of nip rollers are closed when loading and ejecting the paper.

< Opening and closing the Nip Roller>
HCPP motor moves OC lever L and R through the gear. And OC lever L and R move the OC slide cams. And OC slide cams moved the OC calms. and OC came lift up the Nip roller.
When OC slide cam move to the front side, then front Nip Roller is opened.
When OC slide cam move to the rear side, then rear Nip Roller is opened.

< Switching the TR motor transmission>
HCPP motor rotates the OC lever L. And OC lever L's rib (cam) shifts shift gears F and R to switch power to the TR motor.

< How to determine the home position of a HCPP mechanism>

When the PAPER PATH button is pressed to change the paper path, the OC lever operates to detect the ON/OFF state of the HCPP switch under the OC lever L.　OC lever L has a cam to operate the switch, which is closed in REAR TRACTOR side and open in FRONT TRACTOR side.
Detecting the home position done from off state to on state.
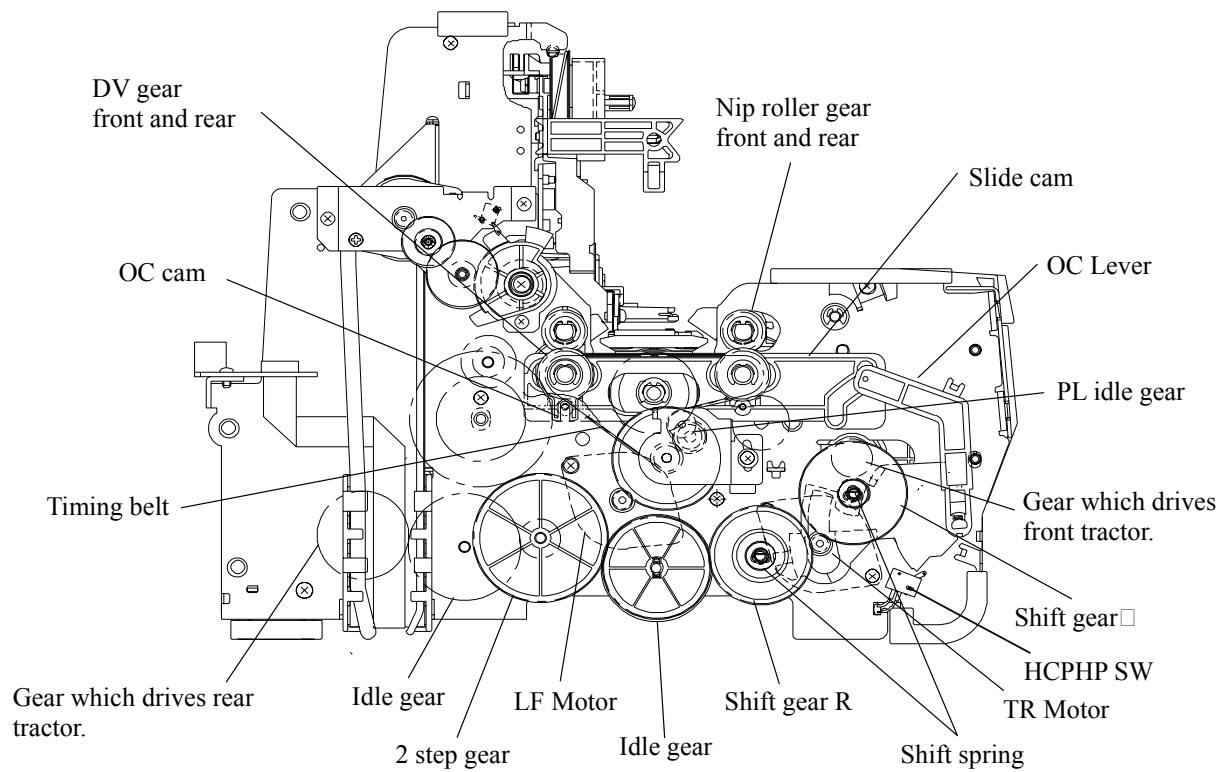
Figure 5.11 HCPP mechanism
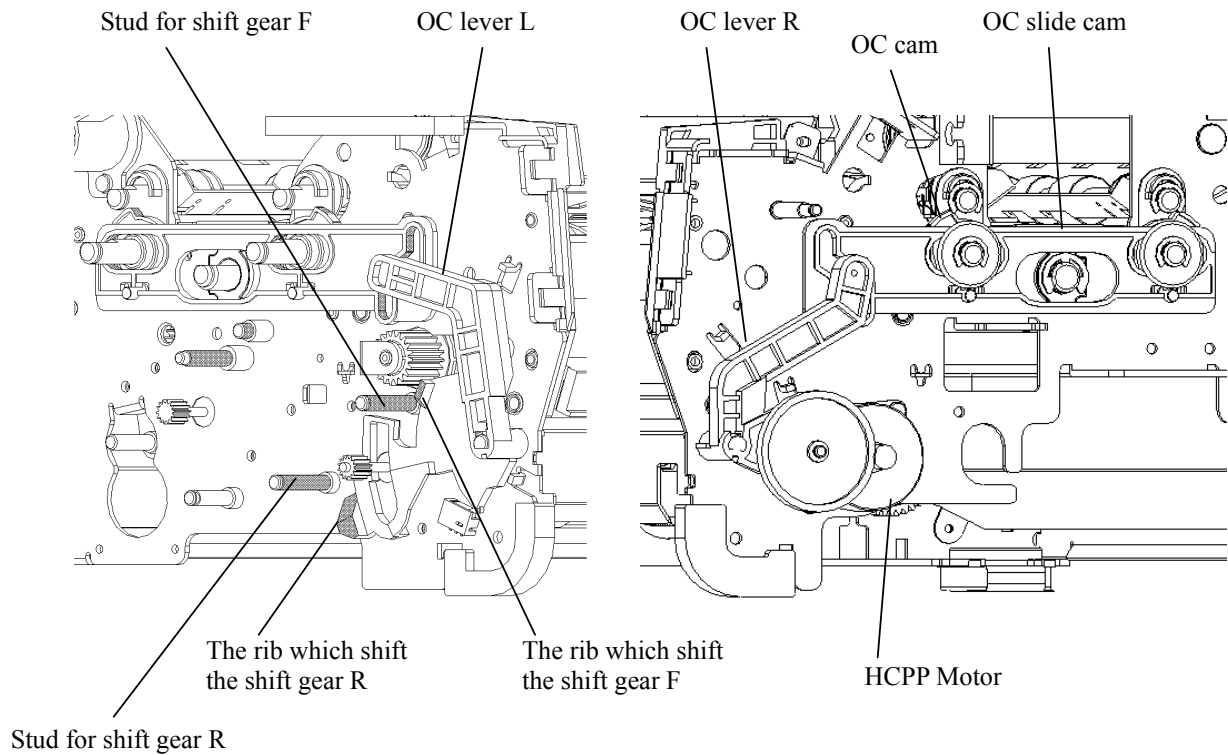
Figure 5.12 HCPP mechanism

5.2.2.3 Paper feed operation

Figure 5.12 shows the driving system of the paper feed mechanism.
The LF and TR motors mounted on the frame via gears feed paper. The LF motor operates for both cut sheet paper and continuous forms to rotate the first and second transport rollers and platen roll. The TR motor operates only for continuous forms to rotate the front or rear tractor to feed paper.

(1) Power transmission
Driving the transport roller
The transport roller is driven by the LF motor, which rotates the first and second transport roller gears (pulleys) via the pulley gear and timing belt.
Driving the front tractor
The front tractor is driven by the TR motor, which transmits power to the tractor driving gear via shaft gear F
Driving the rear tractor
The rear tractor is driven by the TR motor, which transmits power to the tractor driving gear via shaft gear R, idle gear, 2-step gear, and TR idle gear.
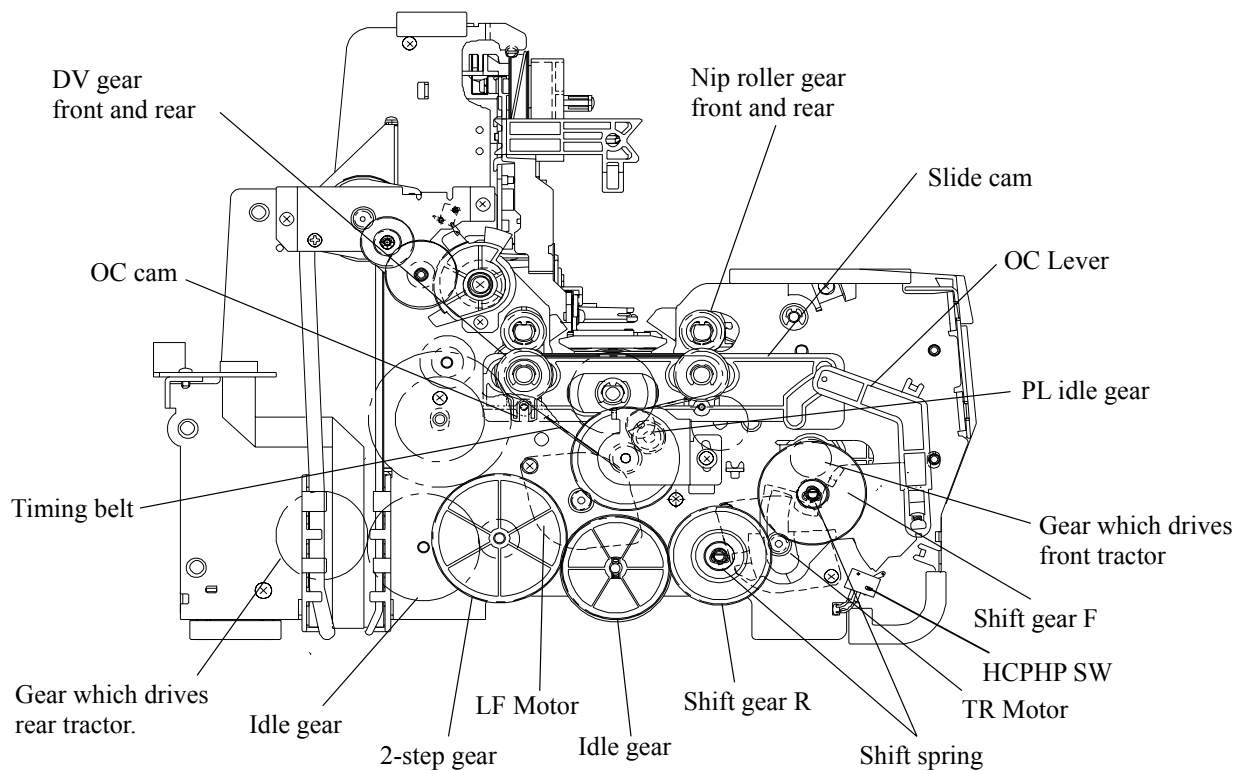
Figure 5.13 Power transmission mechanism

(2) Continuous forms paper feed operation

Figure 5.13 shows the paper feed mechanism for continuous forms.   Continuous forms paper is loaded with its sprocket holes fitted to the pins on the paper feed tractor belt and is fed by transmitting TR motor power to the transmission mechanism to rotate the tractor belt.   The paper fed by the front paper feed tractor is pulled by the first and second rollers driven by the LF motor.   Paper fed by the rear paper feed tractor is also fed in the same way as with the front paper feed tractor and is pulled by the second and first rollers driven by the LF motor.
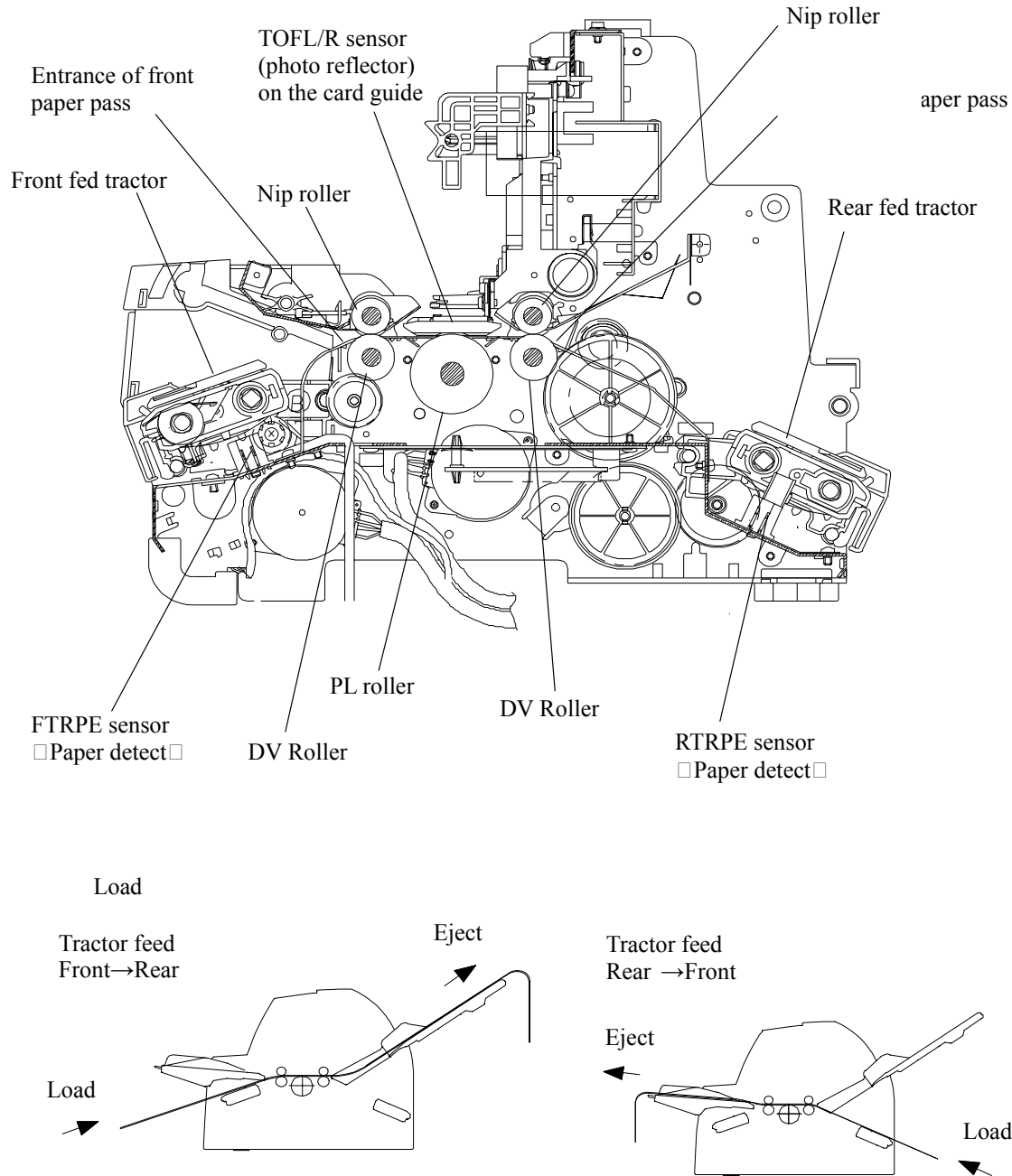
Figure 5.14 Tractor feed mechanism

(3) Cut sheet paper feed operation

Figure 5.14 shows the paper feed mechanism for cut sheet paper.
The cut sheet paper placed on the paper table, which is not shown in the figure below, against the first roller in the cut sheet feeding slot is fed between the first transport roller and first nip roller, which are driven by the LF motor, and pulled by the second transport roller and second nip roller.
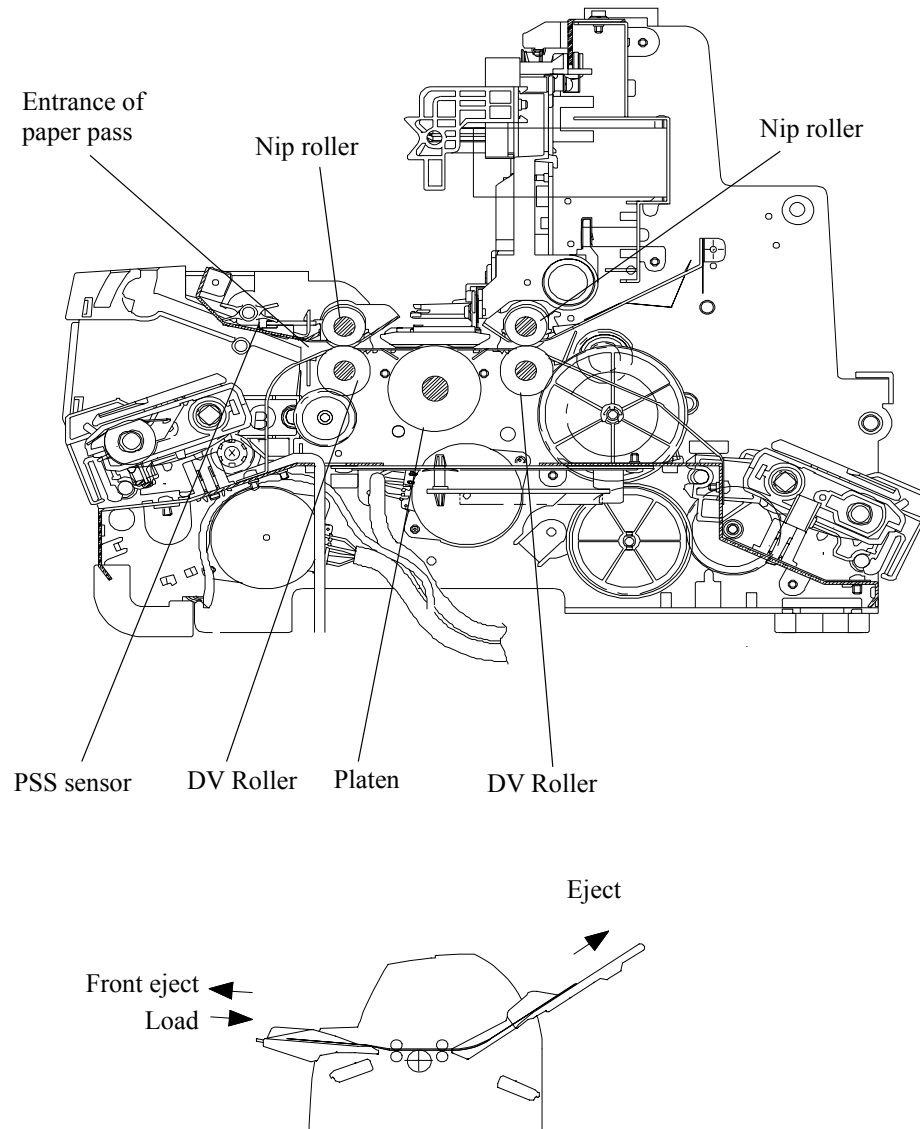
Figure 5.15 Cut sheet feed mechanism

5.2.2.4 Paper loading and ejection operation (auto loading)

Loading the paper is done automatically.

< Continuous forms loading operation >
After setting continuous forms on the front or rear tractor, press the LOAD button to start loading operation. When the top of paper reaches the paper sensor (mounted on the card guide) shown in Figure 5.15, the paper sensor changes from the "no-paper" state to the "paper present" state. Based on this position, the amount of paper sending is determined so that continuous forms are loaded to top of form position.

< Continuous forms unload operation >
Pressing the LOAD button on the control panel while paper is loaded unloads the continuous forms to the position where the tractor detection switch changed from the "paper present" state to the "no paper" state or. If 2 pages have unloaded then stop.

< Continuous forms ejection operation >
Holding the pressing the LF/FF button on the control panel while paper is loaded sends the continuous forms forward. If 1 page has fed then stop.

< Cut sheet loading operation (automatic cut sheet setting operation)>
Operator push against the cut sheet to the feed roller, loading operation begins after 1.5 seconds since the PSS(Paper set sensor)changes from the "no paper" state to the "paper present" state. Default setting of CUTLOAD(in set up mode) is AUTO. If its changed to BUTTON pushing button is necessary to load the cut sheet.
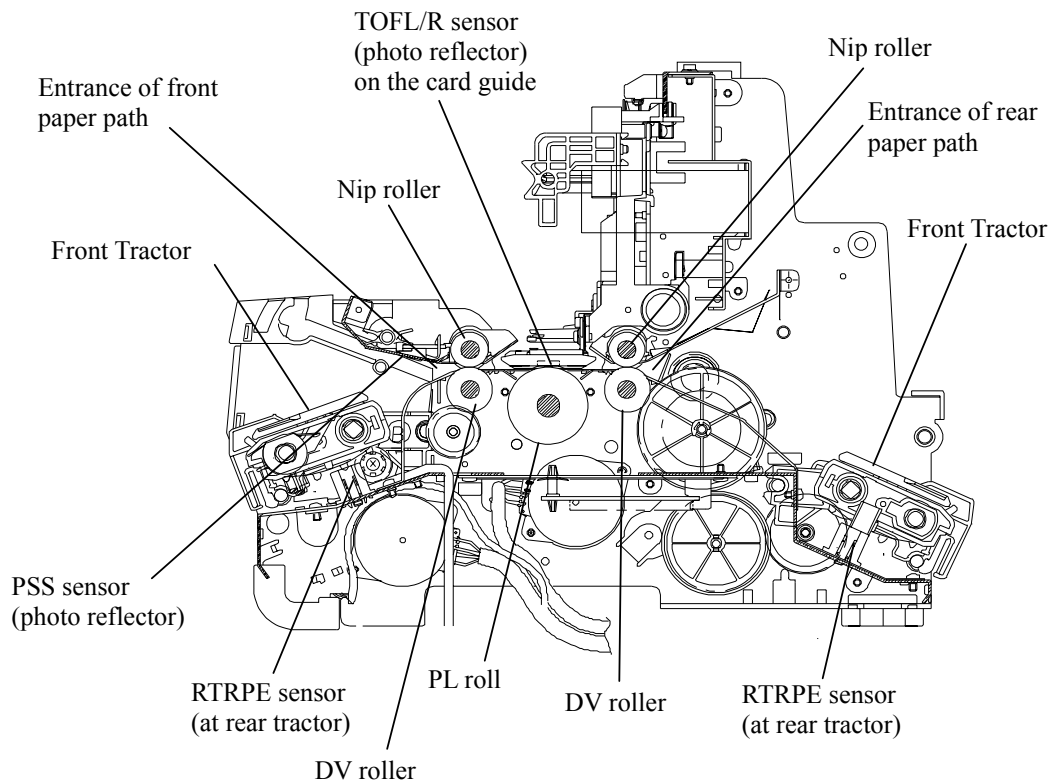
Figure 5.16 Auto loading mechanism

5.3 Electrical Operation

The main control unit uses the MB90706 controller dedicated to the printer.   The controller contains Centronics control and stepping motor control circuits while using 16-bit MPU FFMC-16 as its core element.   It thus implements high-speed, compact, and low-cost control circuits.

The printer contains a full two-line buffer and performs normal/reverse automatic checking and printing to implement high throughputs.

Firmware is put in modules to improve reliability.

> Note
>   EEPROM (part symbol IC30) mounted on the main board contains information on adjusted values and consumables specific to the mechanism.
>   If the main board (GMC06**) of this printer is replaced, remove the EEPROM package in advance from the main board and mount it on the new main board.

5.3.2   Printed Circuit Boards and Basic Configuration

Table 5.3.1 lists the printed circuit boards used in this printer.

Alias of PC board	Drawing number	Major functions
Main board GMC06**	KA21212-B**X	Main control circuit, drive circuit, interface driver/receiver circuit
Control panel board GAO99BA	CA21264-B91X	Serial/parallel converter LSI, display lamps, control switches
Power supply board PW37CZ(100V)	KA02951-0088	+34 V and +5 V power supply
Power supply board PW37BZ(200V)	KA02951-0086	+34 V and +5 V power supply

X: PC board EC level

Table 5.3.1   Printed circuit boards

Figure 5.3.1 shows the basic configuration of this printer.
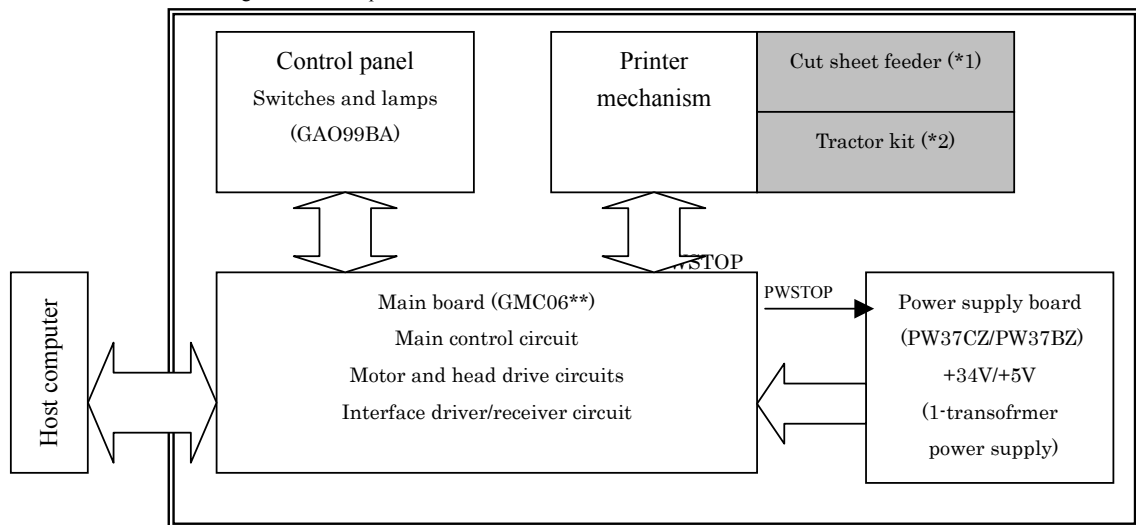
*1: The cut sheet feeder is an option.
*2: The tractor kit is an option.

Figure 5.3.1   Basic configuration

5.3.2.1 Outline of Printed Circuit Boards

Main board (GMC06**)

This printed circuit board consists of three basic blocks: the main control circuit, interface circuit, and drive circuit blocks.

The main board has the following ten connectors:

No.	Name	Abbreviation	Connection destination
	Centronics connector	IFCEN	Host computer
	Control panel connector	CNOP	Control panel board
	Power supply connector	CNPW	Power supply board
	Carriage board connector	CNHD3	Multi-sensor for detection of left and right ends
	Head cable connector	CNHD1 CNHD2	Print head
	Space motor cable	CNSP	Space motor
	Line feed motor cable	CNMLF	Line feed motor
	Tractor motor cable	CNTLF	Tractor motor
	Sheet feeder cable	Front:CNFCSF Rear:CNRCSF	Sheet feeder connector board
10	Sensor board connection cable	CNSEN	Mechanism board (sensor board)
11	USB connector	CNUSB	Host computer
12	RS232C connector	CNRS	Host computer
13	Inter rock connector	INLK	Inter rock switch

Power supply board (PW37CZ/PW37BZ)

This printed circuit board supplies logic power (+5 V) and driving power (+34 V) to the main board.

The driving power can be turned on and off by the control signal (PWSTOP) from the main board.

This printed circuit board has an AC inlet for AC cable connection, the AC switch, and main board connection harness.

Control panel board (GAO99BA)

This printed circuit board has printer status display LEDs and mode setting switches.

It also has the main board connector (CNOP) and cover open switch connector (COS).
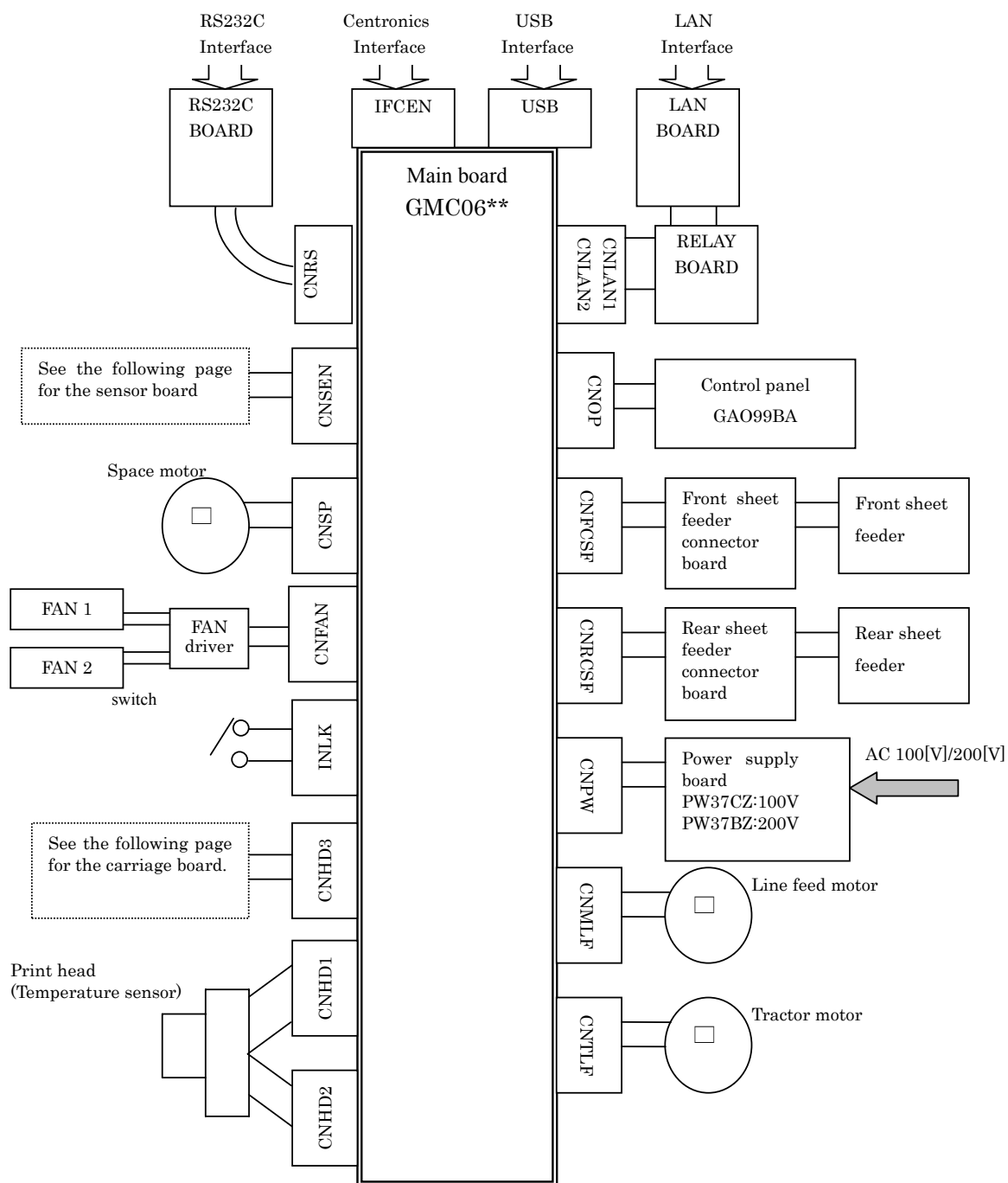
Figure 5.3.2 Main board peripheral configurations

Figure 5.3.3 Sensor board peripheral configuration

Sensor	Connector		
Paper setting sensor	PS1-PS4	Sensor board	CNSEN → Main board GMC06**
Rear-fed continuous forms sensor	RTRPES		
Front-fed continuous forms sensor	FTRPES		RPM → M Skew correction motor
Skew correction roller phase position	RPS		HCPPM → M Front/rear tractor selection. gear open/close motor
APTC reference position sensor	APTCHP		APTCM → M APTC motor
Transport roller position sensor	HCPPPS		

Figure 5.3.3 Sensor board peripheral configuration

Main board GMC06**	CNHD3	Carriage board	TOFL detection sensor
			TOFR
			APTC gap sensor

Figure 5.3.4 Carriage board peripheral configurations
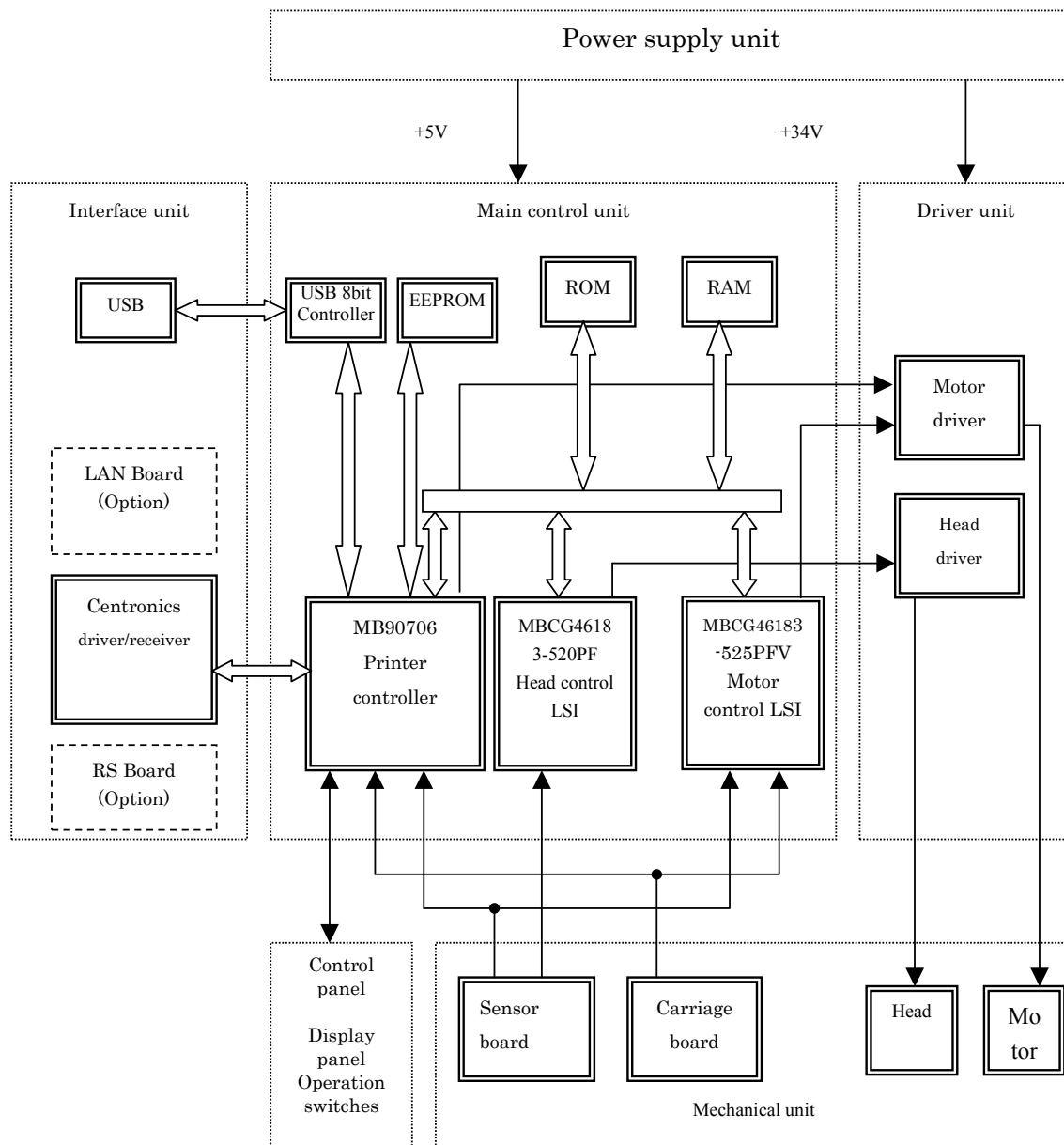
Figure 5.3.5 Internal circuit block diagrams

5.3.3 Control Circuit Operation

5.3.3.1 Printer Special Controller (MB90706)

Figure 5.3.6 is an MB90706 internal block diagram.
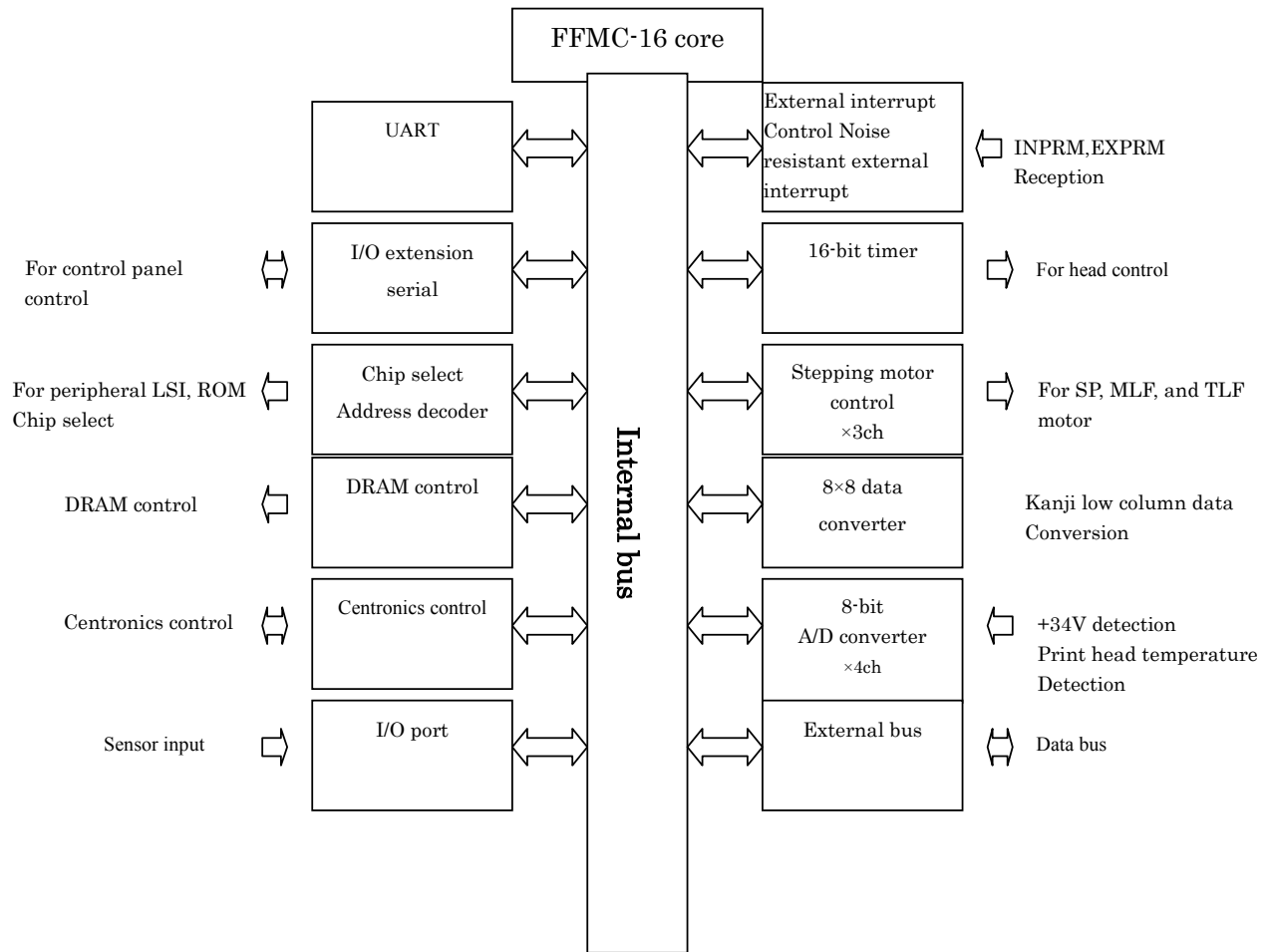
Figure 5.3.6 MB90706 internal block diagram

The MB90706 is a printer controller that has 16-bit MPU FFMC-16 as the core element and the peripheral circuits required for printer control as shown in Figure 5.3.6.

The controller features the following:

 Minimum instruction execution time -> 100 ns (at 10 MHz machine cycle)

 Using a high-level language (C) to support multitasking

 Enhanced interrupt function (eight priority levels)

 Automatic data transfer function independent of the CPU

Device using 160-pin flat package CMOS technology

5.3.3.2 Memory Circuit Control

Figure 5.3.7 is a memory circuit control block diagram.
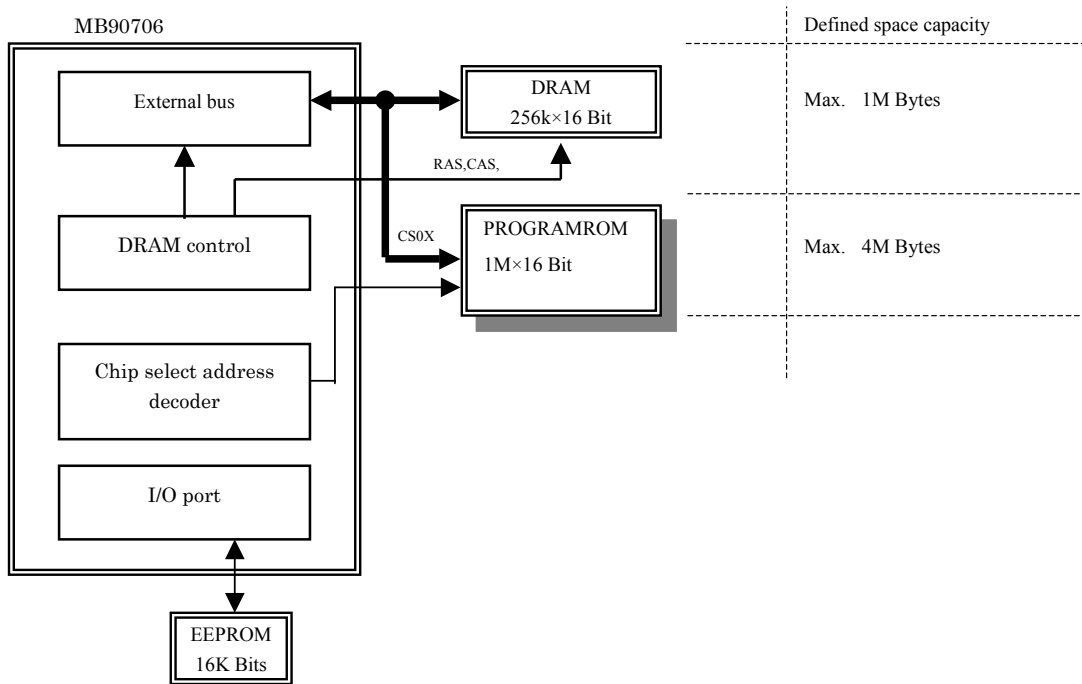
Figure 5.3.7 Memory control block diagram

The MB90706 has the DRAM control and chip select address decoder circuits for memory control as shown in Figure 5.3.7

[DRAM control]
The DRAM control outputs DRAM control signals RAS and CAS to control DRAM data reading and writing and refresh DRAM.

[Chip select address decoder]
The chip select address decoder decodes addresses and outputs a chip enable signal to ROM.
The memory circuit consists of four types of elements, DRAM, PROGRAM ROM, and EEPROM as shown in
 Figure 5.3.7.

[DRAM]
The MB90706 has a "256K x 16 bits" DRAM for control program work areas, line buffers, and external character storage areas.

[EEPROM]

The MB90706 has a 16K-bit serial transmission EEPROM (equivalent to the M24C16) that contains setup
 information, mechanism information, and consumables information.

If the board is replaced, remove the EEPROM from the board to be replaced and mount it on the replacing board.

[ROM]

The MB90706 uses a "512K x 16 bits" flash ROM for programs.

It also permits another flash ROM to be mounted when needed to support various types of emulation.

A 2-megabyte memory space is defined for each ROM.

A 16-megabit mask ROM is used for the character generator.

Address	Capacity	Explanation
000000 to 0000BF	192 bytes	CPU internal I/O area
0000C0 to 0000FF	64 bytes	External I/O area (for head and motor LSI)
000100 to 00037F	640 bytes	CPU internal RAM area
000380 to 5FFFFF	5.9M bytes	Reserved
600000 to 7FFFFF	2M bytes	Program ROM 1
800000 to 9FFFFF	2M bytes	Reserved
A00000 to BFFFFF	2M bytes	Character generator ROM3
C00000 to DFFFFF	2M bytes	Reserved
E00000 to EFFFFF	1M byte	Reserved
F00000 to FFFFFF	512K byte	DRAM

Table 5.3.2   Memory map

5.3.3.3 Centronics Controller

Figure 5.3.8 is an interface control block diagram.
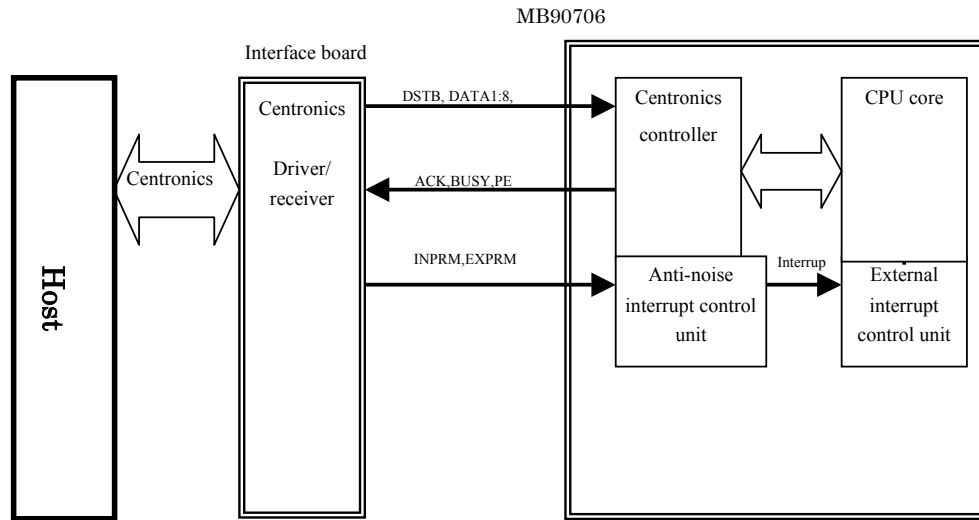
Figure 5.3.8   Interface control block diagram

[Centronics interface control]

The Centronics interface controller uses the Centronics controller built in the MB90706 as shown in Figure 5.3.8

The INPRM and EXPRM signals, which are forcible reset signals from the host, are used as interrupt signals after noise is removed from them by sampling in the anti-noise interrupt control circuit.

This printer supports nibble mode conforming to IEEE Std 1284-1994.

The following shows the circuits used for two-way Centronics control.

(1) Negotiation mode interrupt signal generator
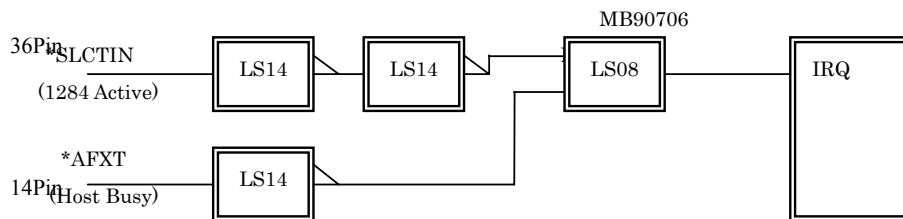
(2) Circuit for generating a strobe signal (Ptr Clk) for data transmission from the printer

MB90706
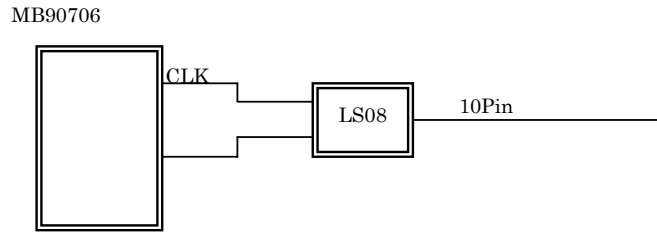
[Centronics control circuit]

Figure 5.3.9 shows a general timing chart for the Centronics control circuit.

The Centronics control circuit latches received data DATA1 to DATA8 to the internal register at the falling edge of data strobe signal *DSTB, and simultaneously sends an interrupt signal to the external interrupt control circuit to inform the MPU of the receipt of data.

The MPU checks that external data has been input, reads the data, and then stores it in DRAM.

After the interrupt is released from the MPU, BUSY is reset and *ACK is sent.

DATA1-8

*DSTB

BUSY

*ACK   Data reading

Interrupt to MPU
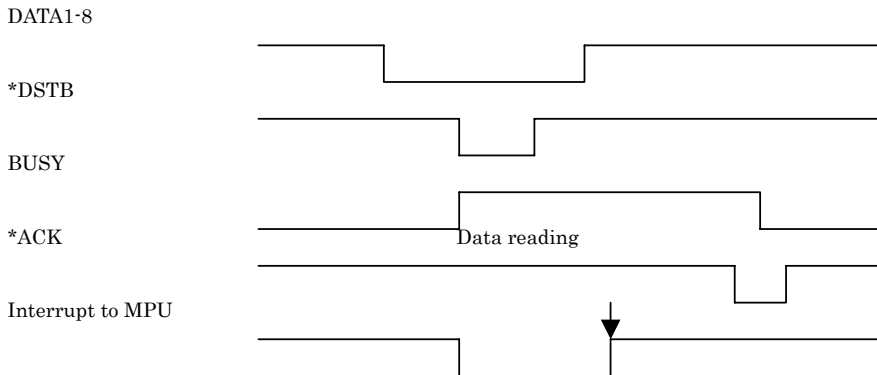
Figure 5.3.9   Interface timing chart

[Anti-noise external interrupt circuit]

The anti-noise external interrupt circuit reads the results of sampling INPRM and EXPRM twice at about 12-microsecond intervals.   It thus prevents malfunction by noise, and receives forcible reset signals INPRM and EXPRM and then causes an interrupt to the MPU.

The MPU initializes the printer based on the interrupt signal.

5.3.3.4 The MPU(MB89P585) has the following main functions

USB 8bit controller
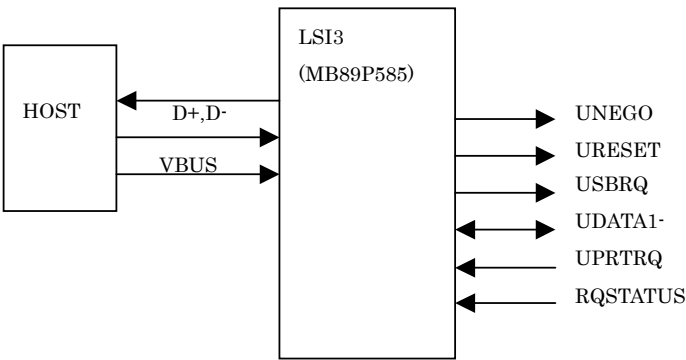
Figure 5.3.10 MB89P585 block diagram

(3) USB interface

USB interface signal

	Signal name	Function
1	VBUS	Power
2	D-	Data transfer
3	D+	Data transfer
4	GND	GND
Shell	Shield	

Specification

Basic specification USB interface conform

Electric power control Self power device

5.3.3.5 LAN interface

LAN interface signal

	Signal name	Dir	Function
1	TXO+	output	Data transfer+
2	TXO	output	Data transfer-
3	RXI+	input	Data transfer+
4	-	-	-
5	-	-	-
6	RXI+	input	Data transfer-
7	-	-	-
8	-	-	-

Specifications

A transfer mode: 10/100BASE

2.3.6 Head Control LSI (MBCG46183-520PF)

Figure 5.3.11 is a head control LSI block diagram.
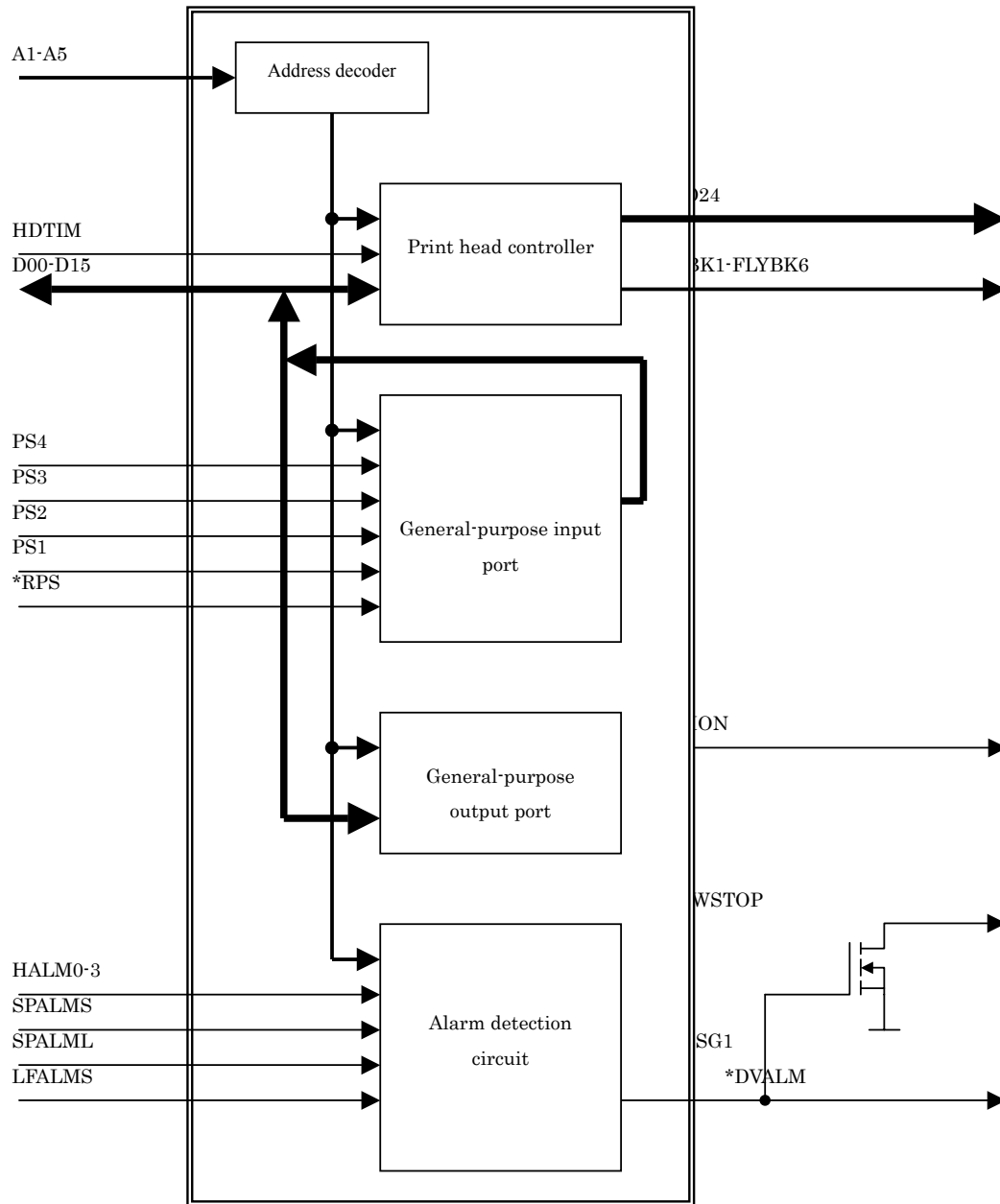
Figure 5.3.11 Head control LSI block diagram

2.3.7 Motor Control LSI (MBCG46183-525PFV)

Figure 5.3.12 is a motor control LSI block diagram.
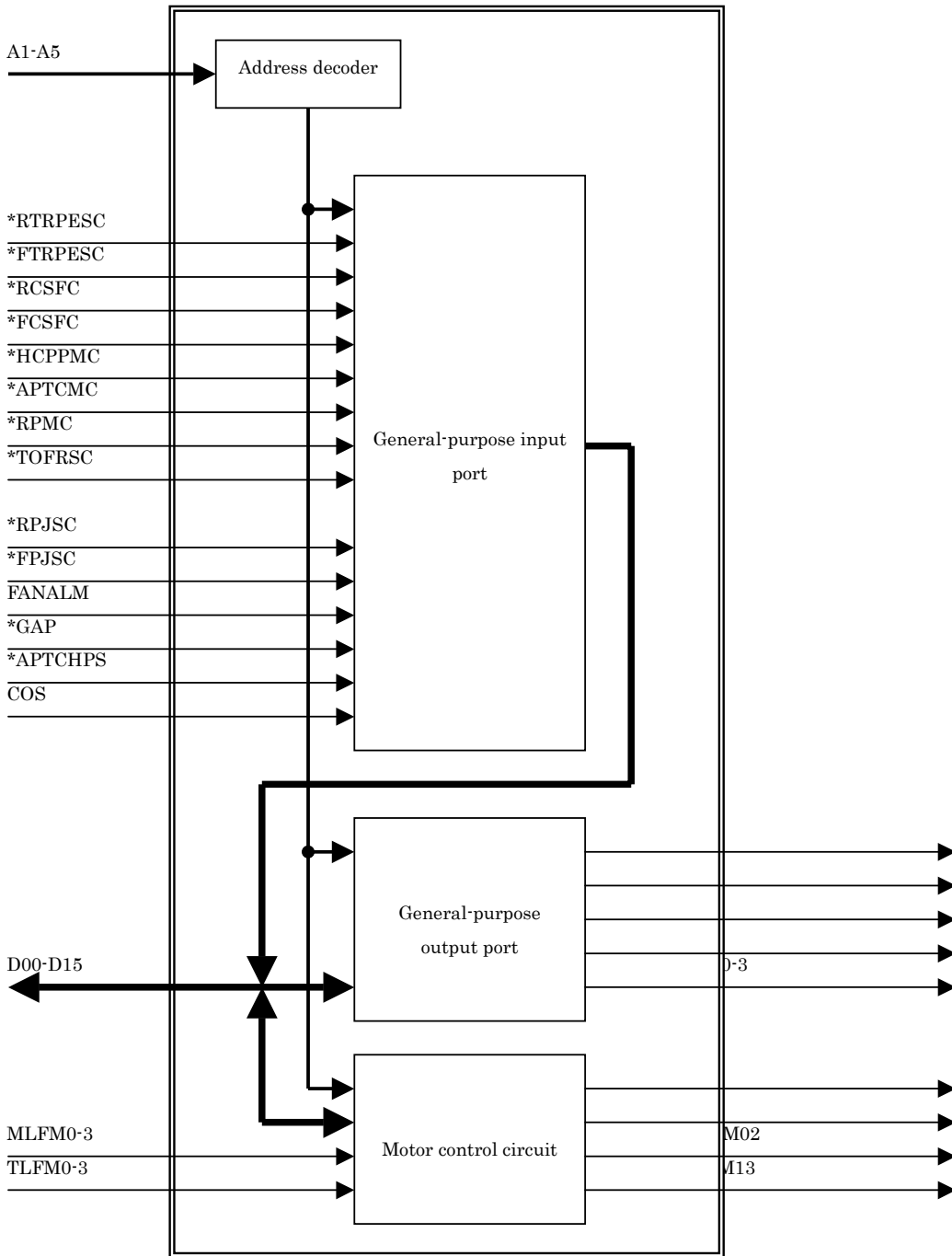
Figure 5.3.12 Motor control LSI block diagram

2.3.8 Control Panel Control

Figure 5.3.13 is a control panel controller block diagram.

Main board (GMC06**)

MB90706

Control panel board (GAO99BA)

MBCG47492-502PF

Switch

LED
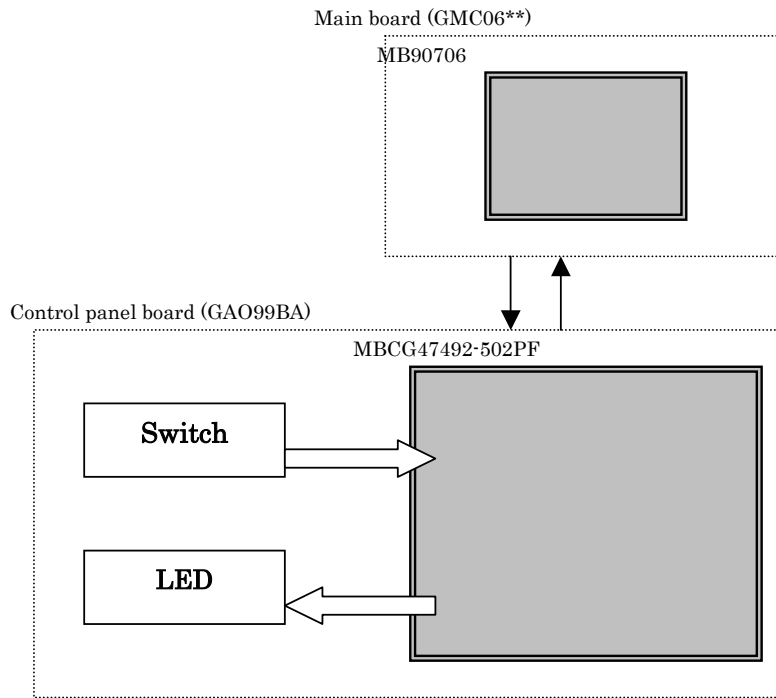
Figure 5.3.13 Control panel control block diagram

Switches and LEDs are provided on the control panel board.

These switches and LEDs are controlled by serial-parallel conversion by the MPLSI (MBCG47492-502PF)

mounted on the control panel.

5.3.4 Motor Control and Drivers

This printer has six motors (space motor, line feed motor, tractor motor, front and rear tractor selection gear open/close motor, APTC motor, and skew correction motor) in a standard configuration.   It also enables two optional motors for the front and rear cut sheet feeders (the driving circuits are built in the sheet feeders) to be mounted.

The printer controller (MB90706) has three stepping motor control boards and controls eight motors using the motor control LSI.
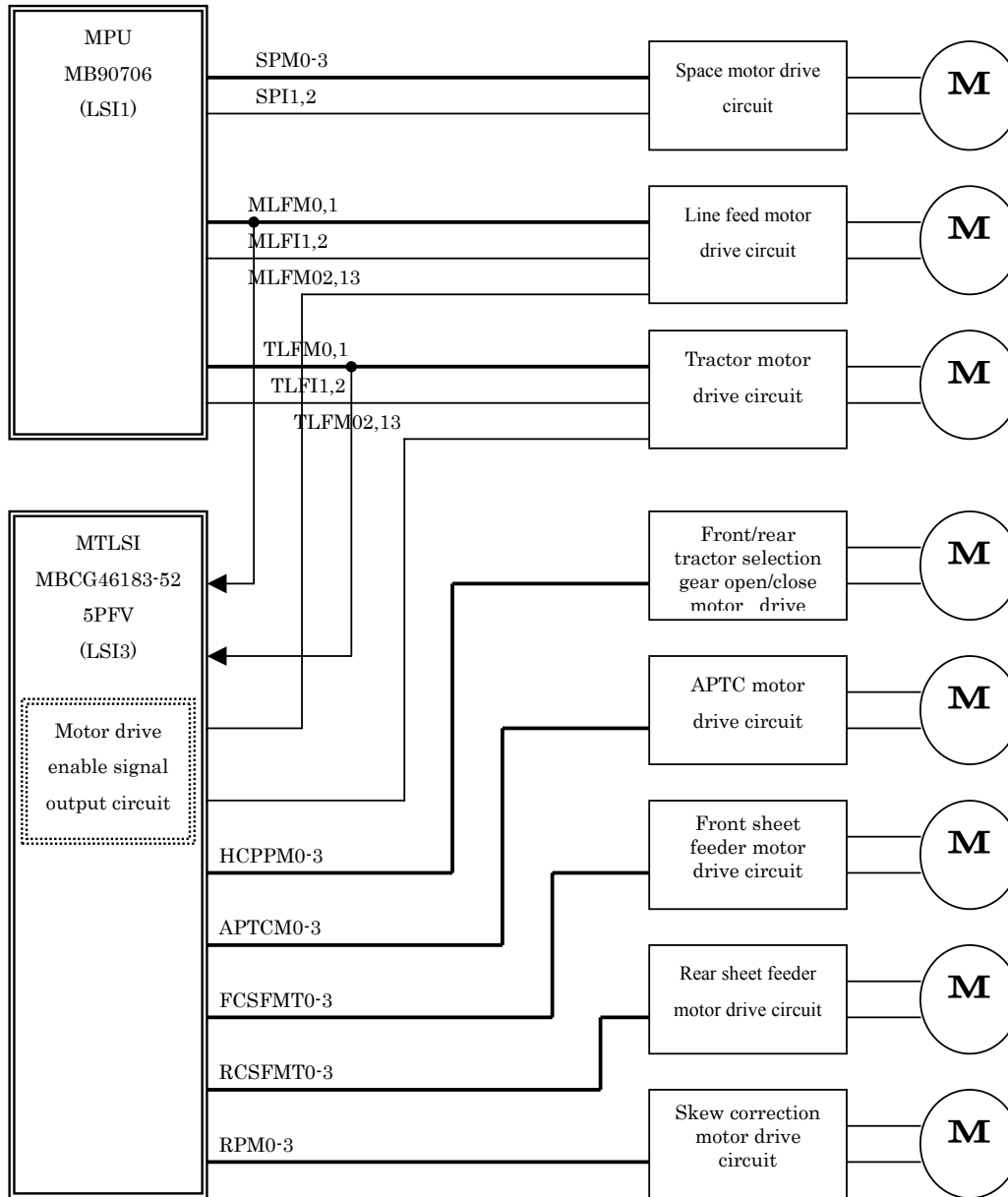
Figure 5.3.14 Motor controller block diagram

[Space, line feed, tractor, CSF, APTC, and skew correction motor drive circuits]

Figure 5.3.15 shows a block diagram of the control and drive circuits for the standard motors in the printer.
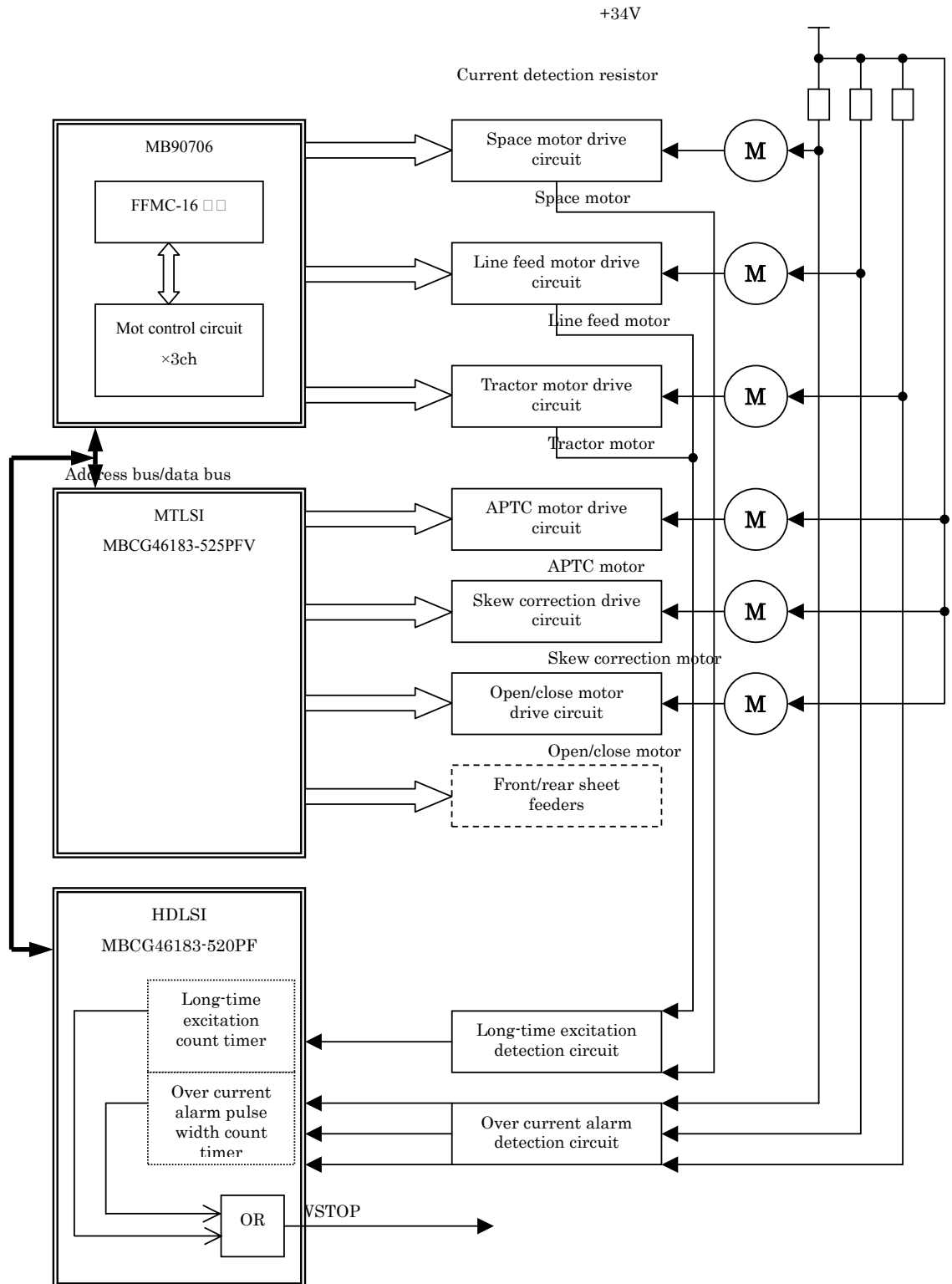
Figure 5.3.15 Block diagram for various motor control and drive circuits

The space motor is rotated as follows:

The MPU reads phase excitation data from ROM.

The rotation direction and initial excitation phase are set in the control register of the stepping motor control circuit and simultaneously current specification data is written to the current specification register as needed.

An internal interrupt is caused to the MPU every step and, when needed, the excitation time and current specification data are changed to control the stepping motor.

Figure 5.3.16 shows the space motor drive circuit.
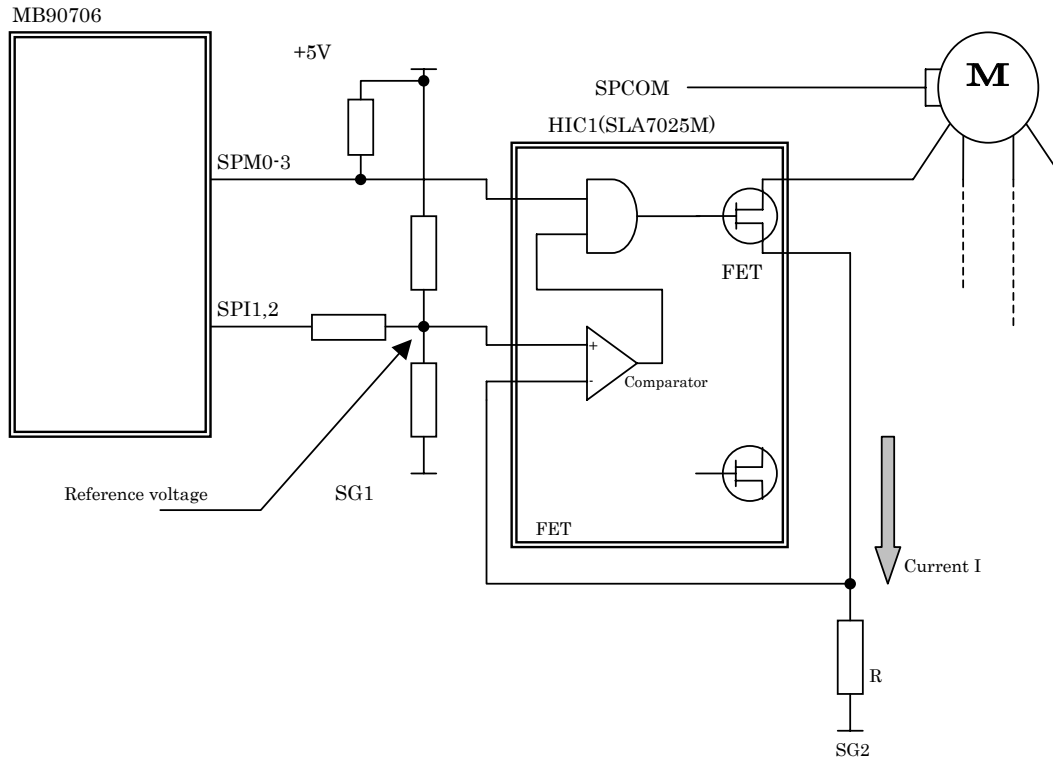
Figure 5.3.16   Space motor drive circuit

The space motor uses a constant current drive circuit as shown in Figure 5.3.16

The constant current drive IC is a hybrid IC used exclusively for motor driving.

The MB90706 stepping motor control circuit outputs SPM0 to SPM3 as phase data.

When the output signal is Hi-Z(H), the FET in the HIC goes on to supply current to the motor phase.

Current I flows to SG2 through resistor R.   Voltage level IR for the SG2 when current I flows into resistor Ris compared with the reference voltage in the HIC comparator.

When IR exceeds the reference voltage, the comparator output and phase signal are ANDed in the HIC to turn off the FET and thereby control flowing current constant.

The reference voltage is generated by pressure division of the resistor as shown in Figure 5.3.16.

The reference voltage is changed at the pressure division resistor by current control signals SPI1 and SPI2 from the motor control circuit, and thus output current is controlled.

[Line feed motor and tractor motor drive circuits]

The 4-phase line feed motor and tractor motor (bi-polar stepping motor) are controlled by the constant current drive circuit shown below.
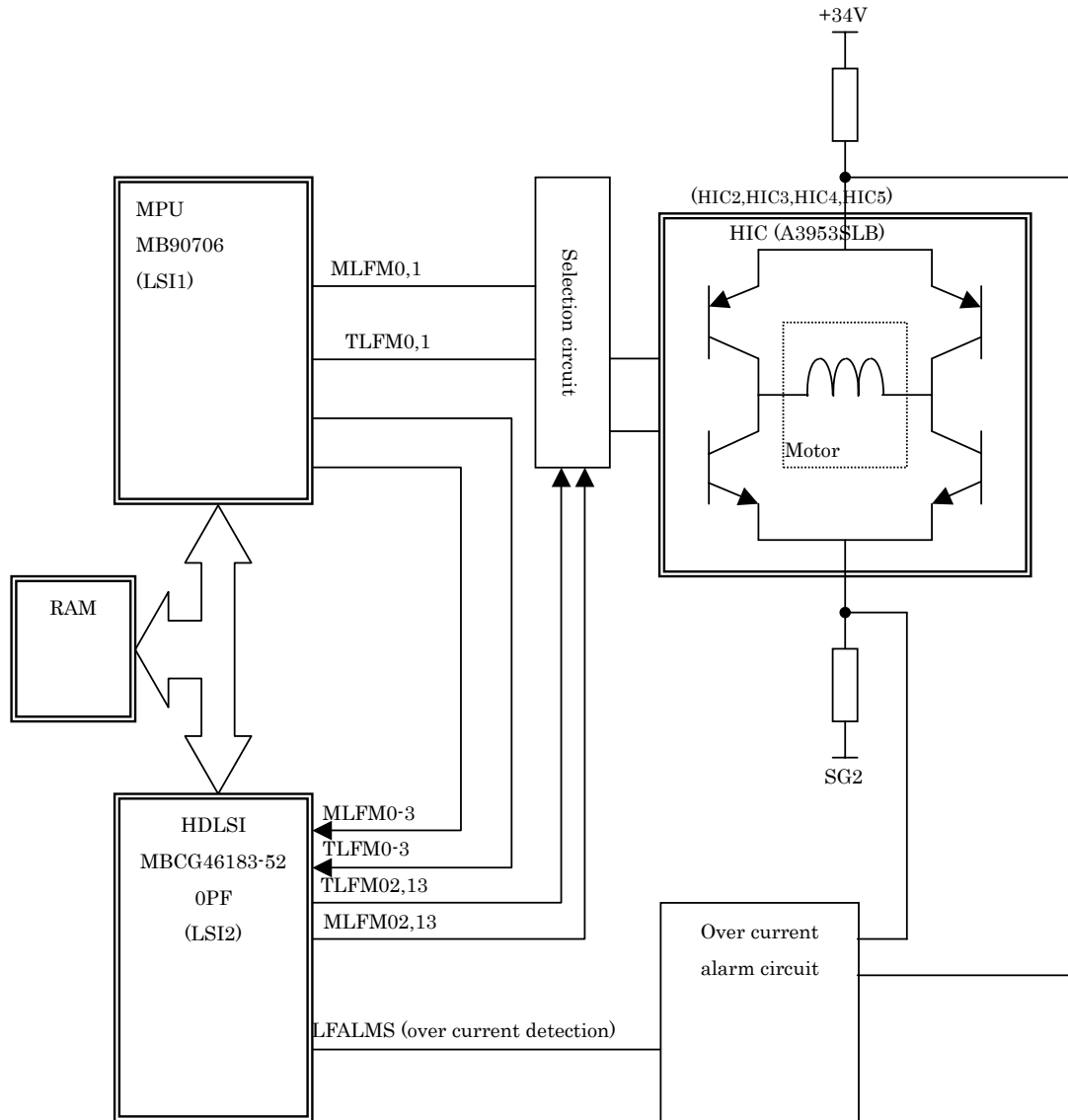
Figure 5.3.17 Bi-polar motor drive circuit

[Error detection circuit]

　Over current detection

If the space motor, line feed motor, or tractor motor current exceeds the respective absolute rated value, an over
current detection signal is sent to the HDLSI.

After a given period of the receipt of the detection signal, the HDLSI controls the PWSTOP signal to turn off +34 V.
It also notifies the MPU of the occurrence of a driver error.

[Open/close, APTC, skew correction, and CSF motor control and drive circuits]

The phase data and switchover timing for the open/close, APTC, skew correction, and CSF motors are controlled by
motor LSI control, but current control is not performed.

[CSF short-circuit protection circuit]

　If abnormal current flows to +34 V for some reason, the fuse is blown to prevent +34 V from being supplied from
the main board (GMC06**).
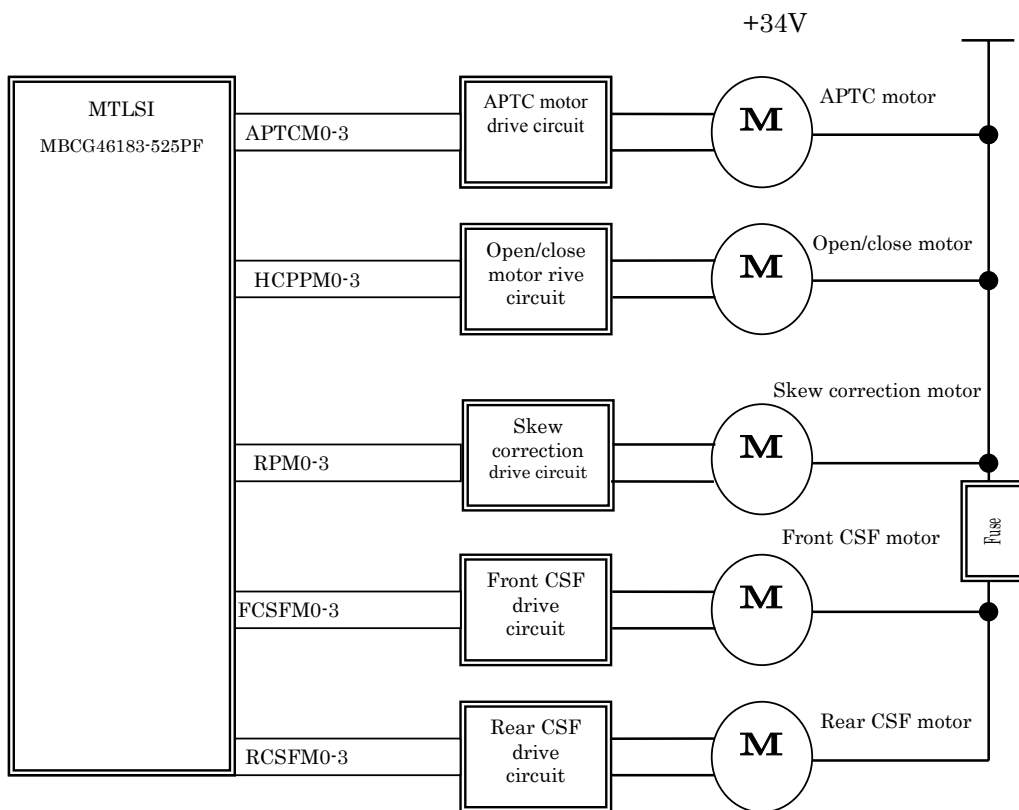
Figure 5.3.18 Open/close, APTC, skew correction, and CSF motor drive circuit block diagram

5.3.5 Print Head Driver

Figure 5.3.19 is a print head drive circuit block diagram.
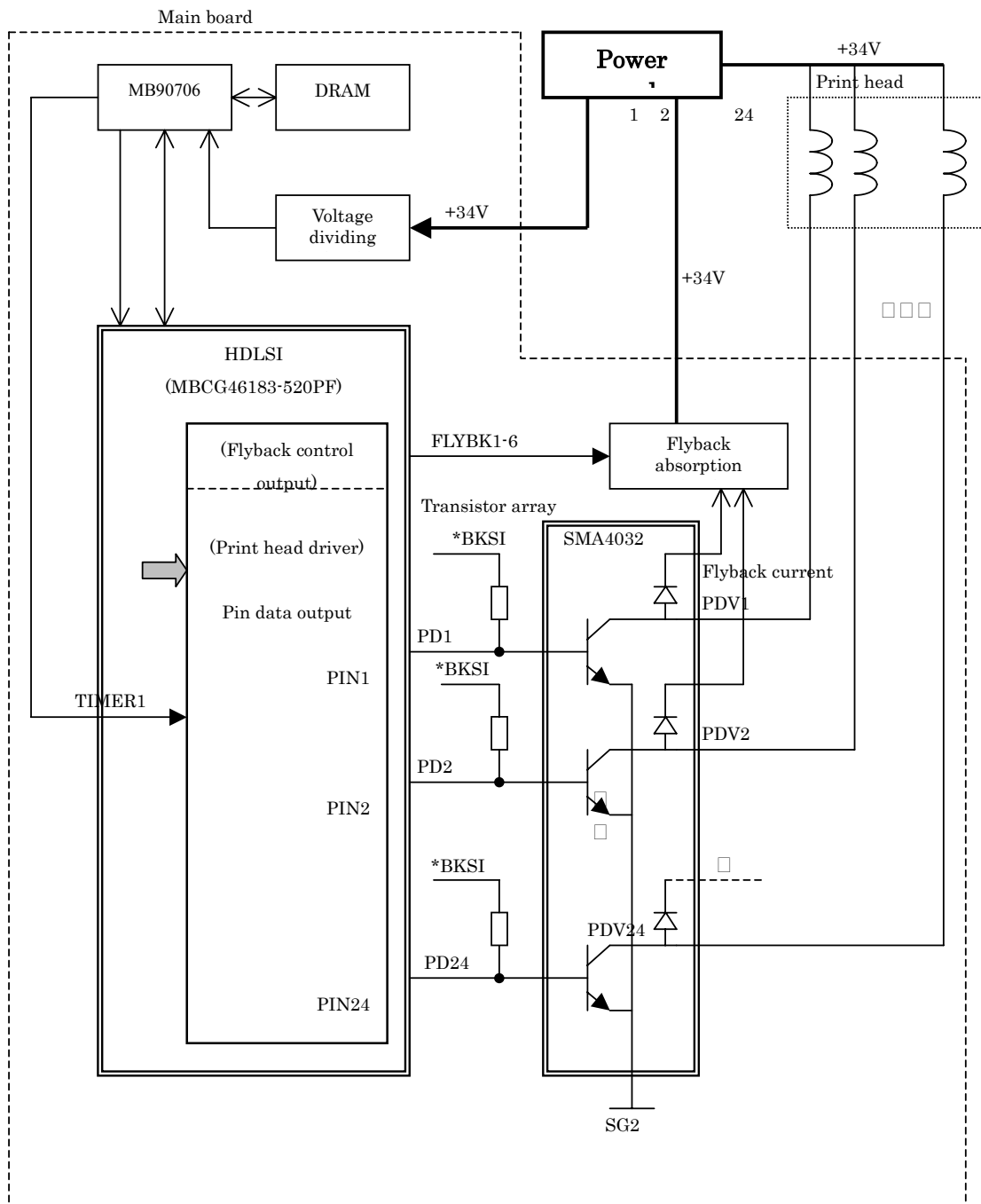
Figure 5.3.19 Print head drive circuit

[Print head drive circuit control]

The controller (MB90706) reads print data from DRAM.

The data is set on the HDLSI print control circuit.

At this point, printing does not begin yet.

The MPU sets the excitation time (T1) and flyback absorption time (T2) in the HDLSI.

The MPU outputs print timing signal TIMER1.

In synchronization with print timing signal TIMER1, excitation signal PDV1-24 is output from the print head driver to turn on the print head drive transistor (SMA4032).

After the specified excitation time has elapsed, the print head drive transistor is turned off and a flyback absorption signal (FLYBK1-6) is output to activate the absorption circuit.

After the specified flyback absorption time has elapsed, the absorption circuit is turned off.
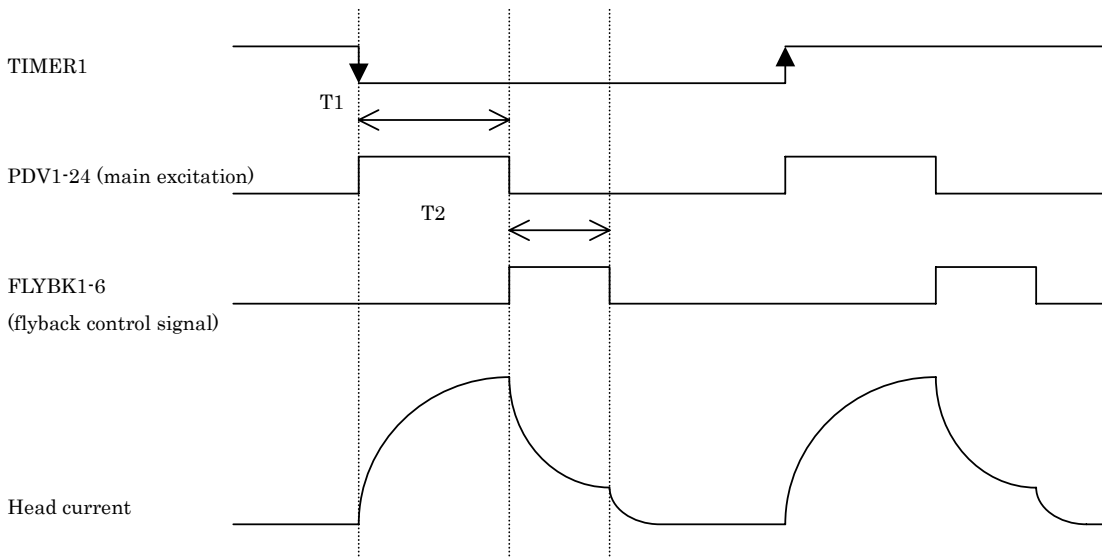
Figure 5.3.20 Print head drive circuit

[Error detection circuit]

Detection of abnormal excitation

When the print head is excited, the head fire check circuit sends an excitation detection signal to the HDLSI.

If an unreasonable period elapses after the receipt of the detection signal, the HDLSI drives the PWSTOP

signal to stop +34 V.

It also notifies the MPU of the occurrence of the driver error.

153

5.3.6 Alarms

5.3.6.1 Fire Check

A fire check alarm occurs if:

Abnormal current flows because of damage to the space, line feed, or tractor motor, or a motor driver.

The space motor has been excited for a long time.

Current flows to the head drive transistor for a period longer than specified.

5.3.6.2 ROM or RAM Error

A ROM or RAM error occurs if an error is detected during the following checks when power is turned on.

   ROM check

Check data is set for each ROM, and an add-up check is performed.

   RAM check

A RAM check is performed while writing 0 and 1 to every RAM address and reading them.

NVRAM (nonvolatile memory) check

   Check data is set for each NVRAM, and an add-up check is performed.

5.3.6.3 Spacing Error

A space alarm occurs if a space error is detected during spacing operation.

A predetermined pulse signal is applied to the space motor but the left-end sensor shows no change.

   The sensor freezes in detection state or detects nothing.

Printer column management is abnormal; the left-end sensor is detected at a place other than the left end or vice versa.

5.3.6.4 APTC Gap Alarm

When the optional automatic paper thickness control mechanism is used, a gap alarm occurs if:

Paper is thicker than the specified value.

The APTC motor drive circuit is damaged and the motor does not rotate.

APTC retract operation does not work normally.

Paper thickness cannot be detected.

The mechanism keeps staying at the retract position when paper thickness detection is performed.

5.3.6.5 HCPP Alarm

An HCPP alarm occurs if:

An attempt to change the paper path failed.

The reference position cannot be detected during initial operation (at power-on).

The reference position cannot be detected during initial operation performed for continuous loading.

5.3.6.6 Skew Unit Error

A skew unit error occurs if:

   The paper feed roller cannot be positioned correctly.

154

5.3.7. Power Supply

The power supply circuit consists of the components shown in the block diagram in Figure 5.3.21
AC input filter
Direct rectifying and smoothing circuit (including surge current preventive circuit)
+5V/+34V switching regulator
This section explains the +5V/+34V switching regulator and surge current preventive circuit according to
the block diagram in Figure 5.3.21.

5.3.7.1   +5 V Switching Regulator

This circuit consists of a one-stone ringing choke converter (RCC) using a hybrid regulator.   Two types of power,
 +5 and +34 V, are output from one transformer.
The circuit has the following functions:

Self-excitation switching control
When AC power is input, the circuit automatically starts oscillation.
It thus cannot be controlled from the outside.

   Over current control (automatic drooping characteristics)
If a short circuit occurs at the +5 V circuit load, the output voltage automatically droops to prevent damage to
the power supply.

   Over voltage control
If the 3-terminal switching regulator malfunctions in short mode, over voltage may occur at the +5V output.
The detection section on the secondary side of this circuit detects the over voltage to prevent abnormal voltage
from being output to the +5 V output.

5.3.7.2   +34 Switching Regulator

This circuit consists of a one-stone forward choke converter using a switching control IC.   It has the following functions:

+34V ON/OFF control
The *PWSTOP signal can be used to turn off the +34 V and +5 V circuits.
(When *PWSTOP is low, the +34 V and +5 V outputs are turned off.   When *PWSTOP is high, the +34 V
and +5 V outputs are turned off.)

- Over current control (automatic drooping characteristics)
If a short circuit occurs at the +34 circuit load, the +34 V switching circuit is stopped intermittently to
 prevent damage to the power supply.

- Over voltage control
If the voltage detection circuit malfunctions and over voltage occurs at the +34 V output, the over voltage
detection circuit detects the over voltage and stops the +34 V switching circuit under +34 V OFF control.
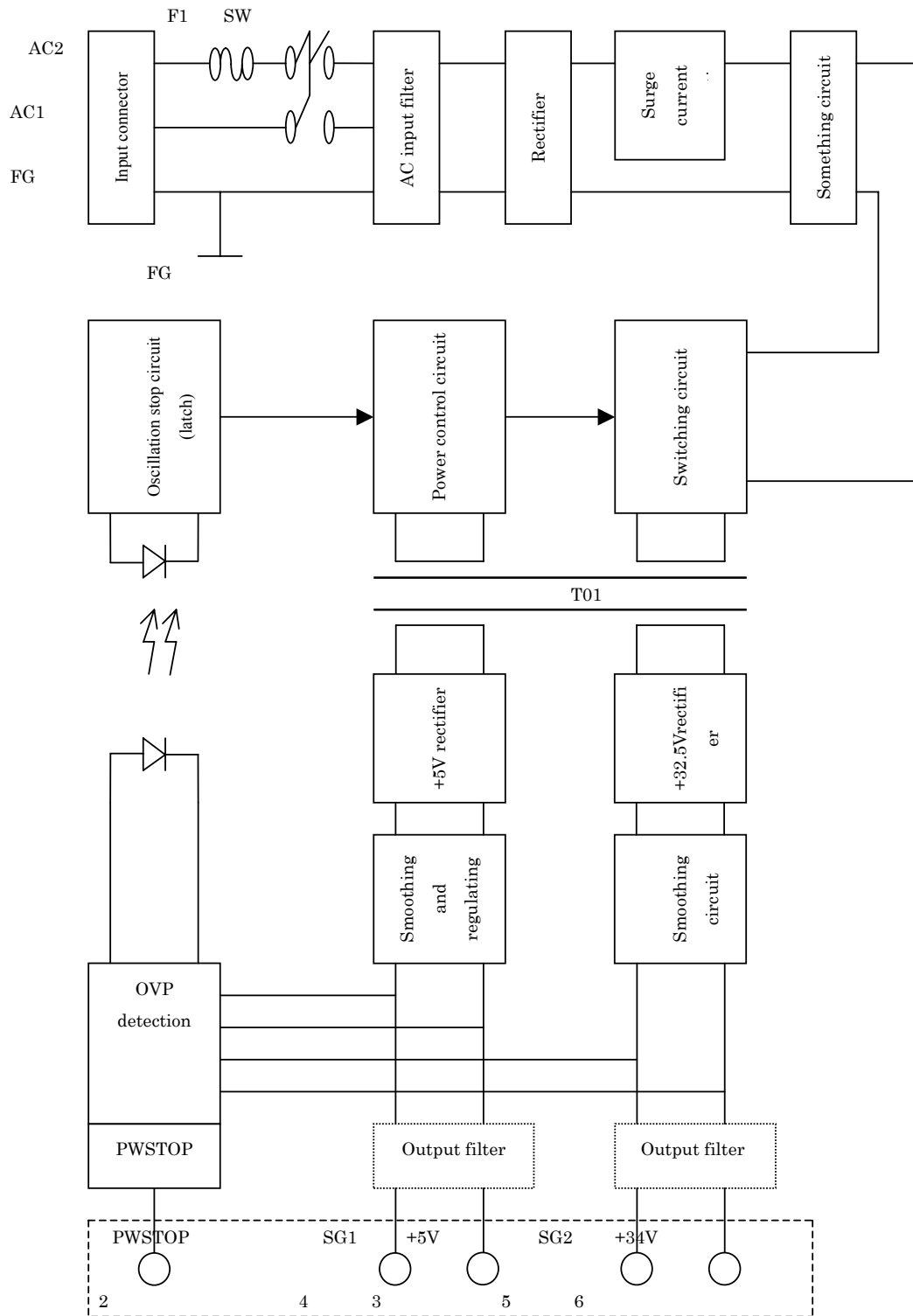
Figure 5.3.21 Power supply circuit block diagram

156

5.3.8 Surge Current Controller
2.8.1 Surge Current Controller

Surge current caused at power-on is controlled by the power thermistor (NTC thermistor) on the power supply board.

This section explains the surge current controller.

At power-on

The power thermistor is directly connected to the power supply input line and normally has several ohms of resistance when power is turned on.

This resistance suppresses surge current at power-on.

During printer operation

Because the power thermistor heats by itself by input current during printer operation, resistance is lowered down to about one-tenth of its initial value to reduce loss.

When power is turned on again

If the power is turned on again immediately after it is turned off, the power thermistor is still warm and may have less suppression effects, and surge current exceeding the specified level may flow.

CHAPTER 6   RECOMMENDED SPARE PARTS

The following table lists parts and product numbers to be used when replacing spare parts, and the sections that explain the replacement:

Item	Description	Parts number	Section to be referred to	area	ASIA	ASIA	FSE	FSE	FAL	FCI	FEL	FEL	FSBT	FTL
				Product number	B119	B219	B111	B211	B251	B203	B110	B210	B217	B228
				Interface	P+USB	P+RS	P+USB	P+RS	P+RS	P+RS	P+USB	P+RS	P+RS	P+RS
				Revision										
1	PR. MECHA ASY	KA02038-D201	4.9.1(13)		○	○	○	○	○	○	○	○	○	○
2	ROM BOARD KIT	KA02038-D202	4.9.1(15)		○	-	-	-	-	-	○	-	-	-
3	ROM BOARD KIT	KA02038-D203	4.9.1(15)		-	-	○	-	-	-	-	-	-	-
4	ROM BOARD KIT	KA02038-D204	4.9.1(15)		-	○	-	-	○	○	-	○	-	-
5	ROM BOARD KIT	KA02038-D205	4.9.1(15)		-	-	-	-	-	-	-	-	○	-
6	ROM BOARD KIT	KA02038-D206	4.9.1(15)		-	-	-	-	-	-	-	-	-	○
7	ROM BOARD KIT	KA02038-D207	4.9.1(15)		-	-	-	○	-	-	-	-	-	-
8	POWER UNIT	KA02038-D208	4.9.1(14)		-	-	-	-	-	○	-	-	-	○
9	POWER UNIT	KA02038-D209	4.9.1(14)		○	○	○	○	○	-	○	○	○	-
10	OP UNIT	KA02038-D210	4.9.1(10)		○	○	○	○	○	○	○	○	-	-
11	OP UNIT	KA02038-D211	4.9.1(10)		-	-	-	-	-	-	-	-	-	○
12	OP UNIT	KA02038-D212	4.9.1(10)		-	-	-	-	-	-	-	-	○	-
13	OP CABLE	KA02038-D213	4.9.1(22)		○	○	○	○	○	○	○	○	○	○
14	CARRIER UNIT	KA02038-D214	4.9.1(40)		○	○	○	○	○	○	○	○	○	○
15	STAY SHAFT	KA02038-D215	4.9.1(40)		○	○	○	○	○	○	○	○	○	○
16	RIBBON ROPE KIT	KA02038-D216	4.9.1(37)		○	○	○	○	○	○	○	○	○	○
17	TRACTOR UNIT	KA02038-D217	4.9.1(1)		○	○	○	○	○	○	○	○	○	○
18	CARD GUIDE KIT	KA02038-D218	4.9.1(38)		○	○	○	○	○	○	○	○	○	○
19	TOF S. L ASY	KA02038-D219	4.9.1(39)		○	○	○	○	○	○	○	○	○	○
20	TOF S. R ASY	KA02038-D220	4.9.1(39)		○	○	○	○	○	○	○	○	○	○
21	SP MOTOR ASY	KA02038-D221	4.9.1(27)		○	○	○	○	○	○	○	○	○	○
22	PLATEN ROLL ASY	KA02038-D222	4.9.1(44)		○	○	○	○	○	○	○	○	○	○
23	APTC UNIT	KA02038-D223	4.9.1(30)		○	○	○	○	○	○	○	○	○	○
24	LF MOTOR	KA02038-D224	4.9.1(28)		○	○	○	○	○	○	○	○	○	○
25	TR MOTOR	KA02038-D225	4.9.1(29)		○	○	○	○	○	○	○	○	○	○
26	HCPP MOTOR	KA02038-D226	4.9.1(31)		○	○	○	○	○	○	○	○	○	○
27	SP TIMING BELT	KA02038-D227	4.9.1(41)		○	○	○	○	○	○	○	○	○	○
28	PS PCA	KA02038-D228	4.9.1(34)		○	○	○	○	○	○	○	○	○	○
29	TRPES ASY	KA02038-D229	4.9.1(36)		○	○	○	○	○	○	○	○	○	○
30	SENSOR PCA	KA02038-D230	4.9.1(26)		○	○	○	○	○	○	○	○	○	○

Item	Description	Parts number	Section to be referred to	area	ASIA	ASIA	FSE	FSE	FAL	FCI	FEL	FEL	FSBT	FTL
				Product number	B119	B219	B111	B211	B251	B203	B110	B210	B217	B228
				Interface	P+USB	P+RS	P+USB	P+RS	P+RS	P+RS	P+USB	P+RS	P+RS	P+RS
				Revision										
31	RELAY CABLE 35P	KA02038-D231	4.9.1(24)		○	○	○	○	○	○	○	○	○	○
32	CSF CONNECT PCA	KA02038-D232	4.9.1(23,24)		○	○	○	○	○	○	○	○	○	○
33	FRONT CSF CABLE	KA02038-D233	4.9.1(23)		○	○	○	○	○	○	○	○	○	○
34	REAR CSF CABLE	KA02038-D234	4.9.1(24)		○	○	○	○	○	○	○	○	○	○
35	HCPP SW ASY	KA02038-D235	4.9.1(35)		○	○	○	○	○	○	○	○	○	○
36	S. COVER TR F	KA02038-D236	4.9.1(36)		○	○	○	○	○	○	○	○	○	○
37	S. COVER TR R	KA02038-D237	4.9.1(36)		○	○	○	○	○	○	○	○	○	○
38	LF TIMING BELT	KA02038-D238	4.9.1(43)		○	○	○	○	○	○	○	○	○	○
39	DV ROLLER ASY2	KA02038-D239	4.9.1(47)		○	○	○	○	○	○	○	○	○	○
40	NIP ROLLER ASY	KA02038-D240	4.9.1(46)		○	○	○	○	○	○	○	○	○	○
41	NIP SPRING 1	KA02038-D241	4.9.1(45)		○	○	○	○	○	○	○	○	○	○
42	NIP SPRING 2	KA02038-D242	4.9.1(45)		○	○	○	○	○	○	○	○	○	○
43	PRINT HEAD	KA02033-E659	4.9.1(9)		○	○	○	○	○	○	○	○	○	○
44	STACKER ASY	KA02038-D243	4.9.1(4)		○	○	○	○	○	○	○	○	○	○
45	FLAP	KA02038-D244	4.9.1(7)		○	○	○	○	○	○	○	○	○	○
46	AC SWITCH ASY	KA02038-D245	4.9.1(18)		○	○	○	○	○	○	○	○	○	○
47	INLET ASY	KA02038-D246	4.9.1(19)		○	○	○	○	○	○	○	○	○	○
48	REACTOR	KA02038-D247	4.9.1(20)		-	-	-	-	-	○	-	-	-	○
49	TILT BAR	KA02038-D248	4.9.1(13)		○	○	○	○	○	○	○	○	○	○
50	STACKER PLATE	KA02038-D249	4.9.1(3)		○	○	○	○	○	○	○	○	○	○
51	PAPER TABLE ASY	KA02038-D250	4.9.1(5)		○	○	○	○	○	○	○	○	○	○
52	FRONT CAVER ASY	KA02038-D251	4.9.1(11)		○	○	○	○	○	○	○	○	○	-
53	FRONT CAVER ASY	KA02038-D252	4.9.1(11)		-	-	-	-	-	-	-	-	-	○
54	TENSION BRACKET	KA02038-D253	4.9.1(42)		○	○	○	○	○	○	○	○	○	○
55	LAN RELAY PCA	KA02038-D254	4.9.1(16)		○	-	○	-	-	-	○	-	-	-
56	LAN CABLE 17P	KA02038-D255	4.9.1(16)		○	-	○	-	-	-	○	-	-	-
57	RS232C BOARD	KA02038-D256	4.9.1(17)		-	○	-	○	○	○	-	○	○	○
58	INLK SW ASY	KA02038-D257	4.9.1(33)		○	○	○	○	○	○	○	○	○	○
59	FAN UNIT	KA02038-D258	4.9.1(32)		○	○	○	○	○	○	○	○	○	○
60	FAN UNIT 2	KA02038-D259	4.9.1(21)		○	○	○	○	○	○	○	○	○	○