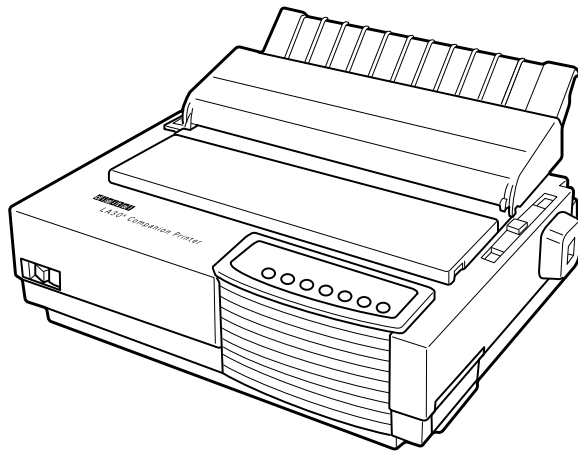


LA30^N/LA30^W Companion Printer



Service Manual



Order Number: ER-LA30N-SV-003

LA30N/LA30W Companion Printer

Service Manual

Digital Equipment Corporation
Maynard, Massachusetts

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PREFACE

This manual is for engineers who operate, install, or maintain the LA30N/LA30W Companion Printer. The topics covered are:

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: Spare parts

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CHAPTER 1 PRINTER SPECIFICATIONS, PERFORMANCE, AND CONFIGURATION

1.1 Overview

This manual is for maintenance engineers, and covers overall maintenance of the Digital LA30N and LA30W Companion Printers, together with detailed information such as troubleshooting and component replacement.

The information in this manual applies both to the Digital LA30N Companion Printer (80-column printer) and to the Digital LA30W Companion Printer (136-column printer). However, illustrations are of LA30N Companion Printer unless otherwise stated.

Recommended references are:

- LA30N/LA30W Companion Printer Illustrated Parts Breakdown (Order Number: ER-LA30N-IP-002)
- LA30N/LA30W Companion Printer User Guide (Order Number: EK-LA30E-UG-001)

The former contains information on location and order number of all parts needed for printer maintenance. The latter contains general information on printer operation.

The main difference between the LA30N and the LA30W is the “*print span*”. The LA30N is an 80-column printer and the LA30W a 136-column printer. As shown in the figures below, the physical specifications are thus different (size, weight, ...). Some minor differences concern mechanical internal parts that do not impact the general maintenance of the printer (top cover hinges, bail rollers mechanism, ...). The only visible difference concerns the accurate location of the notch scale of the paper thickness lever.

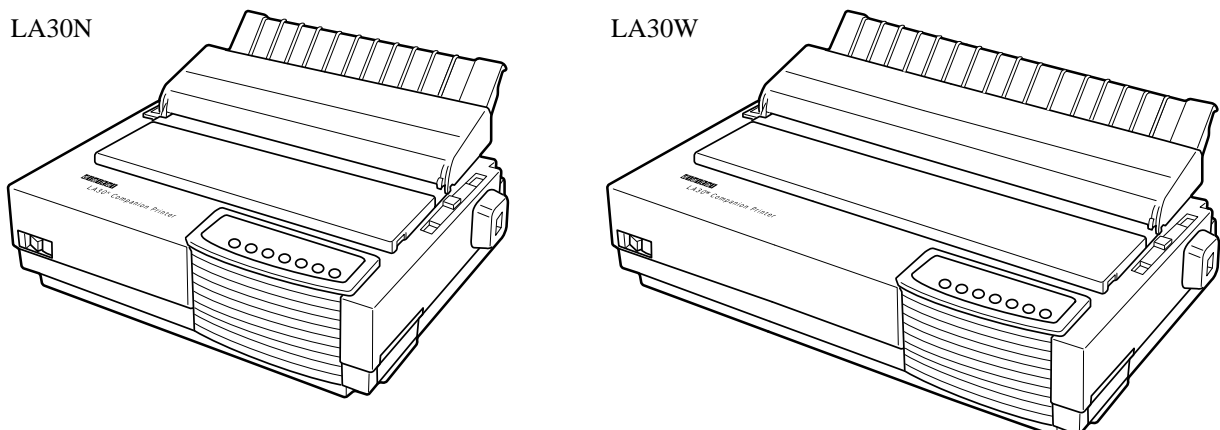


Figure 1.1 LA30N and LA30W printers

1.2 Equipment Structure

1.2.1 Overview

This section outlines printer structure and features.

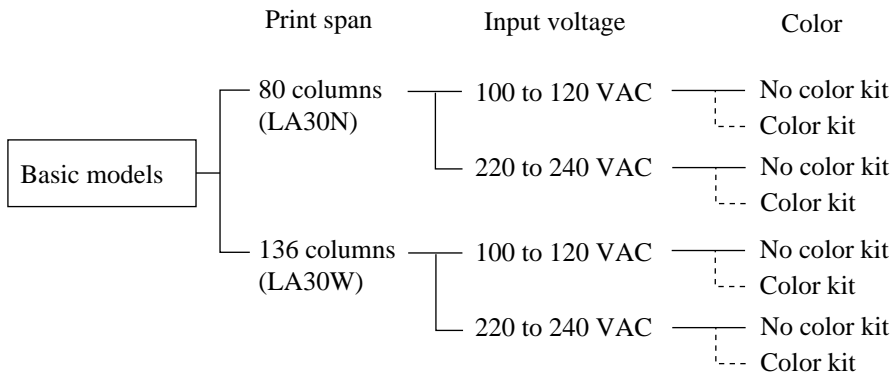
1.2.2 Model configuration

There are two basic models. The LA30N is an 80-column printer and the LA30W a 136-column printer. Each model has two optional components: power supply and color kit (color ribbon shift mechanism).

Power supply: factory option

Color kit (consisting of a color ribbon shift mechanism and ribbon): user option

The model configuration varies with the combination of the three options, as follows:



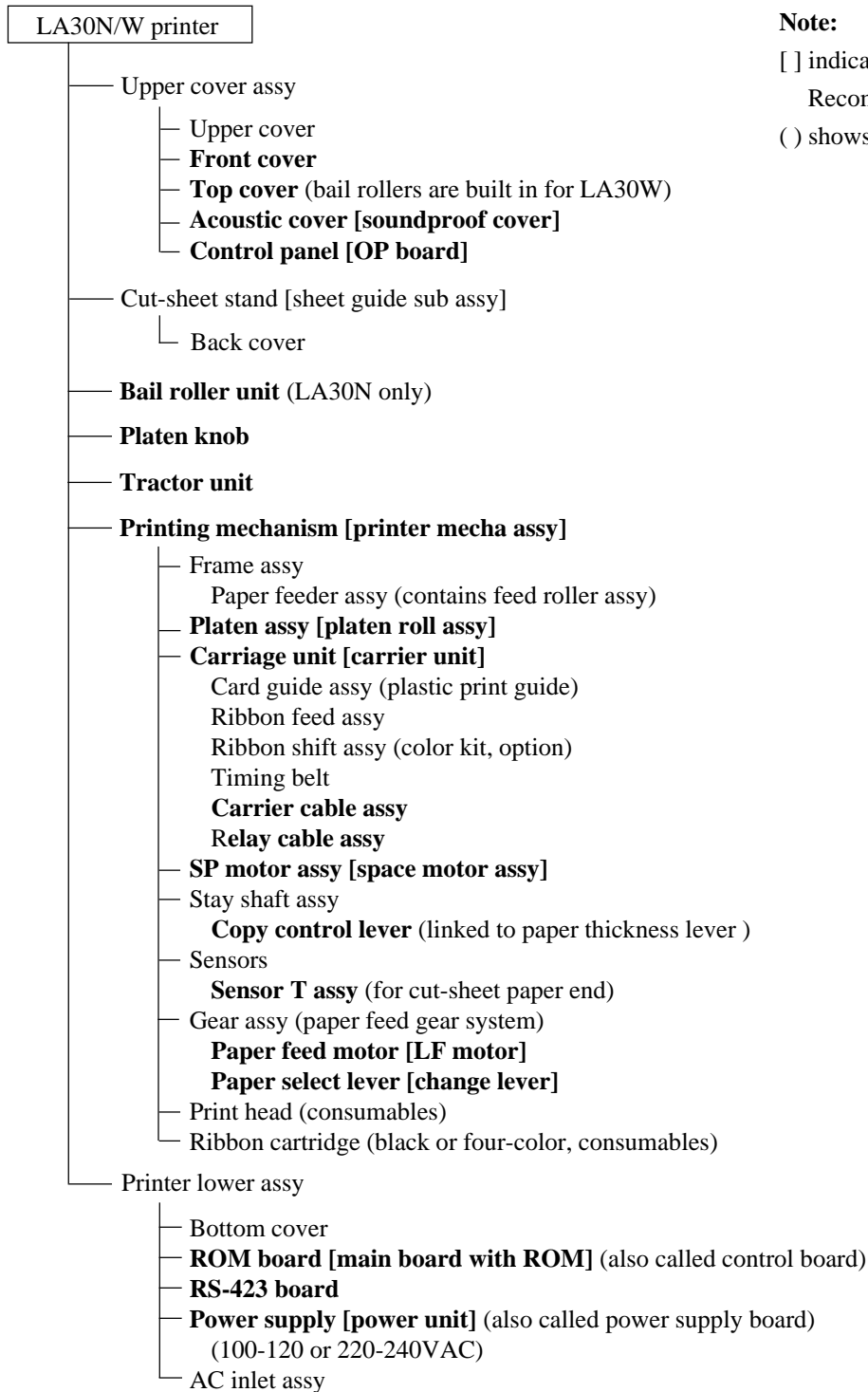
The monochrome model prints in color when the optional color kit is installed.

Each model has three emulations: Digital PPL2, IBM Proprinter X24E and XL24E, and Epson ESC/P2.

Each model is equipped with a dual interface: Centronics parallel and RS-423 serial (to be exact, IEEE 1284 parallel and DEC-423 serial).

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 the field by maintenance service engineers. Replacement and adjustment are detailed in Chapter 4.



Note:

[] indicates a name referred to in the Recommended Spare Parts List.

() shows additional information.

Figure 1.2 Printer component structure

(1) Upper cover assembly

The screws (two for the LA30N and three for the LA30W) on the back, fasten the upper cover to the bottom cover. The upper cover assembly consists of the upper, front, and top covers, an acoustic cover, and a control panel — all plastic, lightweight, and sturdy. The cut-sheet stand is mounted on this assembly.

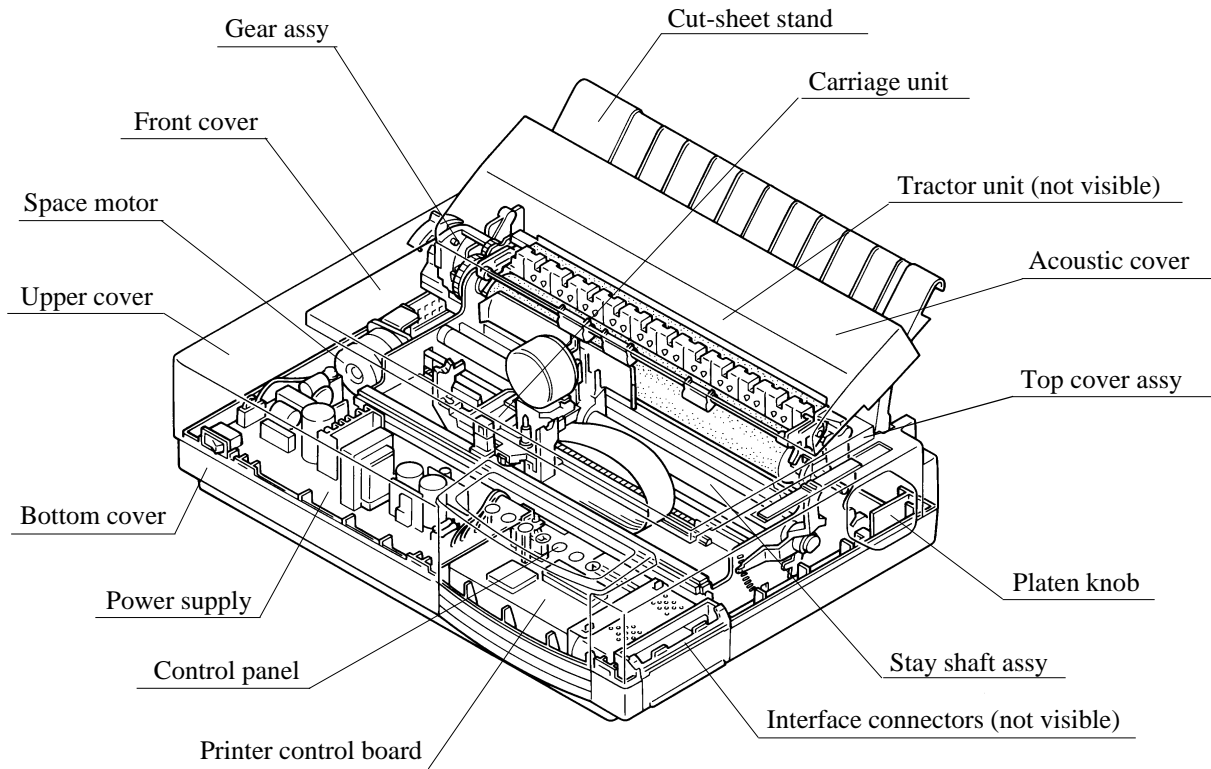


Figure 1.3 Upper cover assembly (LA30N)

a. Upper cover

The interface cable connector is located to the right side, as seen from the front of the upper cover, so that it does not obstruct the paper feed path.

b. Front cover

The front cover is opened when the ribbon cartridge is installed.

c. Top cover

The separator directs the printed paper to the cut-sheet stand. The separator of the LA30W has bail rollers.

d. Acoustic cover

The acoustic cover helps reduce printing noise.

e. Control panel

The control panel consists of an LSI, 7 switches, 16 LEDs, and a buzzer. The switches control operations such as forms loading and feeding, font selection, and conditions selected in setup mode. The LEDs display printer statuses, the selected font, and a setup menu number. The buzzer sounds to indicate operating and printer statuses.

f. Cut-sheet stand

The cut-sheet stand catches printed pages ejected by the printer. It must be raised while printing cut sheets and laid down while printing continuous forms. It must also be raised while printing paper-stapled continuous forms in push-tractor mode.

g. Back cover

The back cover, which is installed on the cut-sheet stand, is opened to set continuous forms on the tractor unit from the back of the printer. It must be closed while the printer is operating.

(2) Printing mechanism assembly

The two hooks on the bottom cover hold the printing mechanism in place and the two screws fasten it to the bottom cover.

a. Frame assembly

The frame assembly consists of metal plates, a rack rail for ribbon feeding and a paper feed assembly.

b. Carriage unit

The carriage unit supports the removable 24-wire print head and endless inked-ribbon cartridge (black or four-color), and slides back and forth on the stay shaft. The ribbon feeder (gear system) moves the ribbon in one direction regardless of carriage movement. The color kit, consisting of a color selection shift motor and four-color ribbon, is installed on the cartridge. One of the two sensors detects left, right, top, and bottom edges of paper and the other detects the left end of cartridge movement and information on installed options.

c. Space motor and stay shaft assemblies

The main stay shaft and guide rail support the carriage unit, which the space motor moves horizontally through the timing belt. The paper thickness lever rotates the eccentric main stay shaft that adjusts the gap between the print head and platen.

d. Sensors

Three of four sensors detect paper outages and the other detects the paper select lever.

e. Forms feed mechanism

The paper feed motor drives the platen and/or the tractor unit via gears in feeding paper. The paper select lever switches power transmission to the tractor unit.

f. Tractor unit

The convertible tractor unit is used on the back of the printer as a push tractor and on top of the printer as a pull tractor.

Bail roller unit (LA30N only)

The bail rollers hold down paper on the platen. For the LA30W, the bail rollers are built in the top cover.

(3) Lower cover assembly

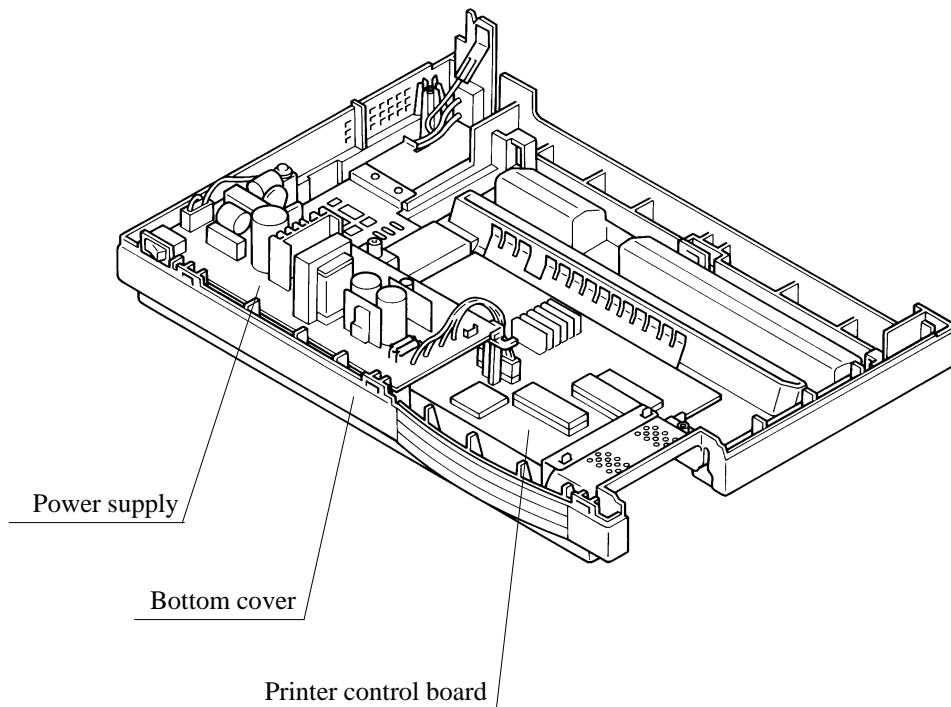


Figure 1.4 Printer lower assembly (LA30N)

- a. Bottom cover
The bottom cover supports the printer mechanism.
- b. Printer control board
The printer control board controls the host interface, control panel, and printing mechanism, using an MPU and an LSI. Memory holds resident character patterns and firmware, including resident emulation programs. This board has drivers and receivers for other components. Sensor receivers convert signals from sensors. Drivers supply power to motors, print head wires, and other components. It also has a Centronics parallel interface controller and RS-423 serial interface controller.
- c. Power supply
The power supply at the front of the printer outputs a constant voltage, regardless of fluctuation in input AC line voltage, between 100 and 120 VAC or 220 and 240 VAC. It includes an AC line switch and noise filter.

CHAPTER 2 UNPACKING, PERFORMANCE CHECK, AND CONNECTION

The contents of this chapter are briefly reproduced from the *Setting Up Your Printer* in the *User Guide* for reference in maintenance although the contents are originally for users of the LA30N and LA30W printers.

2.1 Overview

The LA30N and LA30W printers come 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 printer:

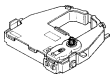
- Place the printer on a level, vibration-free surface.
- Keep the printer away from sunlight and heaters.
- Be sure printer ventilation ports are not blocked.
- Do not operate the printer in a humid or dusty environment.
- Use an outlet that is separated from noise-generating equipment such as motors.
- Use the correct AC voltage to avoid unexpected problems.
- Be sure the platen knob is able to turn freely during printer operation. Obstructions may cause incorrect printing.

2.3 Unpacking

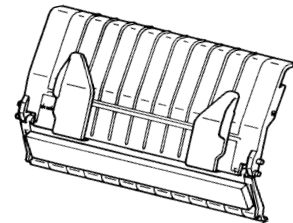
Unpack the printer as follows (Figure 2.1):

1. Open the carton and remove accessories — the user guide, Windows driver floppy disk, cut-sheet stand, platen knob, power cord (100–120 or 220–240 VAC), serial interface cable, and ribbon cartridge.
2. Lift out the printer together with its packing cushions (not shown in the figure). Remove cushions and place the printer carefully on a level, vibration-free surface.

Ribbon cartridge



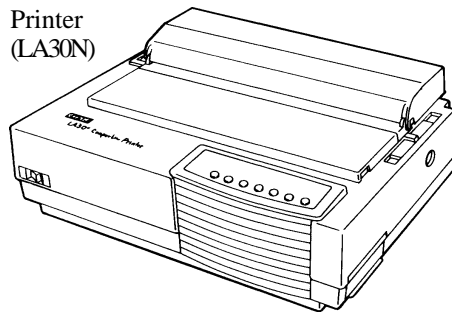
Cut-sheet stand



Windows driver floppy disk



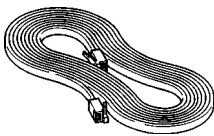
Printer (LA30N)



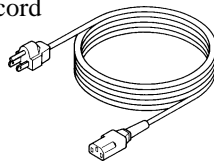
Platen knob



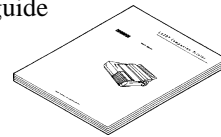
Serial interface cable



Power cord



User guide



Shipping carton

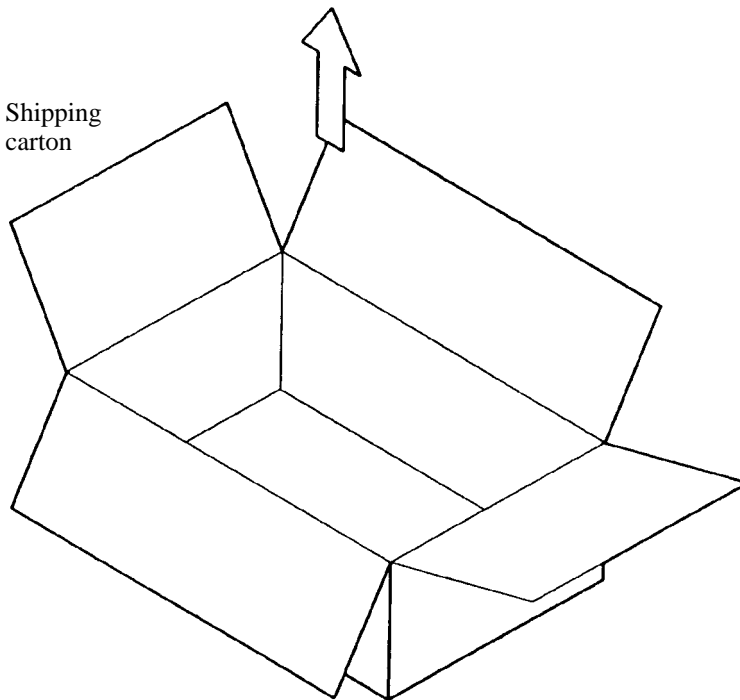


Figure 2.1 Unpacking the printer and accessories

3. Remove tape securing the acoustic cover. Adhesive tape is applied along the front edge of the acoustic cover. For LA30W printers, two adhesive tapes are applied at the back of the acoustic cover.
4. Open the front cover and remove the print head shipping restraint (cardboard).

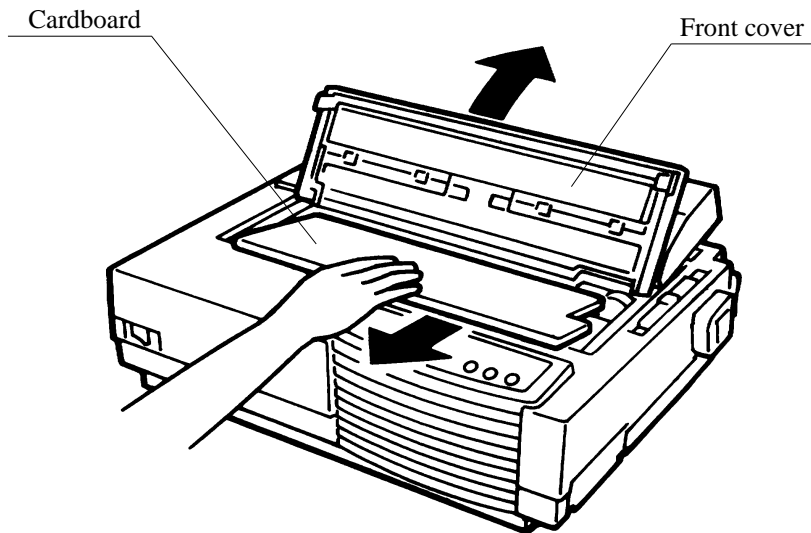


Figure 2.2 Removing the print head shipping restraint (cardboard)

5. At the back of the printer, remove the two tractor unit securing adhesive tapes [A]. For LA30N printers, remove also the bail unit shipping restraints (two adhesive tapes [B] and a cardboard [C]).

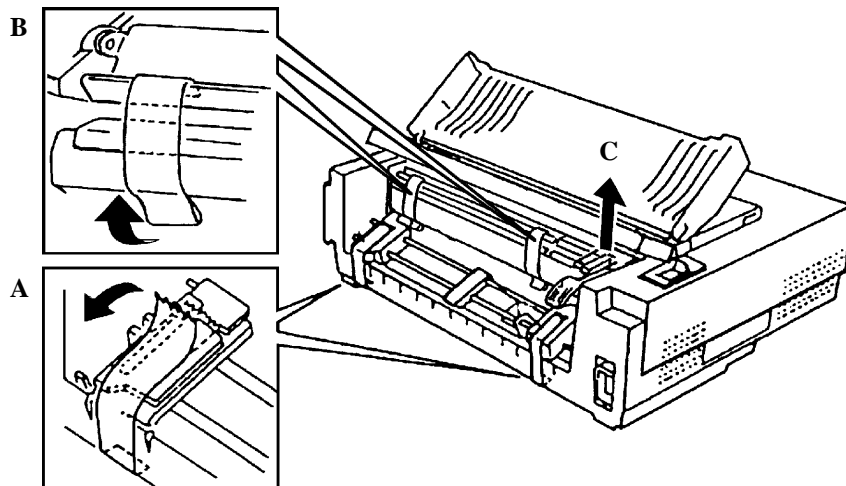


Figure 2.3 Remove the bail stopper and four tapes (LA30N)

6. Store the original shipping carton and packaging materials for future use, for example, in moving or shipping the printer to another location.

2.4 Inspection after Unpacking

1. Carefully check the printer and the accessories for visible damage.
2. Install the cut-sheet stand (Figure 2.4). The cut-sheet stand enables smooth feeding of not only cut sheets but continuous forms, and its paper guides position cut sheets for printing.
3. Install the platen knob.
4. Install the ribbon cartridge. See the *User Guide* for details.
5. Check the rated voltage for the printer and AC power outlet, then connect the AC power cord between the printer and AC power outlet.
6. Close the front cover.
7. Turn on the power switch.
8. Load a cut sheet or continuous forms as explained in the *User Guide*.

Check printing performance and quality using self-test printing, detailed in Section 4.10.1 “Self-test printing”.

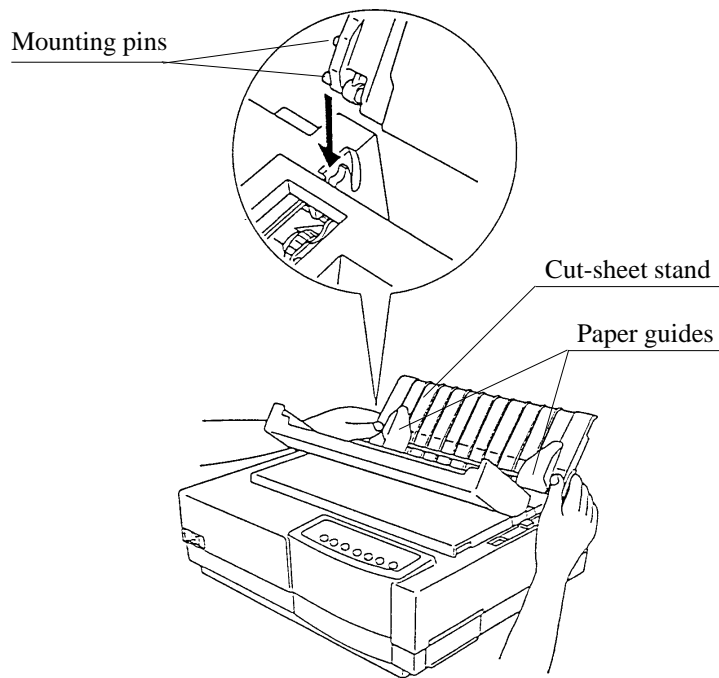


Figure 2.4 Installing the cut-sheet stand

CHAPTER 3 TROUBLESHOOTING

This chapter helps pinpoint the causes of problems with the printer.

Sections 3.1 to 3.5 are troubleshooting diagrams. The flowcharts show how to determine what is wrong with the printer and what to do to correct the problem.

Section 3.6 explains error displays on the control panel that help clarify the cause of a problem.

For replacement and adjustment after recovery, see Chapter 4.

Figure 3.1 shows printer functional components and connecting cables without showing their names since locating the connectors is easy.

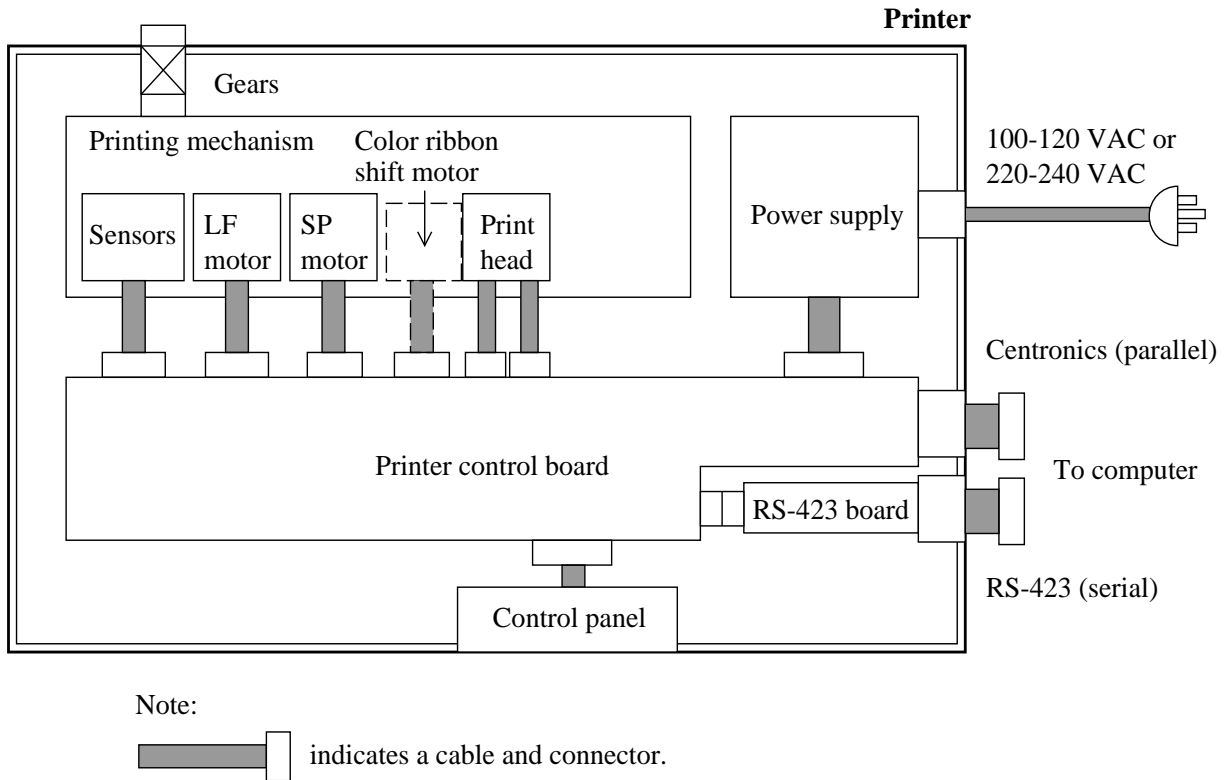


Figure 3.1 Printer functional block diagram

a. Printing mechanism

The printing mechanism consists of the print head and carriage, carriage drive, forms feed mechanism, sensors, and print head gap adjustment mechanism. The carriage includes ribbon feed and other sensors. The printing mechanism has two motors, for driving the carriage and feeding forms.

b. Printer control board

The printer control board consists of a main controller, memory, drivers, sensor receivers, and Centronics parallel interface controller. This board governs the computer interface, control panel, and printing mechanism using the main controller and memory that holds resident character patterns and firmware, including resident emulation programs.

c. RS-423 board

The RS-423 board controls the RS-423 (DEC-423) serial interface.

d. Control panel

The control panel is used by the operator for operations such as changing or feeding forms, resetting the printer, and selecting operating conditions in setup mode. The panel displays the printer status via a buzzer and LEDs.

e. Power supply

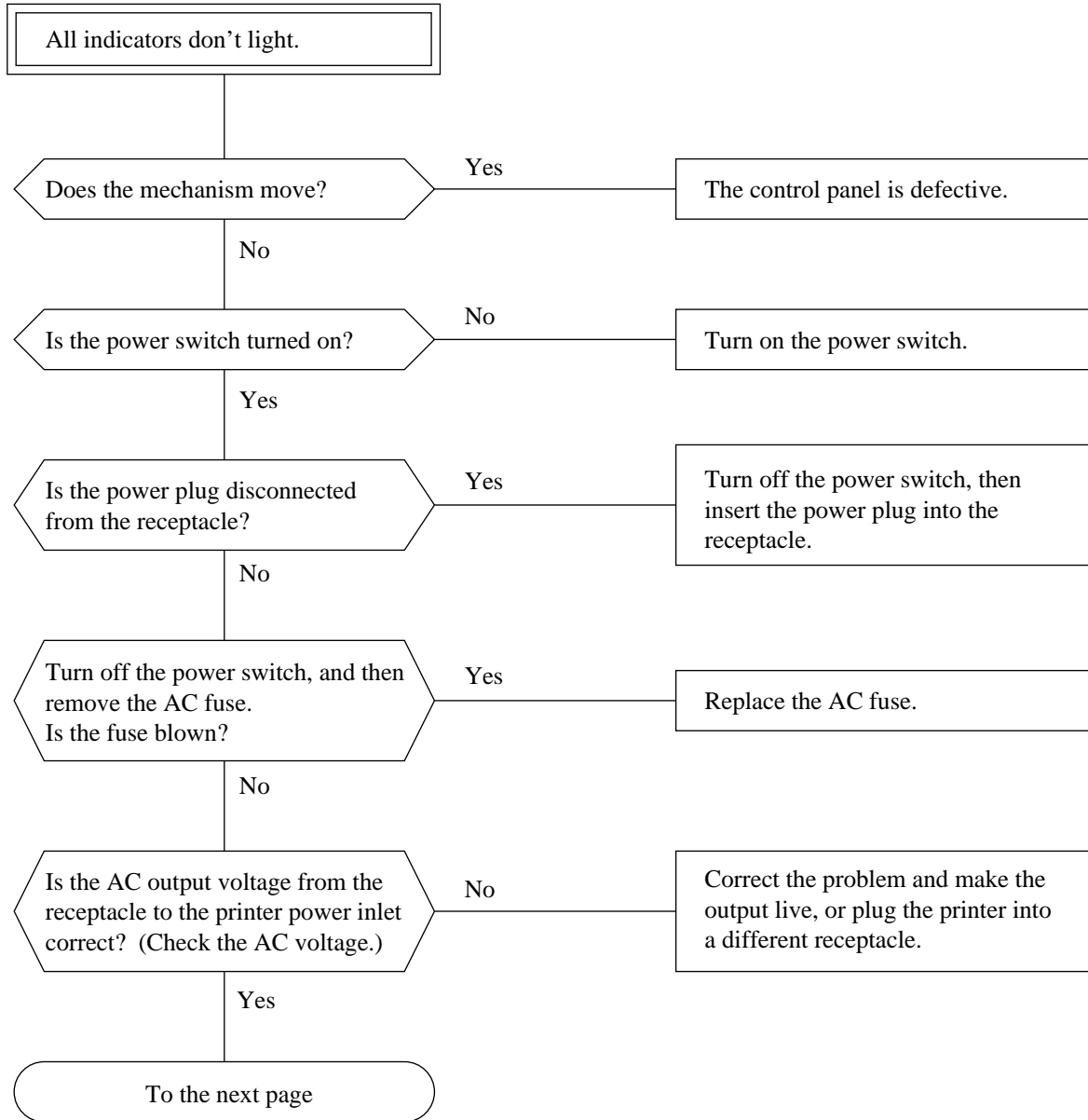
The power supply provides power for operating the printer. Its specifications depend on the input AC voltage.

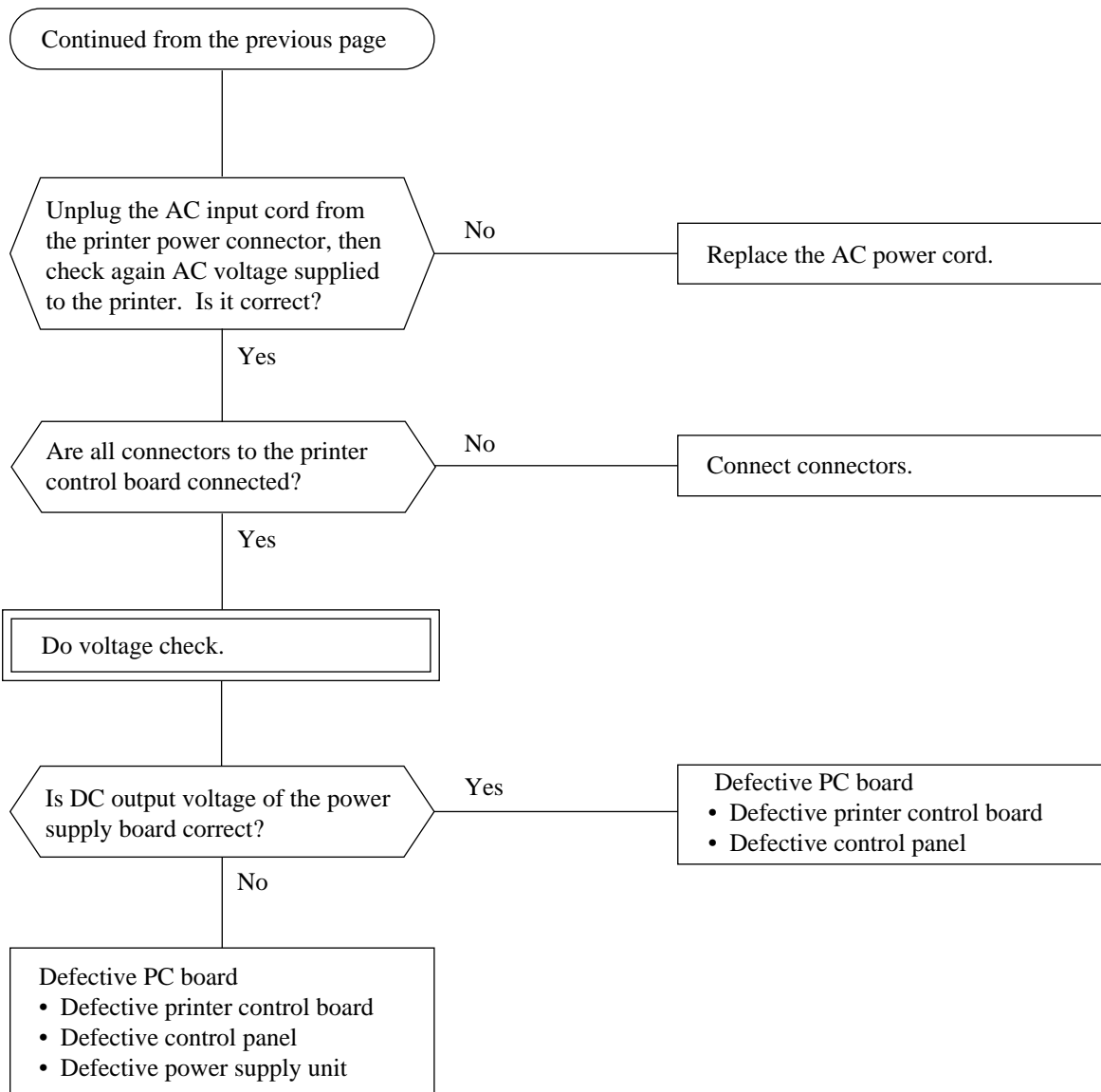
f. Color kit (user option)

The color ribbon shift motor, installed on the print head cartridge, enables printing in seven colors, if supported by software. It uses either four-color cartridges or black ribbon cartridges.

3.1 All Indicators Don't Light

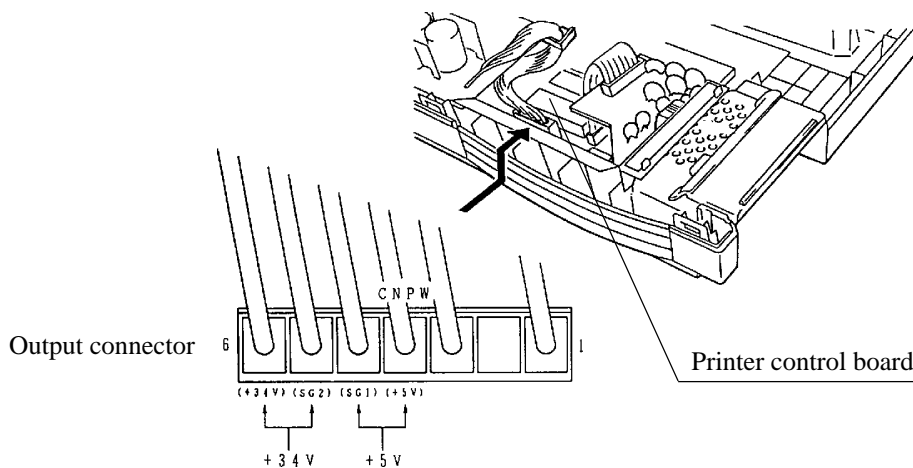
The flowchart below shows what to do if all indicators don't light.





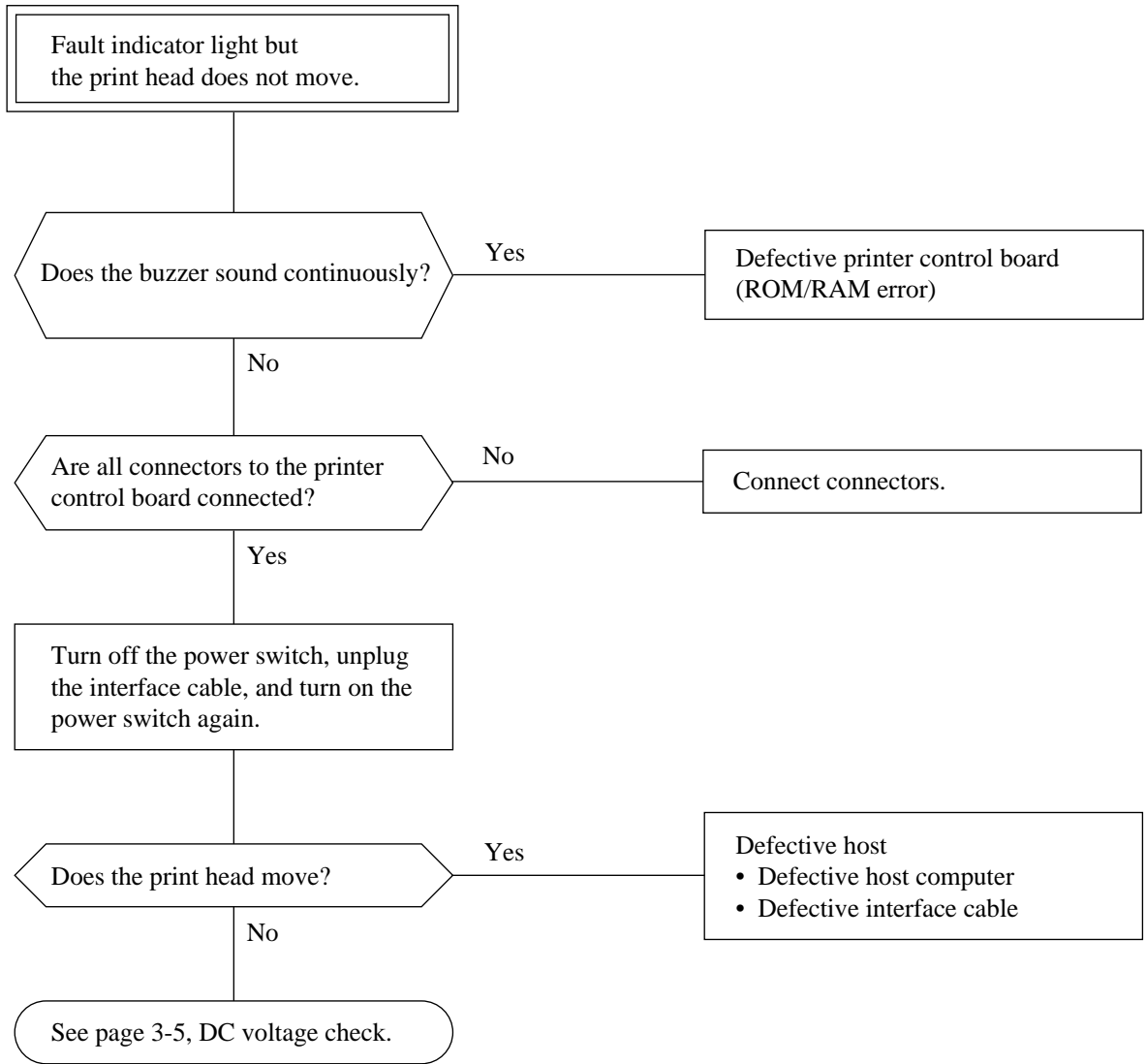
Note:

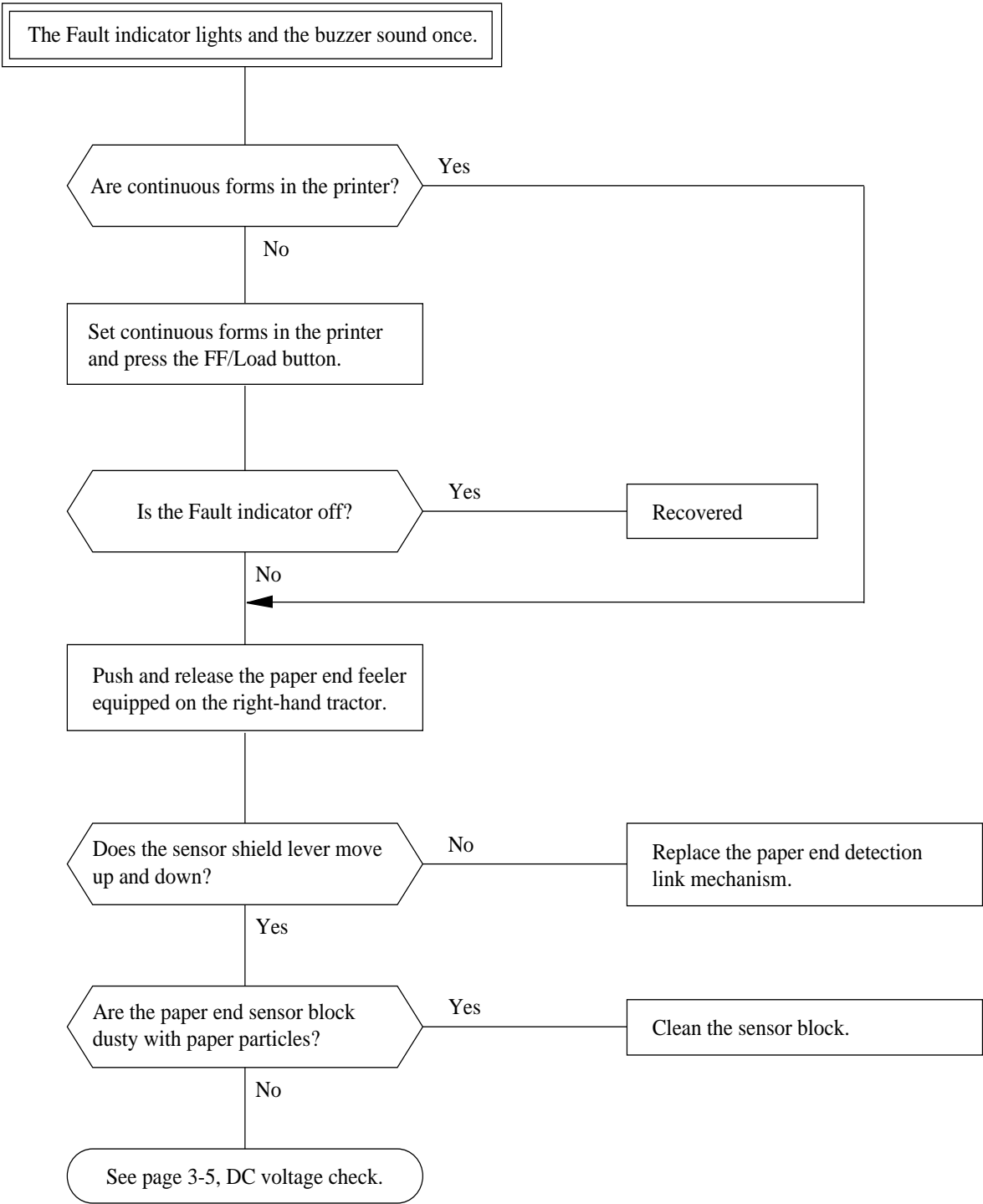
To check DC voltage, use the output connector to the printer control board. Pin assignment of voltages are as follows:

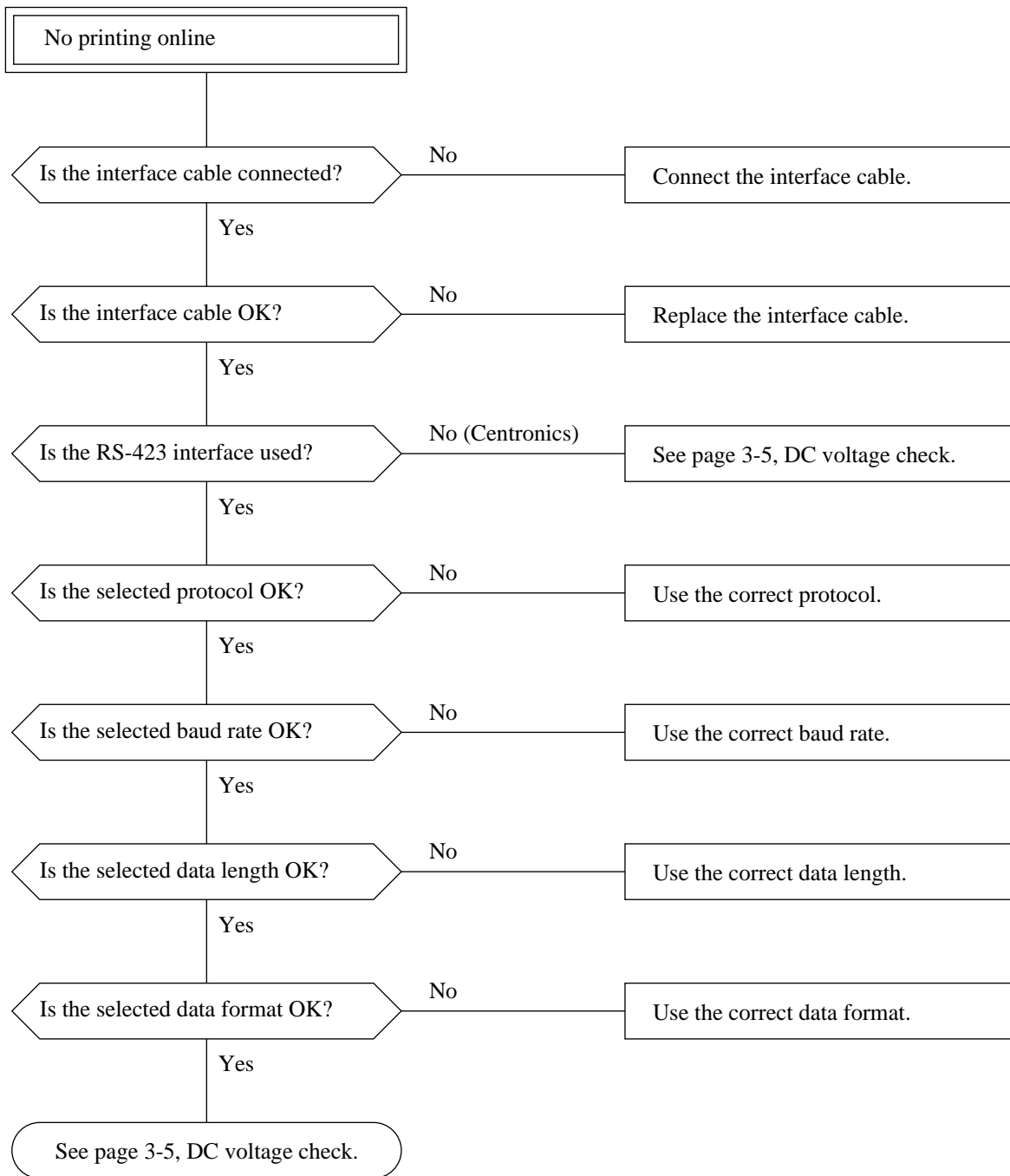


3.2 No Print Head Movement

The flowchart below shows what to do if the print head does not move even though certain indicators light.







3.3 Incorrect Printing due to Defective Nonvolatile RAM

If the printer uses defective nonvolatile RAM or the contents of nonvolatile RAM are written incorrectly, unexpected phenomena will occur. For example:

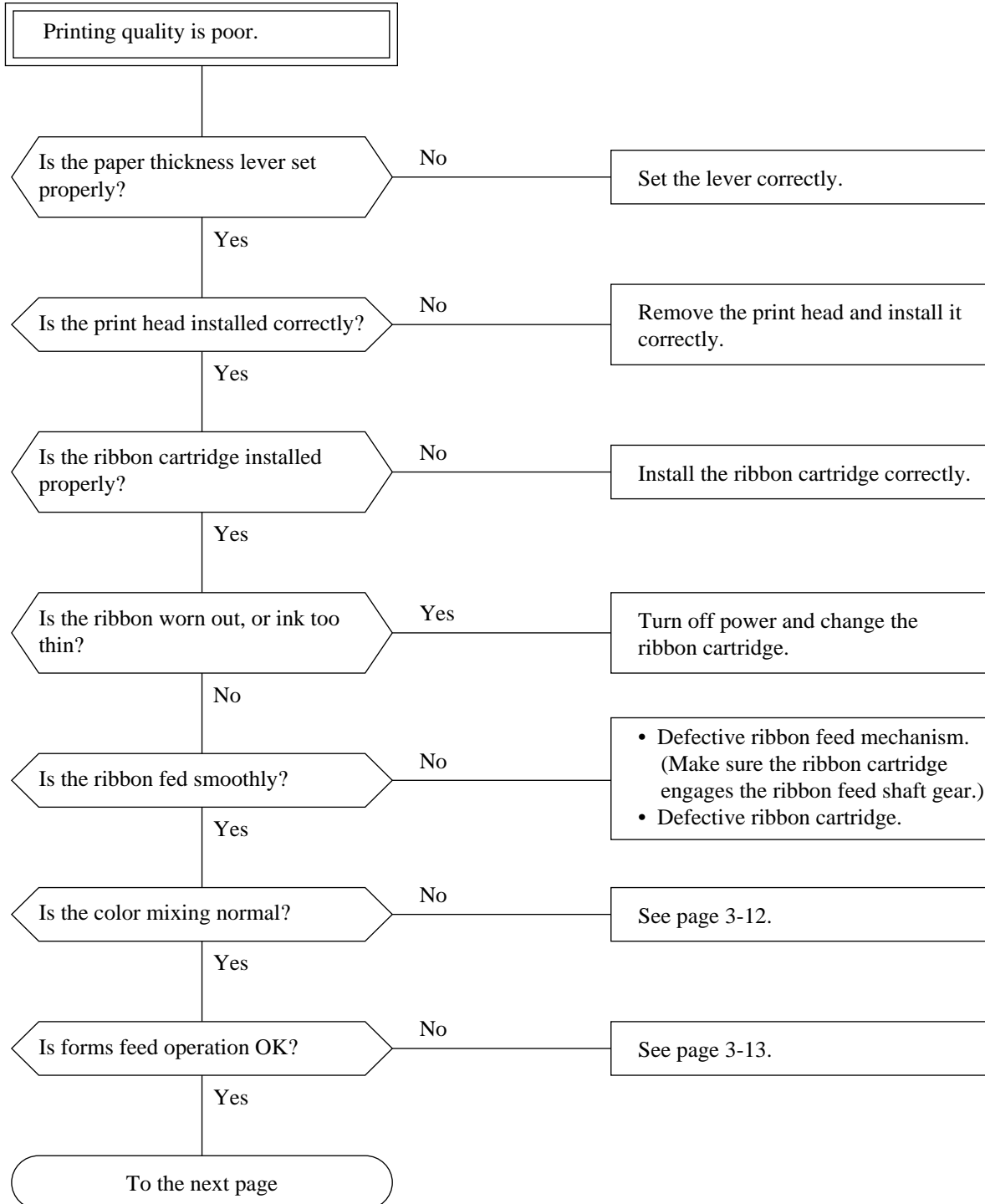
- Printing is not performed even though no error is apparently detected. This may be caused when the interface type specified is the Centronics parallel, but the RS-423 serial interface is mistakenly selected internally.
- Printing is not done in specified columns. This may be caused when setup parameters are mistakenly changed internally for the character pitch.

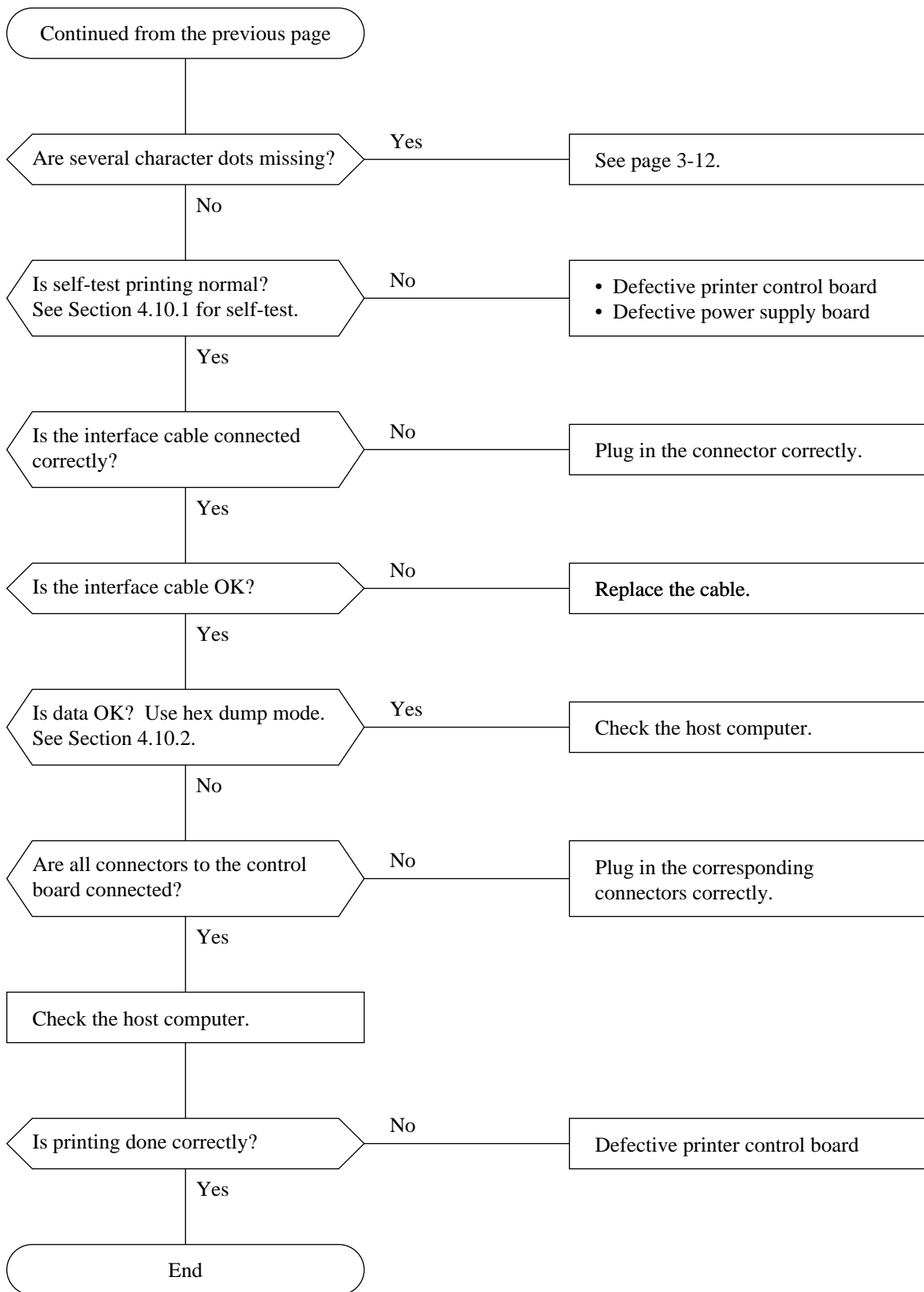
For the above cases, do as follows:

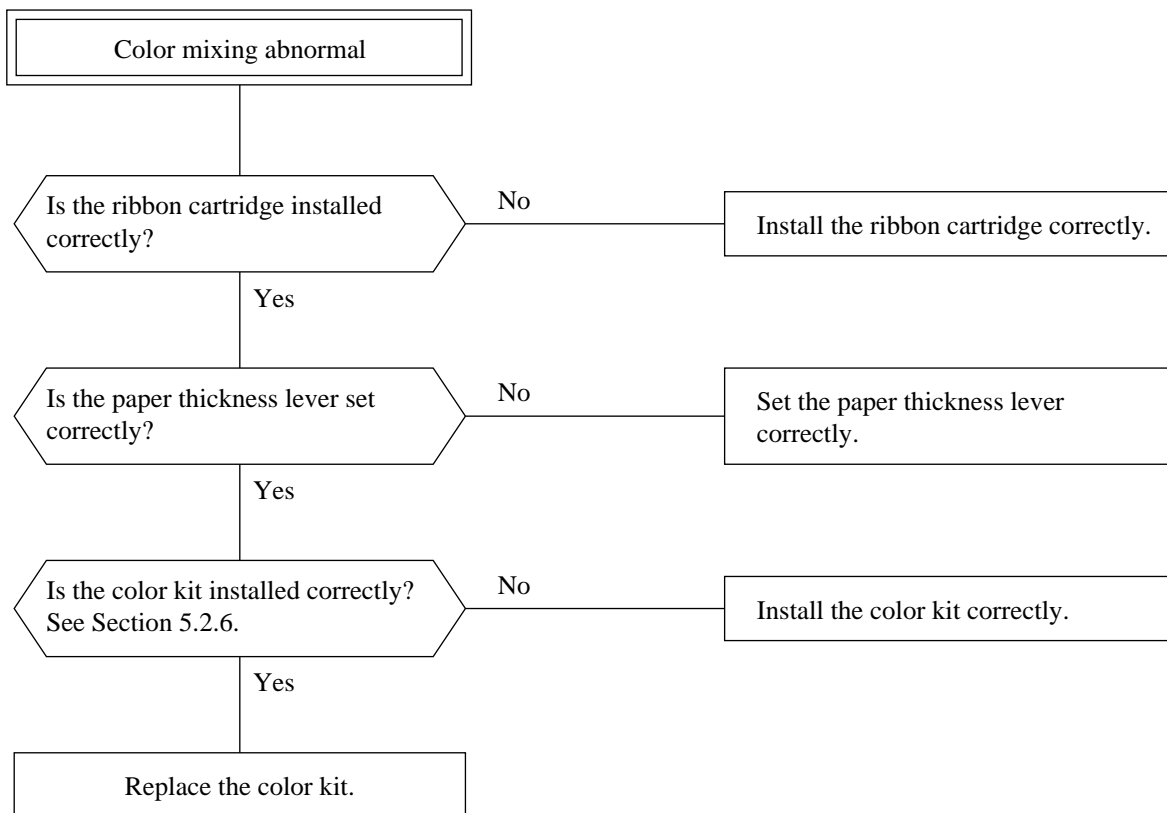
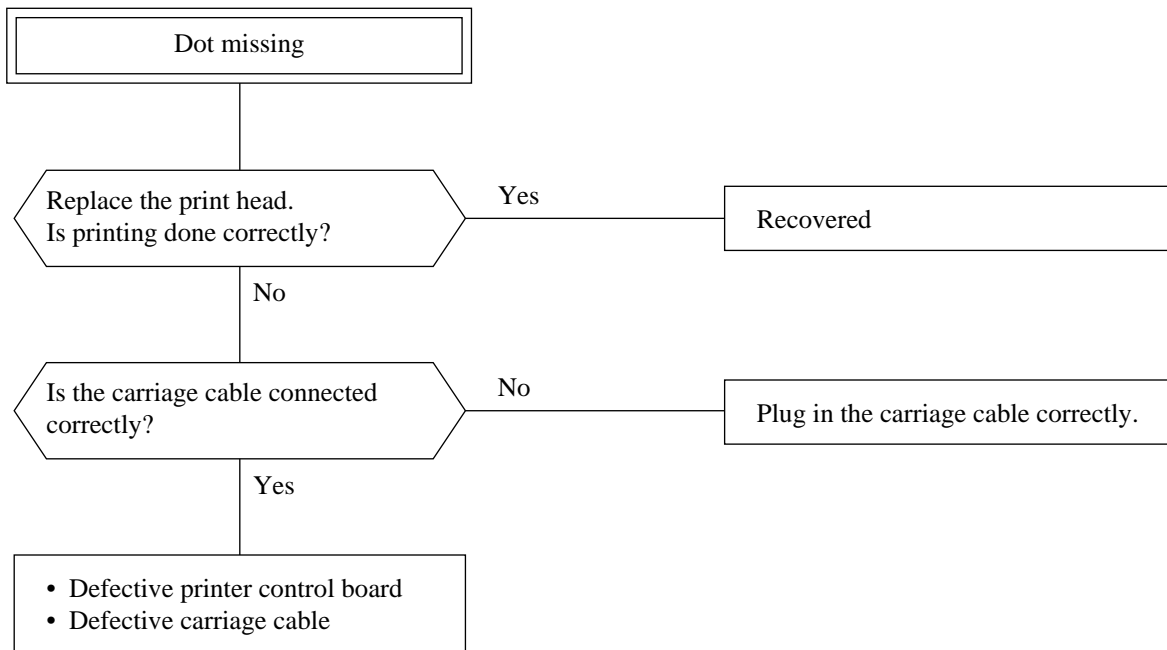
1. Restore the factory defaults into the RAM. See Section 4.10.3.
2. If the printer still does not operate correctly, replace the control board (ROM board).

3.4 Printing Quality Abnormal

The flowchart below shows what to do if the printing quality is not good.

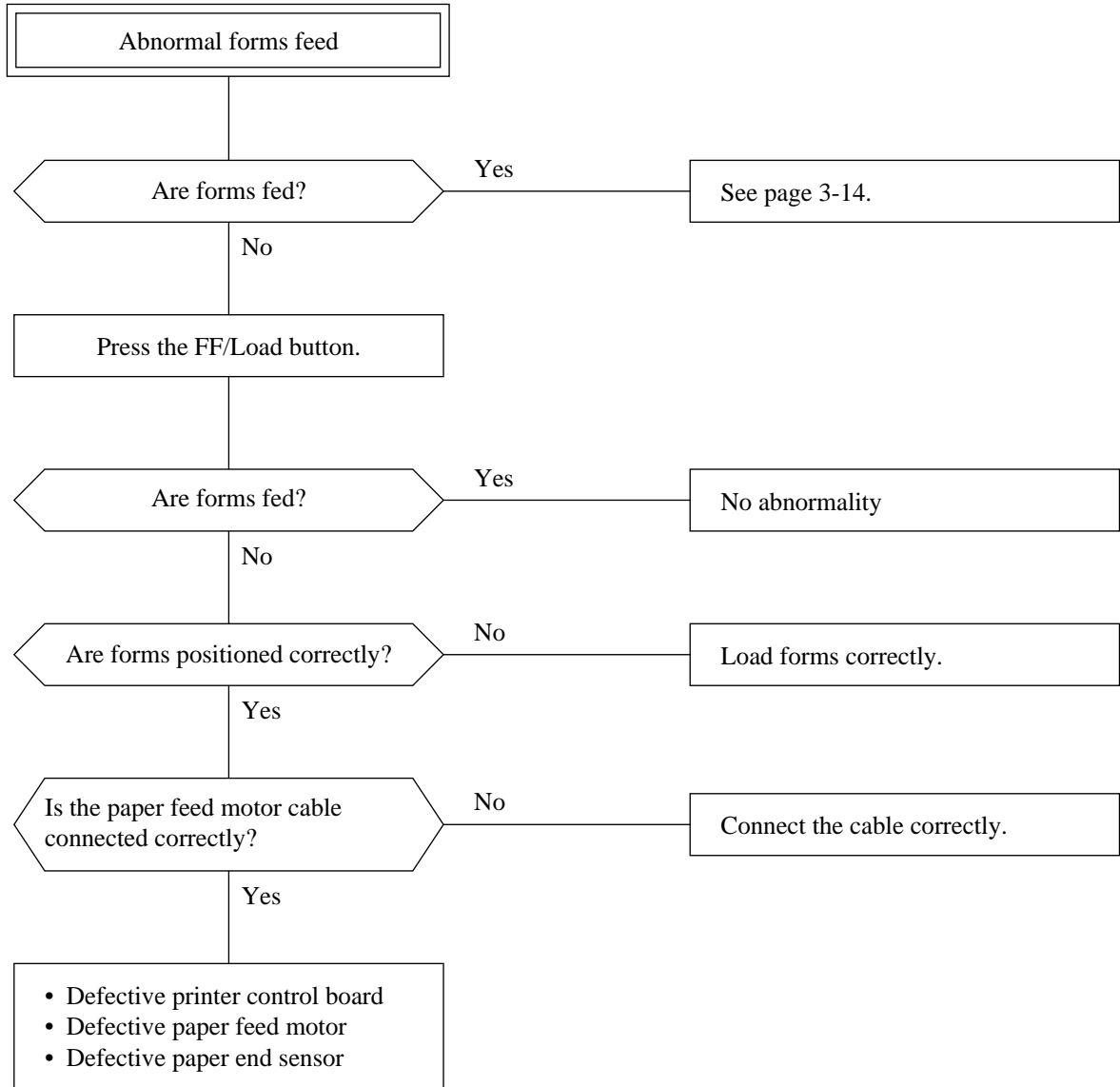


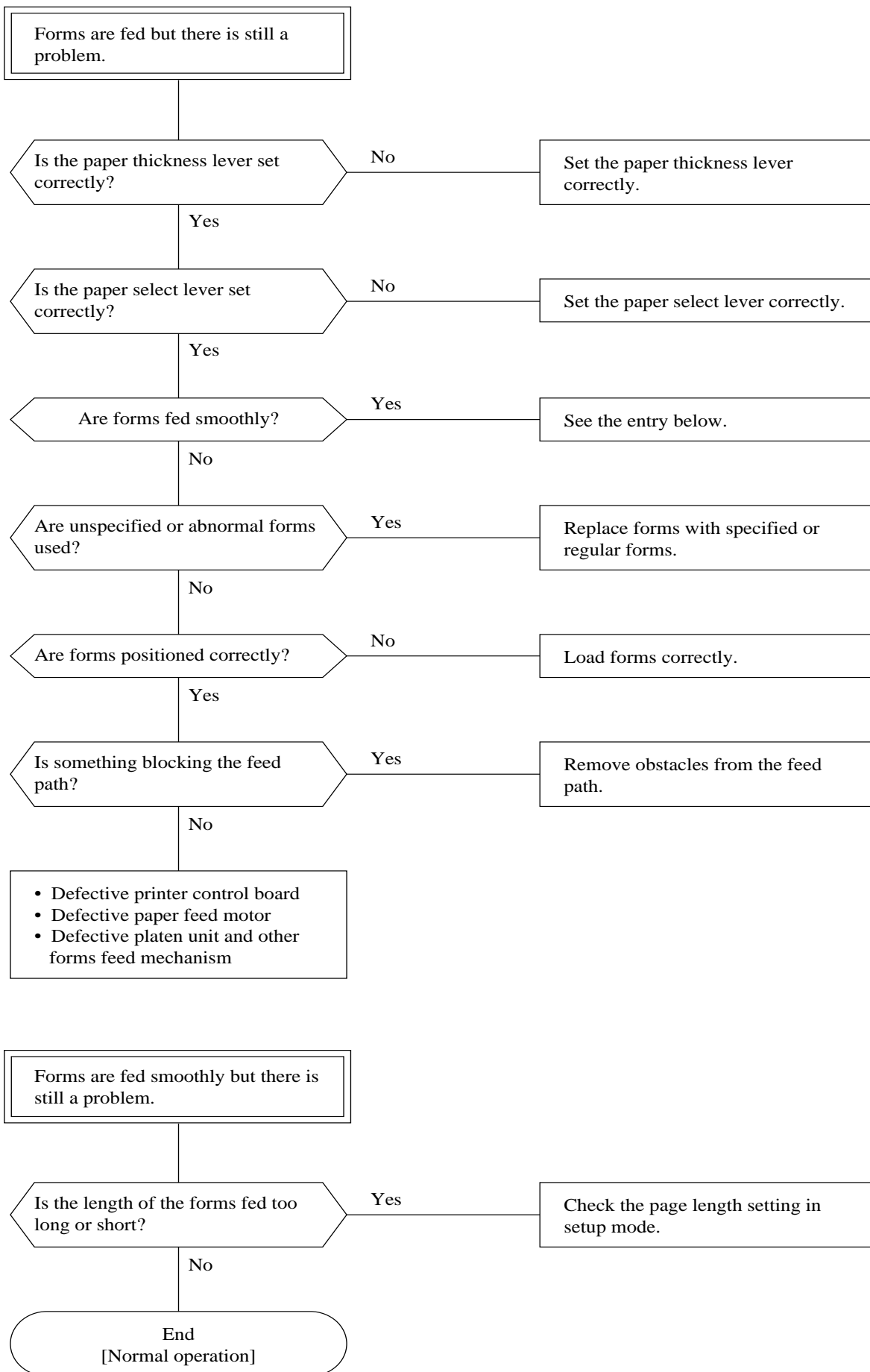




3.5 Forms Feed Abnormally

The flowchart below shows what to do if forms feed incorrectly.





3.6 Error Display

This printer indicates errors on the panel using a combination of the Fault indicator and the buzzer. Possible error combinations are described below:

Table 3.1 Errors indicated by the Fault indicator and buzzer

Fault indicator	Buzzer sound	Error cause	Action for recovery from error
Lighting steadily	Sounds once	Paper end detection	See page 3-7.
Flashing	Sounds once	Low voltage error	Check DC voltage (see page 3-5).
Flashing	Sounds once	Communication error	Check parameter settings of the RS-423 interface in Set-Up mode (see page 3-8).
Flashing	Sounds once	Carriage error	Remove paper from the feed path and check the carriage for smooth movement.
Flashing	Sounds continuously	ROM/RAM error	Replace defective printer control board.

The printer cannot display an alarm if detecting one of the following alarms that turn off the printer. Disconnects the corresponding components or connectors, then turn on the printer to check if the alarm recurs.

Table 3.2 Alarms that turn power off the printer

Error name	Cause of the error
Head alarm	The head driver circuit or device is faulty.
SP motor driver alarm	The SP motor driver is faulty.
LF motor driver alarm	The LF motor driver is faulty.
High voltage alarm	+34 V is higher than the specified voltage.

CHAPTER 4 MAINTENANCE

This chapter explains the maintenance levels 1, 2, and 3 for cleaning, lubrication, inspection, and adjustment of the LA30N and LA30W printers.

4.1 Overview

Designed using the latest technology, the LA30N/LA30W printer offers high reliability and easy maintenance. Parts requiring lubrication and adjustment have been reduced and the replacement of defective parts made easier than in previous models.

Difference between LA30N and LA30W is as follows:

- LA30N is an 80-column printer and LA30W a 136-column printer. Therefore, many mechanism components differ only in size (length).
- Bail rollers of LA30N are mounted on the printer mechanism as the bail roller unit. Bail rollers of LA30W are built in the top cover.
- Other components are the same.

The printer has useful maintenance functions that can be initiated by the control panel without the host computer. This greatly reduces maintenance time for testing and adjusting the printer.

The printer also has the self-test print and hex dump functions to indicate whether an error is due to the 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 4.1 lists the tools required for maintenance.

Table 4.1 Maintenance tools

No	Tool	Type or part number	Maintenance level
1	Screwdriver M3–M5 (+)	Phillips ^(*1)	2
2	Screwdriver M2–M2.5 (+)	Phillips ^{(*1) (*2)}	2
3	Screwdriver M3–M4 (–)	Standard ^{(*1) (*3)}	2
4	Tweezers	CWZ9068A2 ^(*3)	2
5	Spring hook	CWZ9070A	2
6	Long-nosed pliers	CWZ9248A	2
7	Thickness gage (0.03 ~ 1mm)	CWZ9250A	2
8	Platen gap adjustment gauge	CA02312-F300	2
9	Silicone grease	CA98001-5270	2
10	Floil	D89L-1020-0369	1

*1 A magnetized driver is convenient.

*2 For removing the RS-423 board and the card guide sensor cable holder.

*3 For fitting the E-ring. (Tweezers are convenient, but standard screwdrivers are available.)

4.4 Maintenance Levels

Maintenance for the LA30N/LA30W 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 Parts Drawings

This section gives basic components and their location.

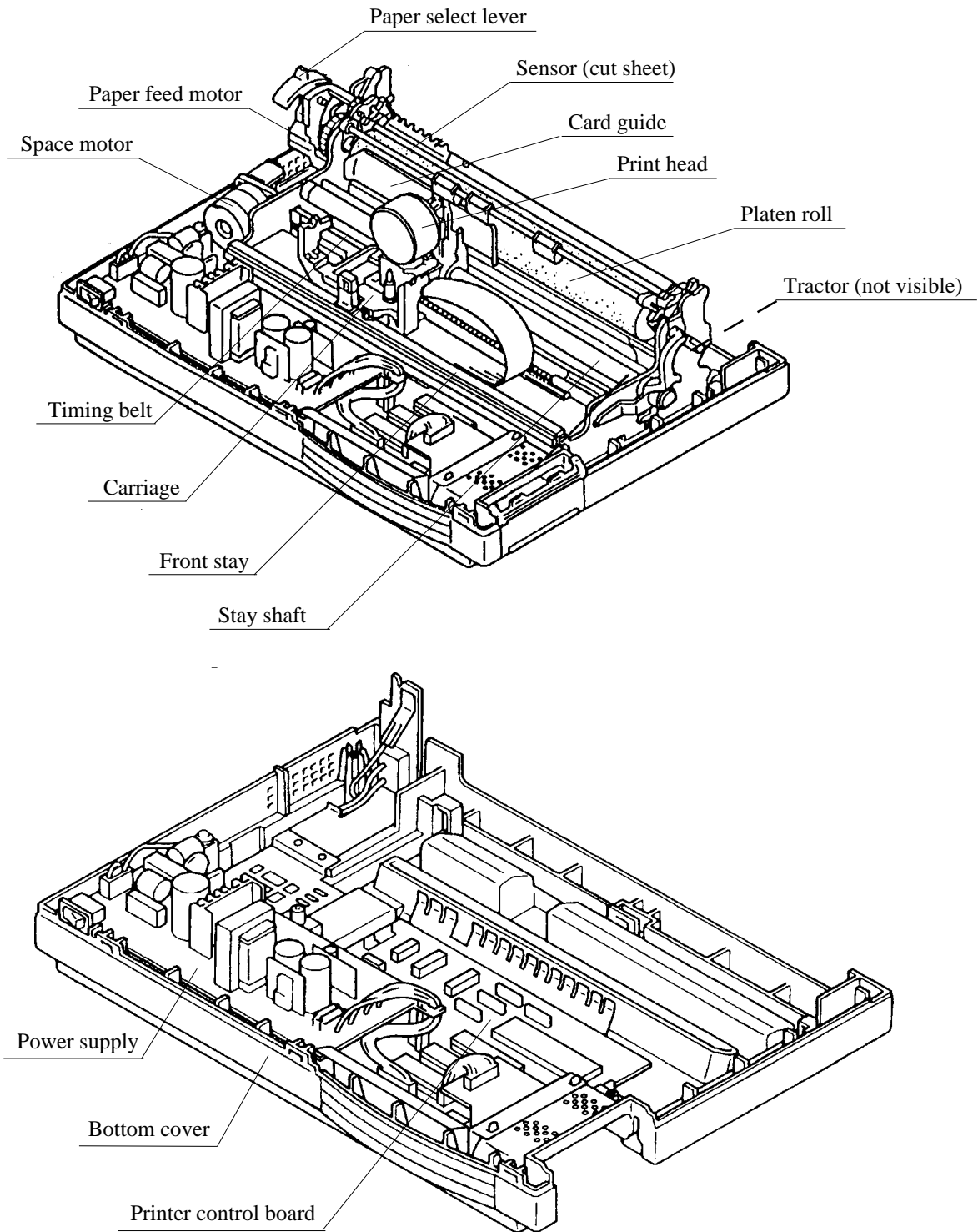


Figure 4.1 Basic components

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 mounting screws not to be loosened or removed.

Table 4.2 Parts not to be disassembled

No	Components	Part	Remarks
1	Frame (L), (R)	4 screws	Screws for holding frame (L) and (R) to main stay
2	Main stay and Front stay	3 screws	Screws for securing front stay to main stay (front)
3	SP motor	All screws and pulleys	
4	Print head	Entire component	

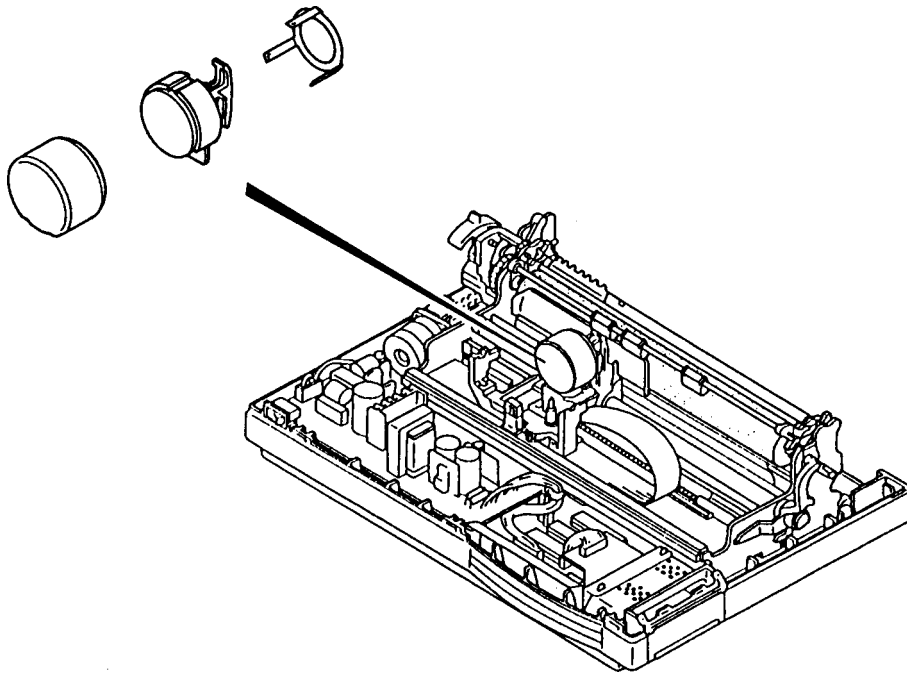


Figure 4.2 Location of parts that must not be disassembled

4.8 Level 1 Maintenance

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

Check inside the LA30N/LA30W printer for paper particles, dust, and dirt, and remove these as explained below. After cleaning, lubricate moving parts.

Table 4.3 Cleaning

Location	Procedure	Remarks
Paper feed path	Remove paper particles and dirt.	
Print head	Remove pieces of paper and dirt from the ribbon.	
Platen	Clean with a soft cloth moistened, not soaked, in alcohol.	(*1)
Card guide	Wipe away ink ribbon debris.	
Stay shaft and front stay (rack rail)	Remove dust, etc., from the shaft and stay surfaces with a soft cloth.	After cleaning, lubricate them. (*2)

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

*2 If stuck with dried oily dust, apply a small amount of alcohol to clean the shaft.

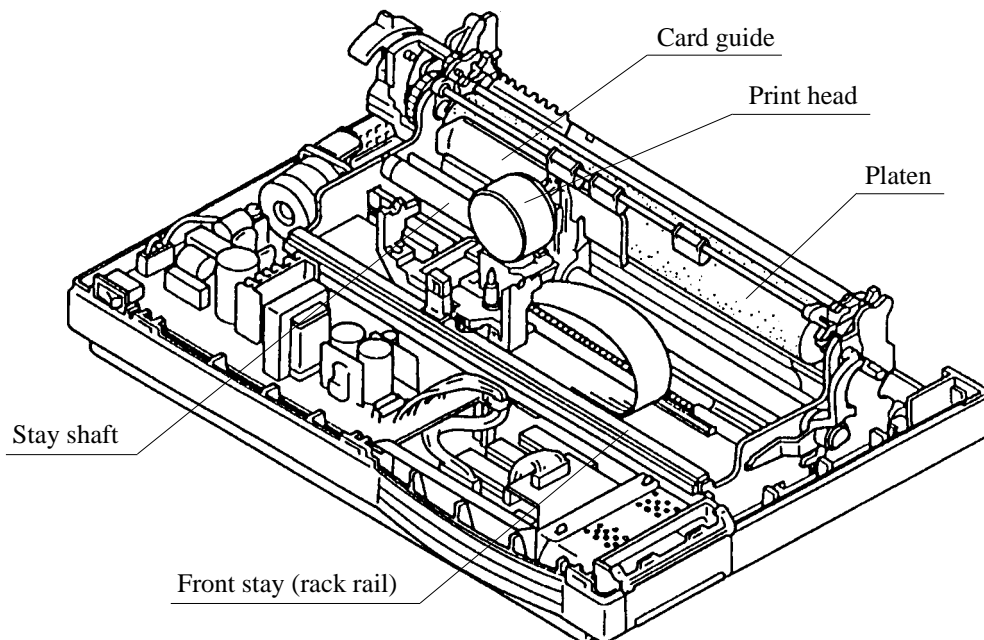


Figure 4.3 Cleaning and lubrication

4.9 Level 2 Maintenance

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

4.9.1 Parts replacement

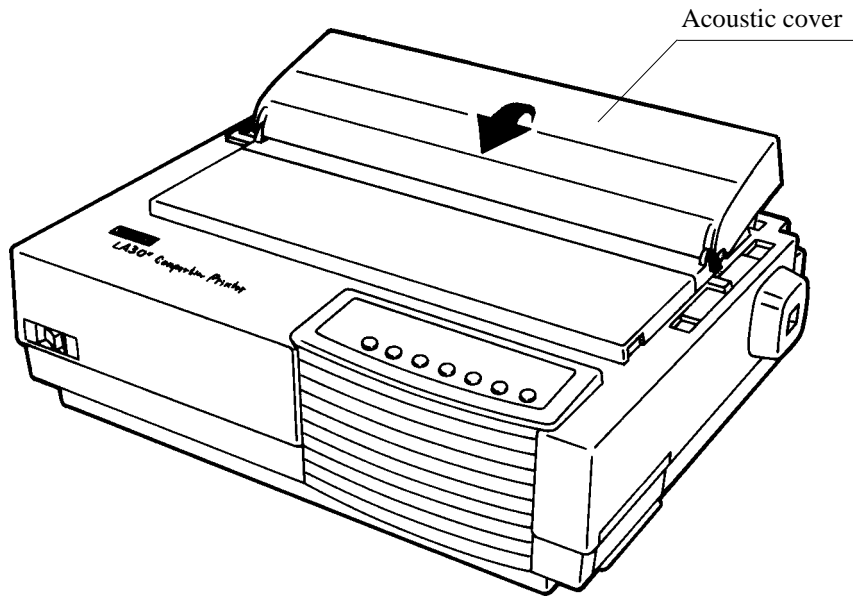
Remember the following notes when replacing any component.

- Keep assembly areas clean.
- Turn off power to equipment and unplug it before disassembly or assembly.
- Follow procedures carefully. Do not disassemble 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) Acoustic cover replacement

Removal

Raise the acoustic cover vertically (the flat surface of the mounting pin orients vertically) and lift the acoustic cover to disengage it from the top cover.



Installation

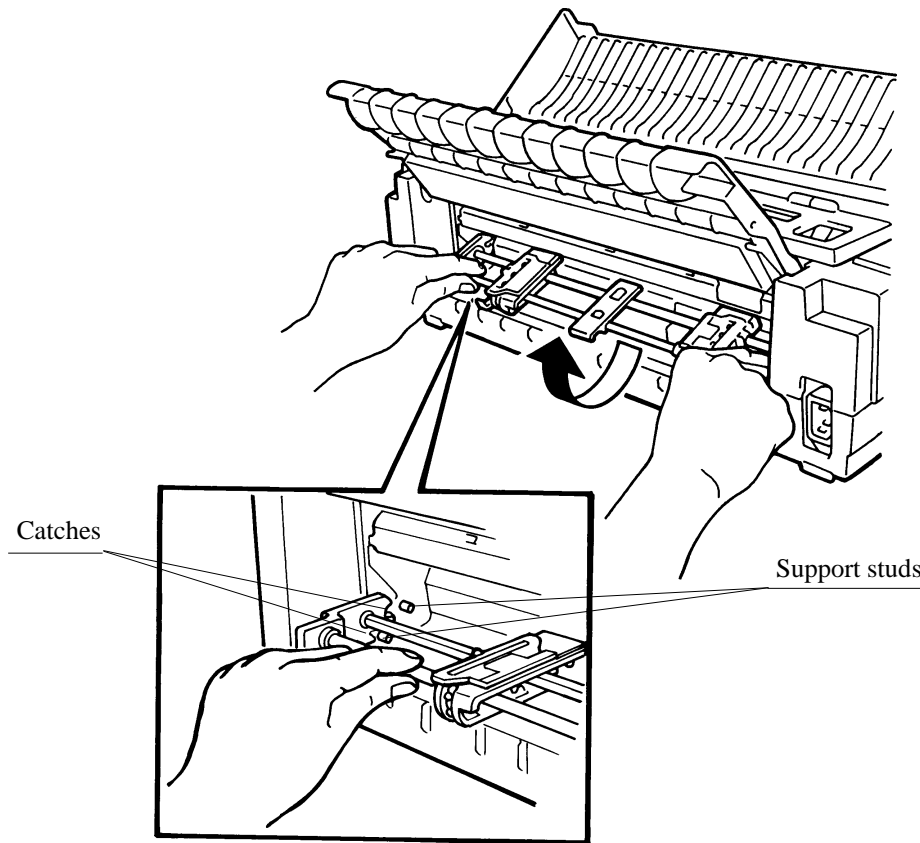
Hold the acoustic cover vertically. Then, push the mounting pins on both side of the acoustic cover into the hook of the top cover. After that, close the acoustic cover.

(2) Tractor unit replacement

- a. Push tractor

Removal

1. Raise the cut-sheet stand and the back cover together.
2. Pull up both ends of the tractor unit to detach the catches of the tractor unit from the support studs. Then pull the tractor unit.



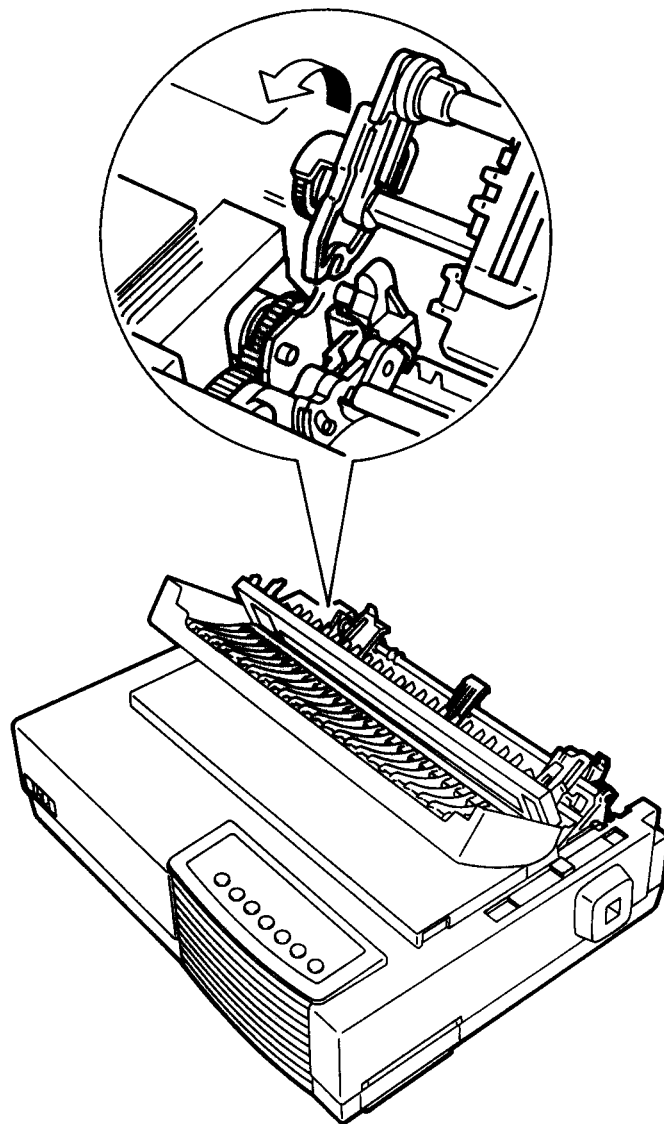
Installation

Place the catches of the tractor unit onto the support studs, push the tractor unit toward the front of printer, and snap down the tractor unit into place.

b. Pull tractor

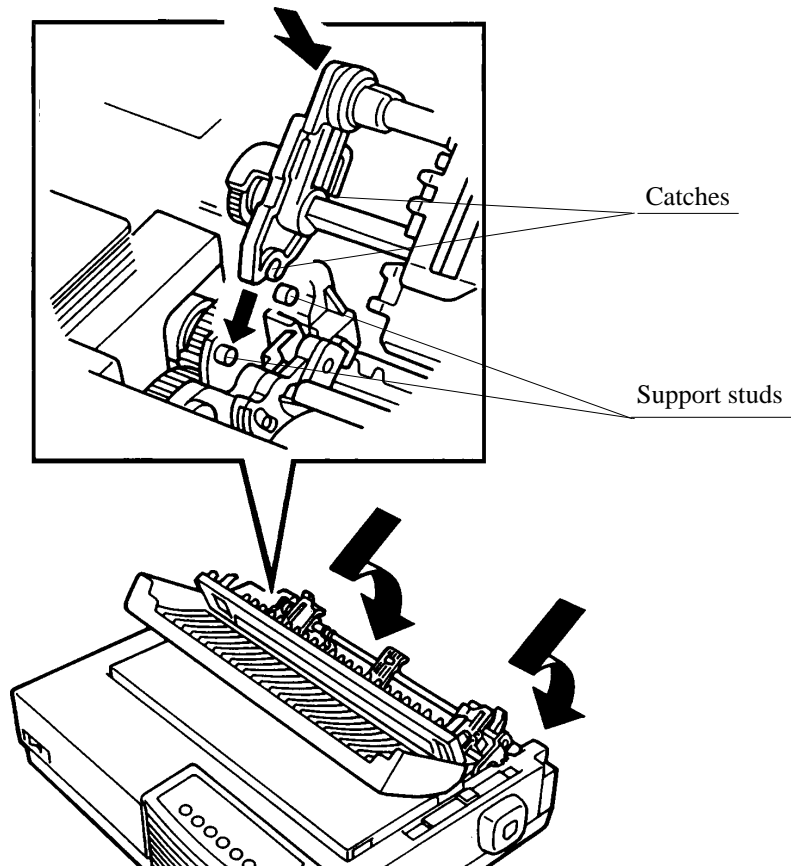
Removal

Hold both sides of the tractor unit and lift and release it from the support studs.



Installation

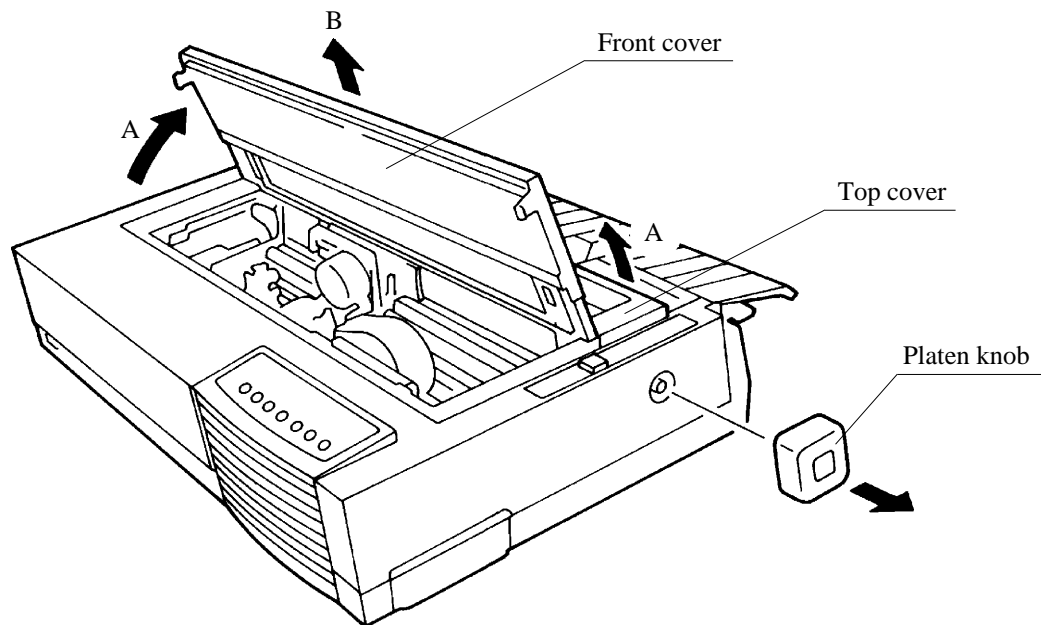
Position the catches of the tractor unit on the support studs near the platen shaft, push the tractor unit toward the front of the printer, and snap down the tractor unit into place so that the catches click on the rear studs.



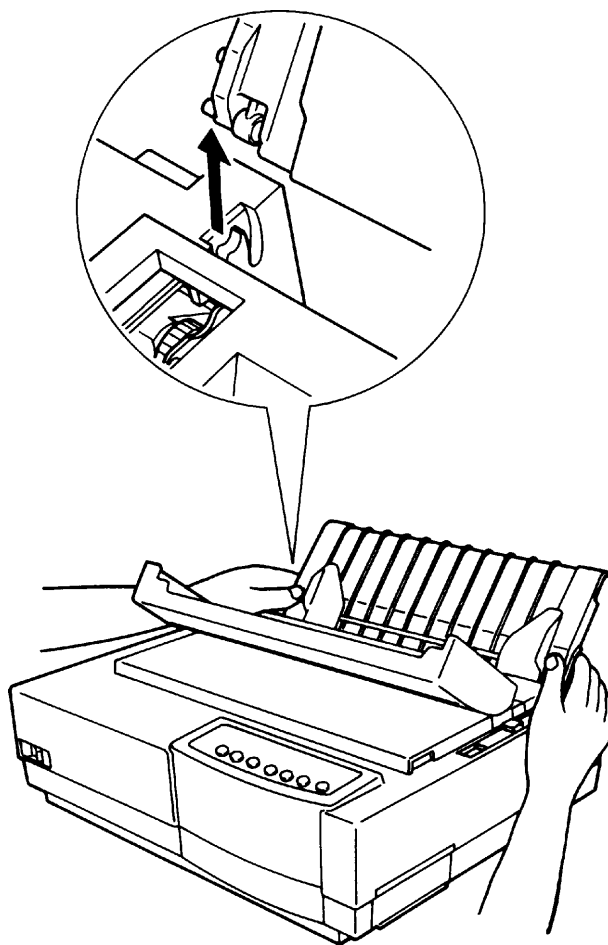
(3) Cover replacement, including platen knob

Removal

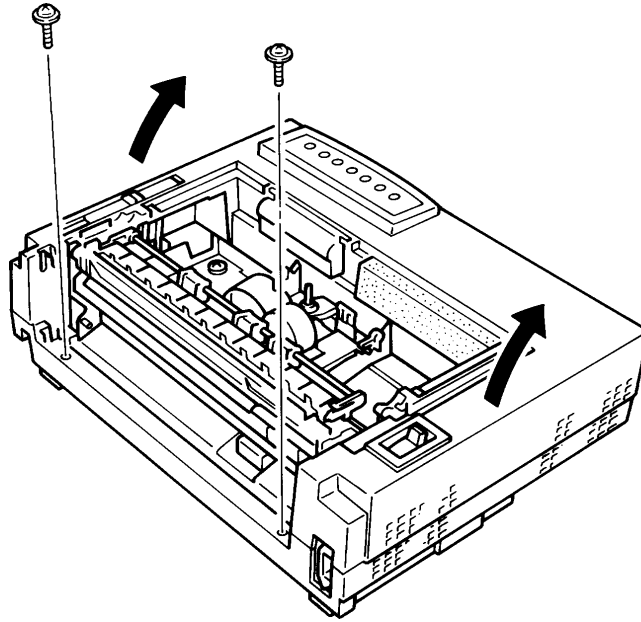
1. Remove the acoustic cover (Section 4.9.1(1)).
2. Remove the tractor unit (Section 4.9.1(2)).
3. Pull off the platen knob.
4. Open the front cover and the top cover nearly vertically (A), then lift and remove them together (B).



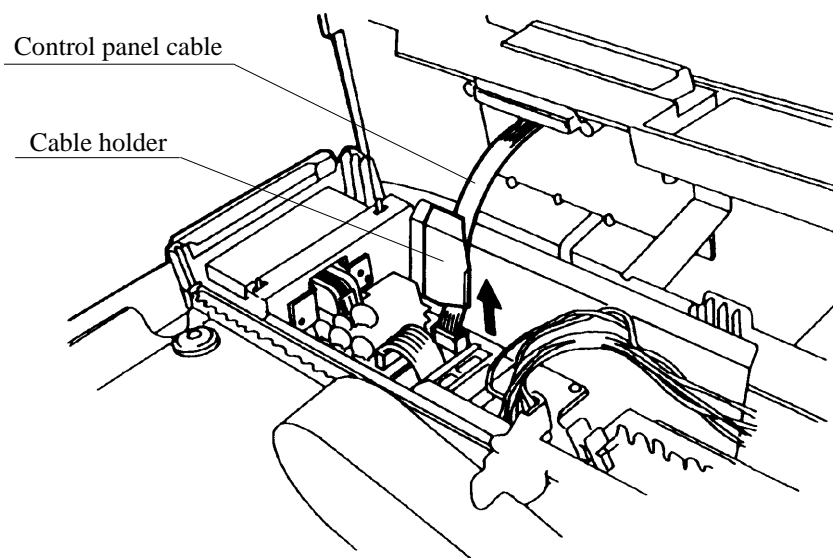
5. Raise the cut-sheet stand and the back cover together, then remove them in the direction of the arrow (A).



6. Remove the ribbon cartridge.
7. Remove the screws (two for LA30N; three for LA30W).
8. Lift the back part of the upper cover.



9. Disconnect the control panel cable from the printer control board and remove the control panel cable from the cable holder.
10. Remove the upper cover.



Installation

Install covers in reverse order of removal.

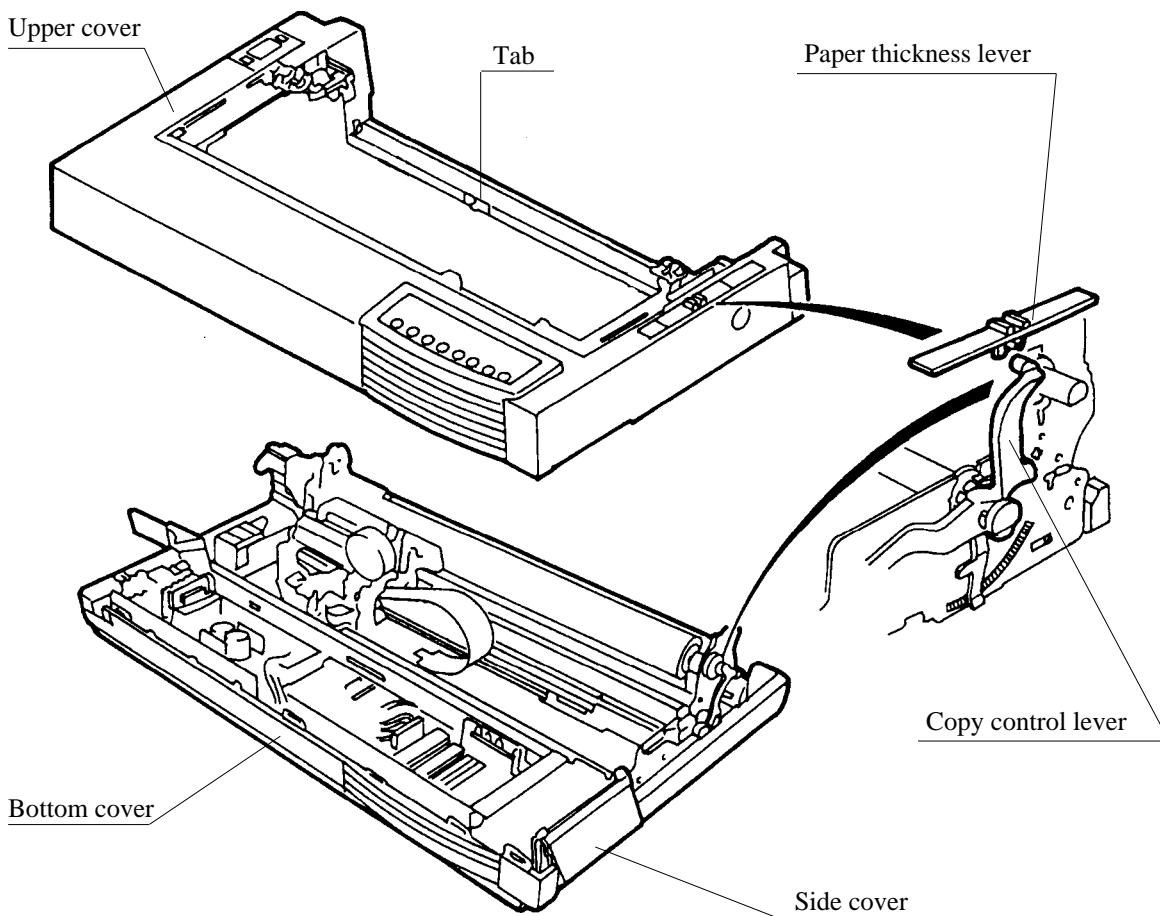
Notes:

Be sure that the control panel cable is inserted behind the cable holder.

Check that the paper thickness lever fits into the copy control lever.

Check that the side cover is in place.

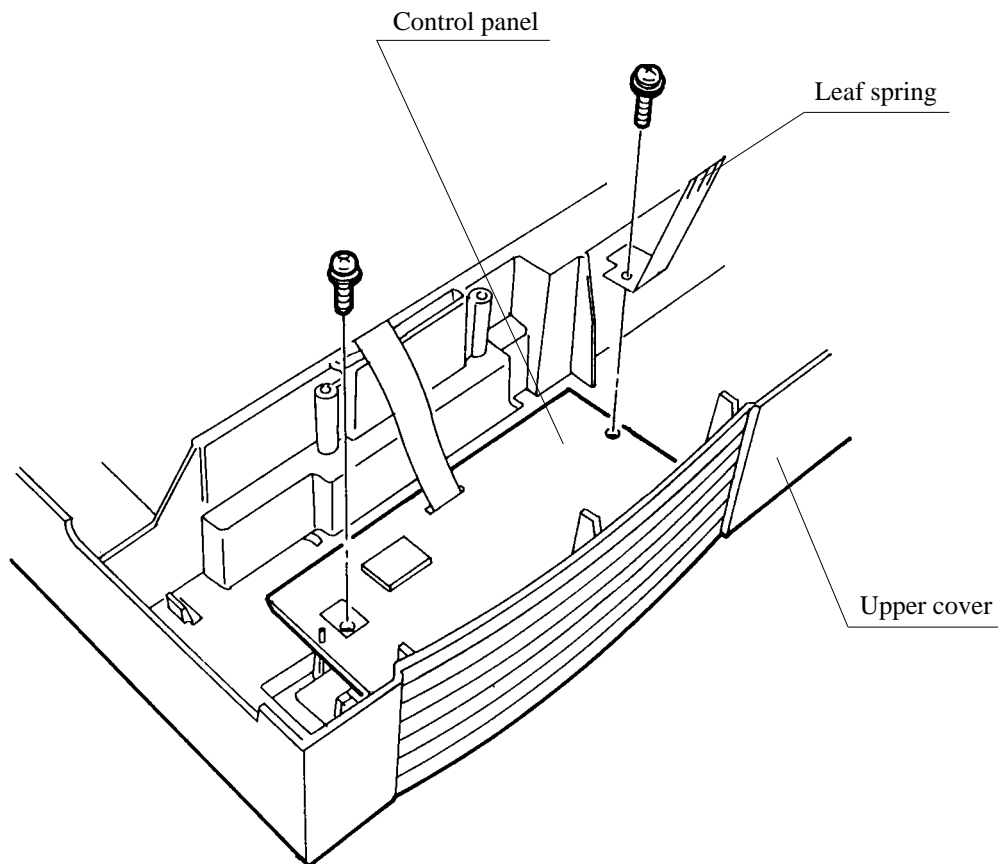
Make sure that the box tab on the upper cover fits the hook of the bottom cover. Then, tighten the upper cover.



(4) Control panel replacement

Removal

1. Remove the tractor unit (Section 4.9.1 (2)) and covers (Section 4.9.1 (3)).
2. Turn the upper cover upside down and the remove the two screws.
3. Remove the control panel.



Installation

Install the control panel in reverse order of removal.

Notes:

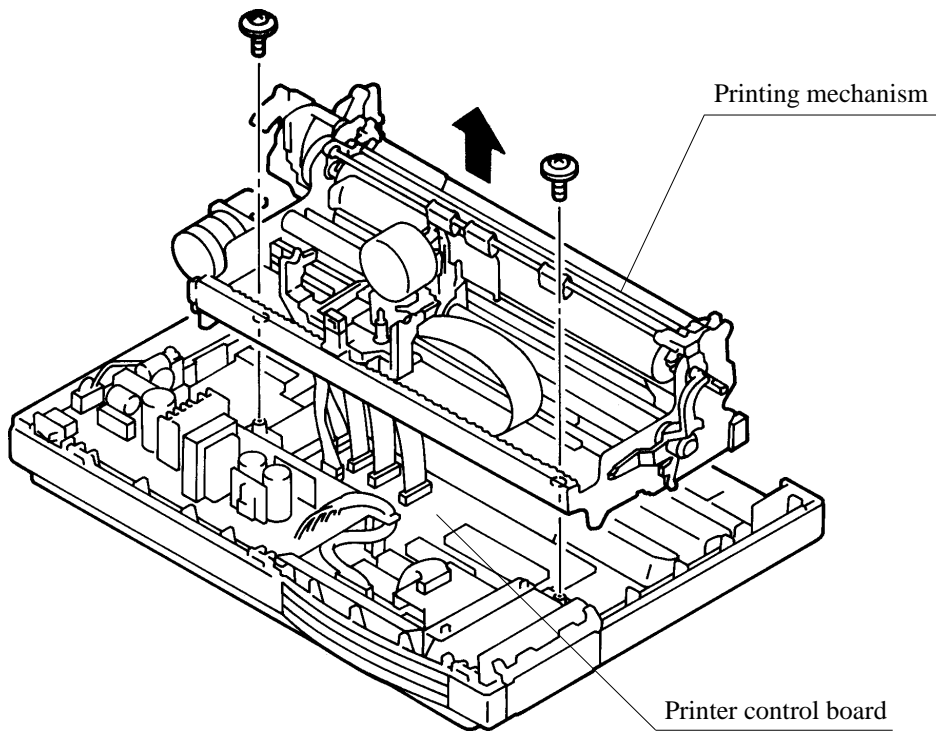
When replacing the control panel, be careful not to bend the tape cable connected with the control board.

Be sure that the leaf spring is between the screw head and printed circuit board.

(5) Printing mechanism replacement

Removal

1. Remove the tractor unit (Section 4.9.1 (2)) and covers (Section 4.9.1 (3)).
2. Remove the two screws.
3. Steadying the printing mechanism, disconnect the six connectors from the printer control board:
Print head cables: CNHEAD1, CNHEAD2, CNHEAD3
Line feed motor wire cables: CNLF
Space motor wire cable: CNSP
Sensor wire cable: CNDET
4. Remove the printing mechanism.



Installation

Install the printing mechanism in reverse order of removal.

Notes:

Be sure to connect all connectors to the control board.

Use cable clamps for the line feed motor, space motor, and sensor cables.

Put the tractor paper-end sensor cable in the recess of the bottom cover.

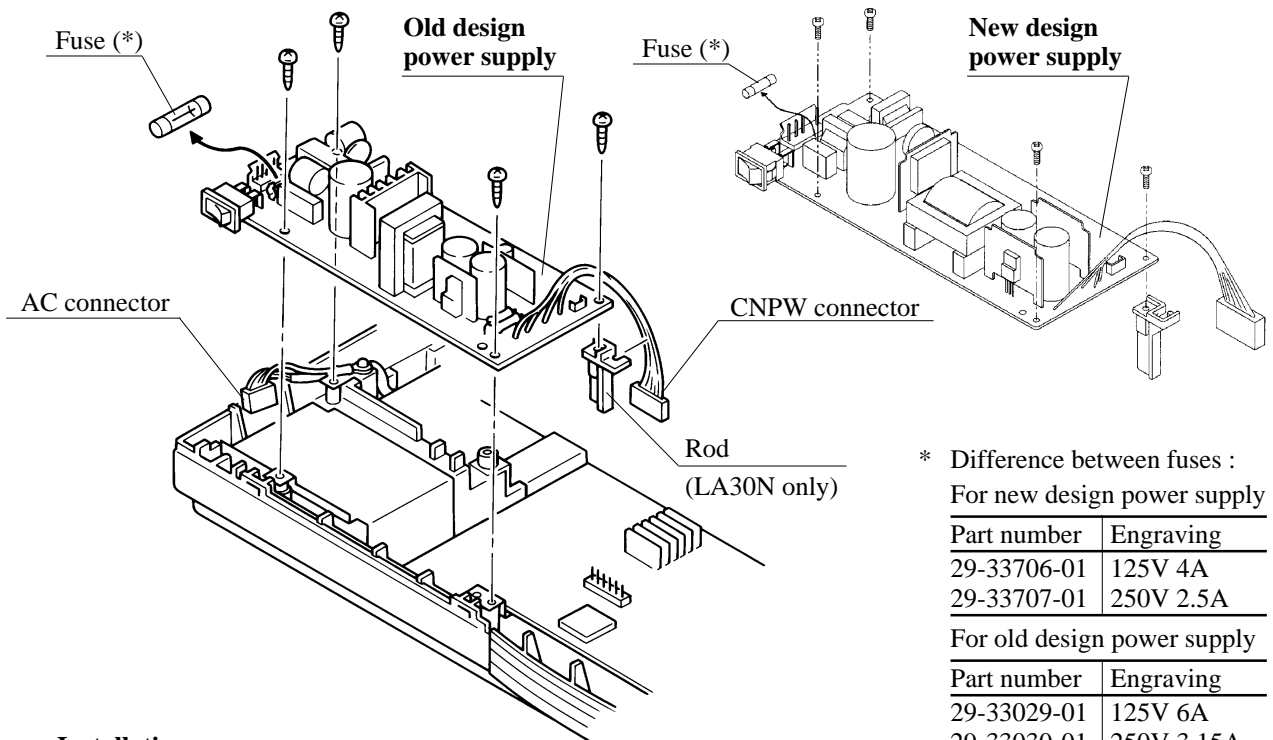
The sensor cable must not hang over the bottom feed slot of the bottom cover.

The SP motor cable and the LF motor cable must not touch the transistor elements on the control board so that cables can not be caught between the control board and the bottom of the mechanism.

(6) Power supply and fuse replacement

Removal

1. Remove the fuse from the power supply, if necessary.
2. Disconnect AC and CNPW connectors.
3. Remove the four screws (three screws for LA30W) then remove the power supply. The rod and its securing screw are not used for LA30W.



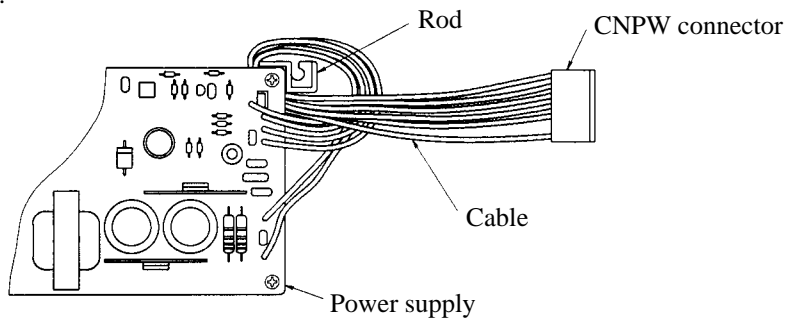
Installation

Install the power supply and fuse in reverse order of removal.

Notes:

Old and new design power supplies are compatible with each other, but their fuses are not compatible.

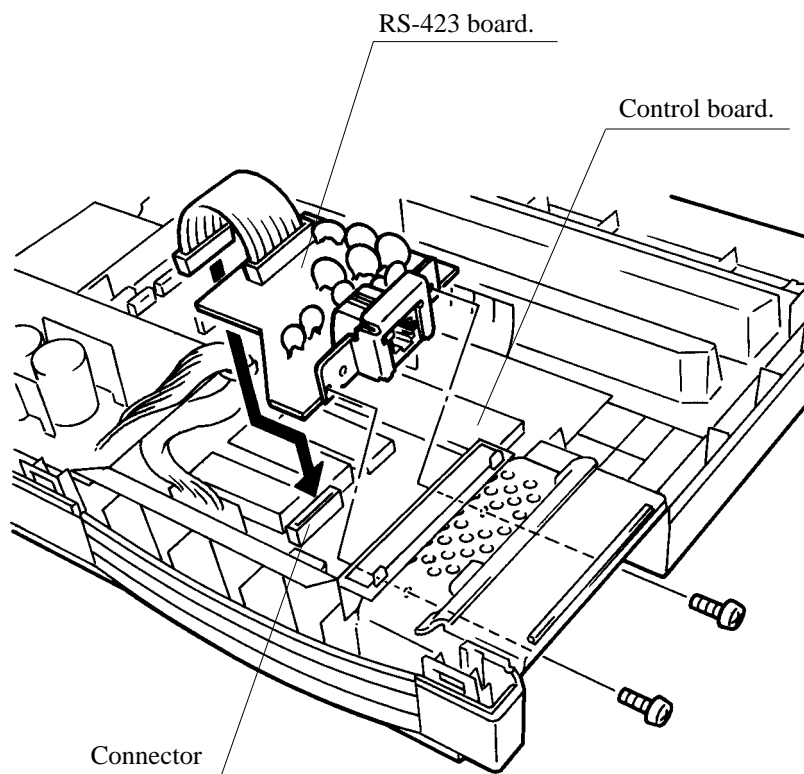
For LA30N only; before connecting the CNPW connector to the corresponding connector on the control board (ROM board), be sure to wind the cable once around the rod. If the cable wires are bound with a tie, cut the tie before winding the cable.



(7) RS-423 board replacement

Removal

1. Remove the two screws using the screwdriver M2-M2.5 (for Phillips screws).
2. Unplug the CNRS connector from the control board, then remove the RS-423 board.



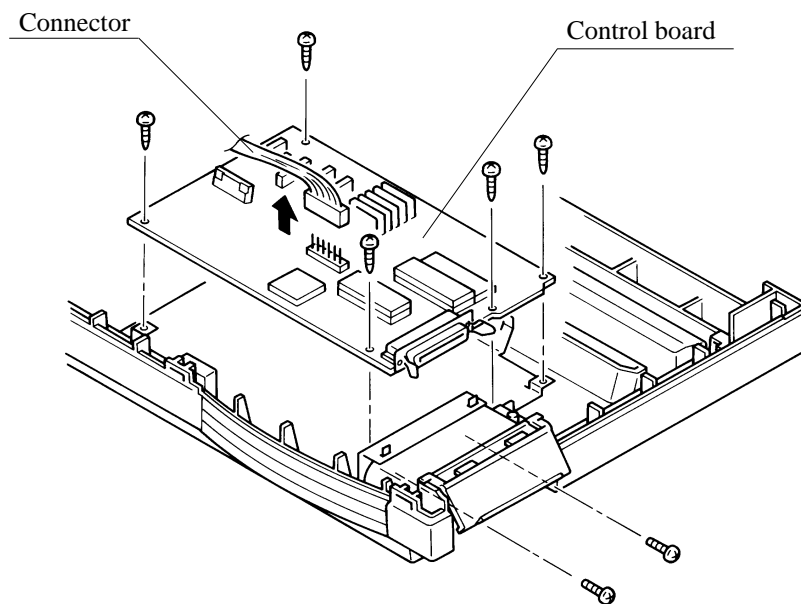
(8) Control board (ROM board) replacement

From the point of the engineers, the control board is referred to by different names: printer control board, main board, ROM board, and main board with ROM.

There are two types of control boards and ROMs respectively (control board: old and new design boards, ROM: EPROM and mask ROM). Any combinations of a board and ROM(s) are available.

Removal

1. Remove the printing mechanism (Section 4.9.1 (5)).
2. Remove the power supply (Section 4.9.1 (6)).
3. Remove the RS-423 board (Section 4.9.1 (7)).
4. Remove the seven screws as shown below, then remove the control board (ROM board).



Installation

Install the control board (ROM board) in reverse order of removal.

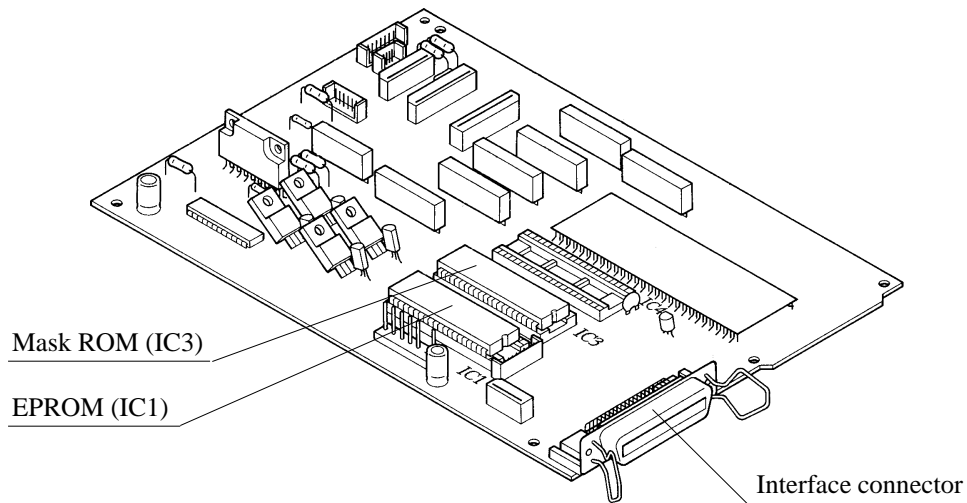
Notes:

For LA30W printers, be sure to install the grounding metal strip in place. This strip establishes grounding connection between the control board and the power supply.

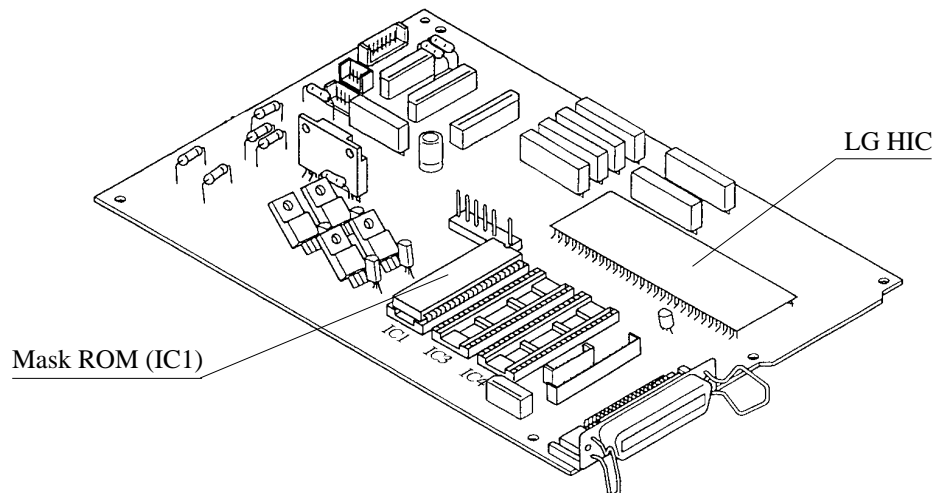
There are two types of control boards and ROMs respectively (control board: old and new design boards, ROM: EPROM and mask ROM; any combinations available). When replacing the ROM(s), use either socket IC1 for an EPROM (program) and socket IC3 for a mask ROM (CG) or socket IC1 for a mask ROM (program and CG). The ROM's orientation mark (cut) must face the interface connector for the old design board, and the LG HIC for the new design board.

Whenever the ROM is replaced, initialize the ROM and re-adjust the vertical alignment and the top-of-form line. (Sections 4.9.2 (2) and (3)).

Old design board + EPROM (program) and mask ROM (CG): IC1 and IC3



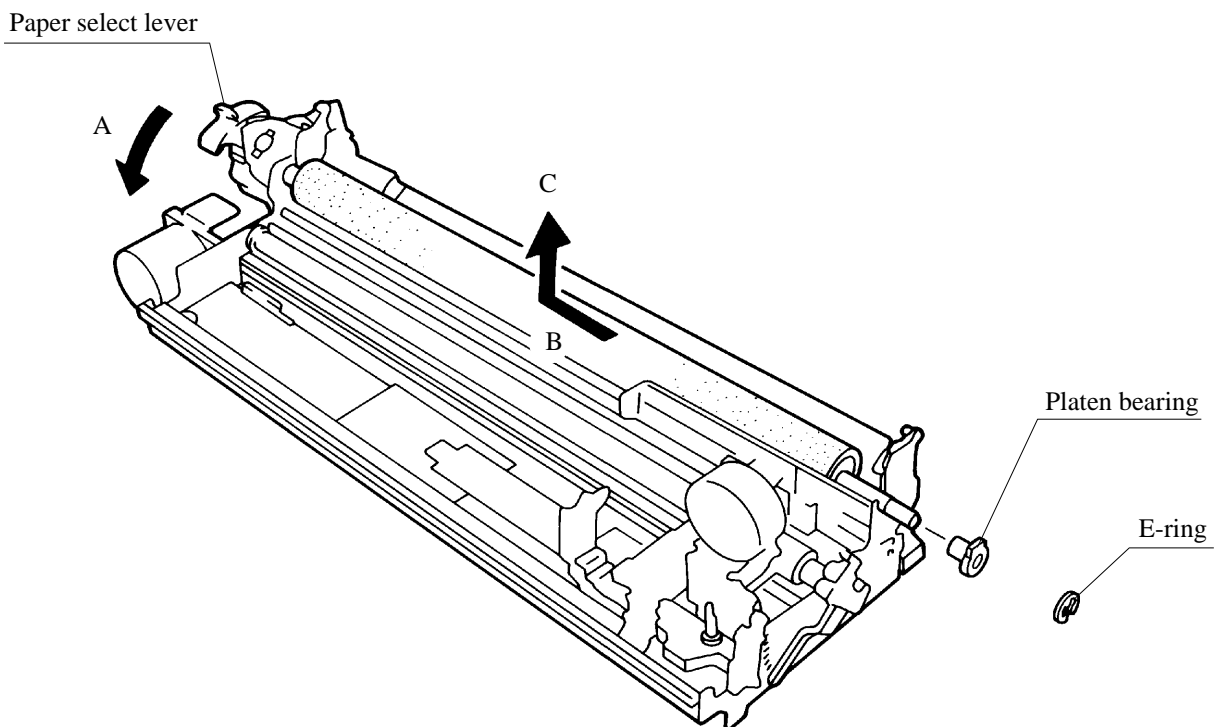
New design board + Mask ROM (program & CG): IC1 only



(9) Platen roll assembly replacement

Removal

1. Remove the tractor unit (Section 4.9.1 (2)) and covers (Section 4.9.1 (3)).
2. Move the paper select lever as shown below (A).
3. Remove the E-ring.
4. Holding the platen, pull the right platen bearing off the shaft.
5. Move the carriage unit all the way to the right.
6. Move the platen roll all the way to the left (B) and remove the left platen bearing.
7. To remove the platen roll, lift it up (C).



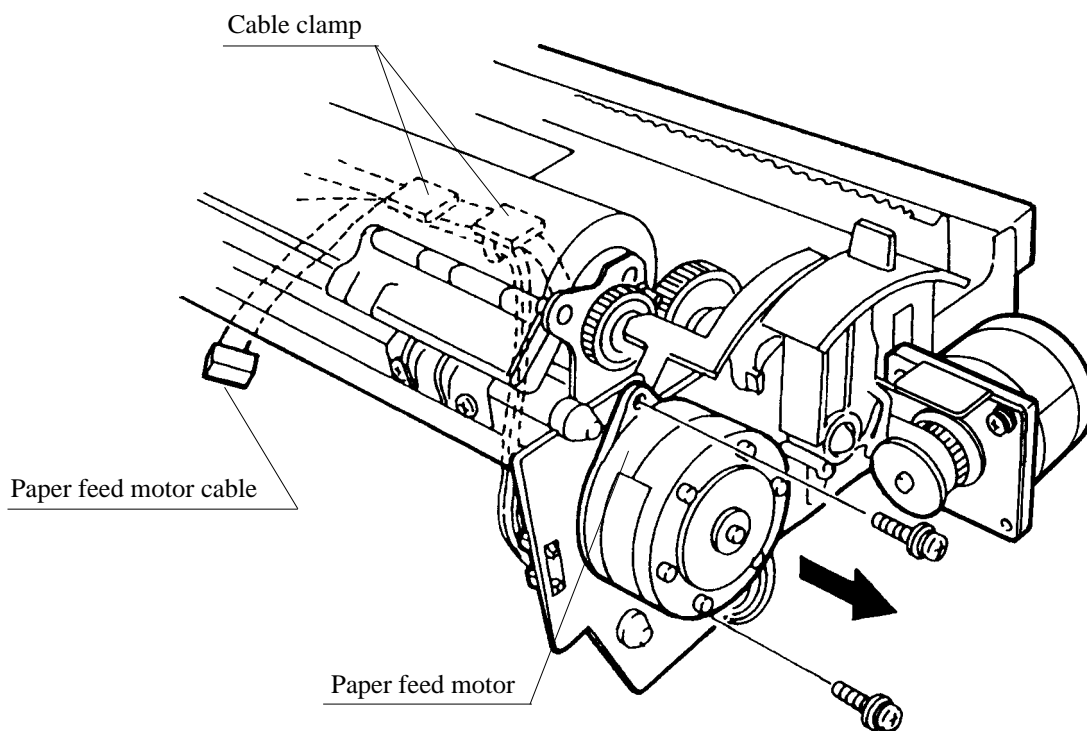
Installation

Install the platen in reverse order of removal. See Section 4.9.2 (1) for print head gap adjustment and Section 4.9.3 (1) for lubrication.

(10) Paper feed motor (LF motor) replacement

Removal

1. Remove the printing mechanism (Section 4.9.1 (5)).
2. Remove the motor cable from the cable clamp.
3. Remove the two screws to remove the paper feed motor.



Installation

Install the paper feed motor in reverse order of removal.

Note:

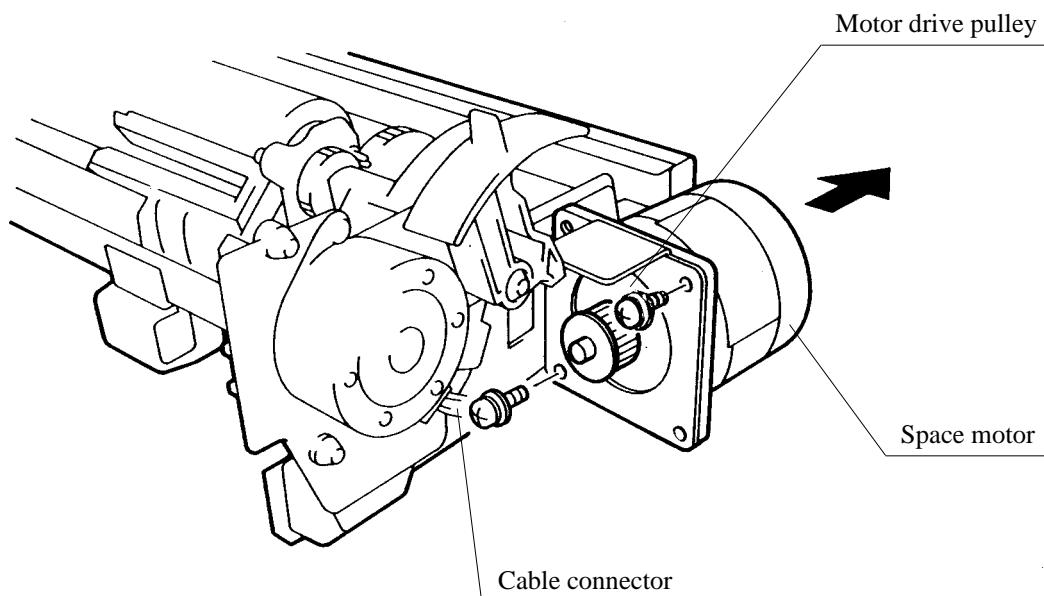
Check that paper feed motor gears are engaged.

Put the motor cable along the side frame and hold it by the cable clamps so that it cannot obstruct the bottom feed slot path.

(11) Space motor (SP motor) assembly replacement

Removal

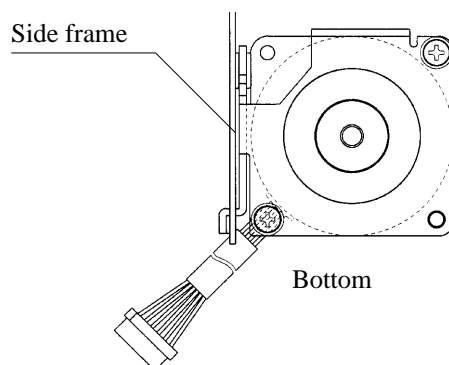
1. Remove the printing mechanism (Section 4.9.1 (5)).
2. Remove the two screws to remove the space motor.
3. Detach the carriage drive belt from the motor drive pulley, then remove the space motor.
4. Remove the motor cable from the cable clamp.
5. Disconnect the cable connector from the space motor.



Installation

Install the space motor assembly in reverse order of removal.

Make sure that the motor cable entrance is oriented toward the bottom and inside the printer as shown below.

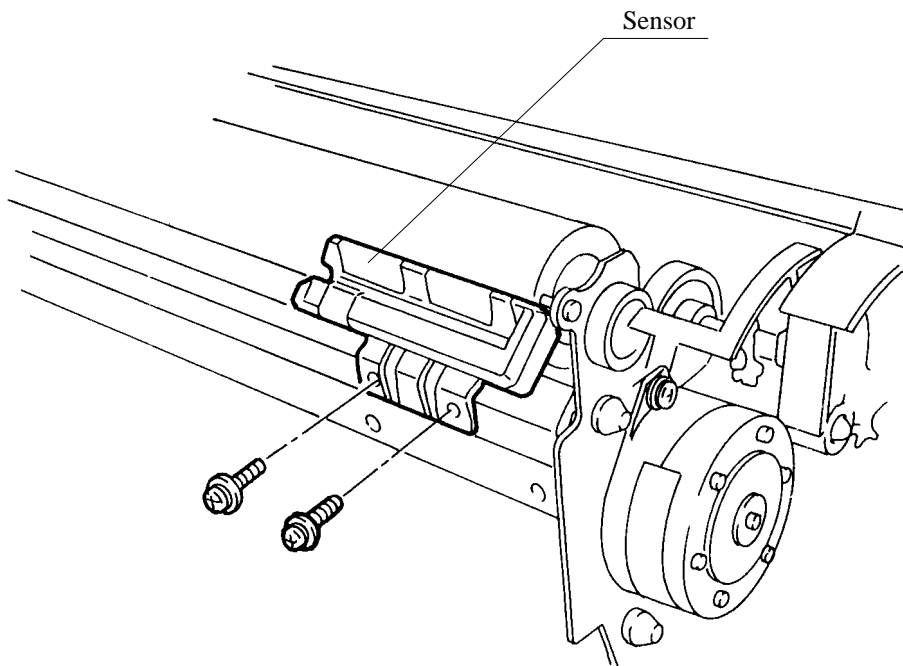


(12) Sensor T assembly replacement

This sensor detects a cut sheet placed on the cut-sheet stand.

Removal

1. Remove the tractor unit (Section 4.9.1 (2)) and covers (Section 4.9.1 (3)).
2. Remove the two screws to remove the sensor T assembly while disconnecting the sensor wire cable.



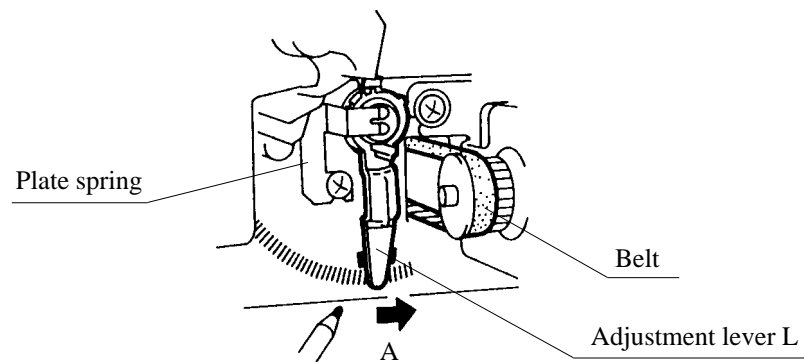
Installation

Install the sensor assembly in reverse order of removal.

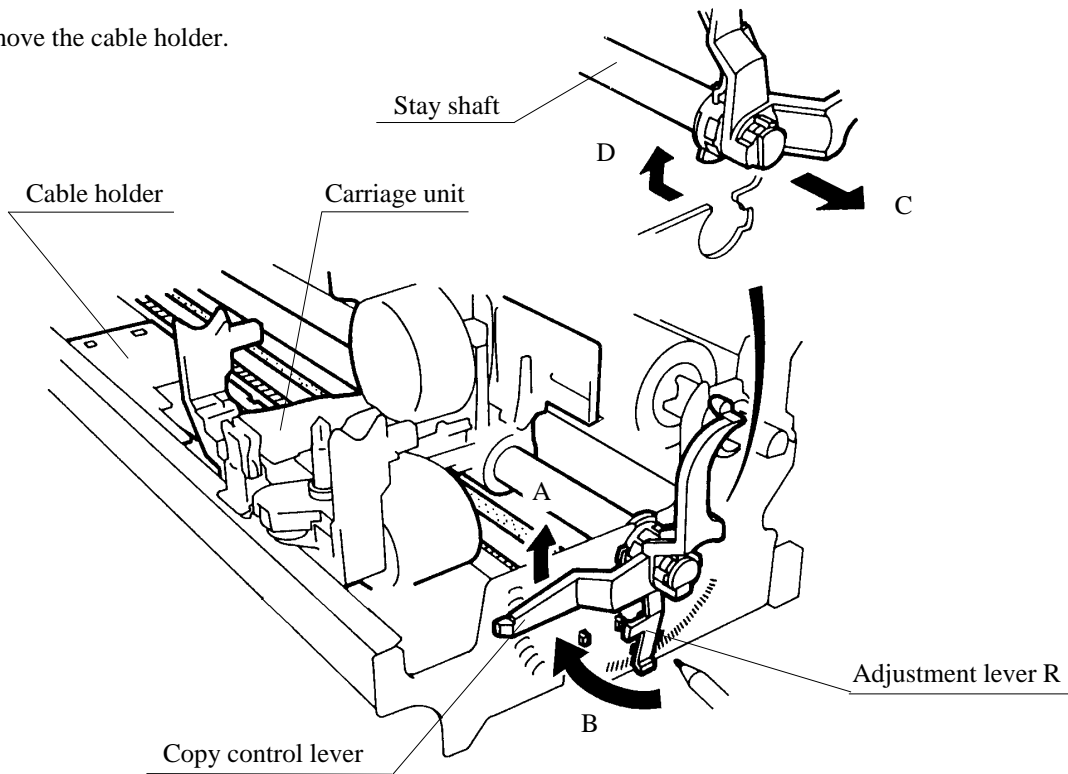
(13) Carriage unit replacement

Removal

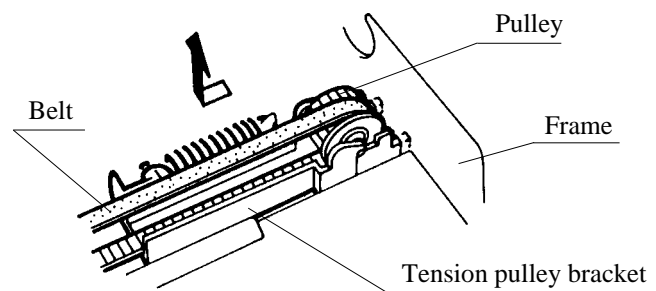
1. Remove the printing mechanism (Section 4.9.1 (5)), SP motor (Section 4.9.1(11)), and print head (Section 4.9.1 (14)).
2. Mark the setting positions of the adjustment levers R and L at both sides of the mechanism. (For adjustment lever R, see the figure on the next page.)
3. Loosen the screw to remove the plate spring.
4. Turn adjustment lever L counterclockwise until it contacts the belt (A).



5. Turn the copy control lever so that its notch side is uppermost (A). Then, turn adjustment lever R clockwise until it is stopped (B).
6. Slide the stay shaft slightly to the right (C) and remove the platen bearing.
7. Remove the stay shaft from the frame (D).
8. Remove the cable holder.



9. Unhook the spring to free the bracket
10. Remove the tension pulley bracket from the frame by sliding and lifting it in the directions of the arrow.
11. Detach the belt from both pulleys.



Installation

Install the carriage unit in reverse order of removal.

Note:

Check that the gear in the carriage unit engages with the rack on the front stay.

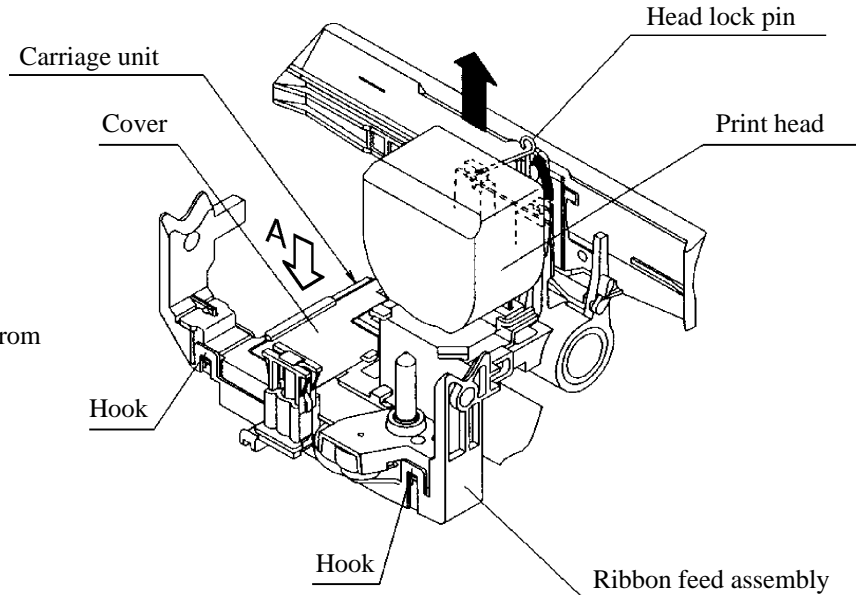
(14) Print head and ribbon feed assembly replacement

The print head and the ribbon feed assembly are mounted on the carriage unit. The print head is a consumable.

Removal

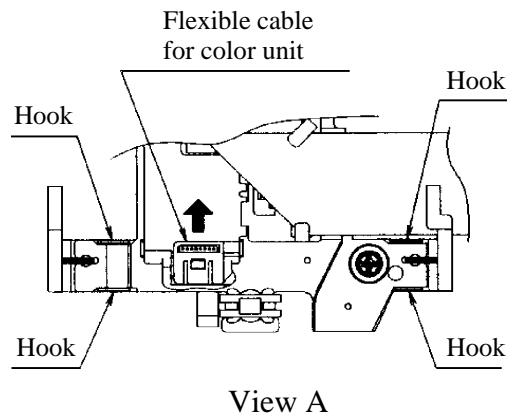
Print head

1. Open the front cover.
2. Set the copy control lever to D.
3. Unhook the head lock pin.
4. Lift and remove the print head from the carriage unit.



Ribbon feed assembly

1. Remove the carriage unit from the mechanism (Section 4.9.1 (13)).
2. Remove the cover from the carriage unit.
3. Disconnect the flexible cable for the color unit in the direction of the arrow.
4. Release the four hooks and push down the ribbon feed assembly.



Installation

Install the print head and the ribbon feed assembly in reverse order of removal.

Note:

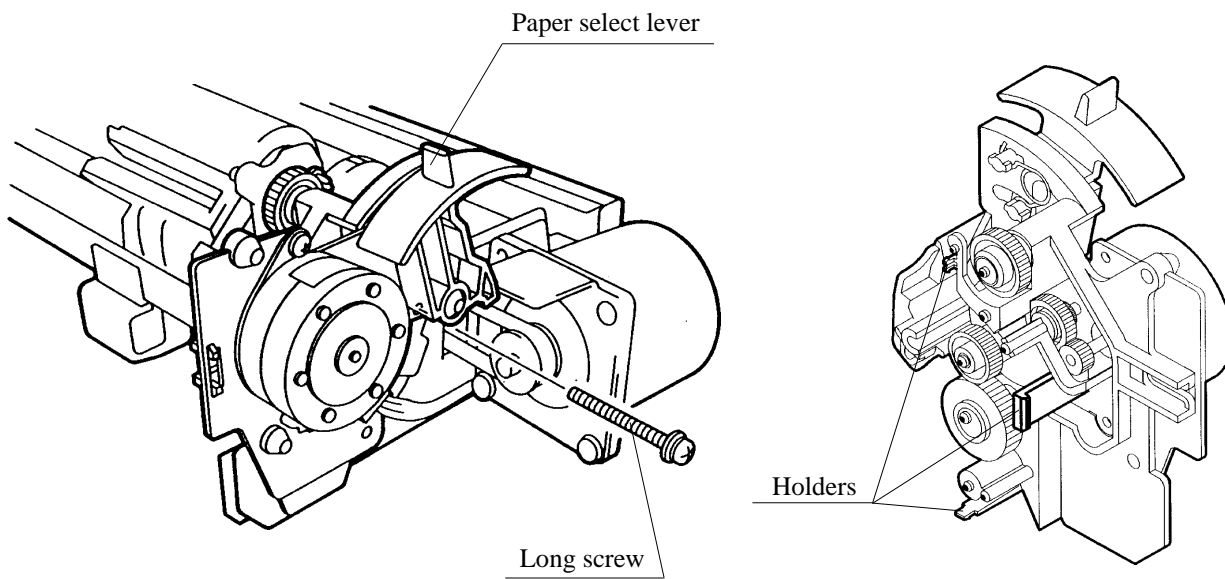
Carefully fit print head guide grooves onto positioning studs on the carriage unit and push the head all the way on.

(15) Gear assembly replacement

The gear assembly transmits power to the paper feed mechanism. It has a mechanism that determines whether power is also transmitted to the push tractor. The assembly includes the LF motor.

Removal

1. Remove the printing mechanism (Section 4.9.1(5)).
2. Remove the platen assembly (Section 4.9.1 (9)).
3. Set the paper select lever toward the back of the printer.
4. Loosen the long screw and unhook the three holders from the side frame to remove the gear assembly.



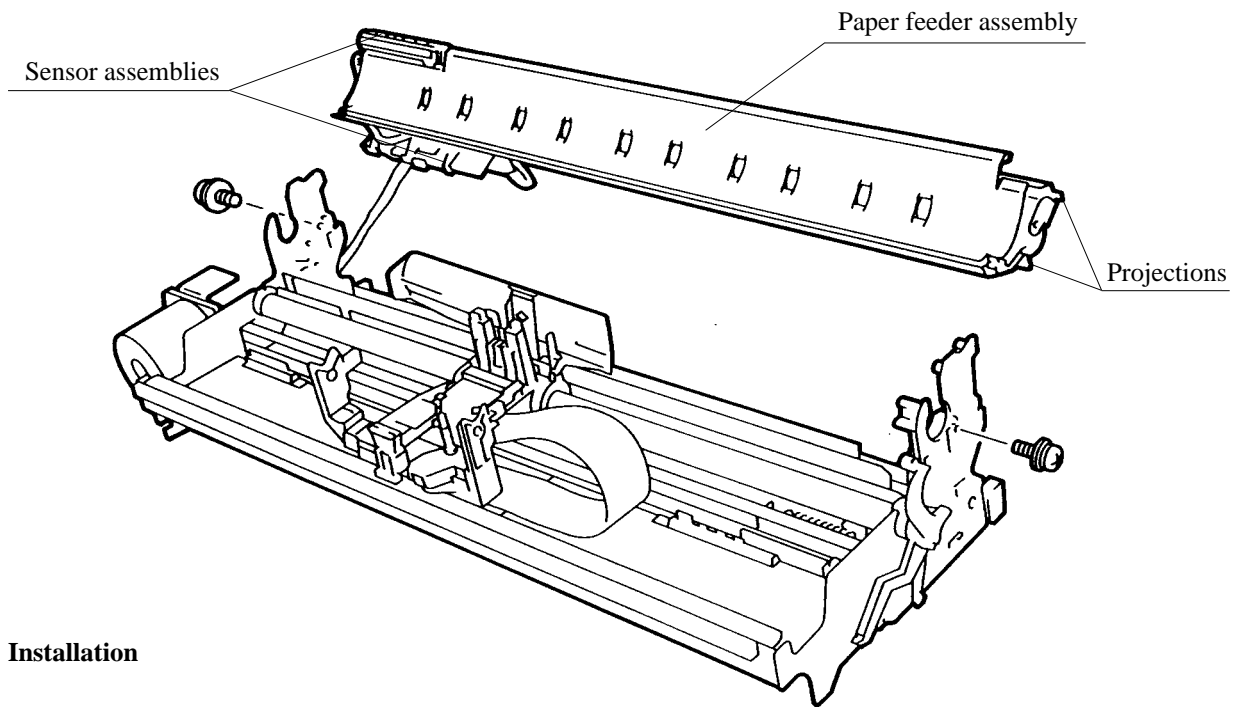
Installation

Install the gear assembly in reverse order of removal.

(16) Paper feeder assembly replacement

Removal

1. Remove the printing mechanism (Section 4.9.1(5)), platen assembly (Section 4.9.1(9)), print head (Section 4.9.1(14)), and gear assembly (Section 4.9.1(15)).
2. Remove the two screws to remove the paper feeder assembly.



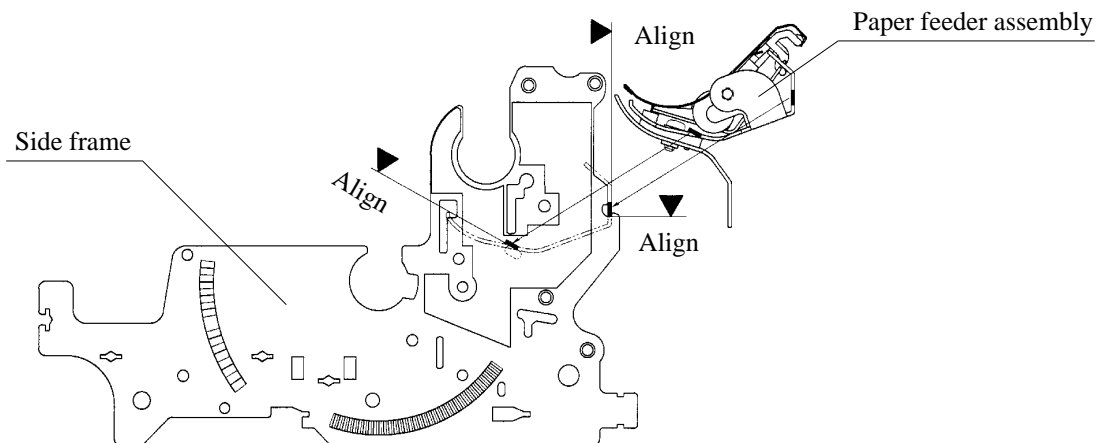
Installation

Install the Paper feeder assembly in reverse order of removal.

Notes:

The paper feeder assembly contains two paper sensor assemblies.

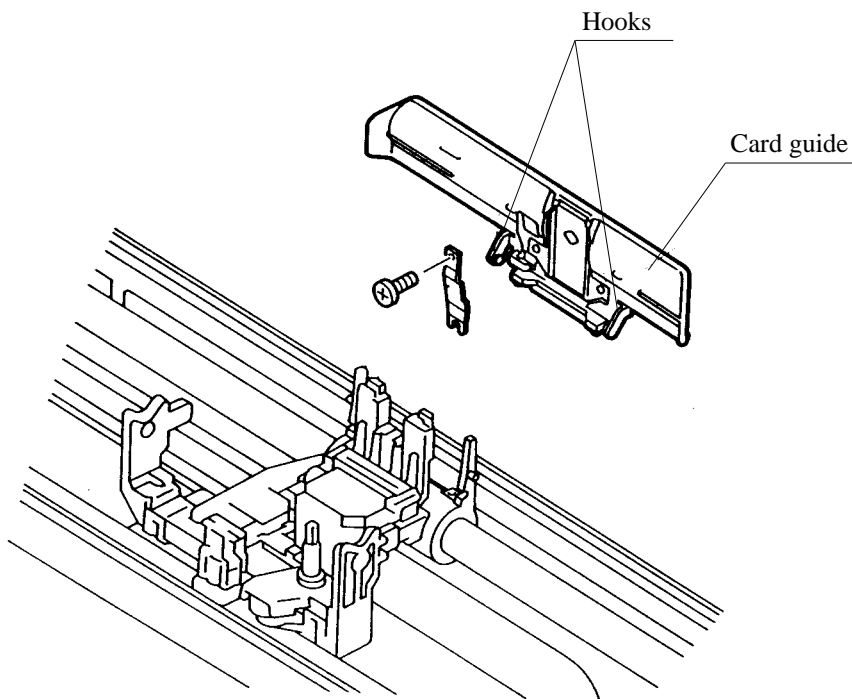
Make sure that the positioning projections at both sides of the paper feeder assembly fit in the corresponding dowels and cuts of the side frames.



(17) Card guide assembly replacement

Removal

1. Remove the platen assembly (Section 4.9.1(9)), print head (Section 4.9.1(14)), and feed roller assembly (Section 4.9.1(16)).
2. Remove the small screw which retains the sensor cable on the card guide.
3. Push the two hooks outwards to remove the card guide from the carriage unit.



Installation

Install the card guide in reverse order of removal.

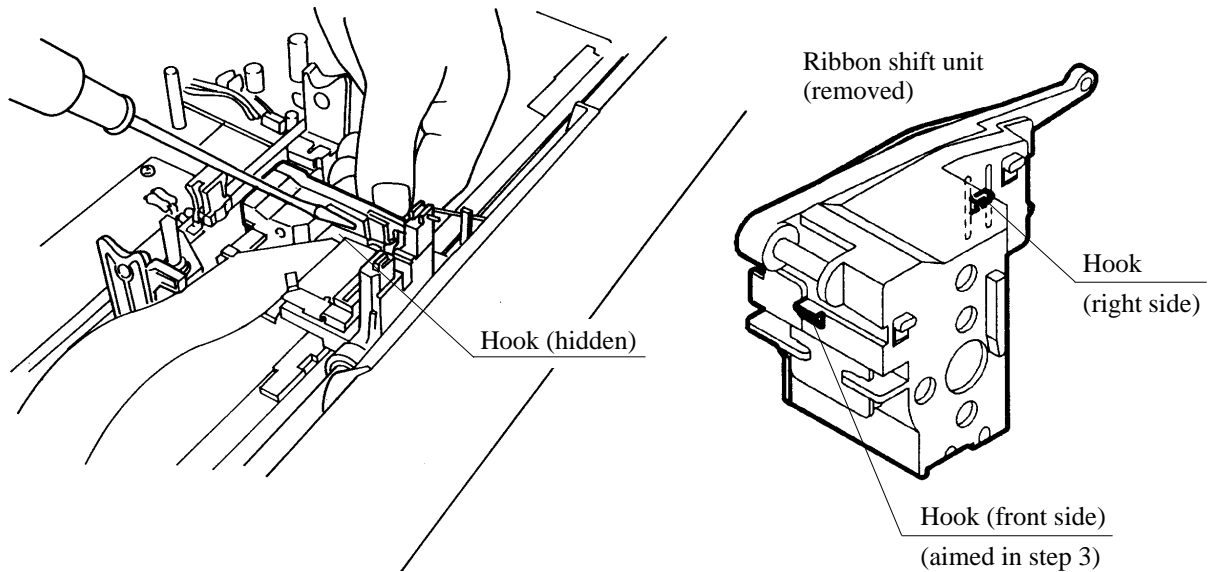
Note:

When replacing the card guide, be careful not to damage card guide hooks.

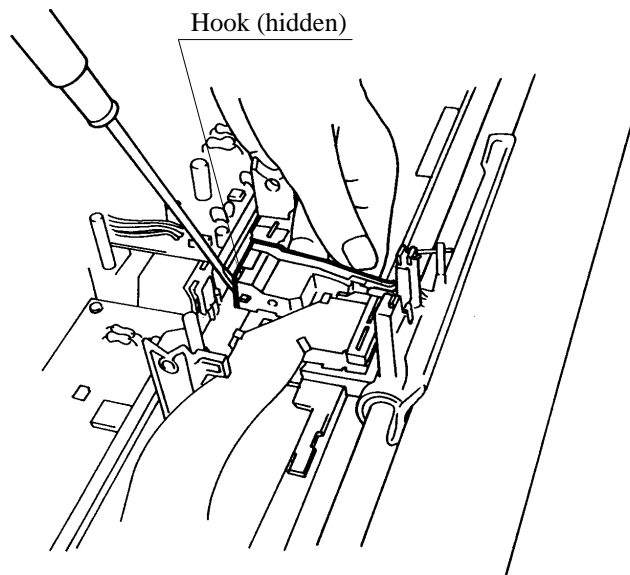
(18) Ribbon shift unit (color kit) replacement

Removal

1. Open the front cover, remove the ribbon cartridge, and remove the print head (Section 4.9.1(14)).
2. Release the hook at the right side of the ribbon shift unit to raise the top of the unit.



3. Release the other hook at the front side of the ribbon shift unit and pull up the entire unit to remove it from the carriage unit.



Installation

Install the ribbon shift unit in reverse order of removal.

Snap down the unit into place.

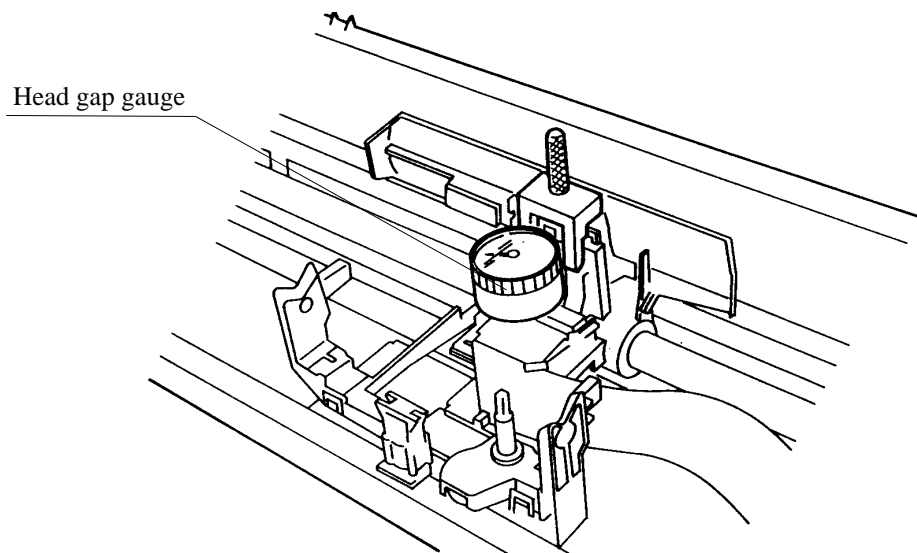
4.9.2 Adjustment

(1) Print head gap adjustment

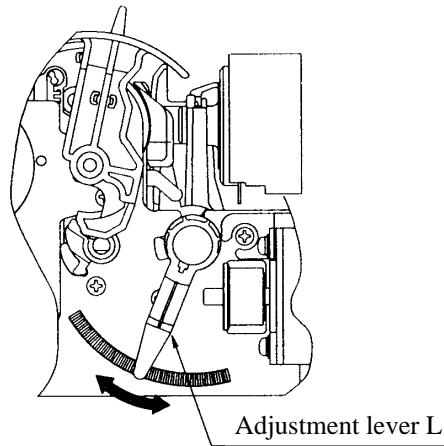
When replacing the carriage unit or platen, check that the gap between the print head and platen is 0.38 ± 0.03 mm at both ends of the platen. To check the gap along the platen, use a platen gap adjustment gauge and move the carriage to the left and right. To adjust the gap, turn the two levers at the ends of the stay shaft.

Procedure

1. Turn off the printer power switch.
2. Remove the covers (Section 4.9.1(3)).
3. Set the paper thickness lever upward (narrowest).
4. Calibrate the platen gap adjustment gauge according to its instruction manual.
5. Remove the print head if it is on the carriage unit, then install the gauge instead.
6. Turn the platen and find the rotational location where the print head gap is widest.

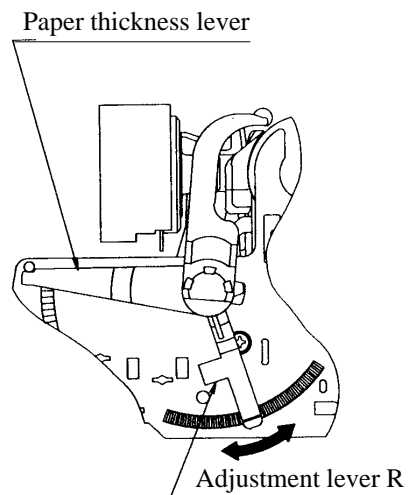


7. Move the carriage unit to the left-end print position (column 1).
8. Turn adjustment lever L at the left end of the stay shaft and adjust it so that the gap is 0.38 ± 0.03 mm.



Left-side frame

9. Move the carriage unit to the furthest right printing position.
10. Turn adjustment lever R at the right end of the stay shaft and adjust it so that the gap is 0.38 ± 0.03 mm.



Right-side frame

11. Move the carriage unit to the center and check the gap. If the gap does not satisfy the value, return to step 8.
12. Move the carriage unit again to the left, center, and right to confirm the gap. If the gap does not satisfy the value, return to step 8.

(2) Vertical alignment

When replacing the ROM board (printer control board) or the carriage unit, check the vertical alignment by using the diagnostic function on the setup mode menu. It adjusts the vertical alignment of characters printed in opposite directions in bidirectional printing. Adjust for the three print qualities (letter, correspondence, and draft).

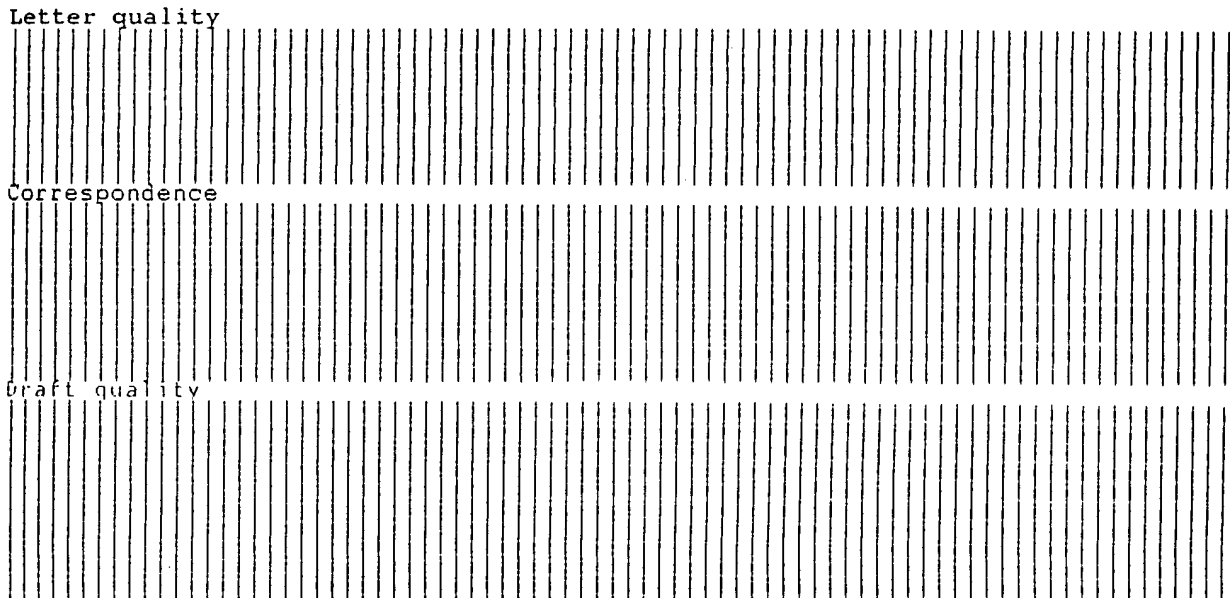
Procedure

1. Load continuous forms at least 203 mm (8 inches) wide onto the printer to avoid printing on the platen.
2. Start vertical alignment by holding down the Protocol button while turning on the power switch.

The printer will print vertical bars both forward and backward, beginning with letter quality. Printing sample is shown as follows:

**** Vertical Alignment Adjustment ****

Buttons	Action
→	Shift backward print position to right
←	Shift backward print position to left
↓	Change to next print quality
↑	Change to previous print quality
Exit/Save	Save and exit to Normal mode



3. Check that alignment is correct.
4. If alignment is not correct, press the \emptyset or \blacklozenge button to correct alignment. That is, if forward printing bars come to the left of reverse printing bars, press the \blacklozenge button to make the vertical line straight.

If the forward printing bars come to the right of reverse printing bars, press the \emptyset button to make the vertical line straight.

5. Check alignment again. If alignment is not still correct, repeat step 4. If correct, press the \rightarrow button to change to the next print quality and repeat steps 3 and 4. When optimum alignment is obtained for the three print qualities, go to step 6.
6. Press the Exit/Save button. The printer stores the timings for the three optimum alignments in nonvolatile memory on the ROM board and returns online.

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

Top-of-forms (TOF) adjustment in this item is used in the factory to micro-adjust the reference position of the TOF. This mode is not disclosed to users in general. The actual position of the TOF is set by the Top-of-Form adjustment as described in page 2-28 of the *User Guide*.

Note that this adjustment has an impact on the tear-off position. If this adjustment does not satisfy the standard (see the description of the Top button below), the perforation of paper cannot be positioned in front of the tear bar.

TOF adjustment is accessed by depressing three buttons 'Macro' + 'Protocol' + 'Park' simultaneously while powering on the printer.

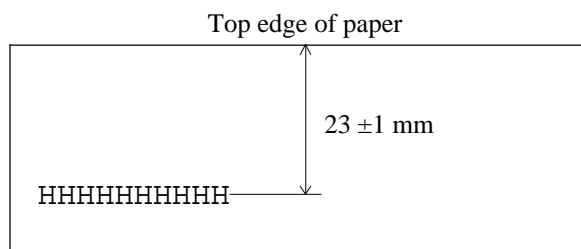
In TOF adjustment mode, the following buttons are active:

- : -1/180 inch adjustment to TOF position
- : +1/180 inch adjustment to TOF position

The valid range for adjustment is $\pm 20/180$ inches. Outside the range, the buzzer will sound and further adjustment will be performed.

Top: Paper will be loaded according to the value of TOF currently stored and 'H's will be printed by a line. Pressing the Top button in this condition returns the paper to the park position, then reload the paper and overprints 'H's.

Use this button to check or confirm the value of TOF already stored. The center of the horizontal line of a letter H must be positioned 23 ± 1 mm from the top edge of the paper when one-part paper is used. If it is not satisfied, perform the TOF adjustment using the → and ← buttons.



Park: If paper source is continuous forms, the continuous forms are returned to the park position. If paper source is a cut sheet, the cut sheet is ejected.

Use this button after finishing TOF adjustment for one paper source. Switch the paper select lever to change the paper source, then adjustment for the other paper source can be performed. When switching from cut sheet to continuous forms, be sure to remove the cut sheet ejected

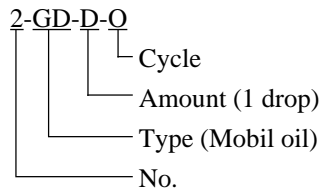
Save: The current value of TOF is stored to the EEPROM before quitting TOF adjustment mode and returning to 'Ready' state.

The TOF adjustment value is initialized to its center value (1/180 inch) if EEPROM initialization II is performed (see Section 4.10.3).

4.9.3 Lubrication

Lubrication is required only when the printer is overhauled or mechanical components are replaced.

Lubrication codes are as follows:



1. No.

Sequential number for the location to be lubricated

2. Type

FL: Floil

SG: Silicone grease

3. Amount

D: 1 drop

S: Several drops

F: Fill the case or oil wick.

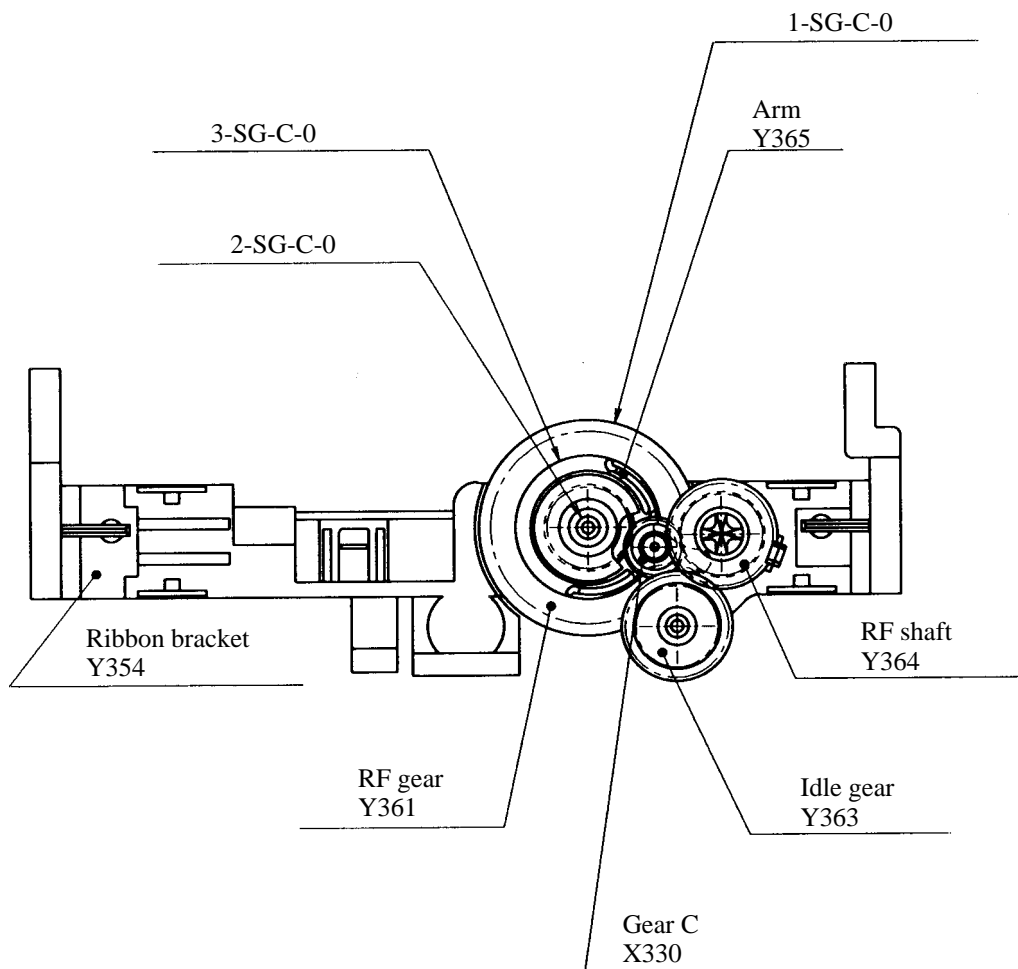
C: Cover with thin uniform film

4. Cycle

O: At overhaul

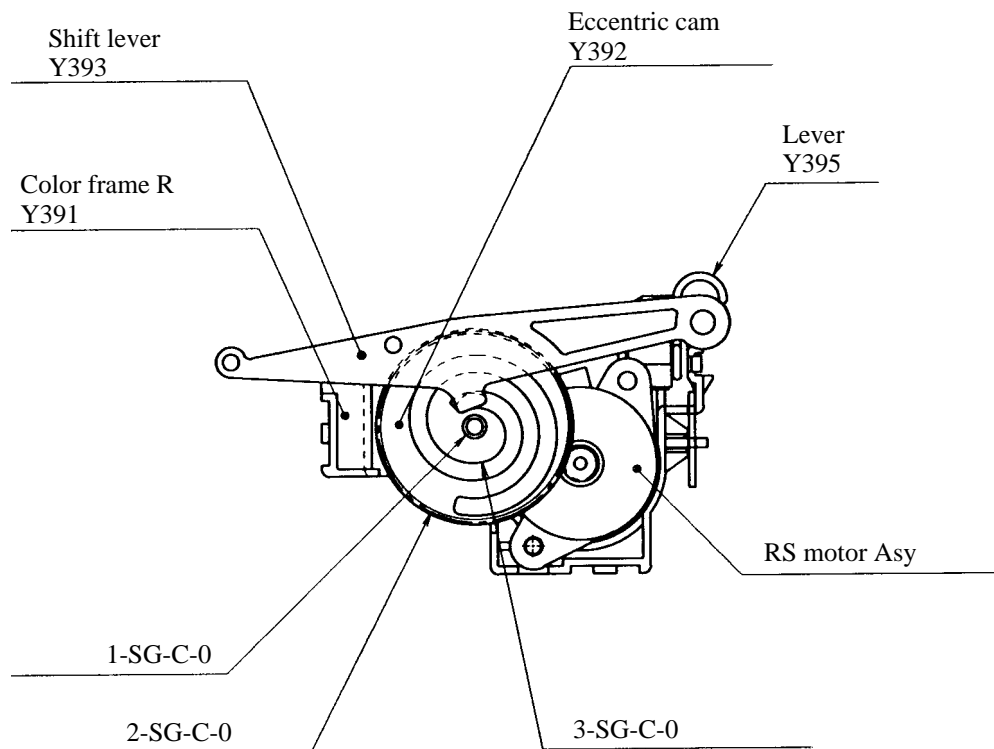
(1) Ribbon drive assembly

No.	Oil	Amount	Location	Remarks
1	SG	C	Gear teeth (4 places)	
2	SG	C	Gear bearing (4 places)	
3	SG	C	Inside the drum	



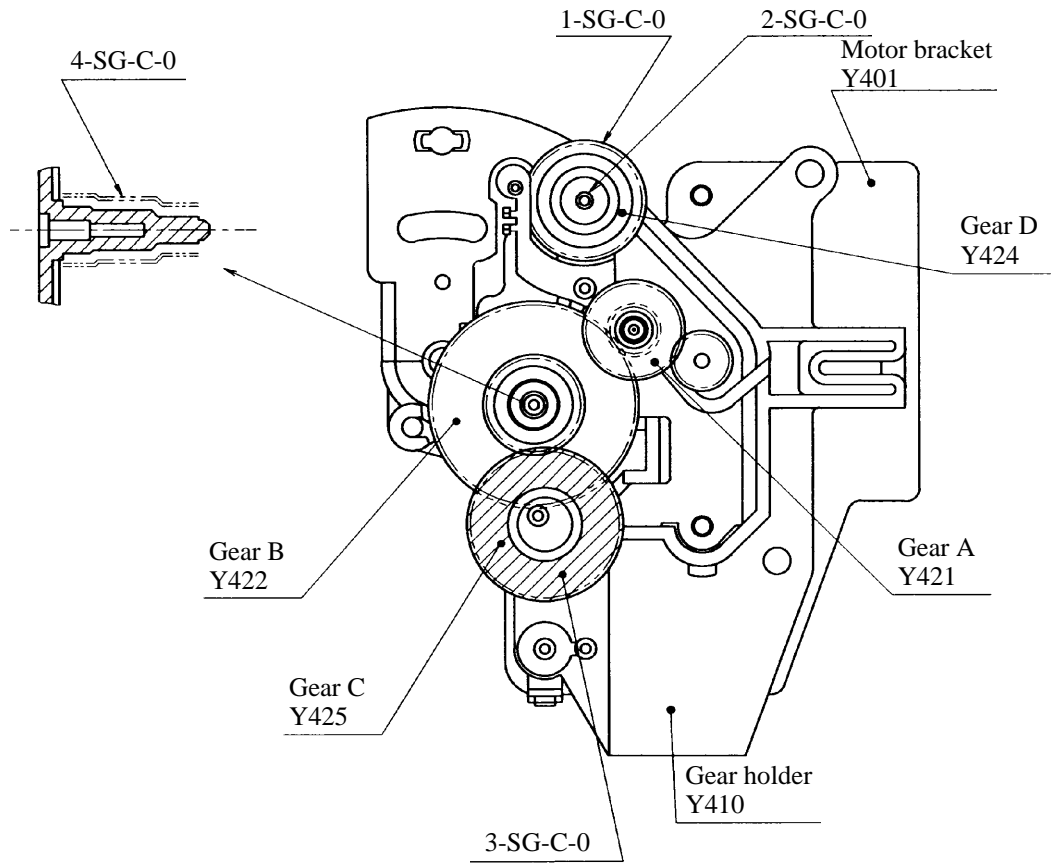
(2) Color ribbon shift motor (Option)

No.	Oil	Amount	Location	Remarks
1	SG	C	Cam center	
2	SG	C	Gear teeth	
3	SG	C	Cam	



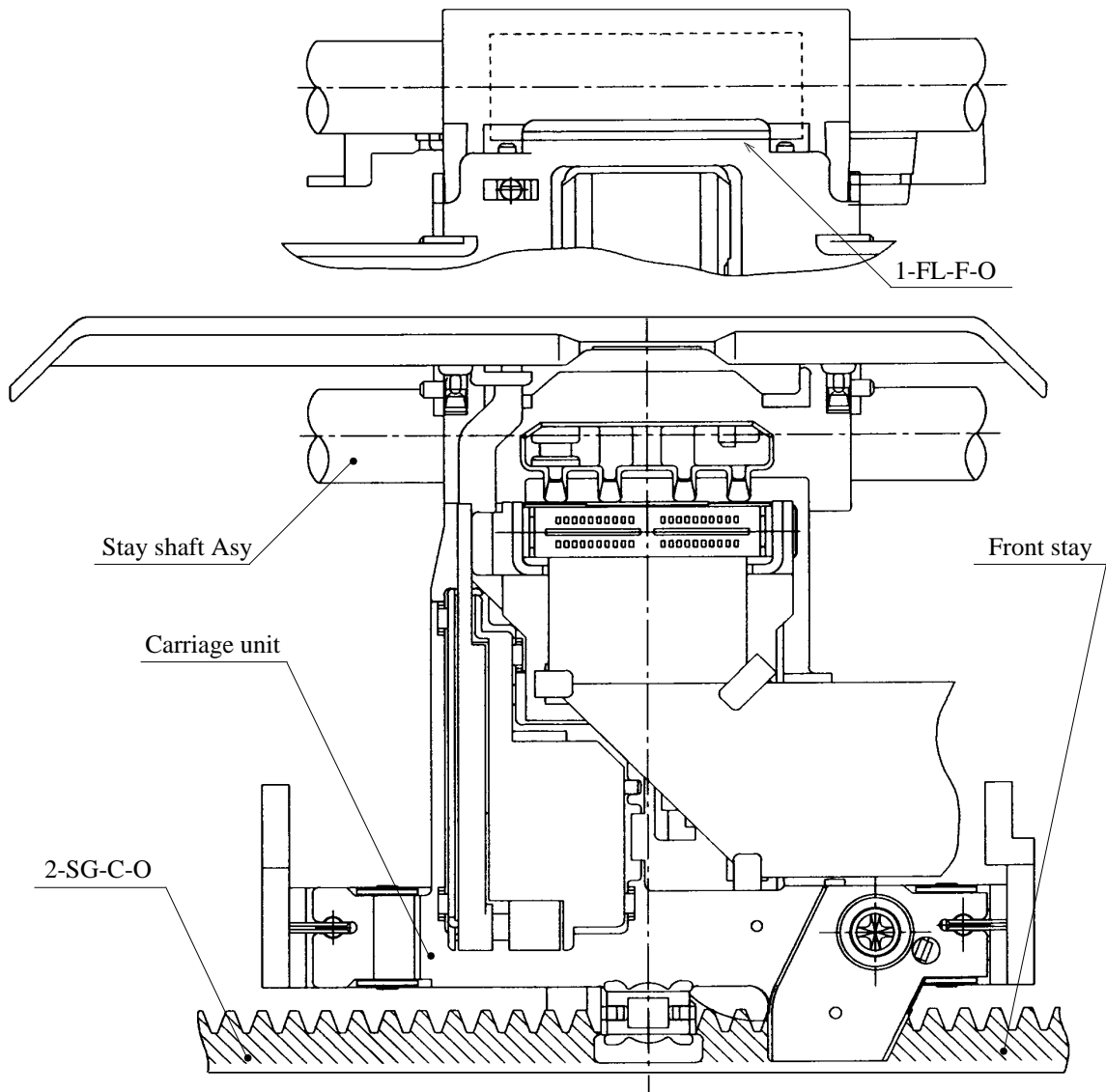
(3) LF gear bearing and continuous/single lever

No.	Oil	Amount	Location	Remarks
1	SG	C	Gear teeth (4 places) (Gear A, B, C, D)	
2	SG	C	Gear bearing (4 places) (Gear A, B, C, D)	
3	SG	C	Gear surface	Shaded portion
4	SG	C	Gear holder boss	



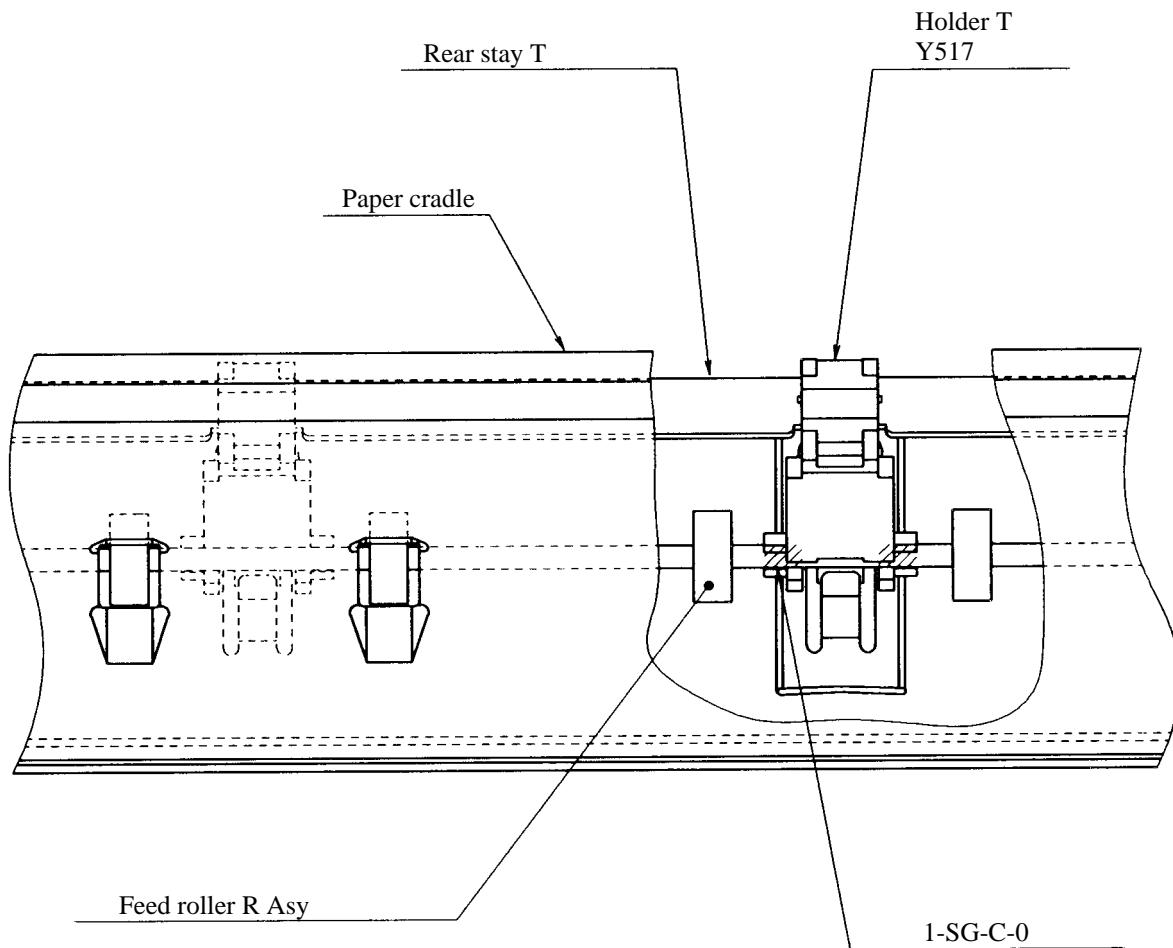
(4) Back cover assembly

No.	Oil	Amount	Location	Remarks
1	FL	F	Sliding section between carriage unit and stay shaft	Oil felt
2	SG	C	Sliding section between carriage unit and front stay	Shaded portion



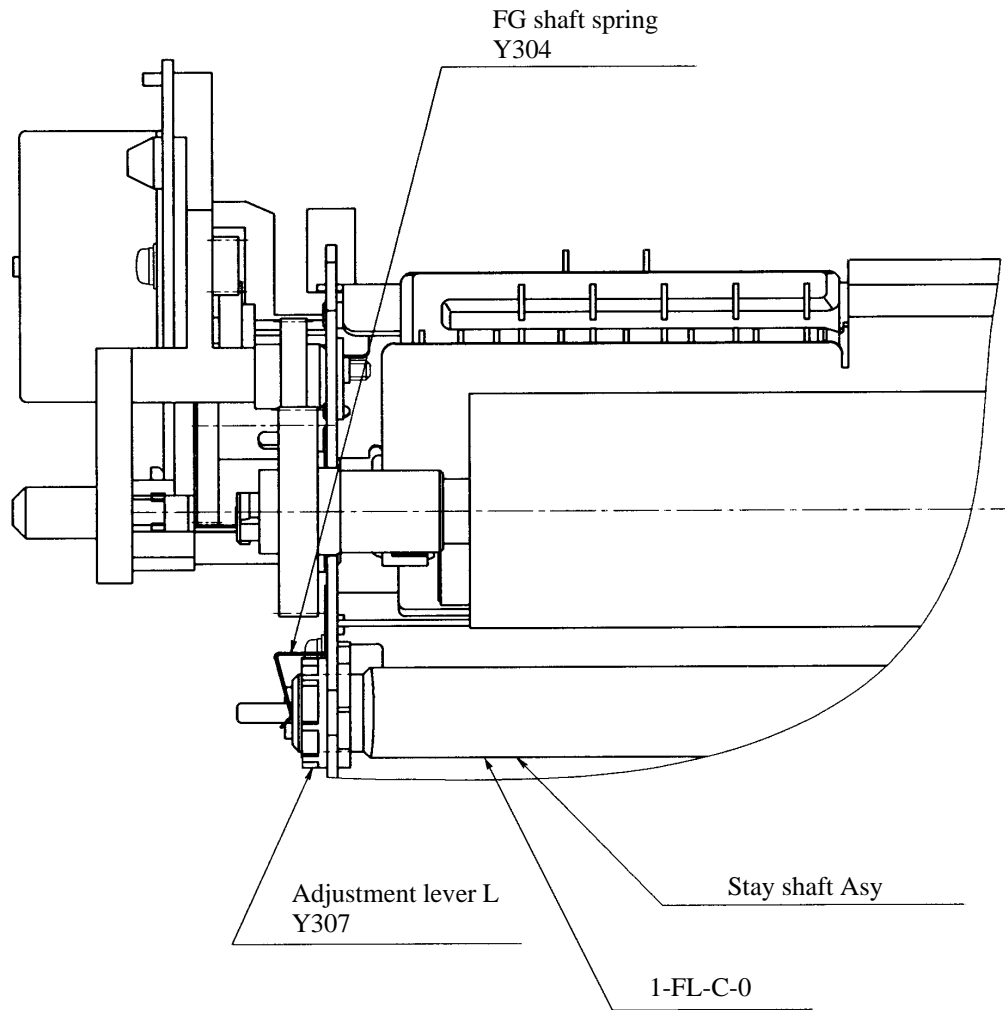
(5) Paper feed roller shaft

No.	Oil	Amount	Location	Remarks
1	SG	C	Feed roller shaft	



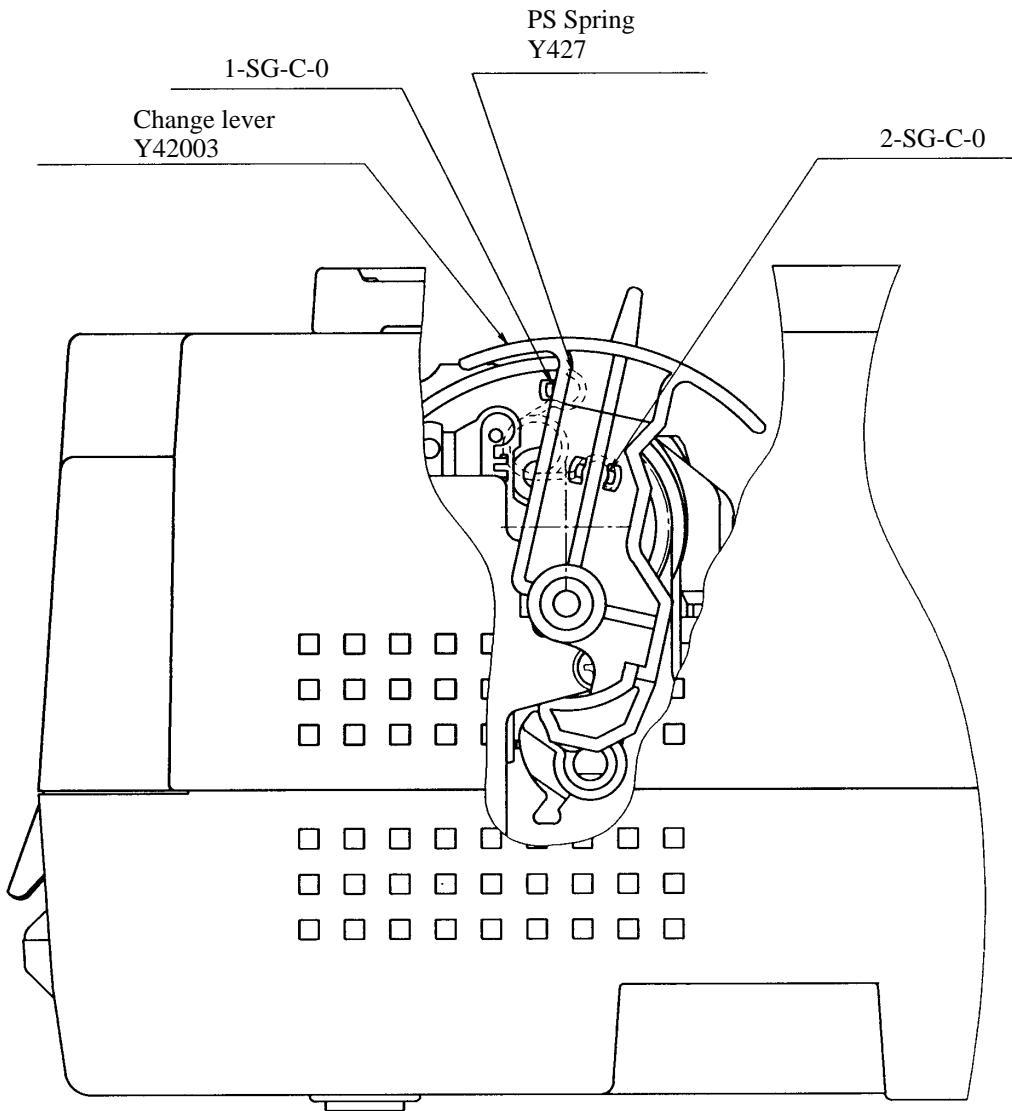
(6) Shaft

No.	Oil	Amount	Location lubricated	Remarks
1	FL	C	Stay shaft	



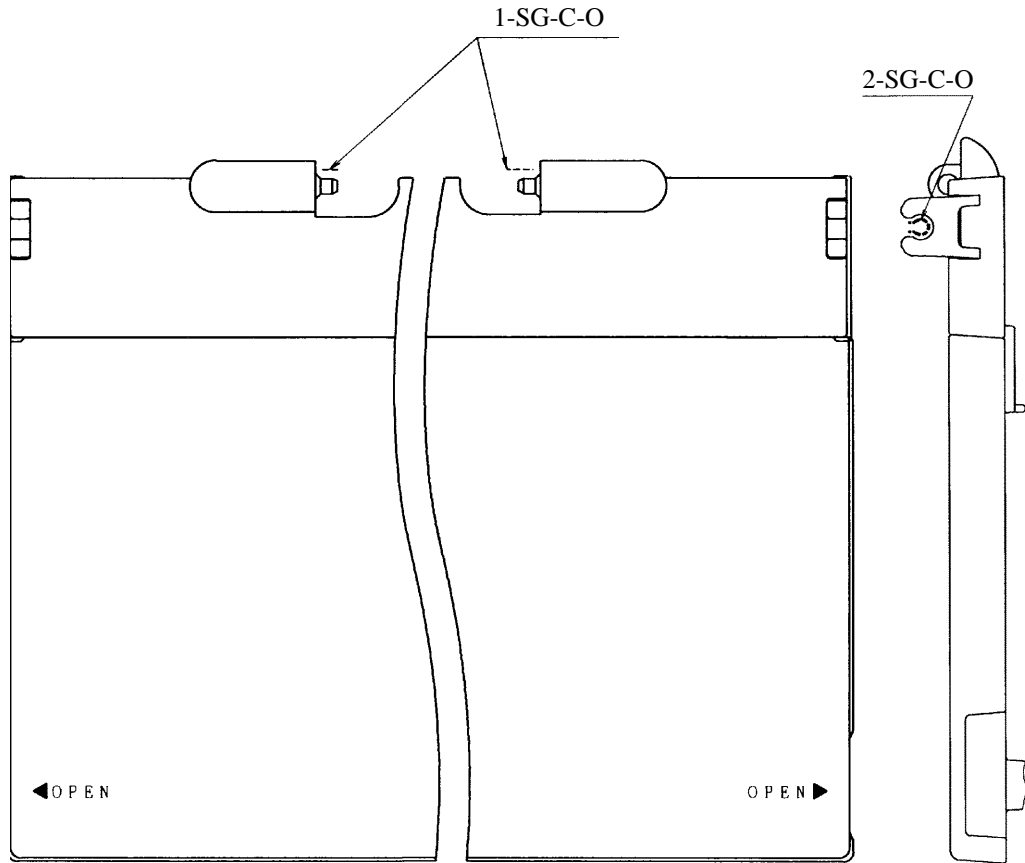
(7) Stay shaft

No.	Oil	Amount	Location	Remarks
1	SG	C	Gear holder boss	
2	SG	C	Change lever boss	



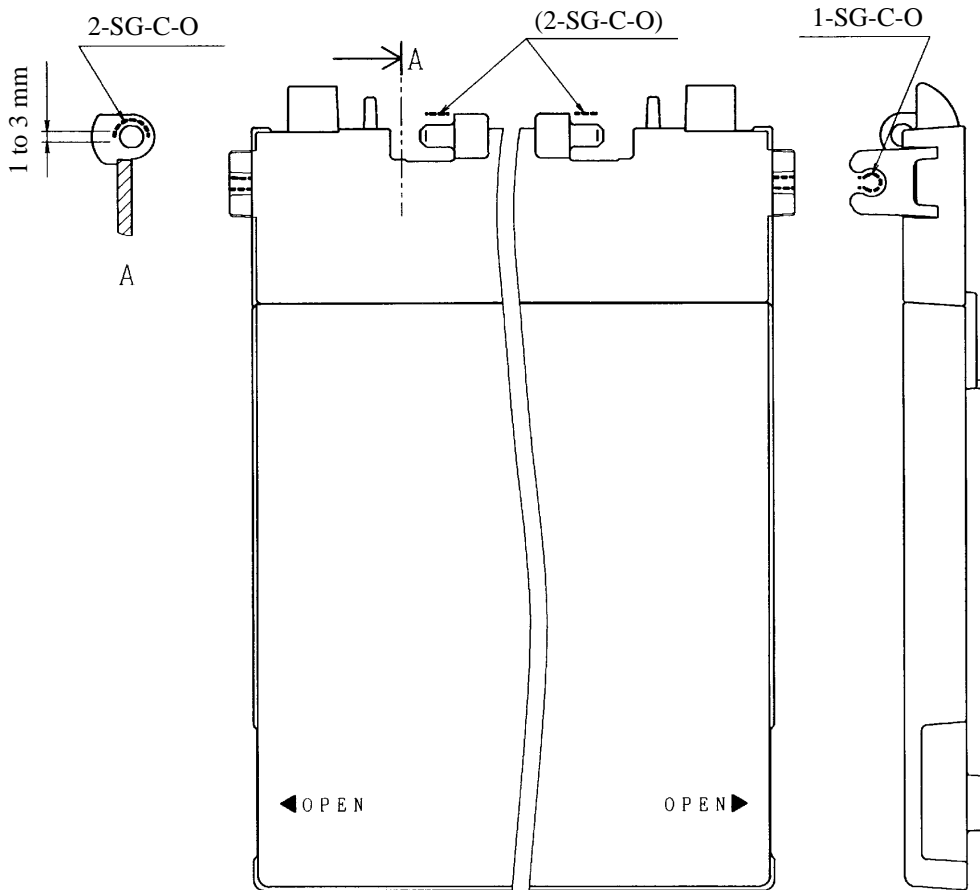
(8) Front and top covers (LA30N)

No.	Oil	Amount	Location	Remarks
1	SG	C	Hinge (two places)	Both sides
2	SG	C	Hinge (two places)	Both sides



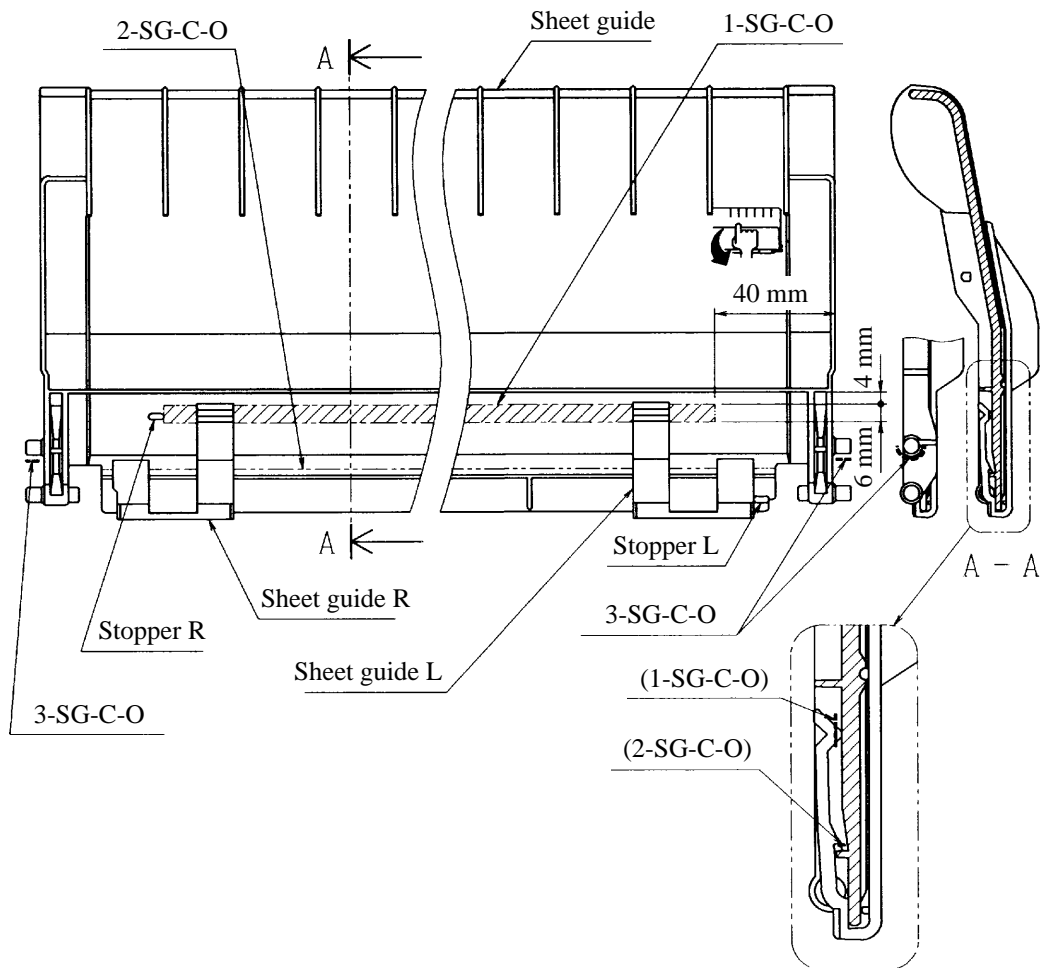
(9) Front and top covers (LA30W)

No.	Oil	Amount	Location	Remarks
1	SG	C	Hinge (two places)	Both sides
2	SG	C	Hinge (two places)	Both sides



(10)Sheet guide assembly

No.	Oil	Amount	Location	Remarks
1	SG	C	Sliding section	Wipe off excess oil after applying
2	SG	C	Sliding section	Wipe off excess oil after applying
3	SG	C	Boss (four places)	Wipe off excess oil after applying



(2) Checking printer performance

The self-test printing pattern includes the following:

- Header (If started from Set-Up mode)
- Help menu briefly explaining how to use buttons (If started from Set-Up mode)
- Repeated printing of 80 characters per line (ASCII Hex 21 to 7E and A0 to FE)

With a color printer (color kit installed printer), 80 characters per line are printed repeatedly using seven colors: black, magenta, cyan, violet, yellow, orange, and green.

The printed font is determined by a FONT option setting in the current active macro (Macro 1 or 2).

(3) Stopping self-test printing

- If self-test printing was started from Set-Up mode:
 - To exit self-test printing and return to Normal mode (Ready state), press the Set-Up/Quit button.
 - To exit self-test printing and return to the <Function> menu in Set-Up mode, press the Exit/Save button.
- If self-test printing was started with power-on:

Power off the printer.

4.10.2 Hex dump

In hex dump, the printer prints data and commands in 2-digit hexadecimal code. The interface operation is the same as online in Normal mode. It enables the checking of character sequences the computer sends to the printer as commands which are interpreted but not printed in regular mode. One line contains 16 two-digit hexadecimal codes and corresponding ASCII characters.

(1) Starting hex dump printing

1. Load continuous forms at least 203 mm (8 inches) wide onto the printer to avoid printing on the platen.
2. Set the printer in Hex Dump mode one of the following two ways:

- Power-on initiated self-test

Turn on the power switch while holding down the Protocol and Park buttons.

- Self-test in Set-Up mode

- a. Turn on the power switch while holding down the Pause button to enter Set-Up mode.
- b. Press the \emptyset button repeatedly to position the red cursor (on the plastic print guide) under TESTS then press the \rightarrow button.
- c. Press the \emptyset button to position the red cursor under HEX-DUMP then press the \rightarrow button.

Start an application program from the computer after the printer prints the header and hexadecimal 0 to F.

*** Hex dump printing ***

Page 1

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
01	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	0000000000000000
02	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	0101010101010101
03	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	! " # \$ % & ' () * + , - . /
04	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	0123456789:;<=>?
05	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	@ABCDEFGHIJKLMNO
06	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	PQRSTUVWXYZ[\]^_
07	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	`abcdefghijklmnop
08	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	pqrstuvwxyz{ }~?
09	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
10	90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F
11	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF	.i¢£.¥. \$¤©ª«...
12	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF	°±²³.µ¶·.¸¹º»¼½.¿
13	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	AAAAAAAAAÆÇÈÉÊËÌÍÎ
14	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DA	DB	DC	DD	DE	DF	.ÑÒÓÔÕÖØÙÚÛÜÝ.ß
15	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	EA	EB	EC	ED	EE	EF	àáâäåæçèéêëìíîï
16	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	FA	FB	FC	FD	FE	FF	.ñòóôõöøùúûüý..

(2) Stopping hex dump printing

- To halt or resume hex dump printing, use the Pause button.
- To exit Hex Dump mode, power off the printer.

4.10.3 Control panel maintenance functions initiated when power goes on

The printer provides several maintenance functions initiated by holding buttons down when power is turned on. Continue pressing until the printer beeps.

Table 4.4 Power-on-initiated maintenance

Button(s) pressed at Power On							Level of test	Type of test	Name of test
Pause	Font	Macro	Protocol	Park	LF	FF/Load			
							User	Logic	Internal logic test
●							User	Adjustment	Set-Up mode
						●	User	Adjustment	Printing test
			●				User	Self-test	Vertical alignment adjust
			●			●	Field	Self-test	Carriage motion test
	●		●				Field	Self-test	LA30N/W service test
	●					●	Field	Self-test	Print head pattern test
	●					●	Field	Adjustment	PLU-PLD test
		●	●	●			Field	Adjustment	Top-of-Form adjust
●		●	●				Field	Adjustment	EEPROM initialize I *
●	●	●					Field	Adjustment	EEPROM initialize II **
	●						User	Adjustment	Printer configuration print
			●	●			User	Adjustment	Hex Dump mode
		●	●				Field	Adjustment	Parallel port loopback test
		●		●			Field	Adjustment	Serial port loopback test
				●	●	●	Field	Adjustment	Menu access reset

●:Buttons to be held down when turning power on.

* Loads factory defaults into EEPROM and sets Normal mode.

Vertical alignment, Top-of-Forms adjustment, and left end adjustment values are not changed.

** Loads all factory defaults into EEPROM and sets Normal mode.

Vertical alignment, Top-of-Forms adjustment, and left end adjustment values are reset to their values.

CHAPTER 5 PRINCIPLES OF OPERATION

5.1 Overview

This section explains the principles of LA30N and LA30W operation. A microprocessor controls the following basic functions:

- Interface
- Carriage drive
- Print head drive
- Paper feed drive
- Ribbon shift drive (color option)

Figure 5.1 gives the function sequence:

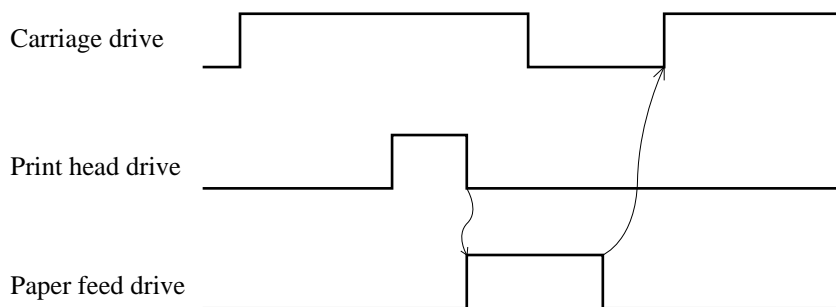


Figure 5.1 Function sequence

5.2 Mechanical Operation

5.2.1 Print head drive

The print head consists of 24 wires in six columns (see Figure 5.2). The print head has 24 electromagnets that drive armatures. When not printing, the armature is set at the stopper by the coil spring connected to the wire.

During printing, the coil for the dot to be printed is excited, the armature is drawn in the direction indicated by the arrow, and the armature pushes the wire in the same direction.

The wire is guided to the top of the print head through four wire guides. When the armature is attracted by the magnet, it snaps the wire against the ribbon, printing a dot.

When coil excitation ends, the armature is returned to the stopper by the coil spring's elasticity and waits for the next operation.

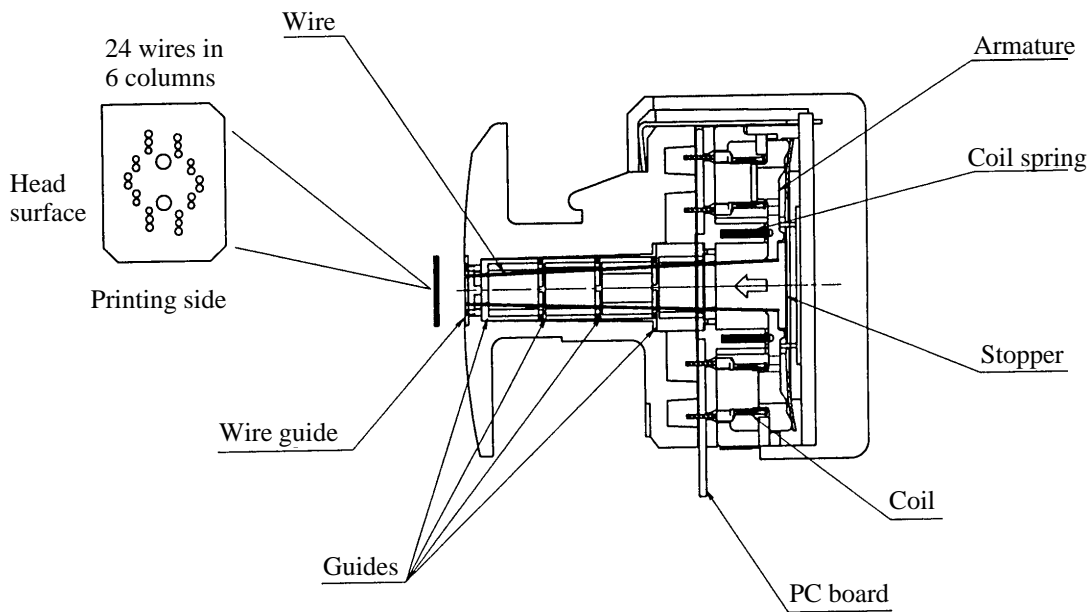


Figure 5.2 Print head

5.2.2 Carriage drive

The print head carriage is moved by the 4-phase space motor (SP motor in the recommended spare parts) in the left corner of the frame.

The drive pulley on the space motor shaft is connected to the tension pulley at the right corner of the frame through the timing belt.

The print head carriage is on the stay shaft parallel to the platen and the front stay (rack rail) fixed on the front of the frame so that it moves in parallel with the platen axis.

The print head carriage is fixed on a part of the timing belt so that it moves left or right along the platen as the space motor rotates.

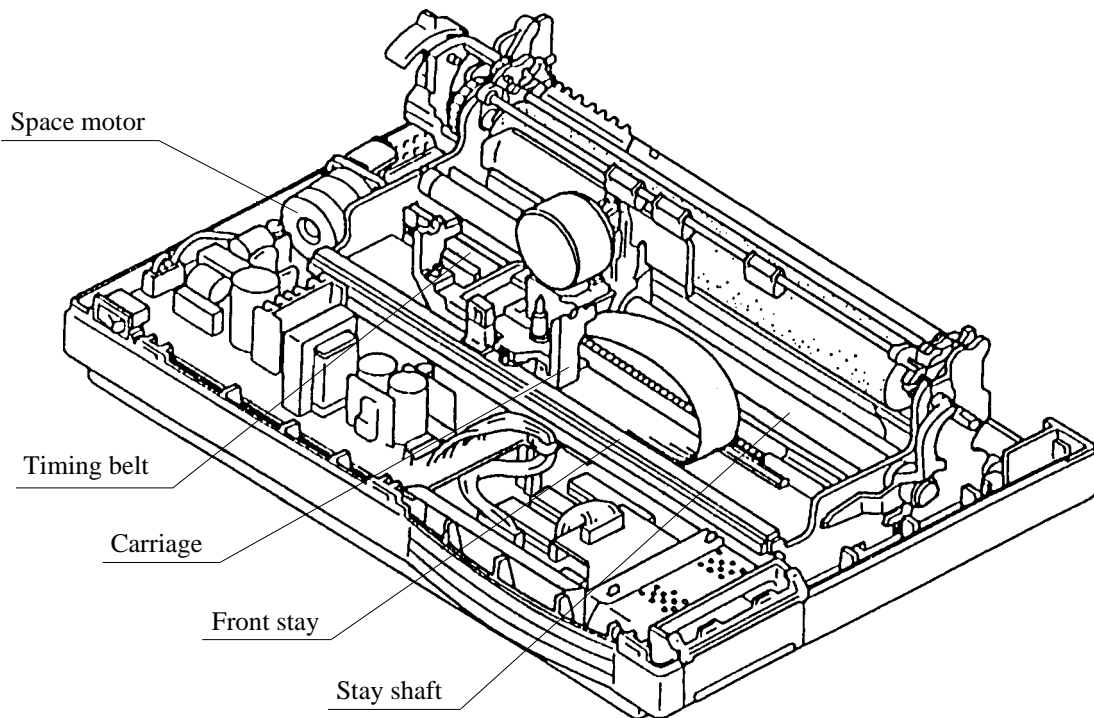


Figure 5.3 Carriage drive

5.2.3 Ribbon feed

Ribbon is fed by the ribbon feeder on the bottom of the print head carriage. This mechanism links carriage movement to ribbon movement so that the ribbon moves in one direction, regardless of whether the carriage moves left or right.

The ribbon feeder receives power from the front stay (rack rail) through the RF gear. Power is transmitted to gear C, a planet gear. Gear C engages one of two gears, depending on carriage movement. When the carriage moves from right to left, gear C directly engages the ribbon drive shaft gear. When the carriage moves from left to right, it engages the idle gear, which in turn engages the ribbon drive shaft gear.

The planet gear makes the ribbon drive shaft rotate in one direction (counterclockwise), regardless of its engagement.

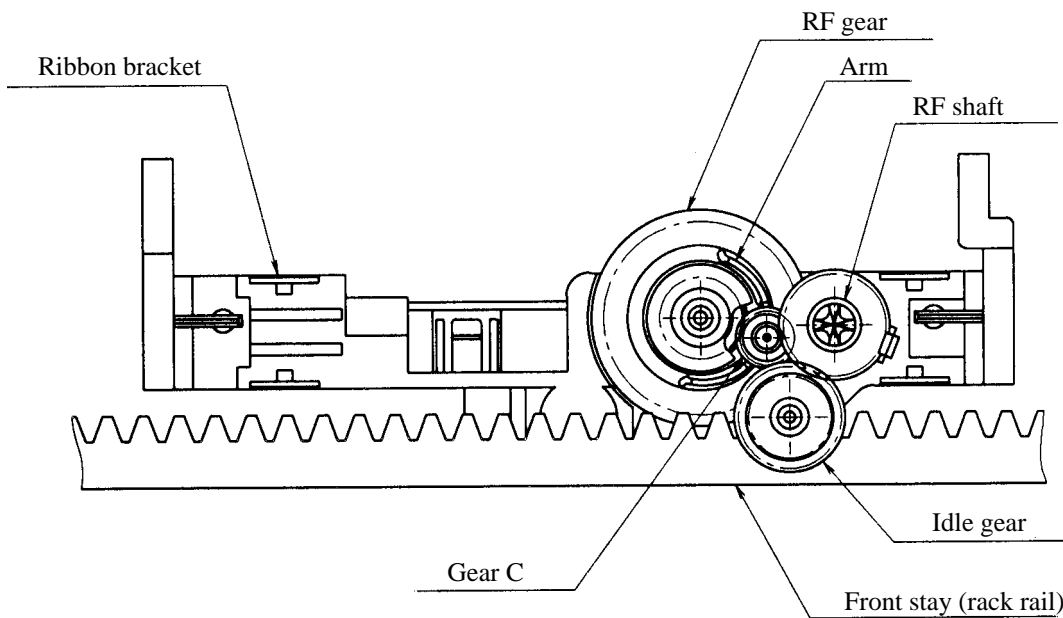


Figure 5.4 Ribbon feed

5.2.4 Paper feed

Paper is fed by the 4-phase paper feed motor (LF motor) on the left side of the frame which rotates the platen and operates the tractor unit.

The LF motor gear transmits power to the platen gear through idle gears A and B.

When the tractor unit is installed at the rear of the printer for use as a push tractor, the paper select lever is set toward the back of the printer (continuous forms side). With this setting, power is also transmitted to the tractor gear through idle gear C because this gear shifts along its shaft and engages both gear B and the tractor gear.

When the tractor unit is installed on the top of the platen for use as a pull tractor, the platen gear transmits power to the tractor gear through idle gear D. This power transmission is valid regardless of setting of the paper select lever, but the paper select lever must be set toward the back of the printer when the tractor unit is used as a pull tractor.

Continuous forms are fed by both the tractor unit and the platen. Cut sheets are fed by the platen only. These operations are explained in the sections that follow, together with autoloading/unloading and paper end detection.

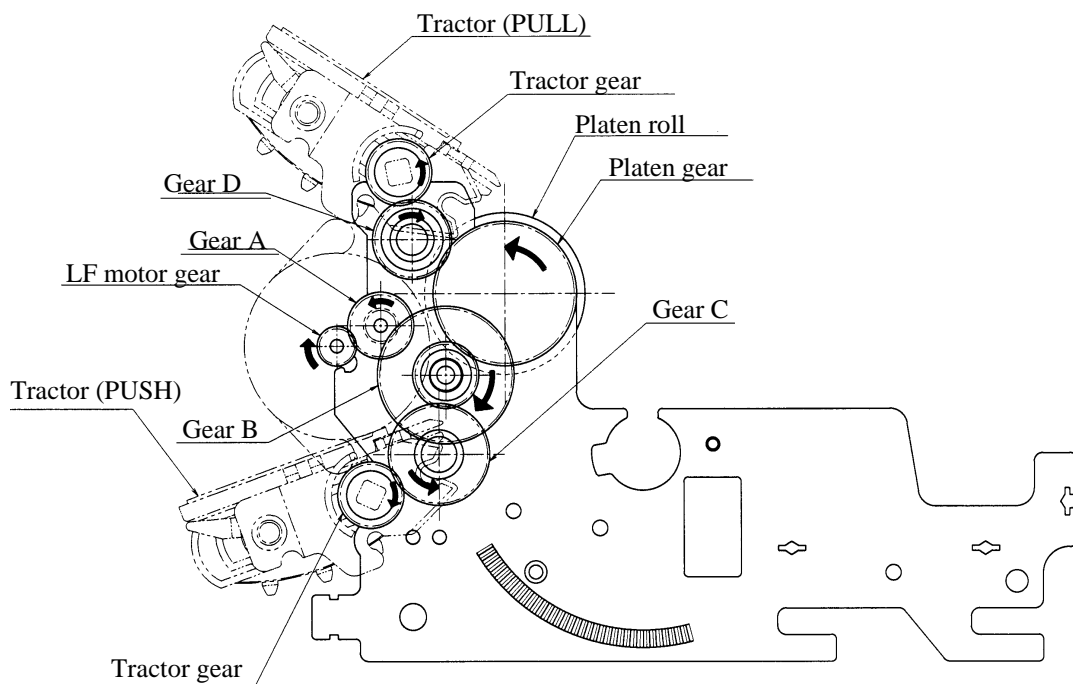


Figure 5.5 Paper feed path

(1) Continuous forms feeding

A pair of left and right pin belt tractors on the square tractor shaft feed continuous forms. The tractor is installed above the printer as a pull tractor or on the back as a push tractor.

a. Push tractor

Continuous forms, fed by pin belt tractors, advance along the card guide on the carriage, then move up over the platen. After passing the card guide, forms are pinched by the platen and bail rollers to remove slack.

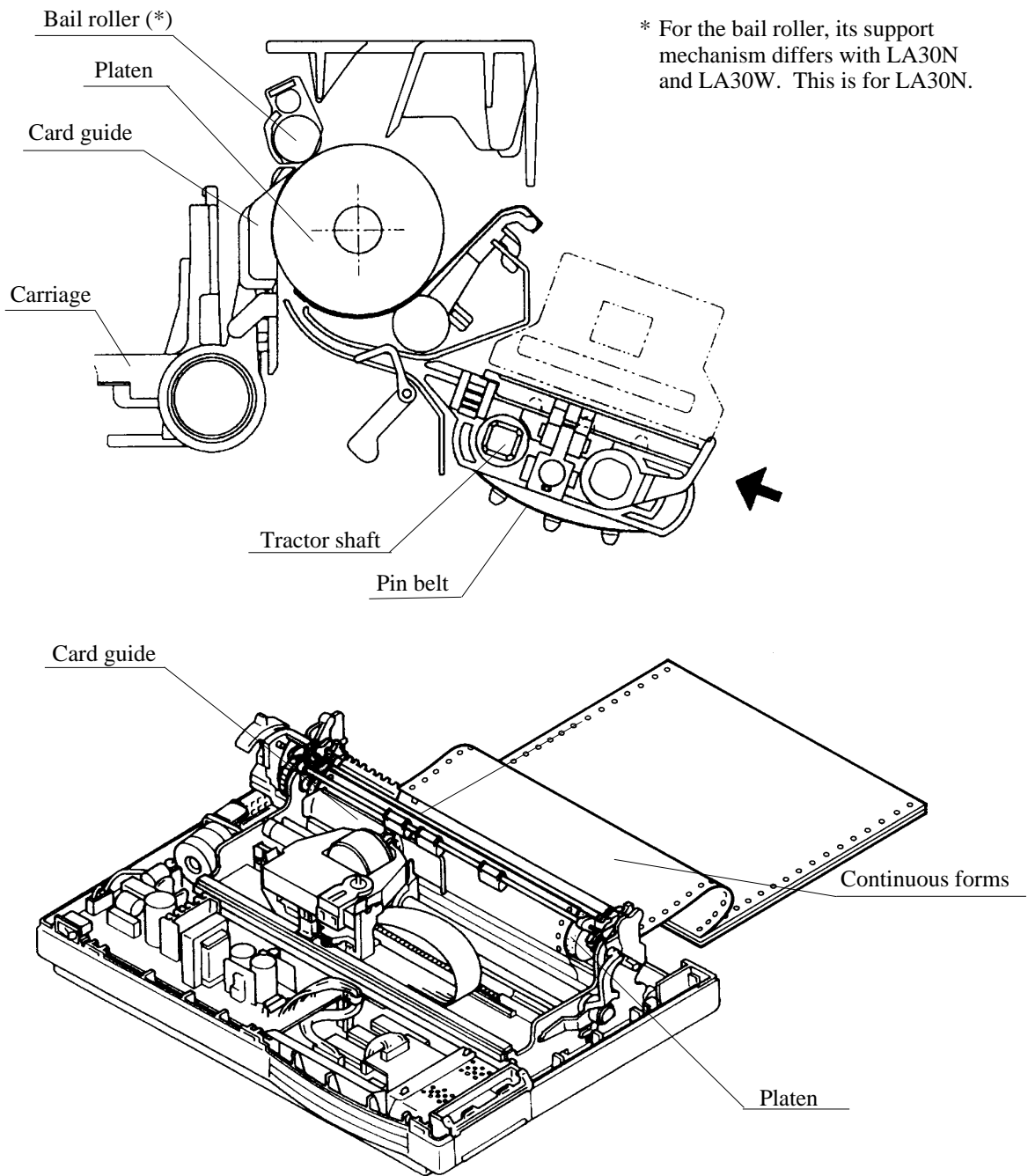


Figure 5.6 Continuous form feeding (push-feed tractor)

b. Pull tractor

Continuous forms fed from the bottom slot, advance along the card guide on the carriage, then, move up over the platen.

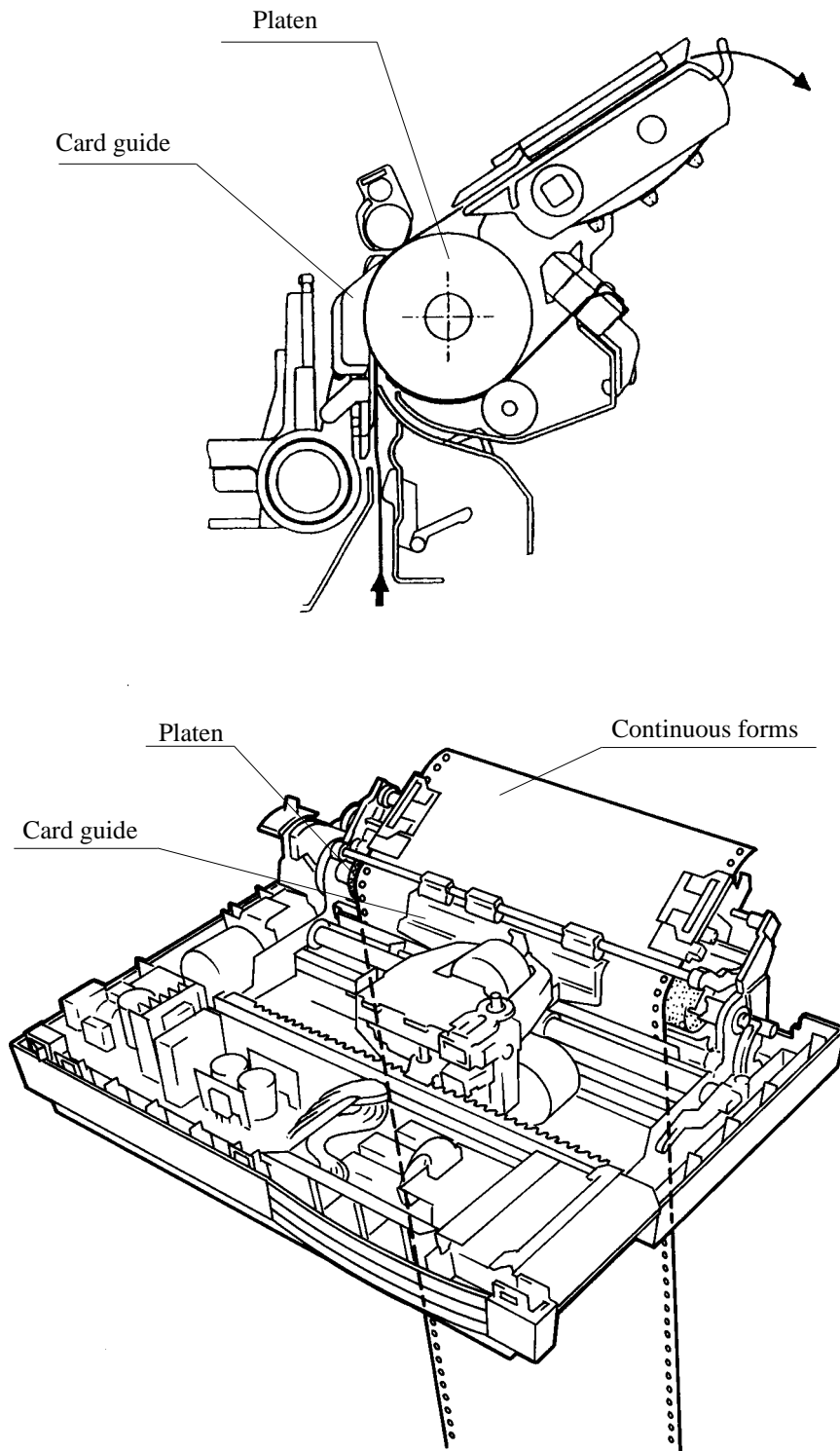


Figure 5.7 Continuous form feeding (pull-feed tractor)

(2) Cut-sheet feeding

As the platen rotates, a cut sheet is pinched between the feed roller and platen and fed forward.

To pass the printing section, the sheet is guided by the card guide and fed further between the bail roller and the platen.

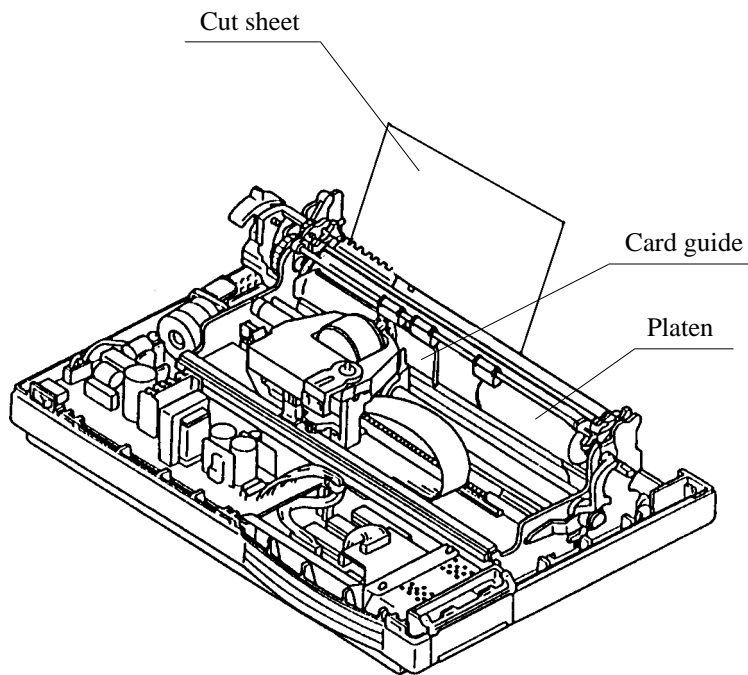
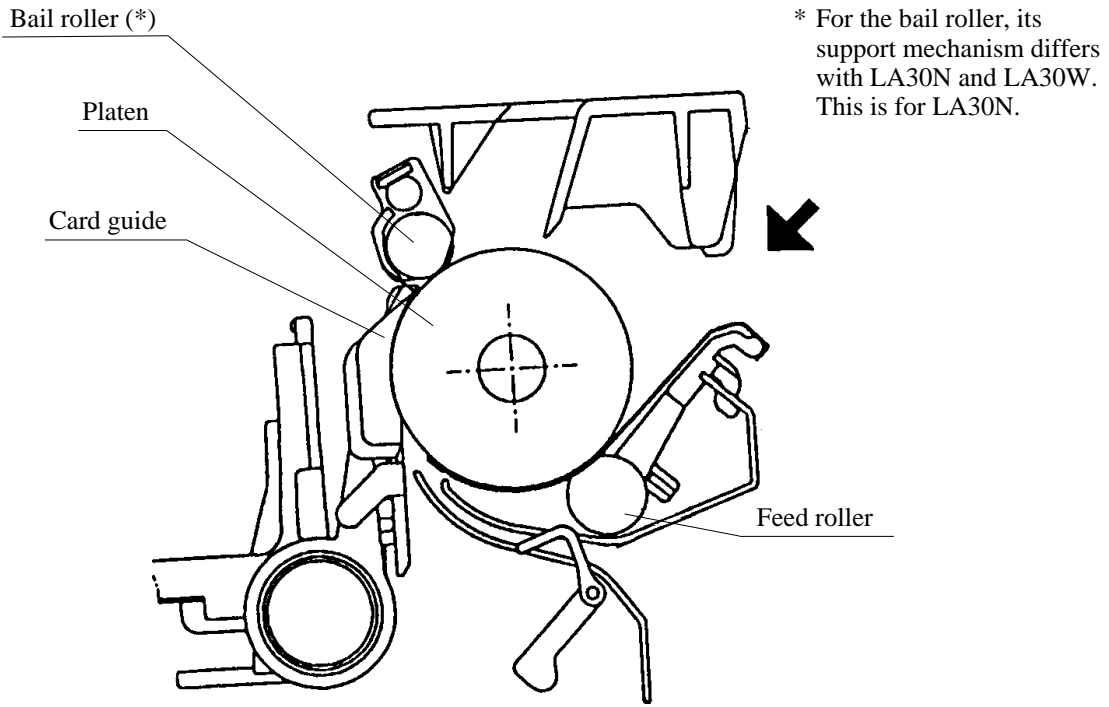


Figure 5.8 Cut-sheet feeding

(3) Paper selection

Since continuous forms and cut sheets are fed differently, the paper feed mechanism is based on the type of paper.

When the paper select lever is switched from the continuous forms location (back) to the cut-sheet location (front) as shown below, gear C slides off the tractor gear and stops transmitting rotation to the continuous forms feed tractor. At the same time, the paper select lever operates the link mechanism then activates the microswitch to indicate the cut-sheet select status. The printer is now ready to feed cut sheets.

To change the printer back to the continuous forms selection (either push tractor feed or pull tractor feed), turn the paper select lever to the continuous forms location (back).

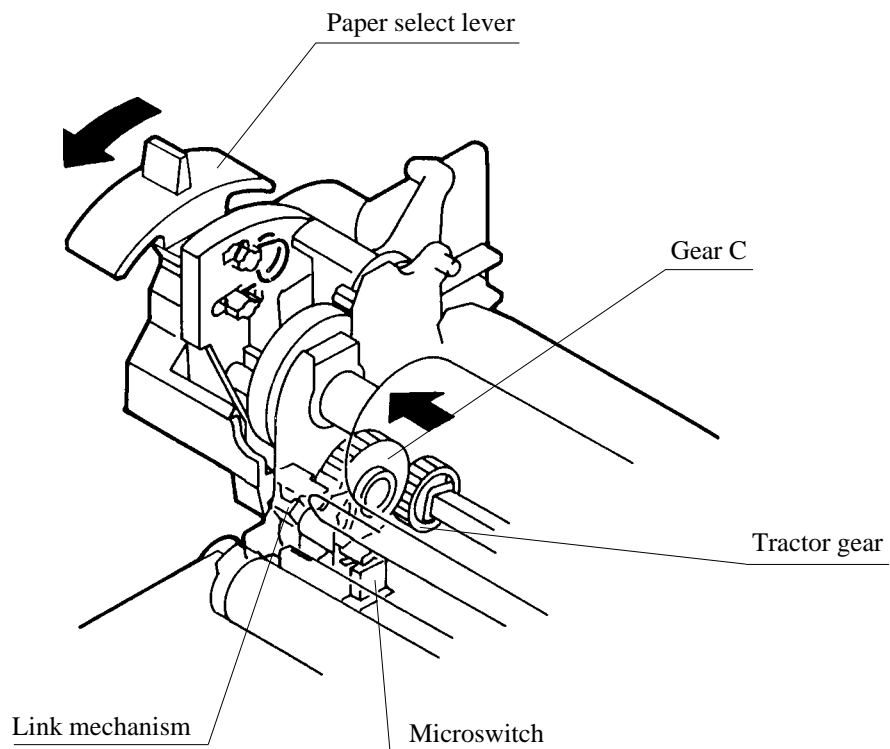
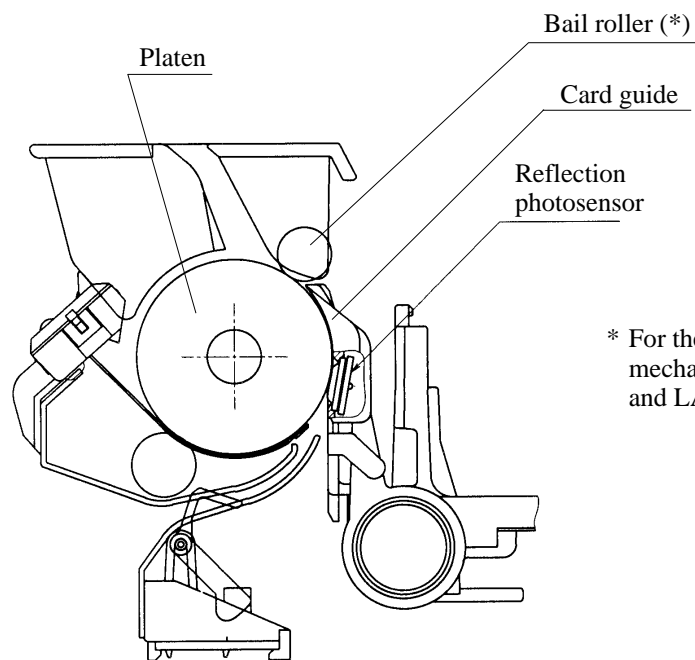


Figure 5.9 Paper selection

(4) Autoloading

In autoloading, paper is loaded up to a specified position without turning the platen knob. Once the FF/Load button on the control panel is pressed, the carriage moves to the center. The LF motor then drives the paper feed mechanism to feed paper. Paper is guided by the card guide on the carriage and pinched between the bail rollers and the platen. Paper is always loaded up to the specified position which is set separately for cut sheets and continuous forms. The paper is loaded until it is detected by the reflection photosensor on the card guide.



* For the bail roller, its support mechanism differs with LA30N and LA30W. This is for LA30W.

Figure 5.10 Autoloading

- a. Continuous forms (push tractor only)
 1. Turn the paper select lever back.
 2. Load continuous forms onto the tractor.
 3. Press the FF/Load button.
- b. Cut sheets
 1. Turn the paper select lever forward.
 2. Load a cut sheet onto the cut-sheet stand.
 3. Press the FF/Load button.

(5) Paper end detection

a. Cut sheet

The presence of paper and paper near end position are detected by sensor A, an interrupt photosensor in the sensor T assembly. When there is paper, the paper shields the sensor light path.

The top edge of paper is detected by sensor B, a reflection photosensor on the card guide. When paper is not loaded, the light emitted from the photosensor is not reflected because the platen is black. When paper is loaded, the light is reflected from paper.

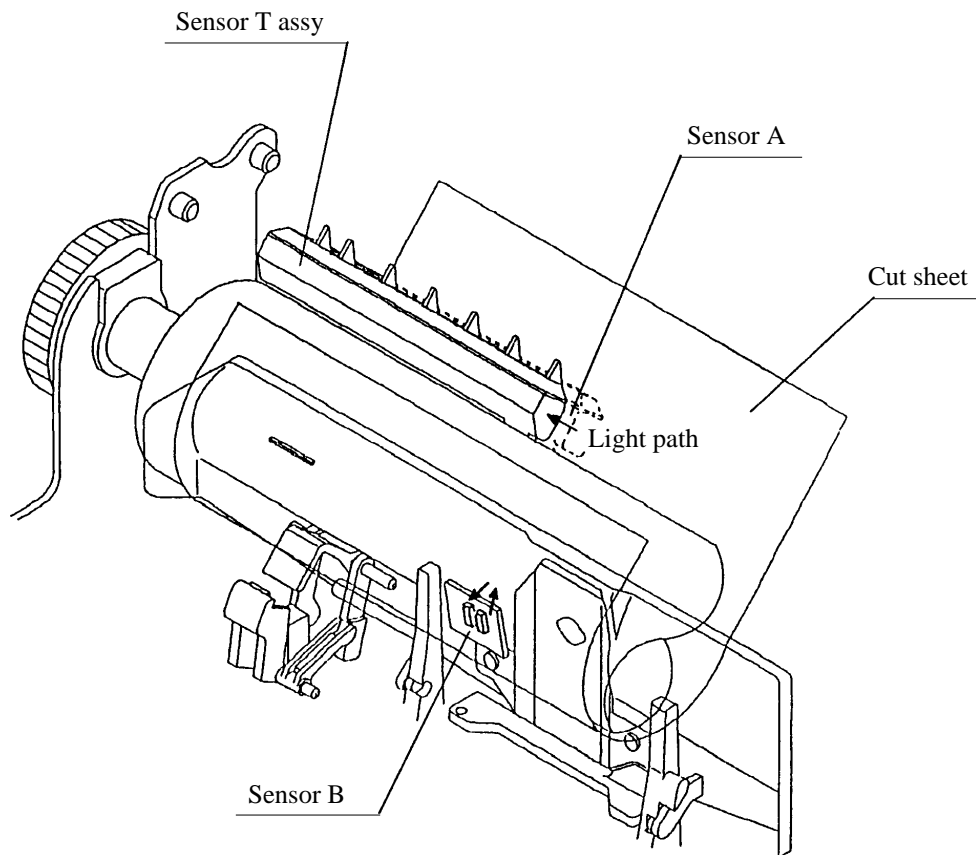


Figure 5.11 Paper end detection (cut sheet)

b. Continuous forms fed via push tractor

The top of continuous forms is detected by sensor B (detailed in Figure 5.11) and by feeler 1 linked to sensor C, an interrupt sensor.

The feeler 1's movement is transmitted to the sensor shield lever. When there is paper, the paper pushes down feeler 1 and the shield lever opens the sensor light path.

Paper end is detected by feeler 2 on the tractor unit. It is approximate 80 mm from the print position.

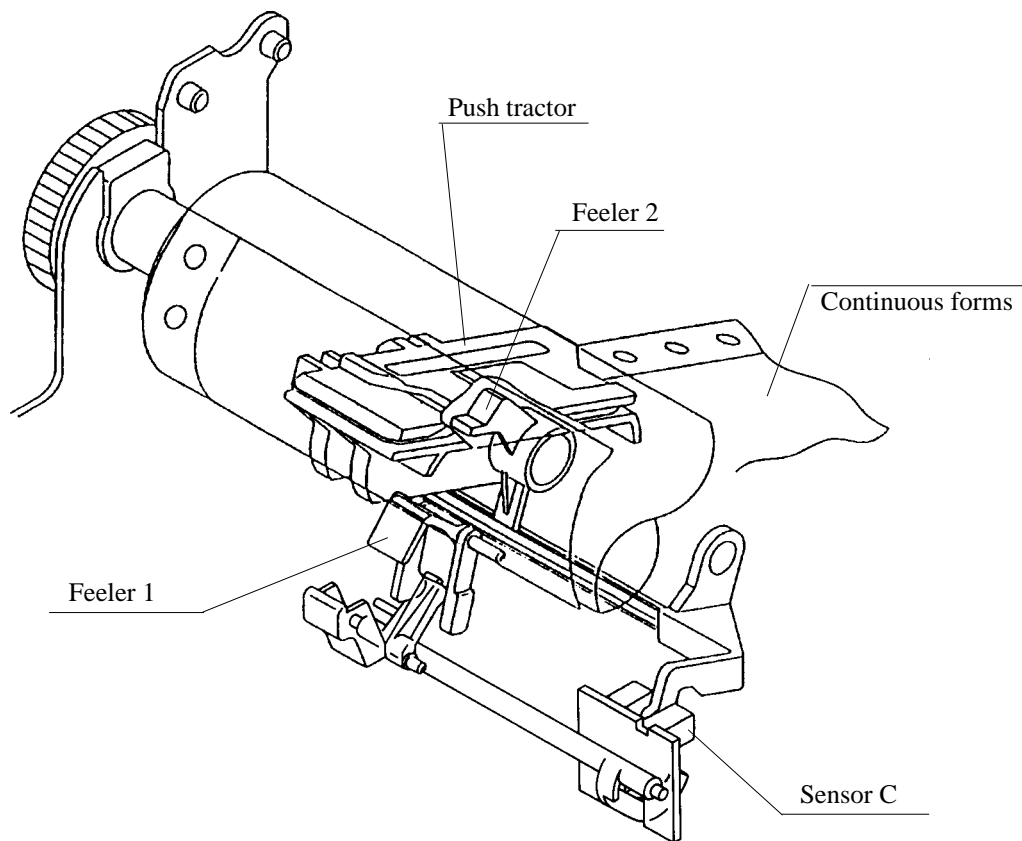


Figure 5.12 Paper end detection (continuous forms via push-feed tractor))

c. Continuous forms fed via pull tractor from the bottom slot

Paper end is detected by feeler 3 linked to sensor C (detailed in Figure 5.12).

It is approximate 35 mm from the print position.

d. Continuous forms fed via pull tractor from the rear side

Paper end is detected by feeler 3 linked to sensor C.

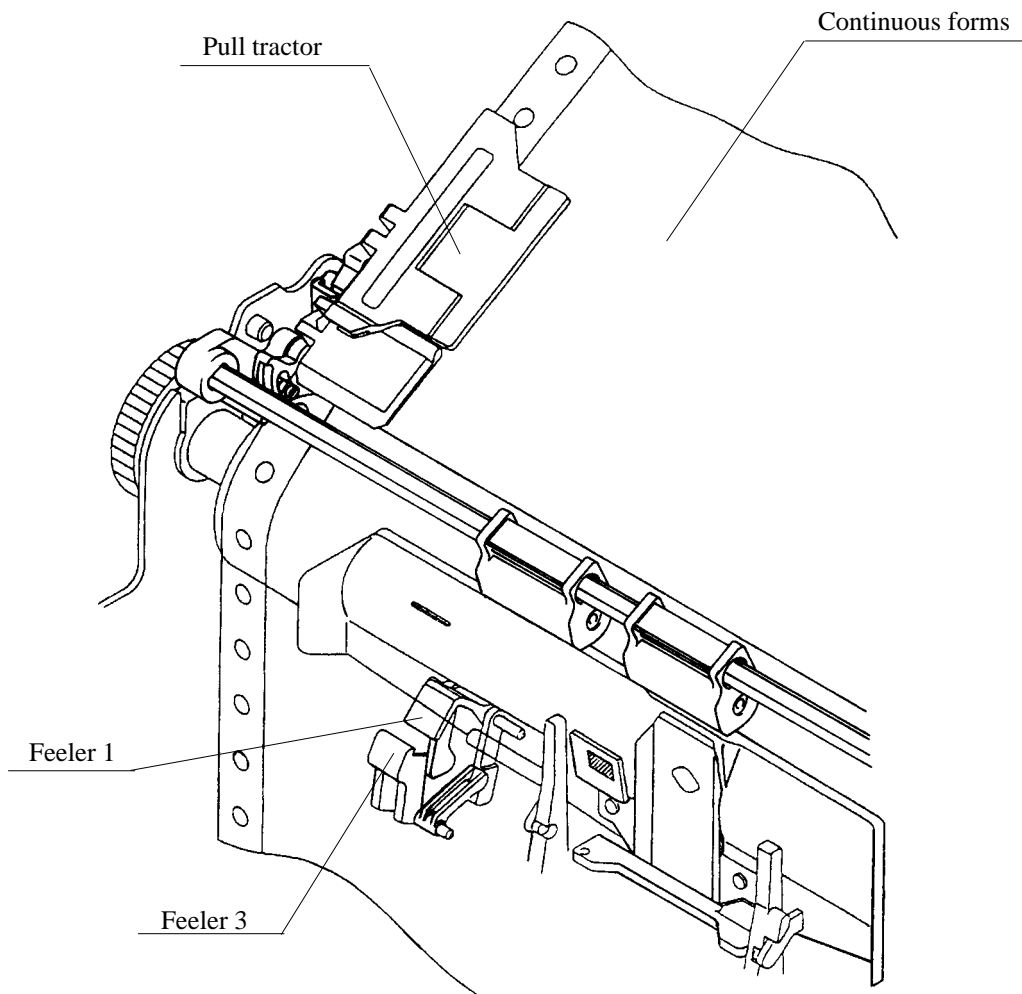


Figure 5.13 Paper end detection (continuous forms via pull-feed tractor)

5.2.5 Print head gap control (paper thickness adjustment)

The print head is mounted on the carriage which is guided by the stay shaft. The stay shaft is eccentric because it has adjustment levers R and L, on each side, that engage eccentrically with side frames. Turning levers adjusts the parallelism of the stay shaft to the platen, thus making the print head gap equal between right end and left end.

The eccentric stay shaft is also rotated by the copy control lever which is linked to the paper thickness lever. The paper thickness lever is set toward the platen to reduce the gap or away to increase it. The paper thickness lever is adjustable to nine different locations (1 to 5 and A to D), each corresponding to about a 0.05 mm change in the gap.

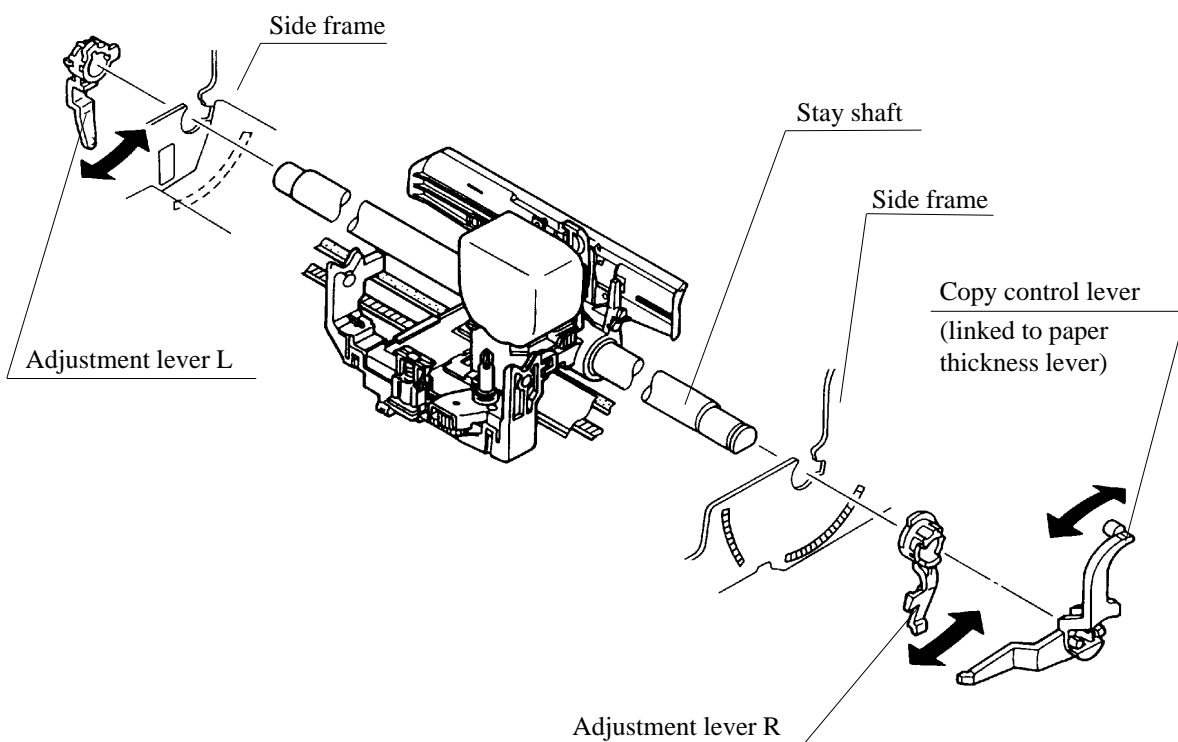


Figure 5.14 Print head gap control

5.2.6 Color ribbon shift motor (option)

The stepping motor turns the eccentric cam to move the ribbon shift lever, which lifts the color ribbon cartridge to the location of a selected color (one of the four colors).

If a monochrome ribbon cartridge is loaded, the color printer works as a monochrome printer.

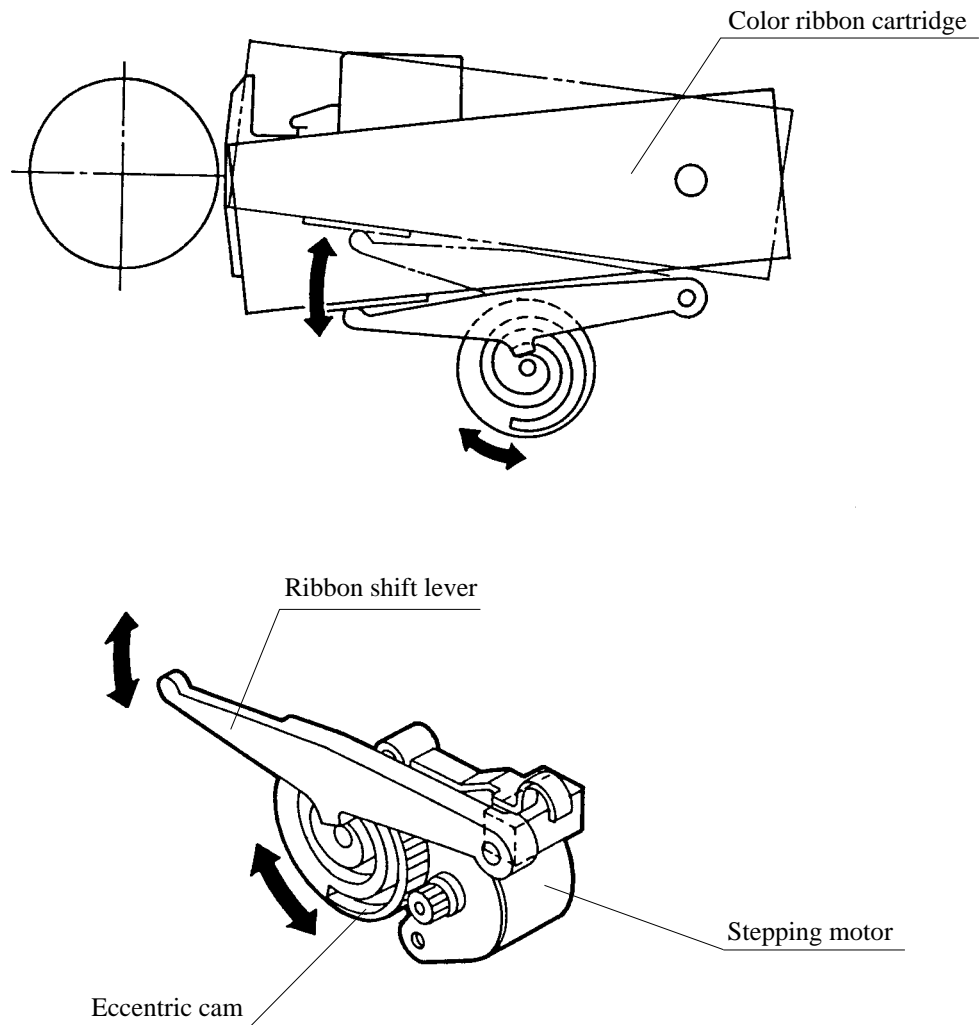


Figure 5.15 Color ribbon shift motor

5.2.7 Option detection mechanism

This printer has the mechanism that automatically detects whether the tractor unit is installed as a push tractor or a pull tractor.

Installing the tractor unit at the rear of the printer pushes down the feeler and raises shield plate A as shown below. The photosensor on the bottom of the carriage detects this condition and determines that the push tractor is mounted.

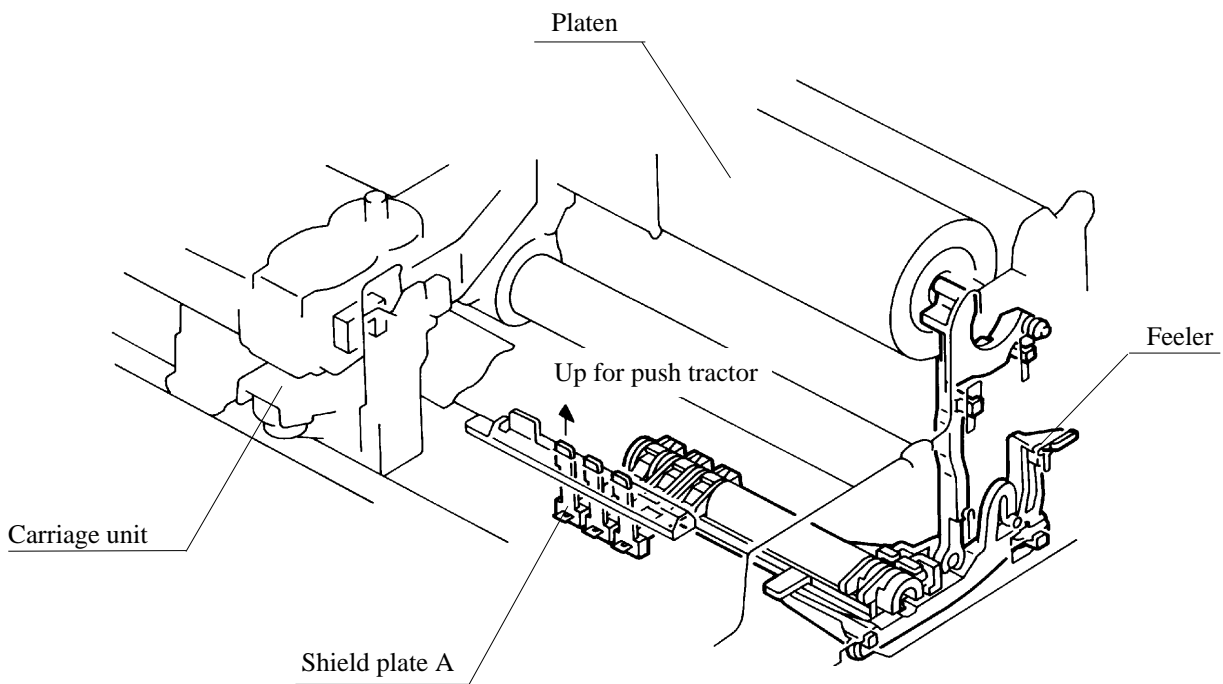


Figure 5.16 Option detection mechanism

5.3 Electrical Operation

This section briefly explains circuits and how they operate.

5.3.1 System configuration

The LGHIC (includes Fujitsu MB90706 MPU) receives data and commands from the host computer and controls the printing mechanism (Figures 5.17 and 5.18).

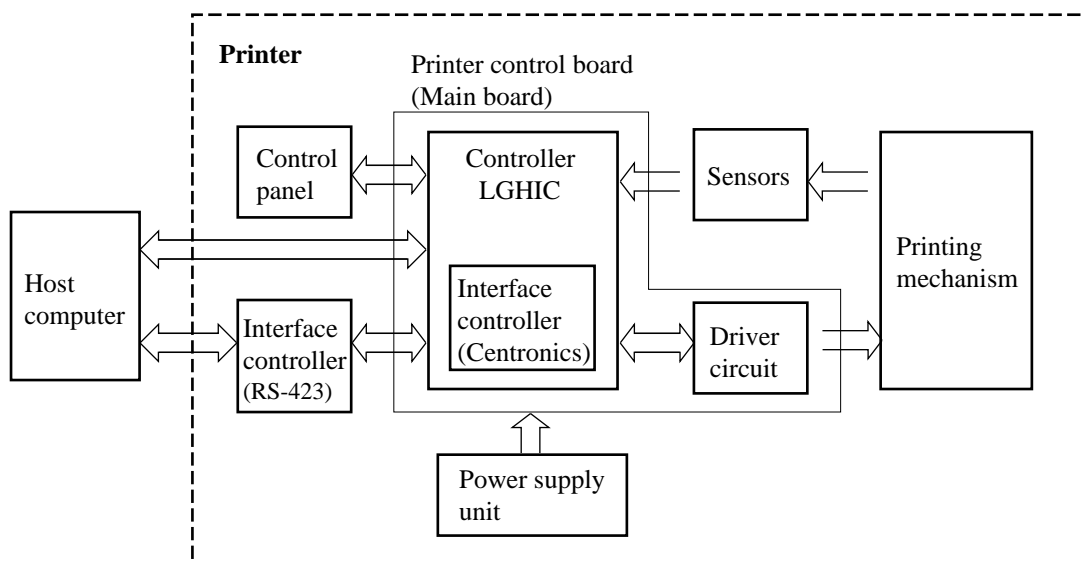


Figure 5.17 System configuration

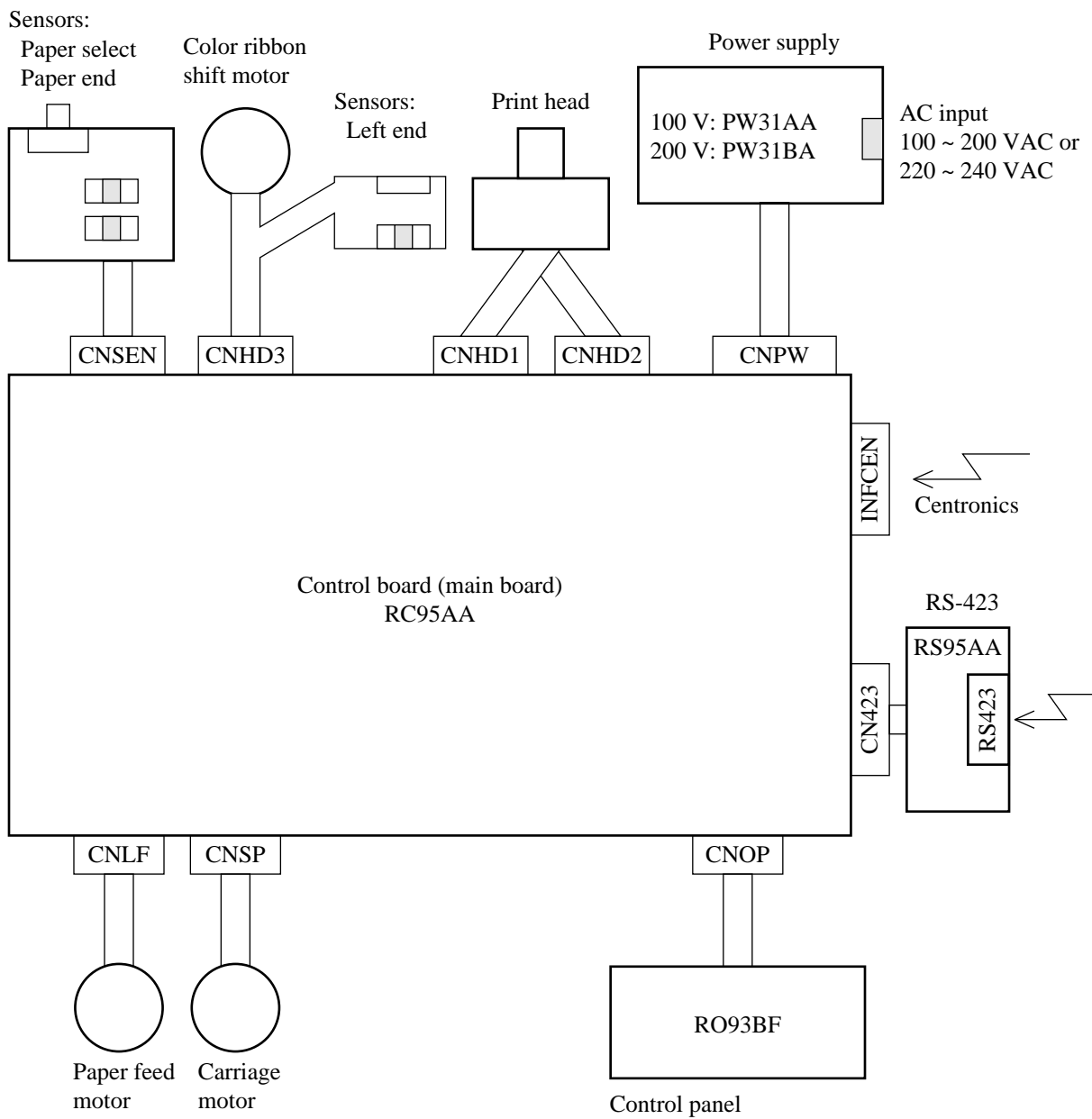


Figure 5.18 Connection diagram

The LA30N/LA30W controller (Figure 5.17) consists of an printed circuit board, called the printer control board or the main board with ROM. The MPU controls operation under control of programs in ROM.

(1) Printer control board (ROM board)

The printer control board governs the interface, memory, and mechanism. It is also called ROM board. The name on the Recommended Spare Parts List is “main board with ROM”.

Interface:

The LA30N/LA30W provides two types of interface — Centronics parallel and RS-423 serial. Interface drivers and receivers convert signals voltage levels.

Controller:

The controller consists mainly of the customized LGHIC, alarm detector (voltage comparator), and reset controller. The LGHIC controls interface communication with the computer and memory devices, RAM, ROM, motor drivers, and print head pin magnet drivers (Figures 5.20 and 5.21).

Memory:

Memory consists of program ROM, character generator (CG) ROM, RAM, and EEPROM.

Drivers:

Drivers include print head and motor drivers and an alarm detector (voltage comparator). The print head and motor drivers increase power, and supply it to the print head, the carriage motor, the paper feed motor, and the optional ribbon shift motor.

Alarm detector:

The alarm detector checks the level of +34 V for each driver and the temperature of the print head.

(2) Power supply unit

The power supply unit supplies power to logic and driver circuits on the printer control board.

(3) Sensors

Sensors (phototransistors and a microswitch) detect status of the printing mechanism such as left-end position of the carriage, paper presence on the platen, setting position of the paper select lever, and installation of options.

(4) Control panel

The control panel — (7 push-buttons, 16 LEDs, a buzzer, and a control LSI) enables the user to communicate with the printer.

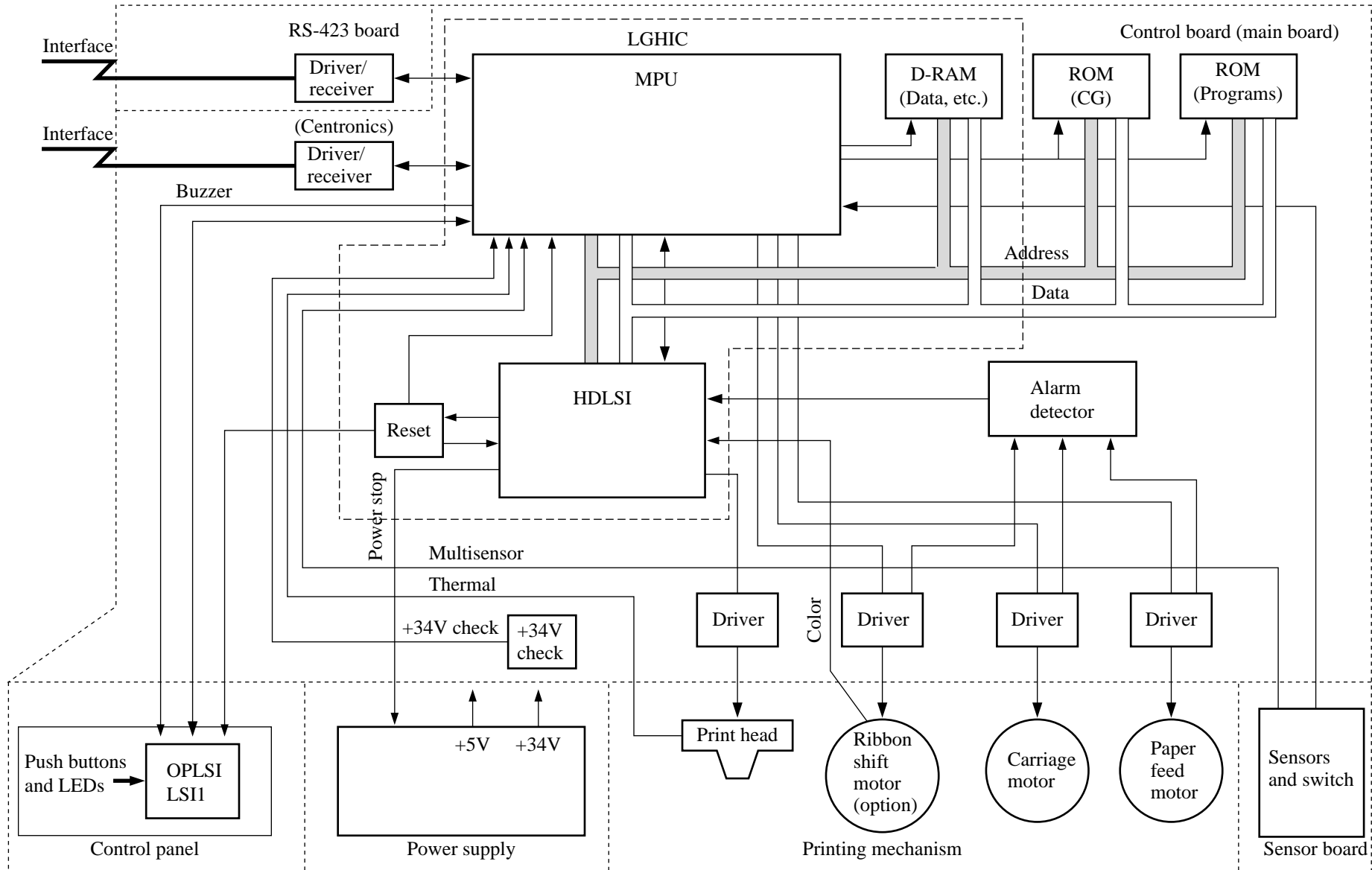


Figure 5.19 Controller block diagram

The MPU (MB90706) has the following main functions:

- Timing controller
- Dynamic RAM controller
- Address decoder
- Interface controller
- Motor controller

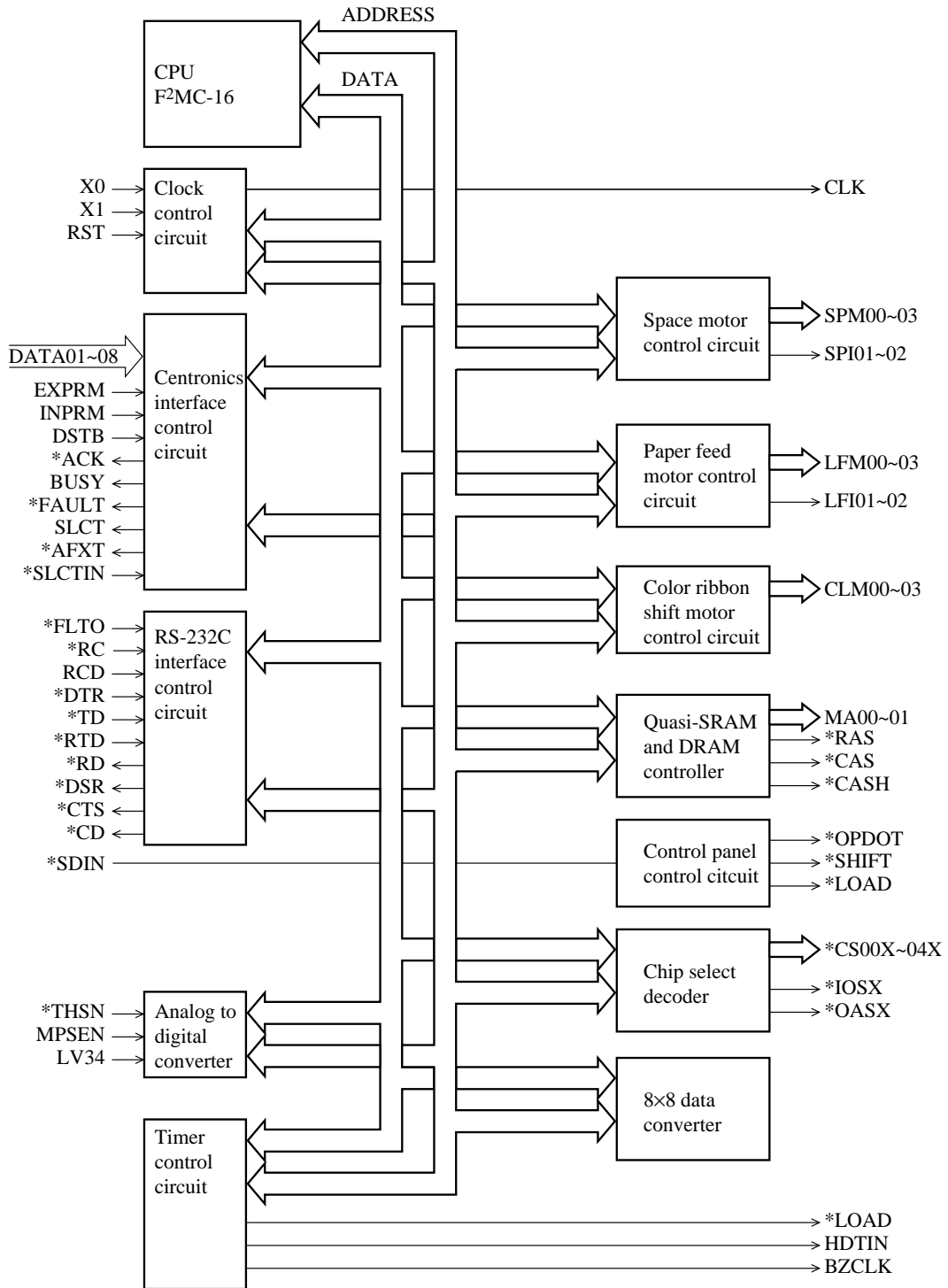


Figure 5.20 MB90706 block diagram

The HDLSI(LSI 2: MBCU20050) has the following main functions:

Head pin magnet drive controller
Output port

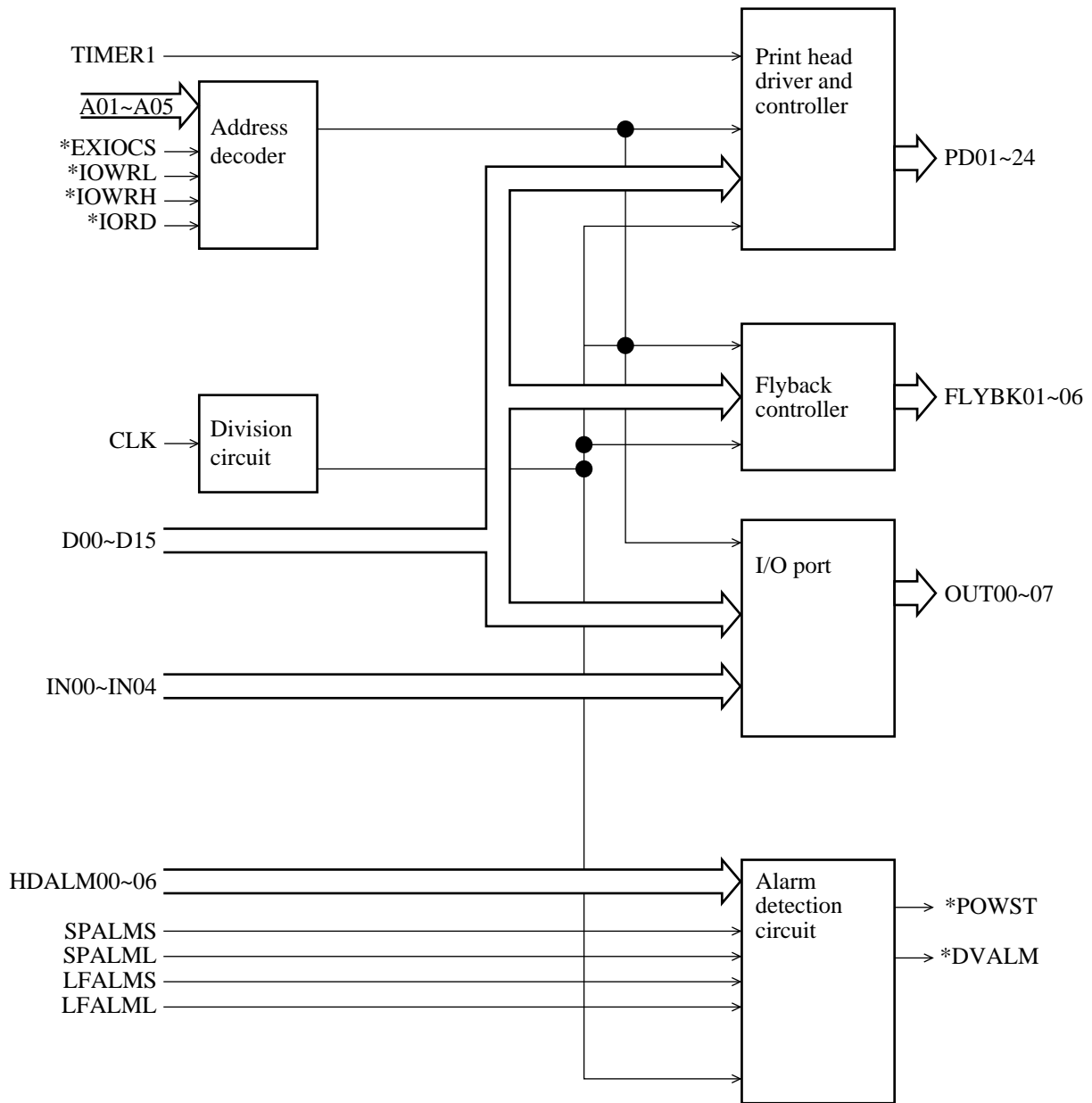


Figure 5.21 MBCU20050 block diagram

5.3.2 Main controller

The main controller circuit of the printer — the MB90706 MPU — has a bus connected to 4M-bit ROM, two-16M-bit ROMs, 128K word x 16-bit RAM, and a control LSI. Firmware functions are built into the 4M-bit ROM and one of the two 16M-bit ROMs is reserved for optional CG data.

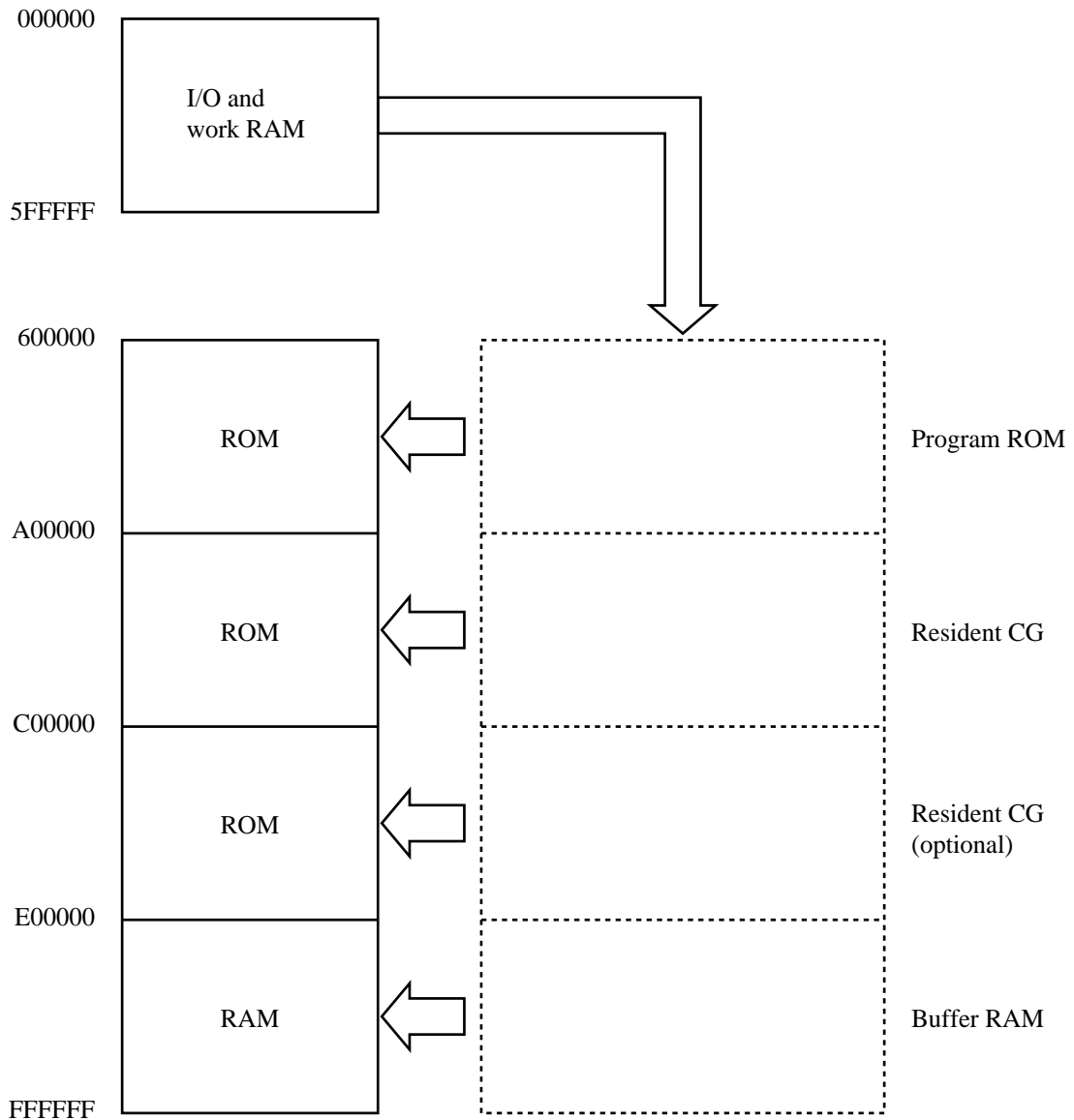


Figure 5.22 Memory configuration

Main firmware ROM has a capacity of 4M bits and contains resident emulation programs.

Table 5.1 shows the memory address map.

Table 5.1 Memory address map

Address area (hex)	Size (bytes)	Read/Write	Description
000000 ~ 0000BF	192	Read/Write	I/O area (direct addressing)
0000C0 ~ 0000FF	64		I/O area (external)
000100 ~ 00037F	640		Work RAM (direct addressing)
000380 ~ 5FFFFFFF	5.9M		Work RAM (extended addressing)
600000 ~ DFFFFFFF	8M	Read	Program access
E00000 ~ EFFFFFFF	1M	Read	Program access (extended)
		Write	RAM (extended)
F00000 ~ FFFFFFFF	1M	Read	Program access
		Write	RAM (receive/download buffer)

Two programs — the initialization program and the program first read to the MPU — are installed in ROM. The MPU starts operating after these programs are executed from ROM. The printer uses different address areas for the resident character generator and work RAM.

5.3.3 Interface control

(1) Centronics parallel interface

Received data DATA1 to DATA8 is latched to the internal MPU register just after the falling edge of the Strobe signal *DSTB. The BUSY signal goes high.

The MPU recognizes that data has been received and stores the information in the receive buffer or processes it immediately. After the operation finishes, the MPU issues the *ACK signal and the BUSY signal goes low.

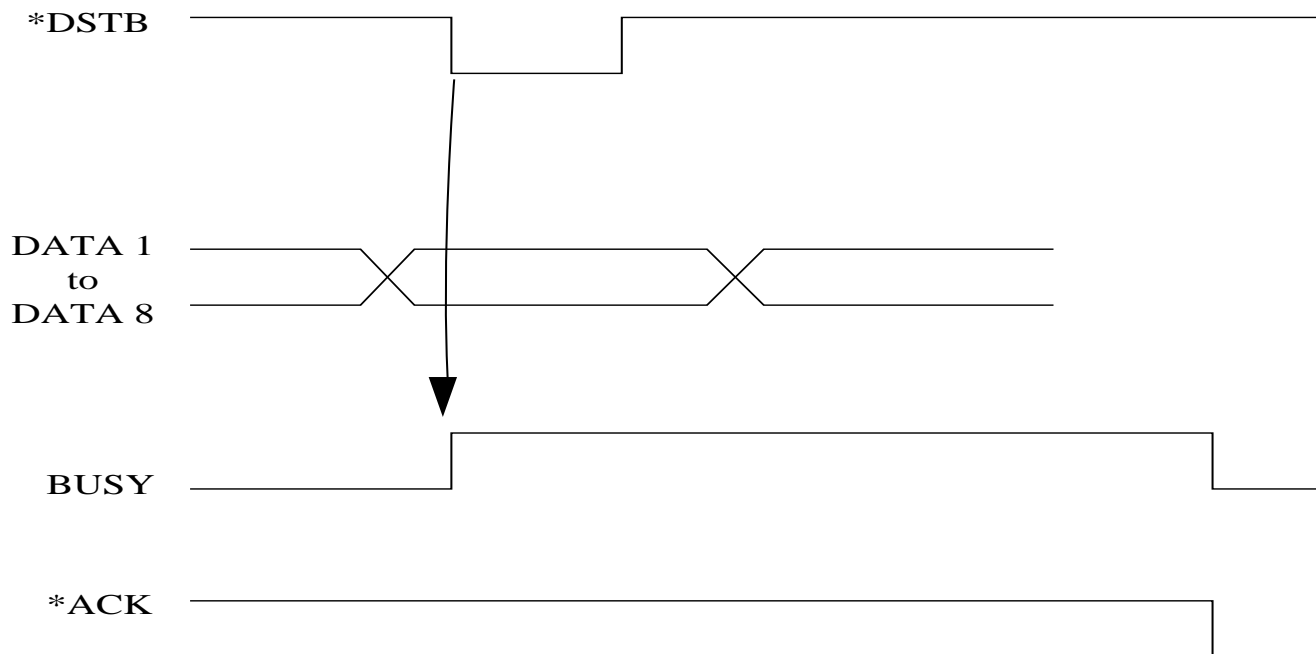
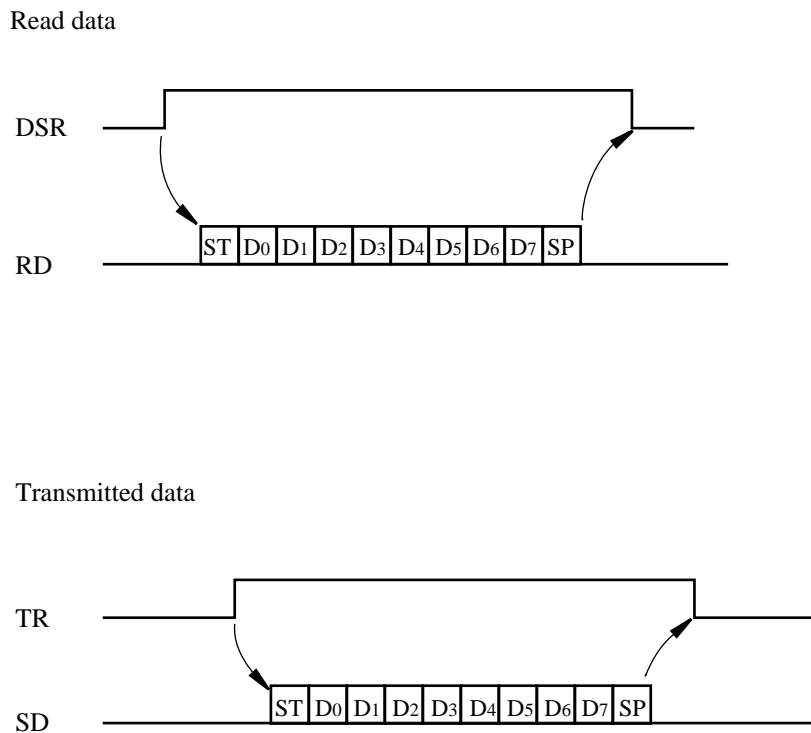


Figure 5.23 Centronics parallel interface signal timing

(2) RS-423 serial interface

The serial interface control circuit is basically the same as the Centronics circuit, except that it has a serial-parallel converter. Serial data sent to the interface circuit input terminal is converted to TTL by the receiver IC and applied to the MPU (MB90706), which converts serial data to parallel. The MPU recognizes that data has been received and stores the information in the receive buffer or processes it immediately. The MPU may send out buffer status information such as DC1/DC3 (buffer near empty or buffer full) from the serial interface output terminal, depending on the selected protocol. It may also change the status such as DTR (ready to accept data) under certain protocols.



Note:

If the signal line TR is open, the printer ignores control related to this signal.

Figure 5.24 RS-423 serial interface signal timing

5.3.4 Carriage motor control

The 4-phase carriage motor, is driven by a constant current chopper drive circuit and six control signals:

- SPM0: This signal drives phase A of the carriage motor.
- SPM1: This signal drives phase B of the carriage motor.
- SPM2: This signal drives phase C of the carriage motor.
- SPM3: This signal drives phase D of the carriage motor.
- SPI1, 2: These signals switch the carriage motor phase current. Four current levels can be selected for high speed, low speed, and stop.

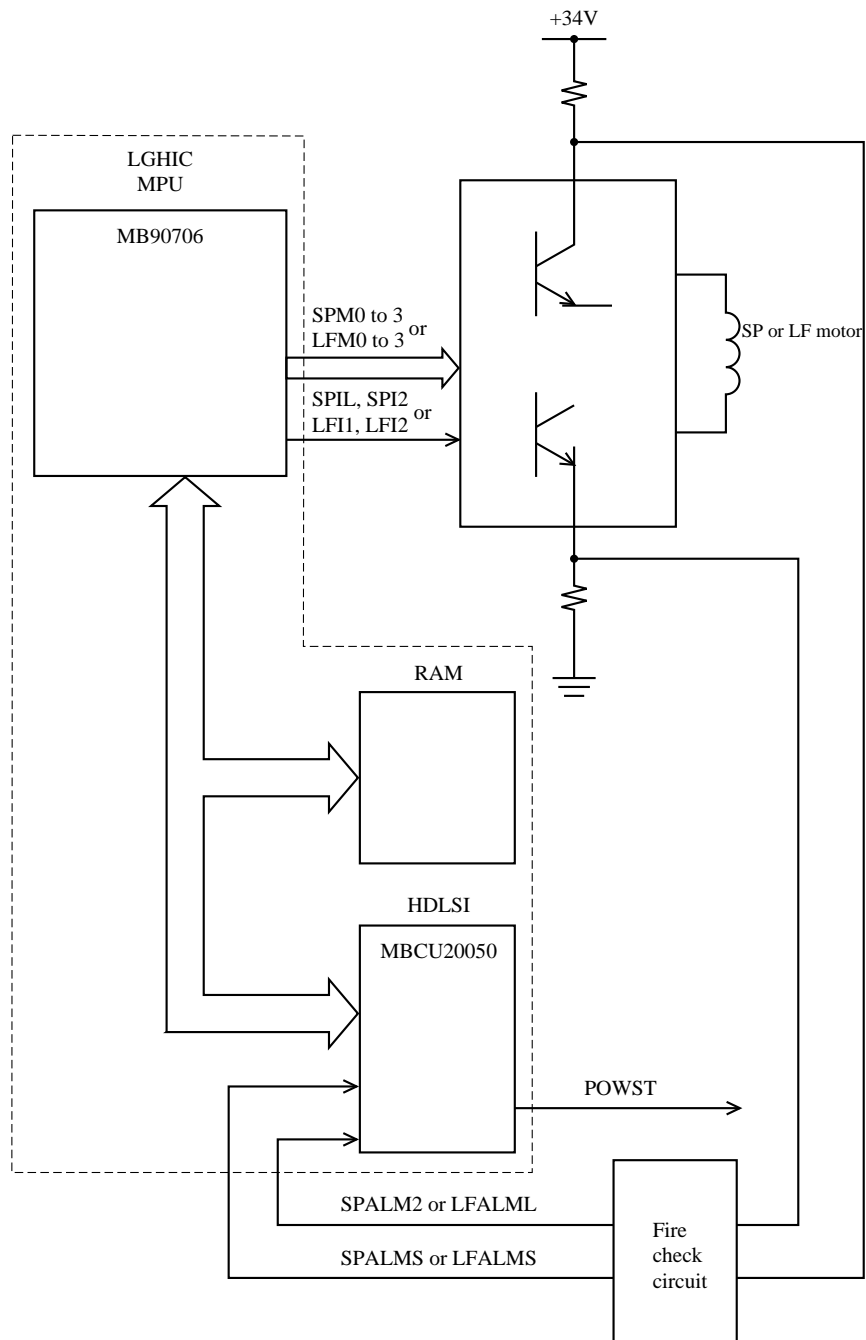


Figure 5.25 Stepping motor drive circuit

The MPU receives phase excitation data for the stepping motor and sends data to turn the motor drive HIC on or off. Data is set to high for a phase to be excited. Motor rotation is controlled by sequentially changing the excitation of the four phases.

Slew control is applied when motor rotation starts or stops:

Start: Gradual acceleration. The excitation period gradually is made shorter.

Stop: Gradual deceleration. The excitation period gradually is made longer.

The motor drive HIC outputs constant current power based on the motor drive mode (idle, low and high speed). To give a correct torque to the motor in each drive mode, the MPU outputs drive current control signals SPI1 and SPI2 to the motor drive HIC.

Phase switching is controlled by the timer in the MPU (Figure 5.26).

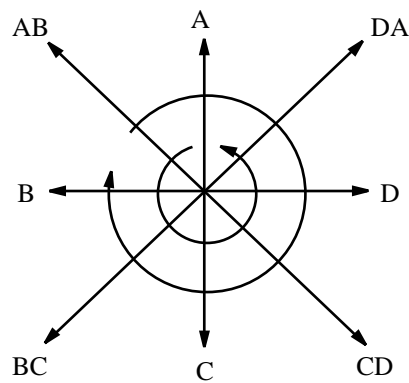
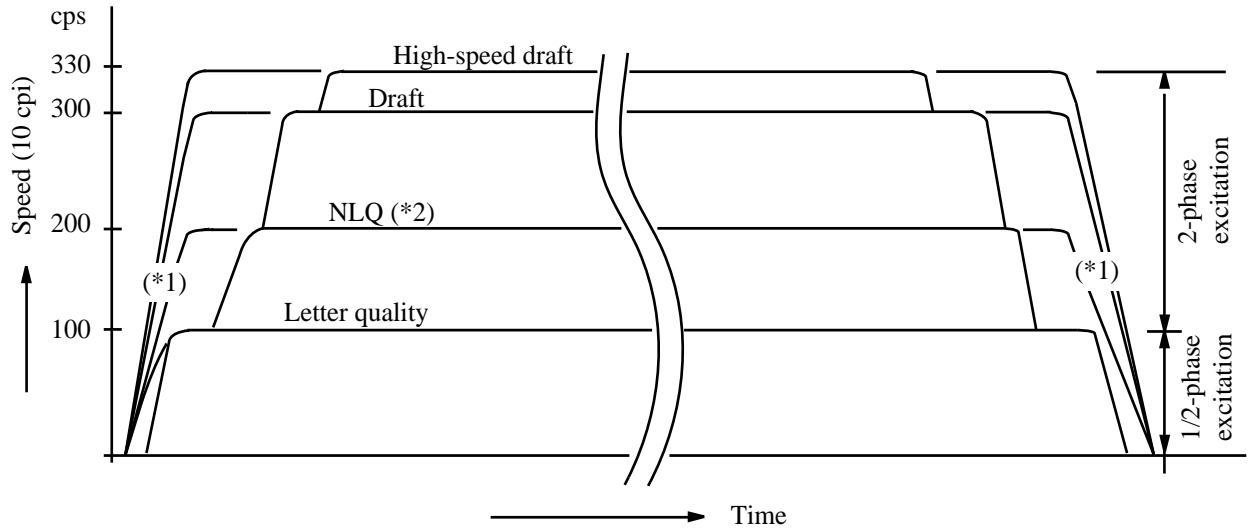


Figure 5.26 Phase switching and carriage drive direction

The LA30N/LA30W printer has several spacing speeds, and drives the carriage either by 1/2 phase or 2-phase excitation, based on speed (Figure 5.27).



- *1 Slewing
- *2 Near-letter-quality, also called correspondence

Figure 5.27 Relationship between carriage drive speed and phase excitation

Figures 5.28 and 5.29 show 1/2-phase and 2-phase excitation.

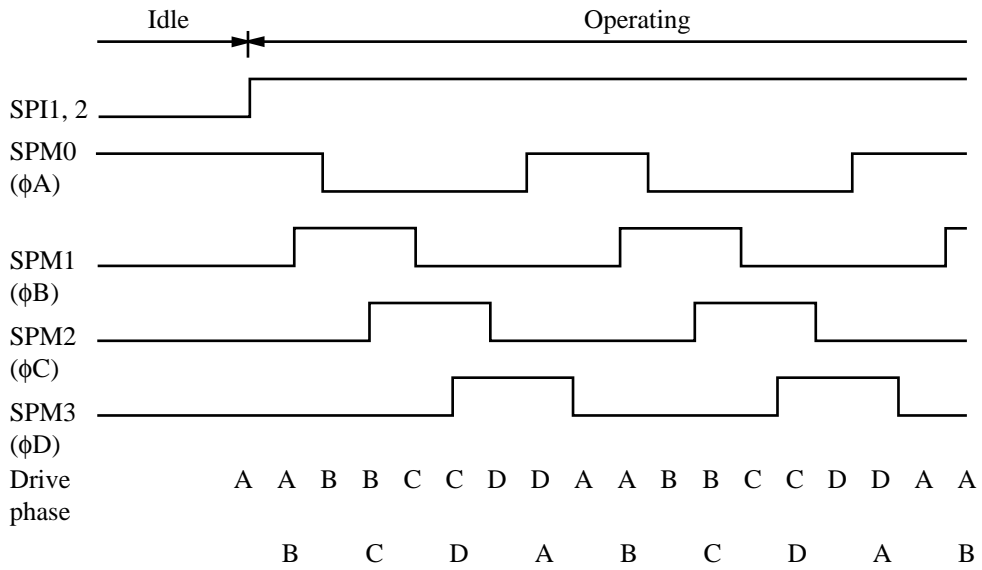


Figure 5.28 Carriage drive 1/2-phase excitation at low speed

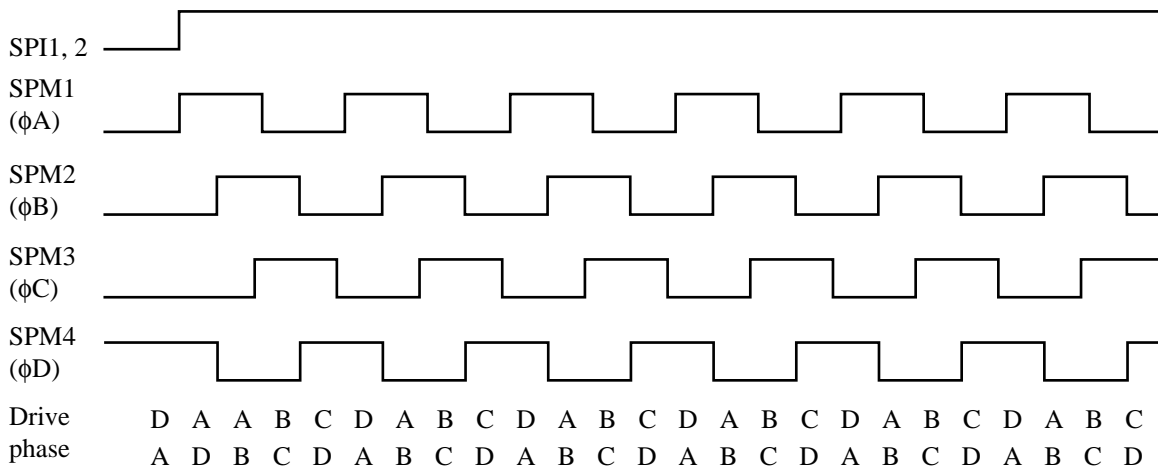


Figure 5.29 Carriage drive 2-phase excitation at high speed

5.3.5 Print head control

Operation from reading print data to driving the pin magnet is as follows (Figure 5.30):

1. Print data is read from line buffer RAM.
2. Data is sent to the print control LSI, being set to high for dots to be printed.
3. Excitation and flyback absorption timers are in the HDLSI (MBCU20050).
4. Print data and excitation time are ANDed and, the result is output by the HDLSI, then the print head drive transistor is turned on.

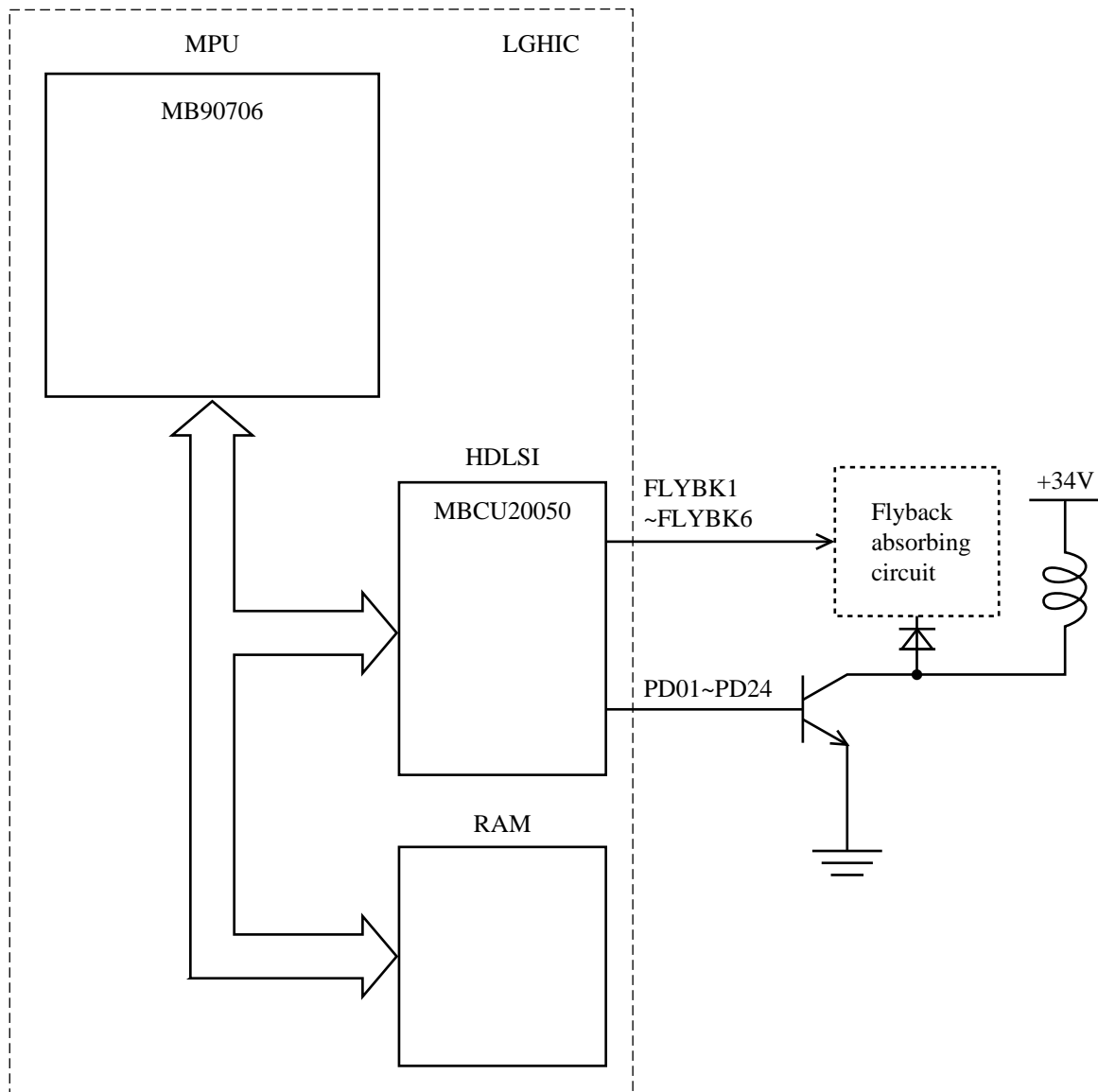
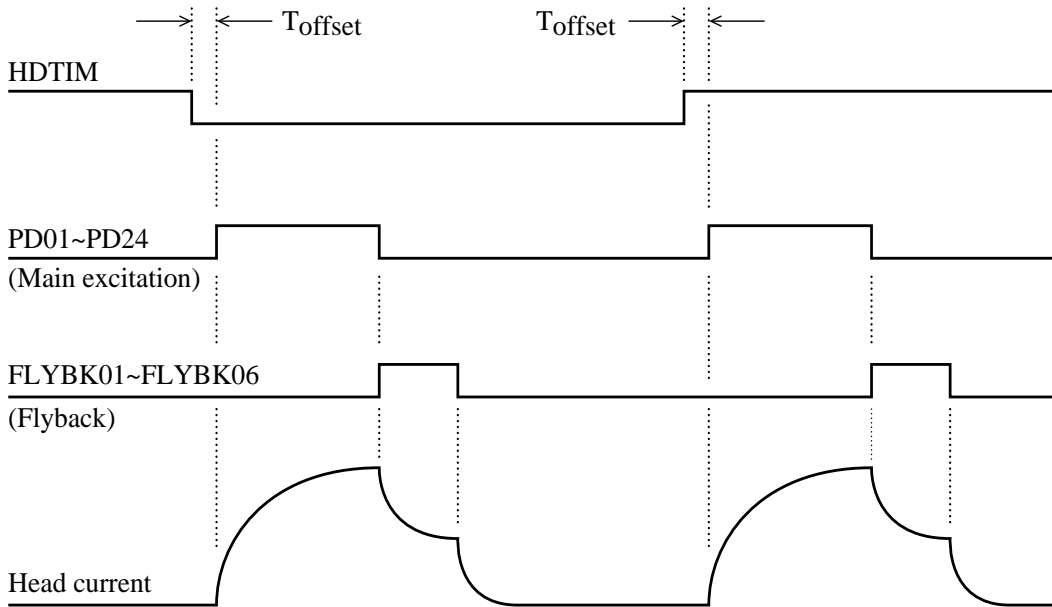


Figure 5.30 Print head pin magnet drive circuit

If +34 volts goes below the prescribed level during printing, the printer splits one line of printing into three-pass printing to limit the number of pin magnets excited at the same time, thus reducing the power load. If low voltage continues even in three-pass printing, an alarm is generated.

Figure 5.31 shows the print timing and waveforms of the head pin magnet drive current.



- HDTIM : Basic print operation timing
- PD01~PD24 : Print head excitation time
- FLYBK01~FLYBK06 : Flyback absorption time
- Toffset : Offset time (for correcting head pin location)

Figure 5.31 Print timing

5.3.6 Paper feed control

The 4-phase paper feed motor is driven by four signals:

- LFM0: This signal drives phase A of the paper feed motor.
- LFM1: This signal drives phase B of the paper feed motor.
- LFM2: This signal drives phase C of the paper feed motor.
- LFM3: This signal drives phase D of the paper feed motor.
- LFII, 2: These signal switch the paper-feed motor phase current. Four current levels can be selected for high speed, and stop.

Phase switching is controlled by the timer in the MPU used to determine the phase drive period. Figure 5.32 shows the relationship between phase switching and the drive direction.

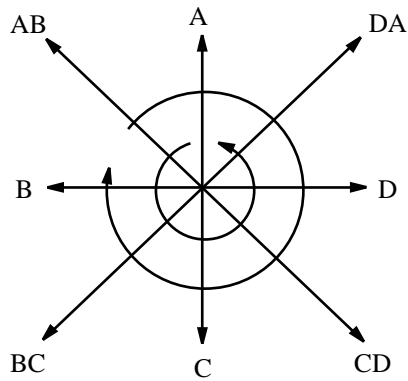


Figure 5.32 Phase switching and paper feed direction

Unlike carriage spacing, paper is fed at only one speed (Figure 5.33), and driving is always done using 2-phase excitation (Figure 5.34).

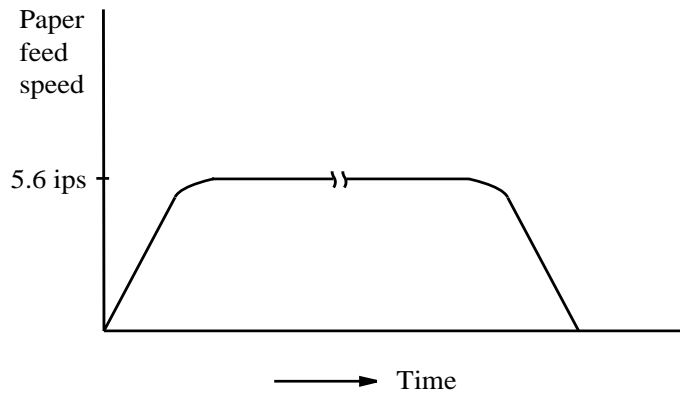


Figure 5.33 Paper feed speed

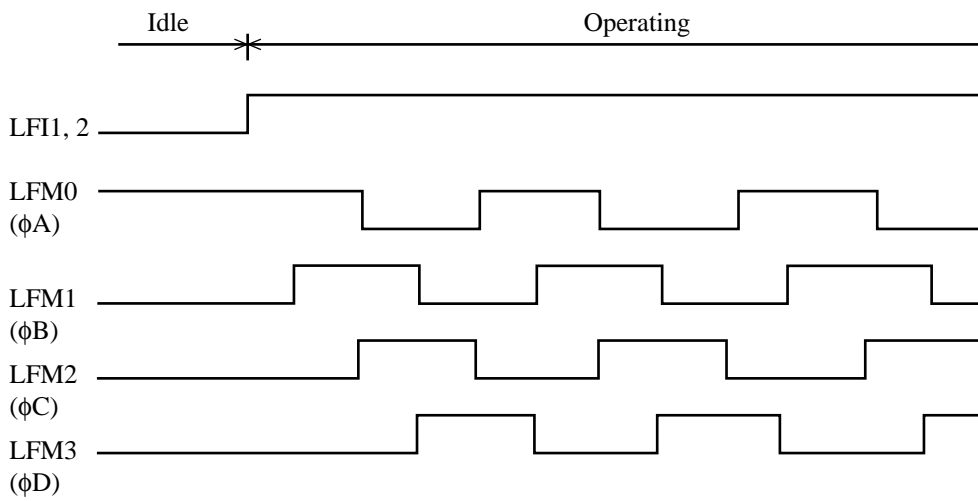


Figure 5.34 1/2-phase excitation of paper feed

5.3.7 Ribbon shift control

The 4-phase ribbon shift motor is driven by four signals:

- CLM0: This signal drives phase A of the ribbon shift motor.
- CLM1: This signal drives phase B of the ribbon shift motor.
- CLM2: This signal drives phase C of the ribbon shift motor.
- CLM3: This signal drives phase D of the ribbon shift motor.

Phase switching is controlled by the timer in the MPU used to determine the phase drive period (Figure 5.35).

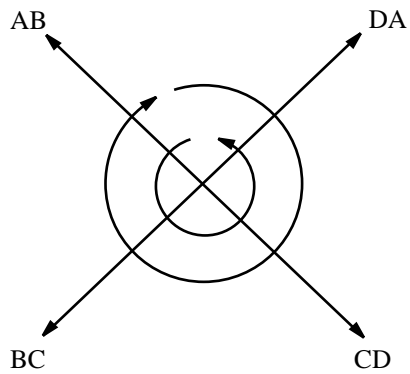


Figure 5.35 Phase switching and ribbon shift direction

Unlike carriage spacing, ribbon shifting is only at one speed (Figure 5.36), and driving is always done using 1/2-phase excitation (Figure 5.37).

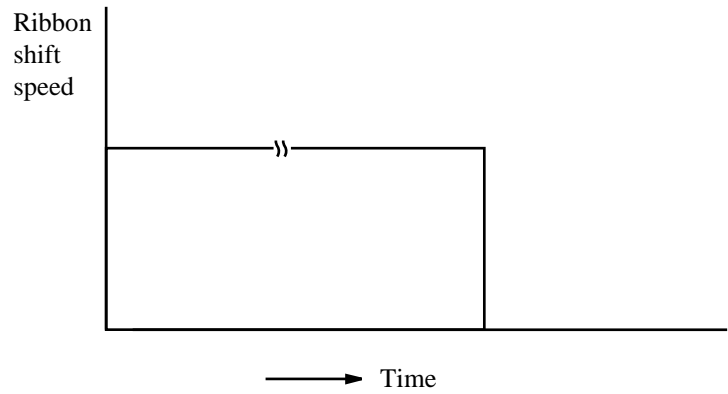


Figure 5.36 Ribbon shift speed

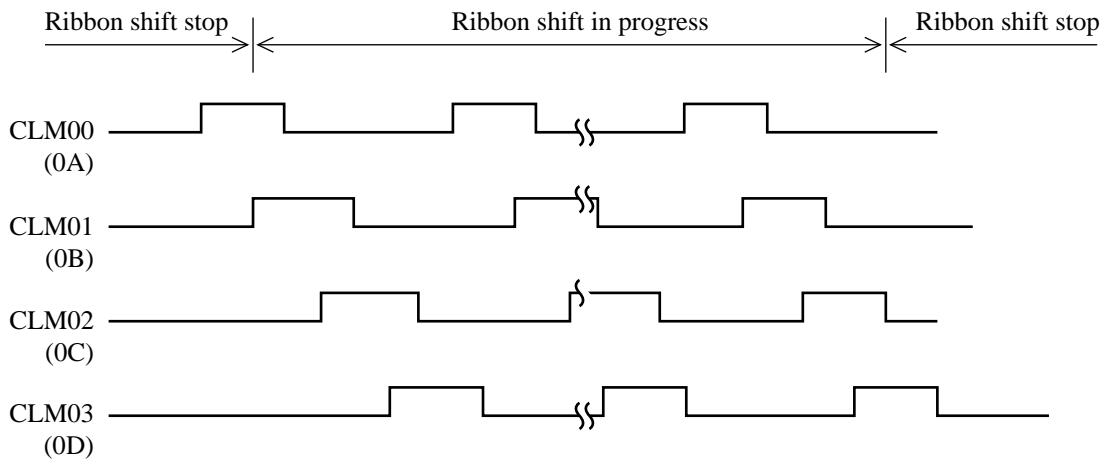


Figure 5.37 Ribbon shift phase excitation

5.3.8 Fire check control

Figure 5.38 shows fire check circuits. The fire check protects the carriage motor (SP motor), paper feed motor (LF motor), and color ribbon shift motor (option) from burning out if the control or drive circuit malfunctions.

Two types of fire check detections are used — short-mode detection for an abnormal large current and long-mode detection for abnormal forcible excitation.

(1) Short-mode detection

a. Detection circuit

Unusually large currents in the SP and LF motors are detected as an analog signal and output to the fire check circuit for conversion to an ON or OFF signal.

b. Time constant circuit

The converted ON/OFF signal passes through the time constant circuit where the waveform is shaped and the compare signal is output to the compare circuit.

c. Compare circuit

If the compare signal voltage exceeds the standard voltage of the compare circuit, the SPALMS or LFALMS alarm signal is issued from the compare circuit to HDLSI (MBCU20050).

d. HDLSI

HDLSI outputs the PWSTOP signal to the power supply after recognizing that the alarm signal is received.

When the PWSTOP signal is output, the power supply unit (+34 V and +5 V circuits) is turned off to keep the SP, LF, and color ribbon shift motors from burning out.

For the color ribbon shift motor (option), the detection circuit shares short mode with the SP motor. Shift motor excitation is detected in item a, above. A fire check alarm error occurs only when an abnormal excitation length occurs in the time constant circuit in item b, above.

(2) Long-mode detection

a. Detection circuit

Excitation of SP and LF motors is detected as an analog signal and output to the compare circuit.

b. Time constant circuit

The converted ON/OFF signal passes through the time constant circuit where the waveform is shaped and the compare signal is output to the compare circuit.

c. Compare circuit

In forced excitation, if the analog signal voltage exceeds the standard voltage in the compare circuit, the SPALML or LFALML alarm signal is issued from the compare circuit to HDLSI (MBCU20050).

d. HDLSI

An internal timer is started by HDLSI after the alarm signal is received and the PWSTOP signal is output to the power supply after counting up.

If the PWSTOP signal is output, the power supply (+34 V and +5 V circuits) is turned off to keep the SP and LF motors from burning out.

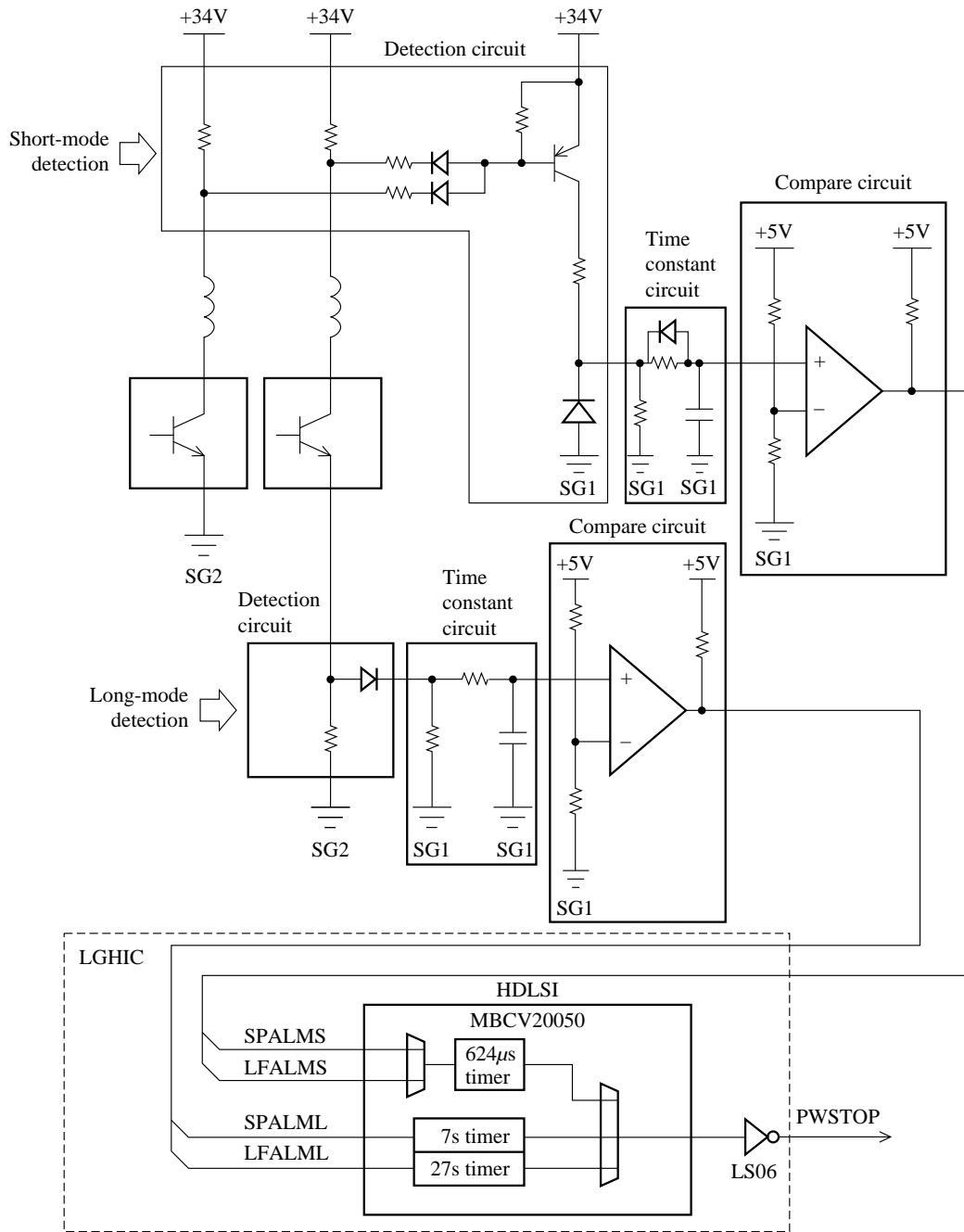


Figure 5.38 Fire check circuits

5.3.9 Control panel control

The control panel has 16 LEDs, 7 push-button switches, a buzzer, and an LSI (MB623829) to control them. The switch contact signals and LED drive signals are transmitted between the main board and the control panel through a flat cable. An LED drive signal is issued from the main board to the LSI as serial data which the LSI converts into parallel data. The switch contact signals are input to the LSI as parallel data which the LSI converts into serial data and issues it to the main board.

The buzzer is driven by the 1-MHz clock signal from MPU (MB90706).

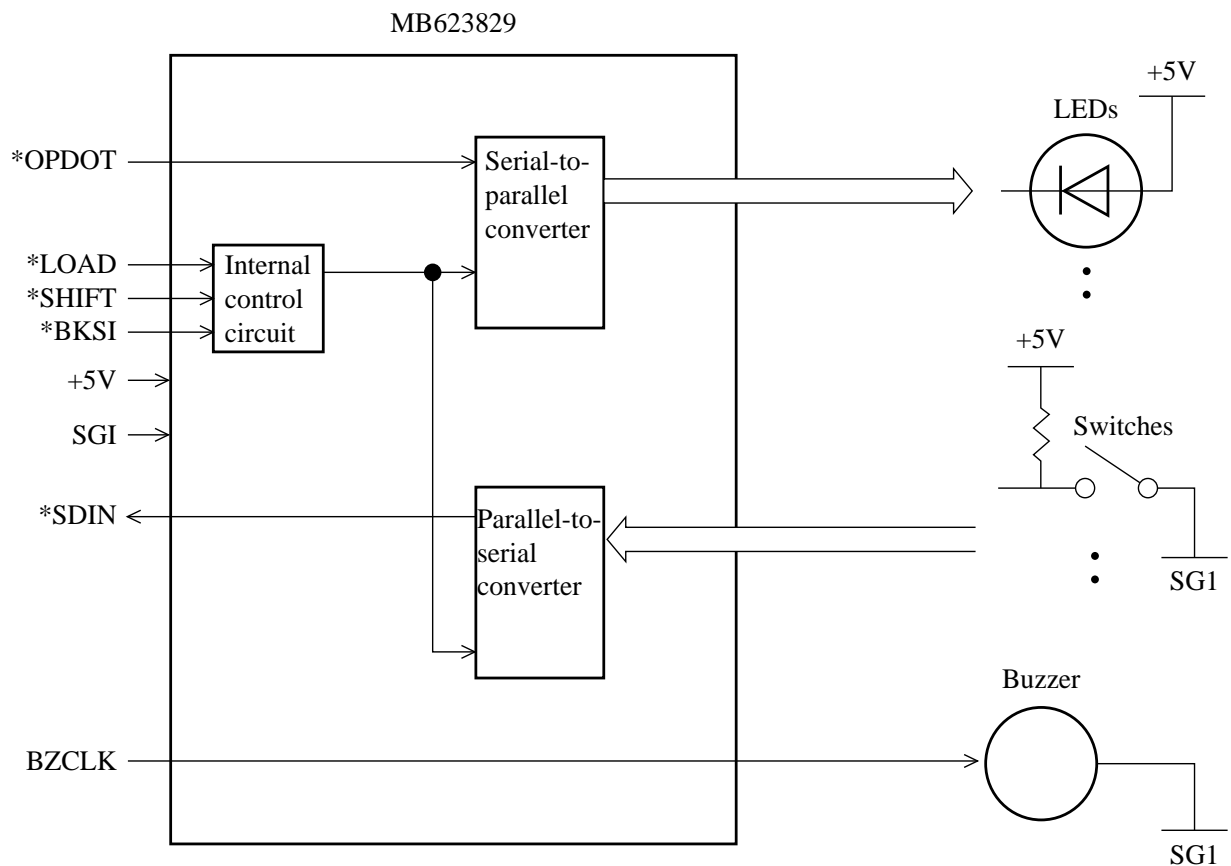


Figure 5.39 Control panel block diagram

5.3.10 Power Supply

There are two types of power supplies:

100-120 VAC input: 29-33026-01 (PW31AA)

220-240 VAC input: 29-33027-01 (PW31BA)

The power supply output voltage is +5 V for the logic circuits and +34 V for the printer mechanism drivers (Figure 5.41).

AC input from the power connector via the power-on switch is converted to DC by rectifier and smoothing circuits. The amount of surge current is limited by the surge current prevention circuit. The DC is converted to a high-frequency on/off voltage by the main switching circuit. The on/off voltage is reduced to +5 V and +34 V by the step-down transformers. These voltages are then rectified and smoothed again.

The power supply's power stop control circuit turns off +5 V and +34 V power if an overcurrent or overvoltage occurs, or the external signal PWSTOP is received from the control board.

(1) Surge current prevention (Figure 5.41 A)

When power is turned on, the charge current flowing into capacitor C3 is limited by the negative temperature NTC thermistor (power thermistor). The power thermistor resistance is a few ohms at room temperature and this initial resistance suppresses surge current. After initial transition, the thermistor becomes hot and its resistance value becomes about 1/10 of the initial value. It does not suppress current in the steady (hot) state.

When the power is turned off and on simultaneously by the user or a instantaneous power drop on the AC line, this system has a little effect to suppress inrush current because the power thermistor is still in a hot condition.

(2) Rectifying and smoothing (Figure 5.41 B)

The full-wave rectifier charges C03, generating DC between the DC+ and DC- terminals of C03 (Figure 5.40).

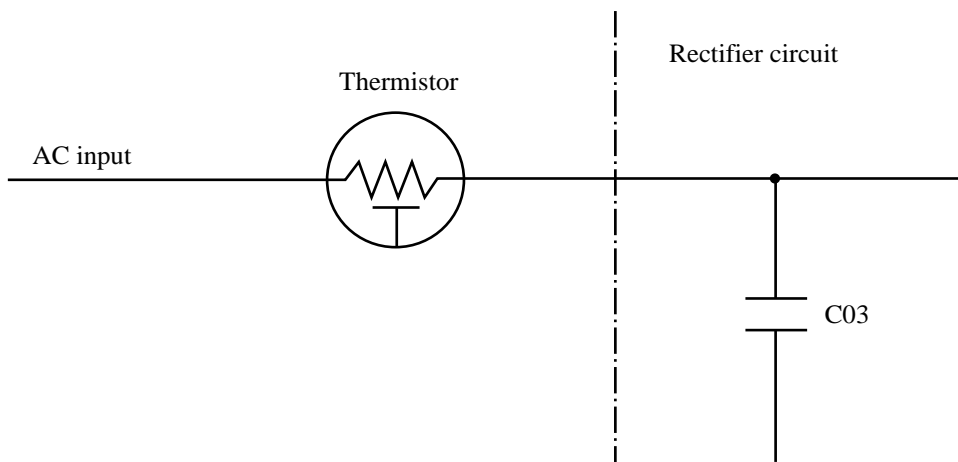


Figure 5.40 Surge current prevention circuit

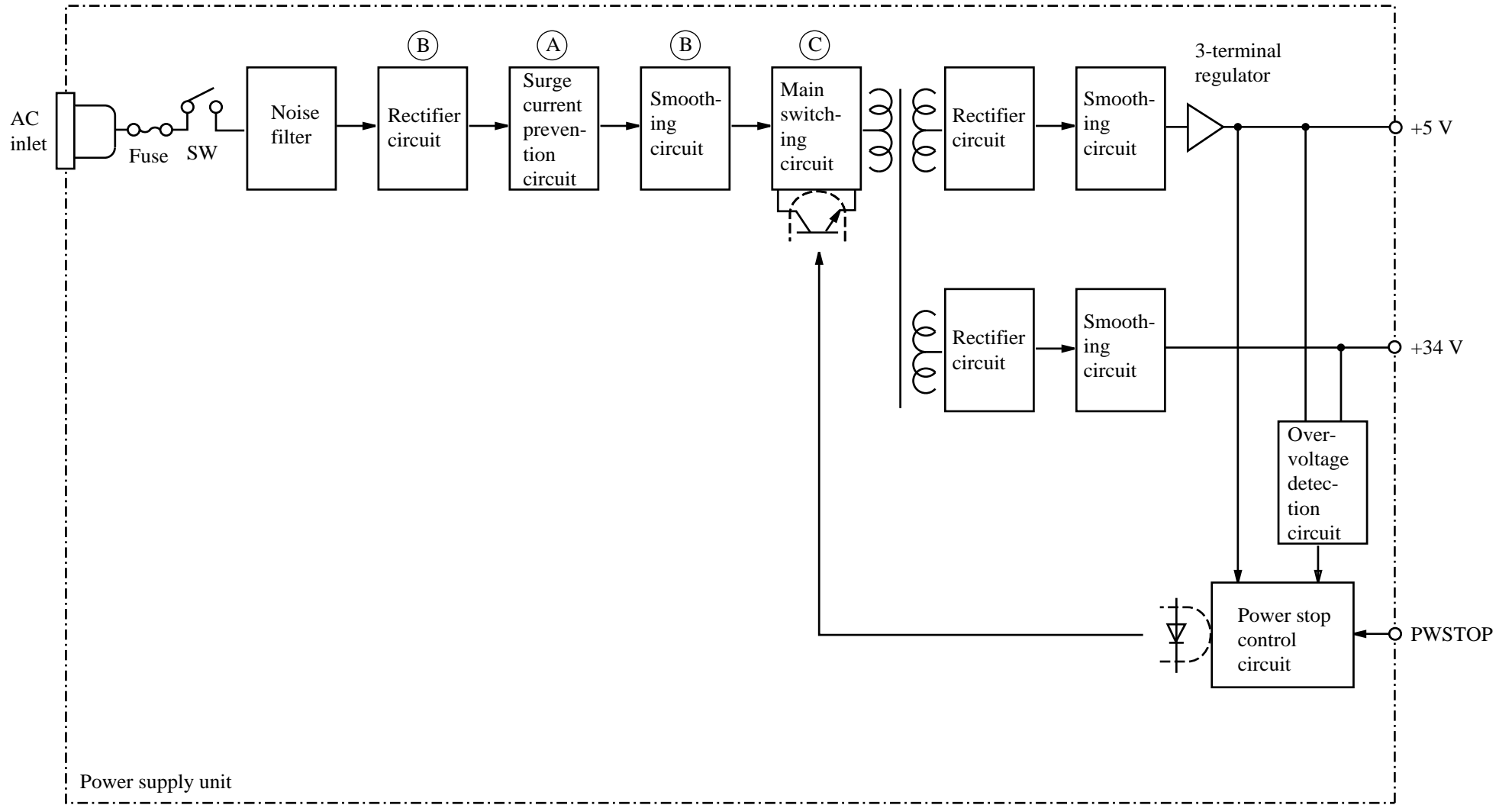


Figure 5.41 Power supply block diagram

(3) Main voltage regulation switching (Figure 5.41 C)

Smoothed DC voltage is converted to high-frequency on/off voltage by changing the frequency and duty of the on/off voltage pulse (Table 5.2).

Table 5.2 Voltage regulation switching control

Voltage	Switching control	Regulation control	Frequency
+5 V +34 V	Self-activated flyback converter	Frequency change (duty also changed)	20 kHz to 250 kHz

(4) Protection

a. Primary circuit protection

A fuse is equipped between the power inlet and the power switch. The fuse holder is near the power switch on the power supply board. The fuse has the following fuse rating:

100 to 120 VAC input: 6.0 A, 125 VAC

220 to 240 VAC input: 3.15 A, 250 VAC

If the rectifier and smoothing circuits (Figure 5.41 B) or the main switching circuit (Figure 5.41 C) malfunctions causing a short circuit, the fuse is blown to prevent a secondary failure.

b. Secondary circuit protection

Overcurrent protection (OCP)

If a short circuit occurs at the load, overcurrent protection starts for the current range below (Table 5.3) to prevent the current from increasing, thus lowering output voltage.

Table 5.3 Overcurrent protection

Voltage	Overcurrent detection	Protection
+5 V	1.0 A or more	Foldback
+34 V	4.3 A or more	Foldback

Overvoltage protection (OVP)

If a malfunction occurs in the power control system, the following protection starts to prevent overvoltage at the output (Table 5.4).

Table 5.4 Overvoltage protection

Voltage	Action
+5 V	If +5 V output reaches +6 V or more, the overvoltage protection circuit in the internal power unit detects the overvoltage and turns off the main switching circuit.
+34 V	The *PWSTOP signal goes high to turn off the main switching circuit if the logic circuit detects that the +34 V output is over +39 V. Then +5 V and +34 V outputs are turned off.

(5) External signal

The power supply receives the PWSTOP signal (Power Stop signal, connector pin No. 2) from other printer components that enables the printer controller to turn off +5 V and +34 V outputs even if problem that can result in power failure occurs outside the power supply.

When power is turned on, the PWSTOP signal is kept low and +5 V and +34 V output go to the prescribed values.

When the PWSTOP signal is made to go high due to a failure, +5 V and +34 V are cut off (Figure 5.42).

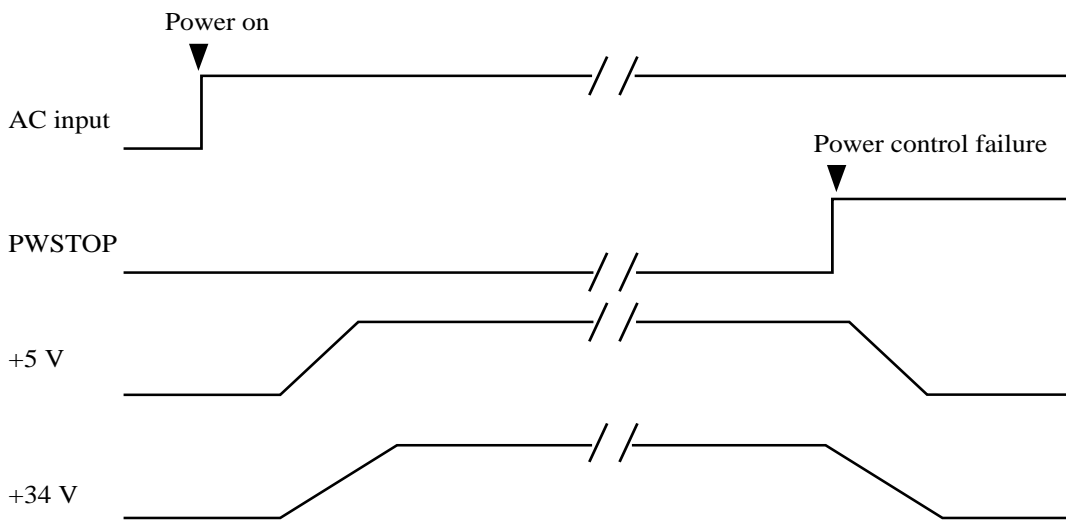


Figure 5.42 PWSTOP signal

5.4 Firmware Overview

LA30N/LA30W firmware, stored in ROM, is separated into three independent software groups, — interpreter control, print control, and base control (Figure 5.43).

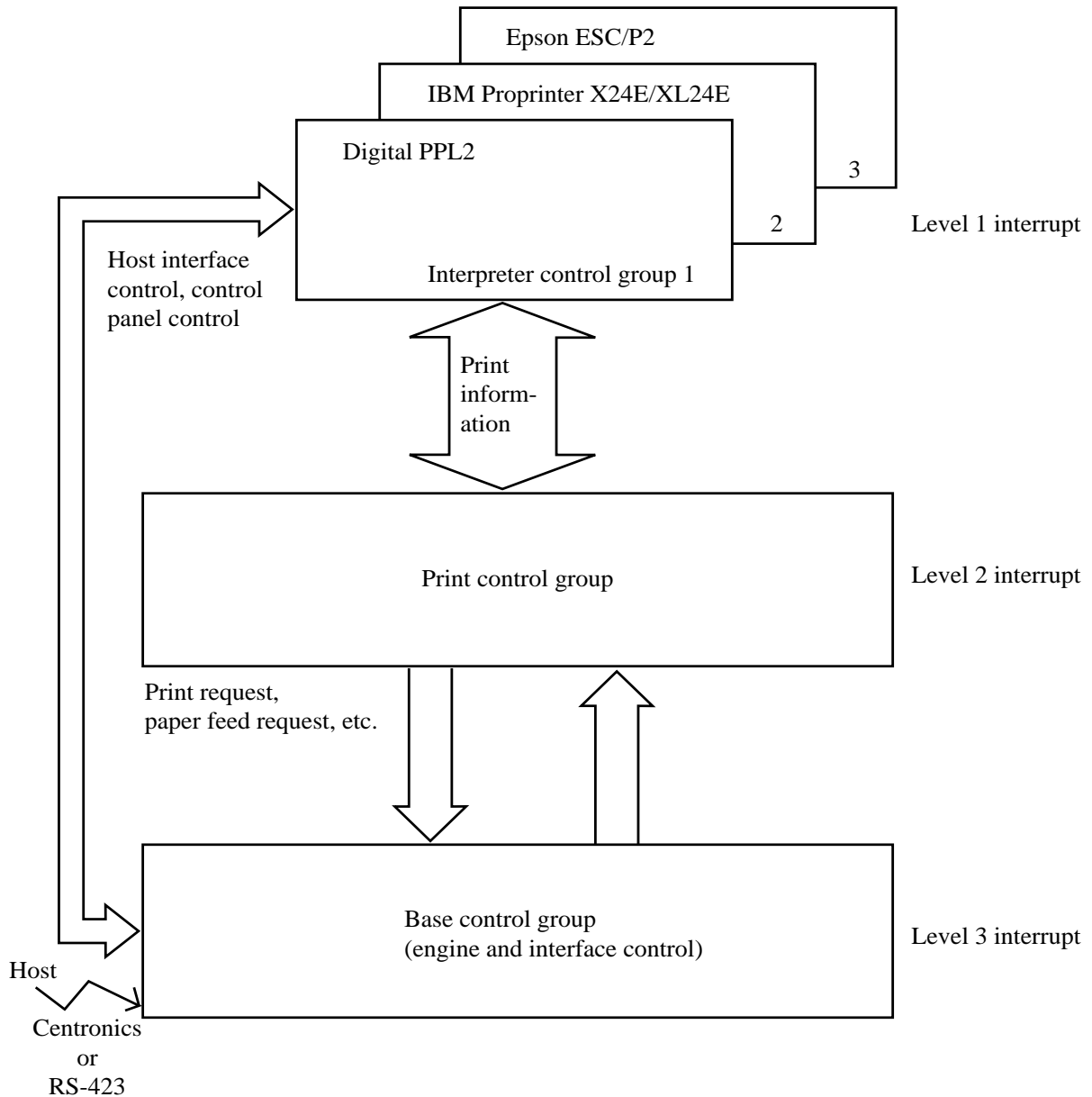


Figure 5.43 Firmware configuration

The interpreter control group analyzes the individual command to each emulation. The print group control is the software module used in common by all emulations in CG control (bit map, scalable), image control, and bar code pattern generation such as picture drawing. The base control group executes BIOS control for the host interface, mechanism section, control panel, and memory.

CHAPTER 6 RECOMMENDED SPARE PARTS

The following table lists parts and product numbers to be used when ordering spare parts. It also indicates the sections that explain the replacement.

No	Part name	Product number	Section to be referred to	Remarks	LA30N/W
1	Main board with ROM	29-33022-01	4.9.1 (8)	ROM board or control board	Common
2	OP board	29-33023-01	4.9.1 (4)	Control panel	Common
3	RS423 board	29-33024-01	4.9.1 (7)	Serial board	Common
4	Sensor T assy	29-33025-01	4.9.1 (12)	For cut sheet paper end	Common
5	Power unit (110V) Power unit (220V)	29-33026-01 29-33027-01	4.9.1 (6)	100-120 VAC (UL/CSA) 220-240 VAC (TÜV)	Common
6	Sensor sub assy	29-33028-01 29-33215-01	(4.9.1 (16))	For continuous forms paper end	LA30N LA30W
7	Fuse 125V 6A Fuse 250V 3.15A	29-33029-01 29-33030-01	4.9.1 (6)		Common
8	Space motor assy	29-33033-01	4.9.1 (11)	SP motor assy	Common
9	LF motor	29-33034-01	4.9.1 (10)	Paper feed motor	Common
10	Printer mecha assy	29-33035-01 29-33214-01	4.9.1 (5)	Printing mechanism	LA30N LA30W
11	Platen roll assy	29-33036-01 29-33216-01	4.9.1 (9)	Platen	LA30N LA30W
12	Platen knob	29-33037-01	4.9.1 (3)		Common
13	Change lever	29-33038-01	(4.9.1 (15))	Paper select lever	Common
14	Lever	29-33077-01	(4.9.1 (3))	Paper thickness lever	Common
15	PS spring	29-33039-01	(4.9.1 (15))	In gear assy (paper select)	Common
16	Carrier unit	29-33040-01 29-33217-01	4.9.1 (13)	Carriage unit	LA30N LA30W
17	Tractor unit	29-33041-01 29-33218-01	4.9.1 (2)		LA30N LA30W
18	Front cover	29-33042-01 29-33219-01	4.9.1 (3)		LA30N LA30W
19	Top cover	29-33043-01 29-33220-01	4.9.1 (3)		LA30N LA30W
20	Sound proof cover	29-33044-01 29-33221-01	4.9.1 (1)	Acoustic cover	LA30N LA30W
21	Bail roller unit	29-33068-01	—		LA30N only
22	Copy control lever	29-33069-01	(4.9.1 (13))	Linked to paper thickness lever	Common

No	Part name	Product number	Section to be referred to	Remarks	LA30N/W
23	Card guide assy	29-33070-01	4.9.1 (17)	Plastic print guide	Common
24	Side cover	29-33071-01	(4.9.1 (3))	Shutter for interface port	Common
25	Sheet guide sub assy	29-33072-01 29-33222-01	—	Cut-sheet stand	LA30N LA30W
26	Timing belt	29-33073-01 29-33223-01	(4.9.1 (13))		LA30N LA30W
27	Feed roller assy	29-33074-01 29-33224-01	(4.9.1 (16))	In paper feeder assy	LA30N LA30W
28	Relay cable assy	29-33075-01	(4.9.1 (13))	Brown cable to print head	Common
29	Carrier cable assy	29-33076-01	(4.9.1 (13))	White cable to print head	Common
30	Upper cover sub assy	29-33699-01 29-33700-01	4.9.1 (3)		LA30N LA30W
31	Gear assy	29-33701-01	4.9.1 (15)	Paper feed	Common
32	Ribbon feed assy	29-33702-01	4.9.1 (14)	Ribbon feed	Common
33	Paper feed assy	29-33703-01 29-33704-01	4.9.1 (16)	Paper feed	LA30N LA30W
34	Fuse 125V 4A Fuse 250V 2.5A	29-33706-01 29-33707-01	4.9.1 (6)		Common

() in the "Section to be referred to" column means the section can be used for replacing the part.
The "Remarks" column includes aliases of the part names generally used on this manual and the user guide.

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