OKI

M-520221
ISSUE 1

MICROLINE 93 DOT-MATRIX PRINTER (Standard Model)

Maintenance Manual

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Maintenance Manual

Preface

PART I User's Manual

PART II Maintenance Manual

PART III Appendixes

We have tried to ensure that the information is accurate, complete, and readily usable. Should any errors or omissions be noted, or should any ideas for improvement occur, however, please notify:

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PART I User's Manual

Preface

This manual consists of three parts:

Part I **User's Manual**, describing the components, installation, and operation of the MICROLINE 93 Dot-Matrix Printer.

Part II **Maintenance Manual**, describing the detailed operation, maintenance procedures, troubleshooting, and parts list of the MICROLINE 93.

Part III **Appendixes**, describing the specifications and functions of the MICROLINE 93.

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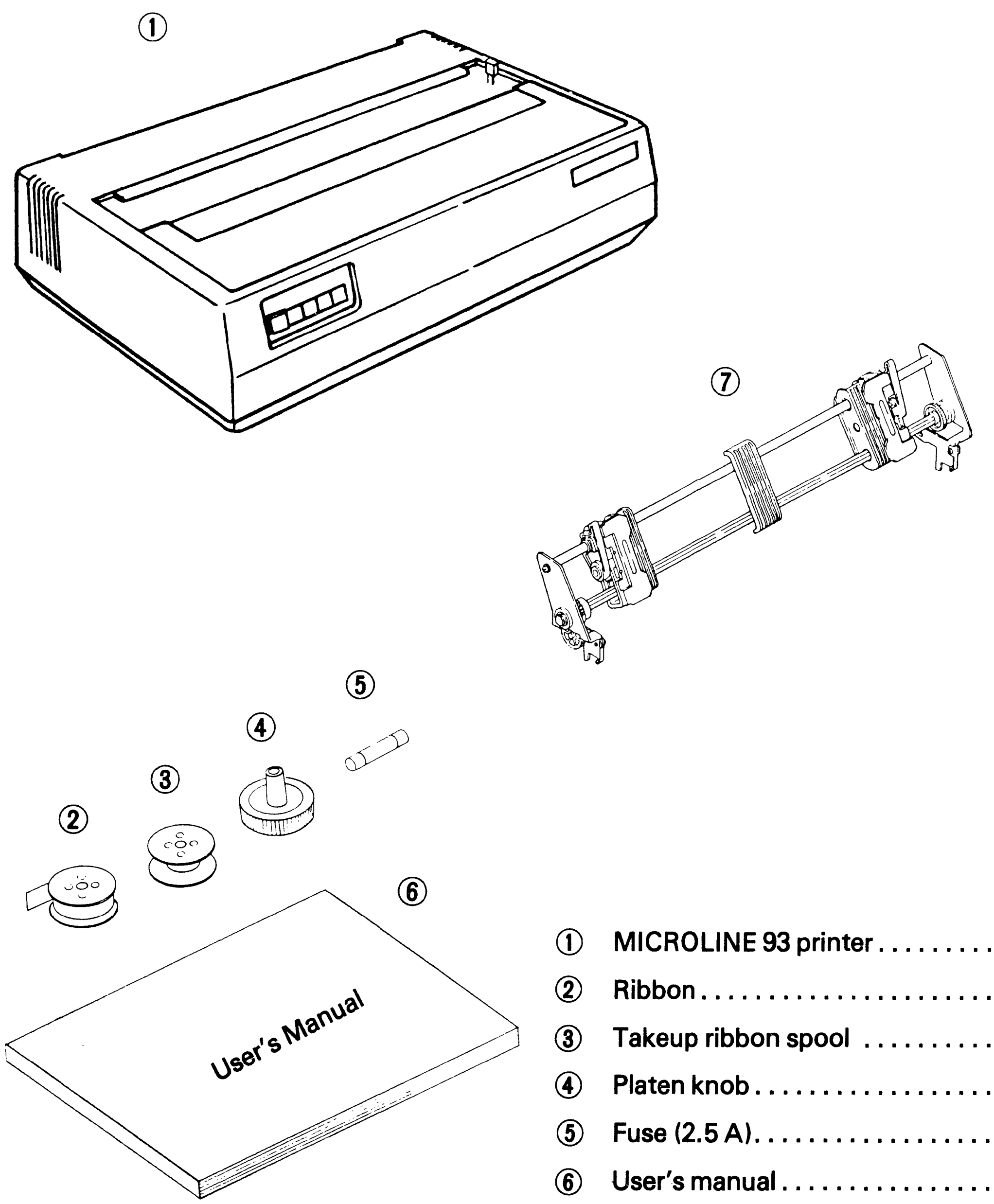
PART I User's Manual

1. GENERAL

1.1 Unpacking

Unpack the carton and check for damage and/or missing accessories. Included in the carton are:



① MICROLINE 93 printer 1
② Ribbon 1
③ Takeup ribbon spool 1
④ Platen knob 1
⑤ Fuse (2.5 A) 1
⑥ User's manual 1
⑦ Tractor unit 1

Figure 1-1 Packing List

1.2 Standard Printer Components

The printer consists of a print mechanism, control unit, operation panel, power supply, covers, and tractor unit.

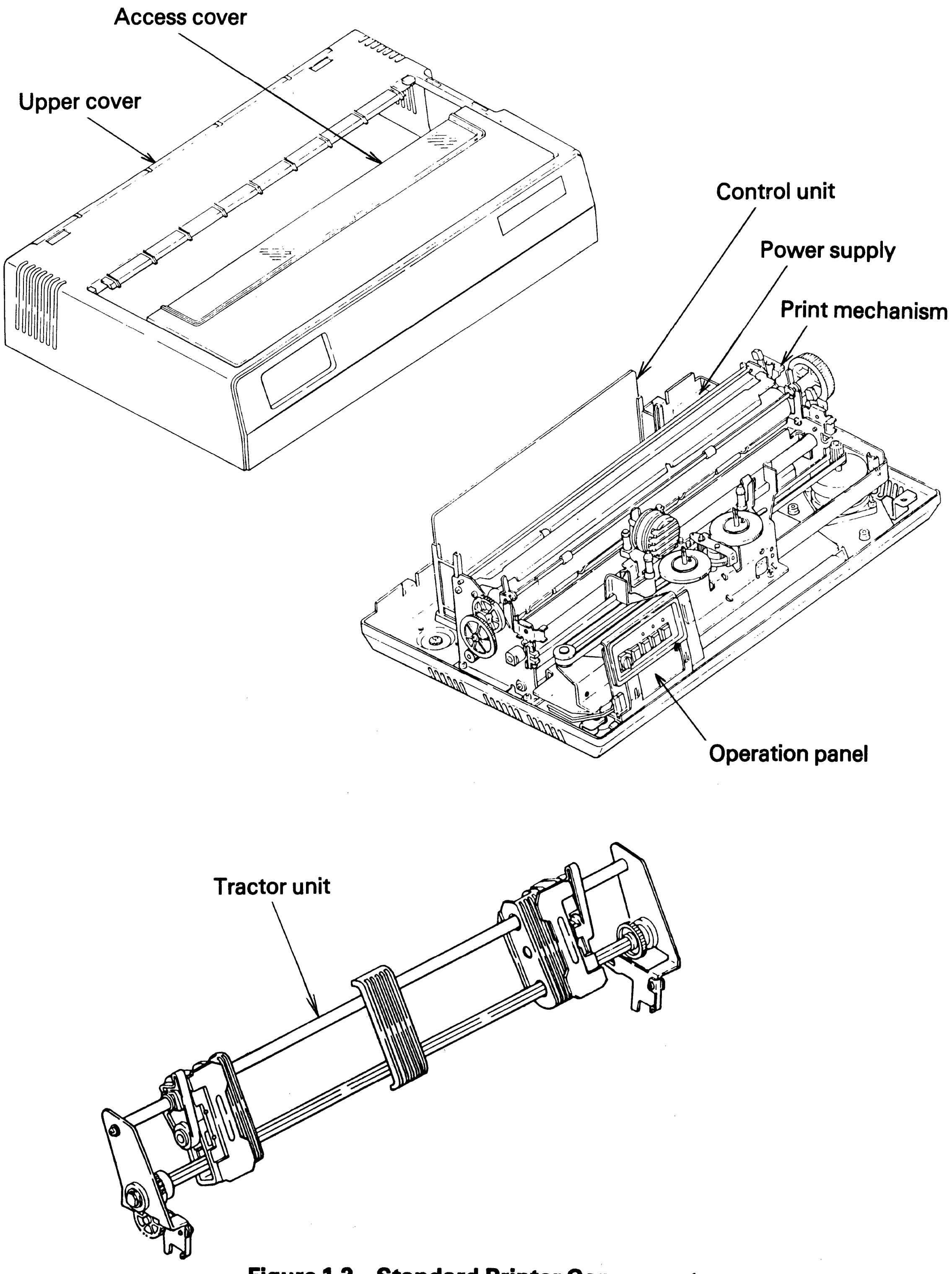


Figure 1-2 Standard Printer Components

1.3 Optional Printer Components

The following interface boards are optional:

(1) High-speed RS-232C serial interface board

(2) Current-loop serial interface board

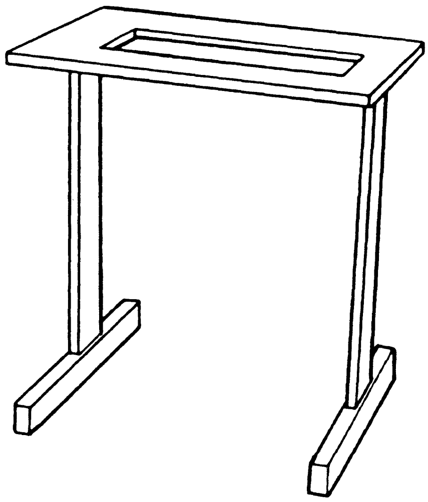
(3) IEEE 488 parallel interface board

2. INSTALLATION PROCEDURE

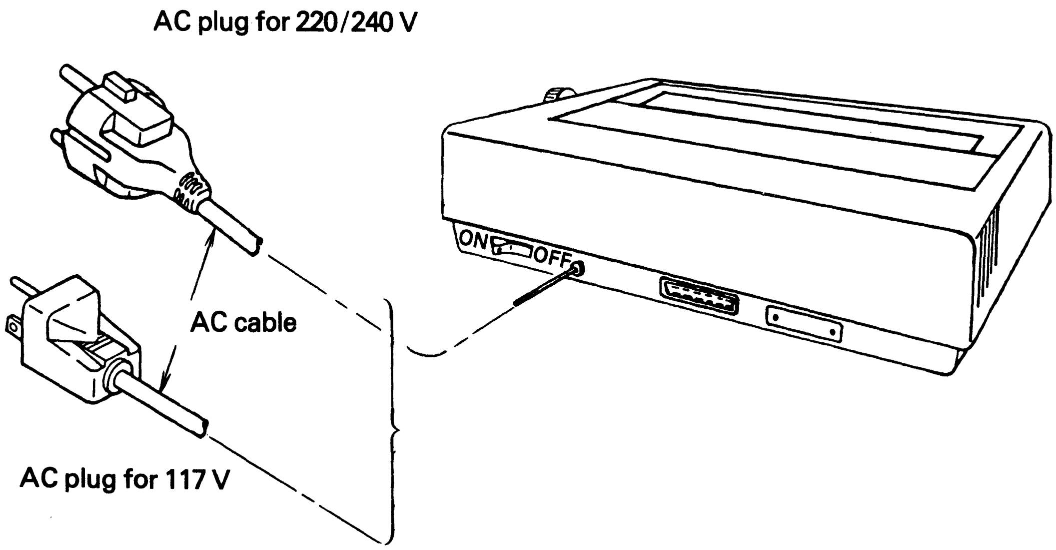
2.1 Preparation

(1) Prepare a printer stand (or desk) for the printer. For bottom paper feed, prepare a printer stand with a hole in the top board. Make sure the hole is wide enough for the width of paper to be used.

Example:



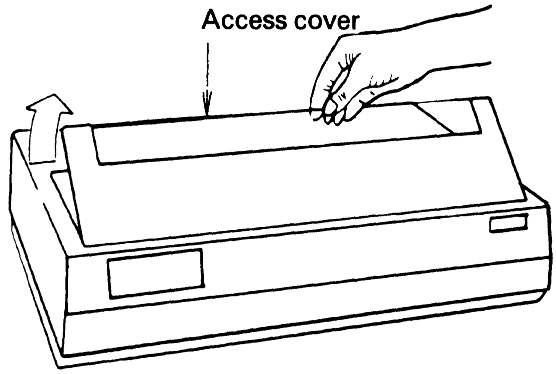
(2) Install the printer near an AC receptacle for convenience; the AC cable provided is 2.3 meters (7.7 feet) long.



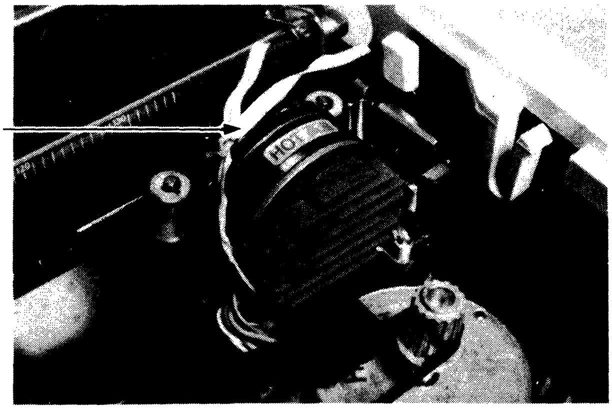
2.2 Installation of Printer

(1) Put the printer on the printer stand (desk).

(2) Remove the access cover.

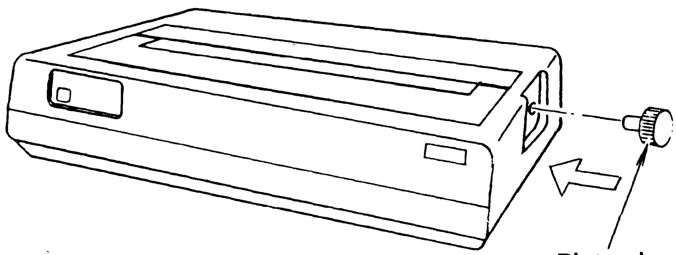


(3) Remove the fastener for transportation.



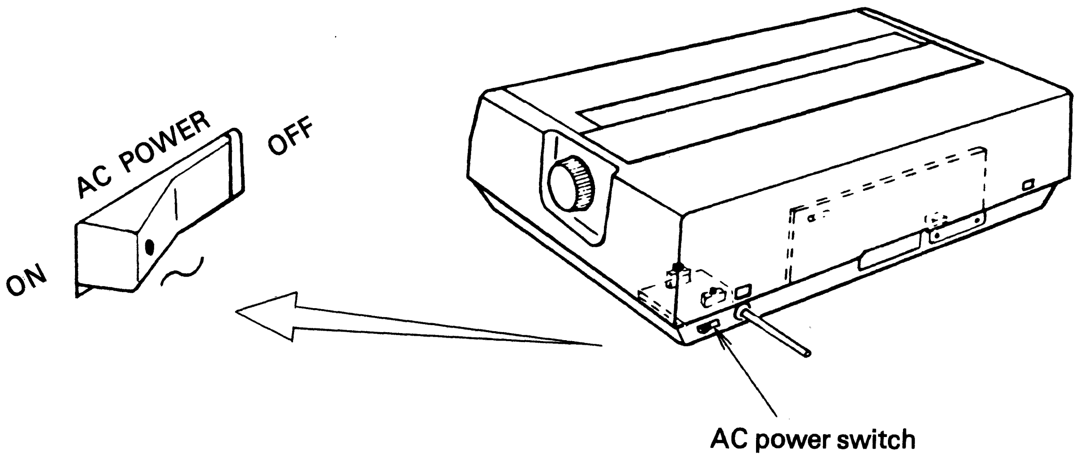
(4) Remove the upper cover (refer to section 2.4) and make sure the voltage select switch is set properly to the input AC voltage (refer to section 3, figure 3-2). (This check is required only for the 220/240 V model.)

(5) Attach the platen knob.

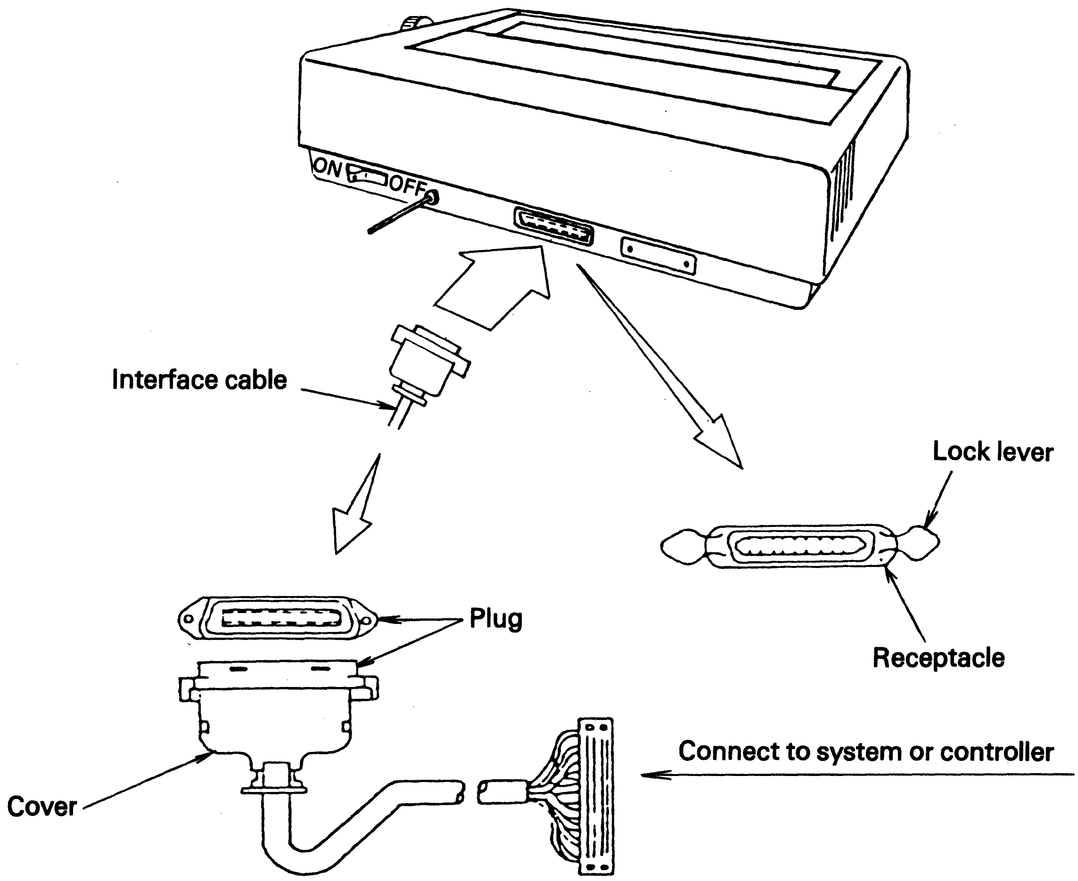


(6) Attach the tractor unit, if using sprocket paper. (Refer to section 2.3.)

(7) Make sure that the AC power switch at the back of the printer is OFF.

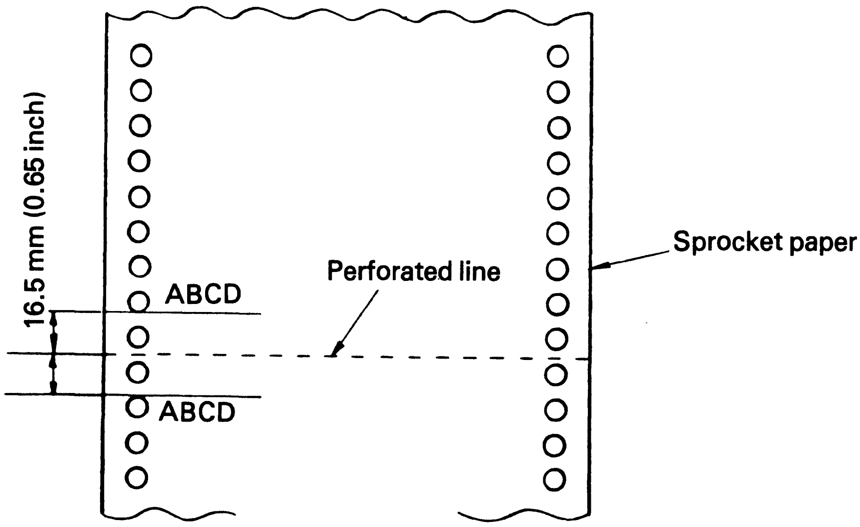


(8) Connect the interface cable plug to the appropriate (serial or parallel) interface receptacle at the back of printer, and lock the plug with the lock lever. Connect the other end of the interface cable to a computer system or controller.

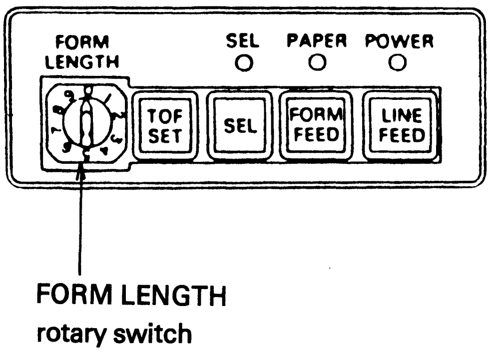


(9) Install a ribbon. (Refer to section 4.)

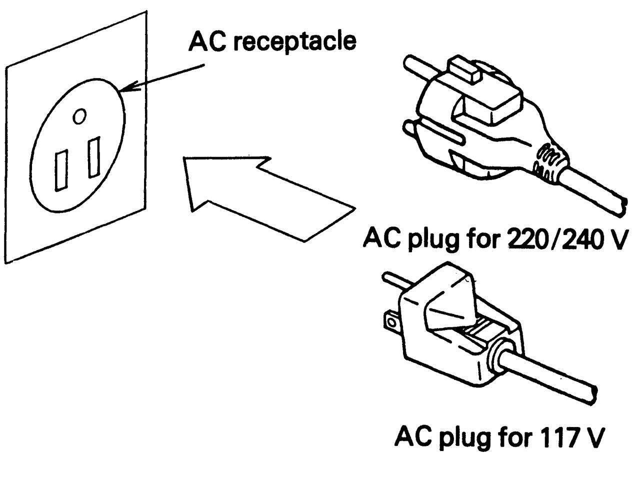
(10) Install paper and adjust it to the top-of-form position. (Refer to section 5.) For sprocket paper, take a margin of 16.5mm (0.65 inch) (4 lines in 6 LPI mode) or more before and after the perforated line.



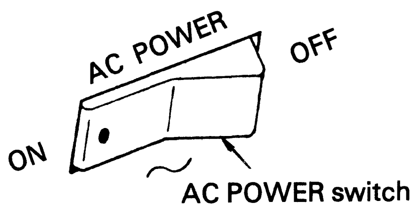
(11) Set the FORM LENGTH rotary switch on the operation panel to a position appropriate to the desired form length. (Refer to section 6.1.)

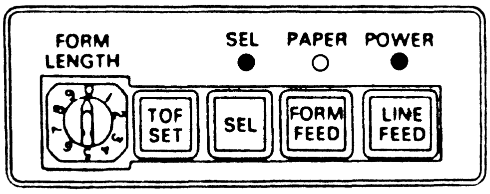


(12) Connect the AC plug to an AC receptacle.



(13) Turn ON the AC POWER switch and verify that the POWER and SEL LEDs (red) on the operation panel light; the printer is in online state.





(14) Press the SEL switch to change the printer to offline state, and perform the operations described in section 6 to verify that the basic functions of the printer work properly.

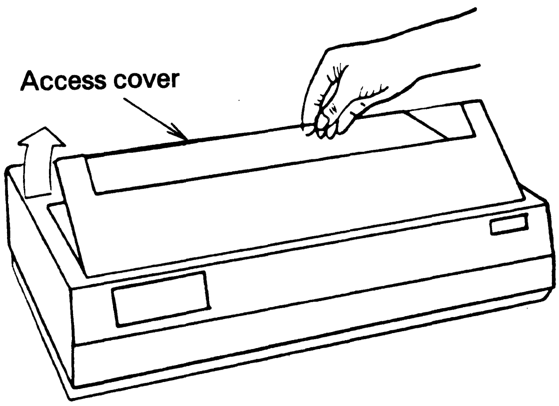
(15) Press the SEL switch again to return the printer to online state. (The SEL LED lights.)

The printer is now ready for receiving data from an external system.

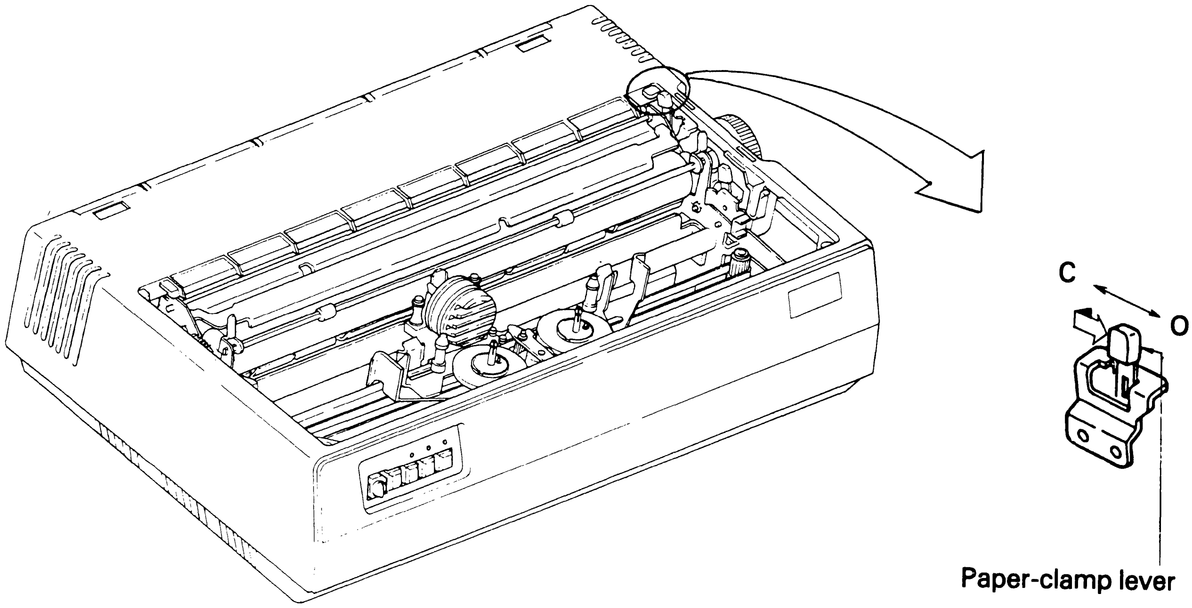
Note: Various printer functions can be selected by setting the DIP switches on the operation panel board behind the upper cover. (For removal of the upper cover, refer to section 2.4. For the DIP switch settings, refer to figure 3-1, tables 3-3 and 3-4.)

2.3 Installation of Tractor Unit

(1) Remove the access cover.



(2) Set the paper-clamp lever to position O (open).



(3) Install the tractor unit according to the following procedure (See figure 2-1):

(a) Hold the tractor unit with both hands.

(b) Slip the tractor unit rear clamp lever ② onto the printer clamp lever shaft ①.

(c) Engage the tractor unit clamp lever ④ with the printer bearing ③.

To remove the tractor unit from the printer, reverse the above procedure.

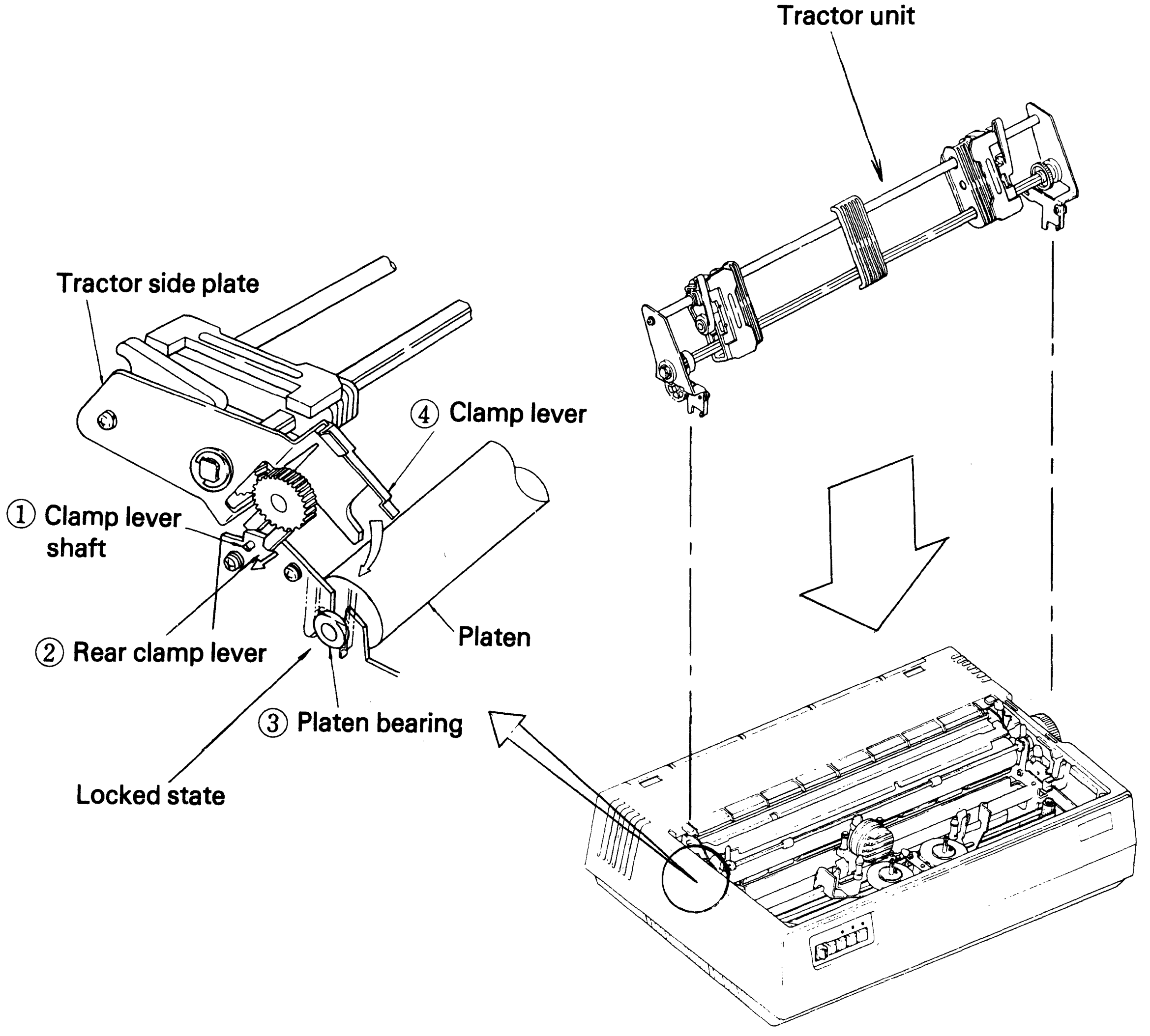
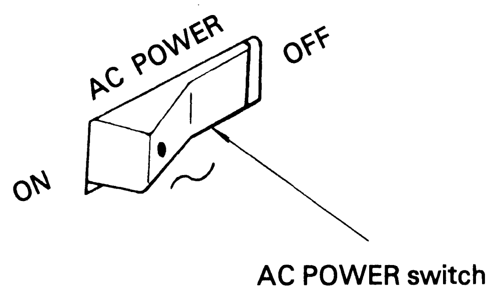


Figure 2-1 Tractor Unit Installation

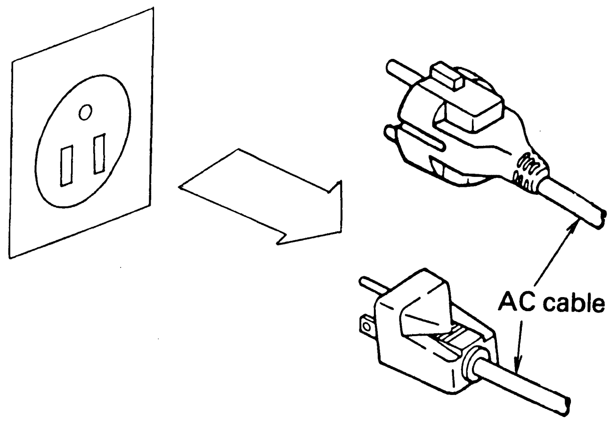
2.4 Removal of Upper Cover

To access the DIP switches, circuit breaker, fuse, and voltage-select switch, remove the upper cover.

(1) Turn OFF the AC POWER switch.

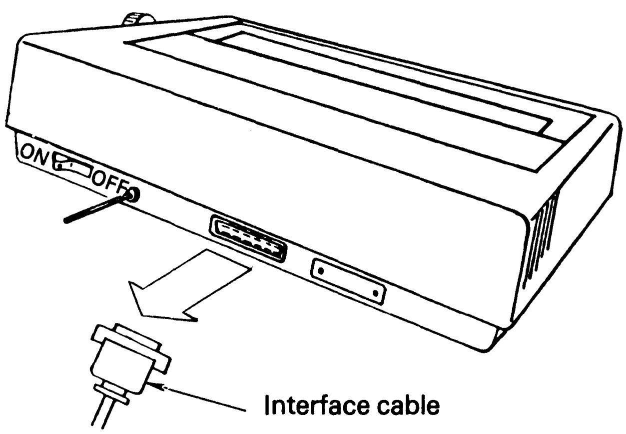


(2) Remove the AC cable plug from the receptacle.

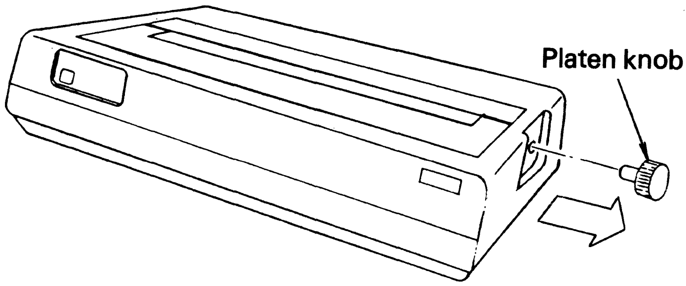


(3) Remove the tractor unit. (Refer to section 2.3.)

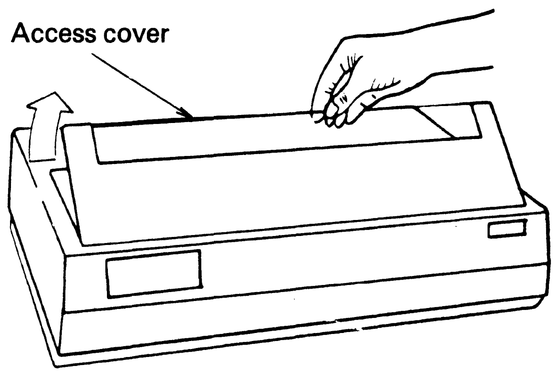
(4) Remove the interface cable from the printer.



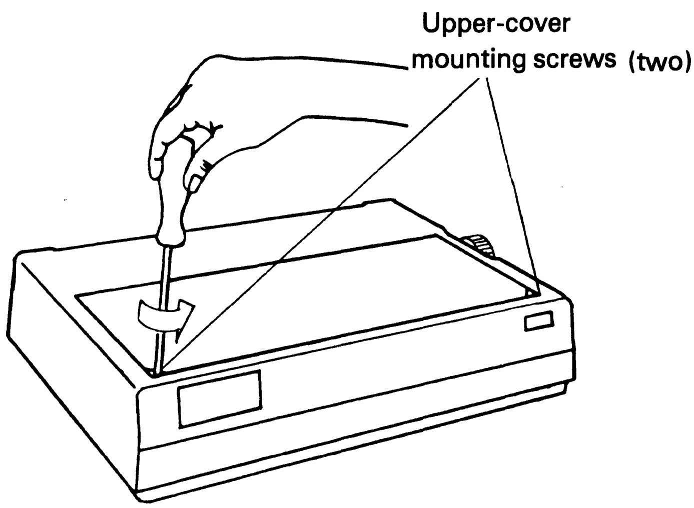
(5) Remove the platen knob.



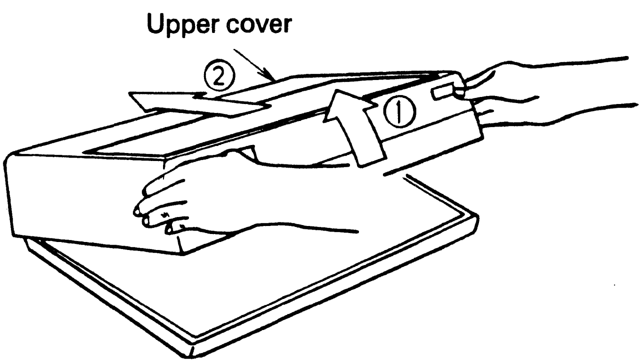
(6) Remove the access cover.



(7) Remove the screws on each side of the upper cover.



(8) Lift the front of the upper cover, tilt it backward, and remove it from the lower cover.



To install the upper cover, reverse the above procedure.

3. CONTROLS

3.1 Locations of Controls and Indicators

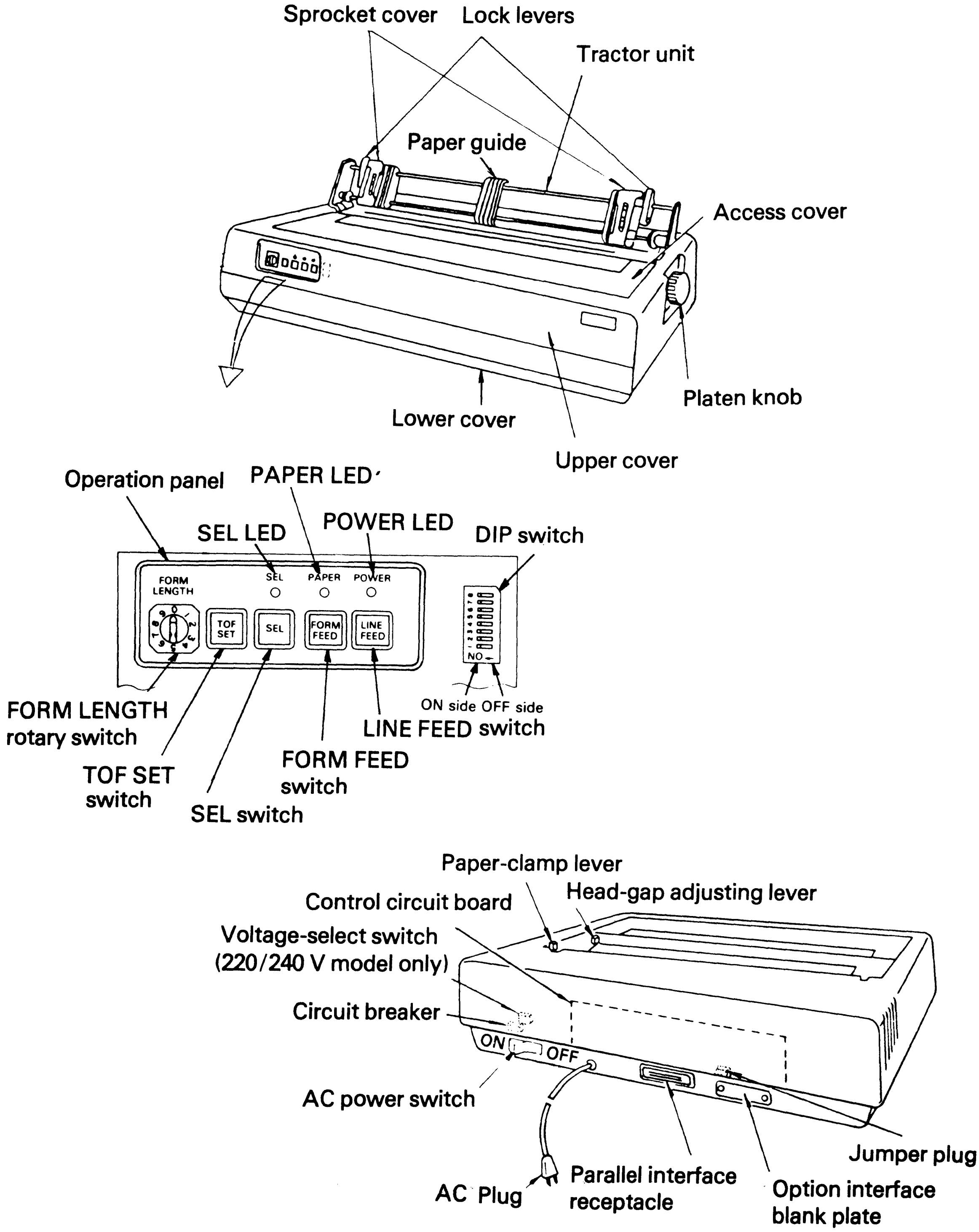


Figure 3-1 Locations of Controls and Indicators (1/2)

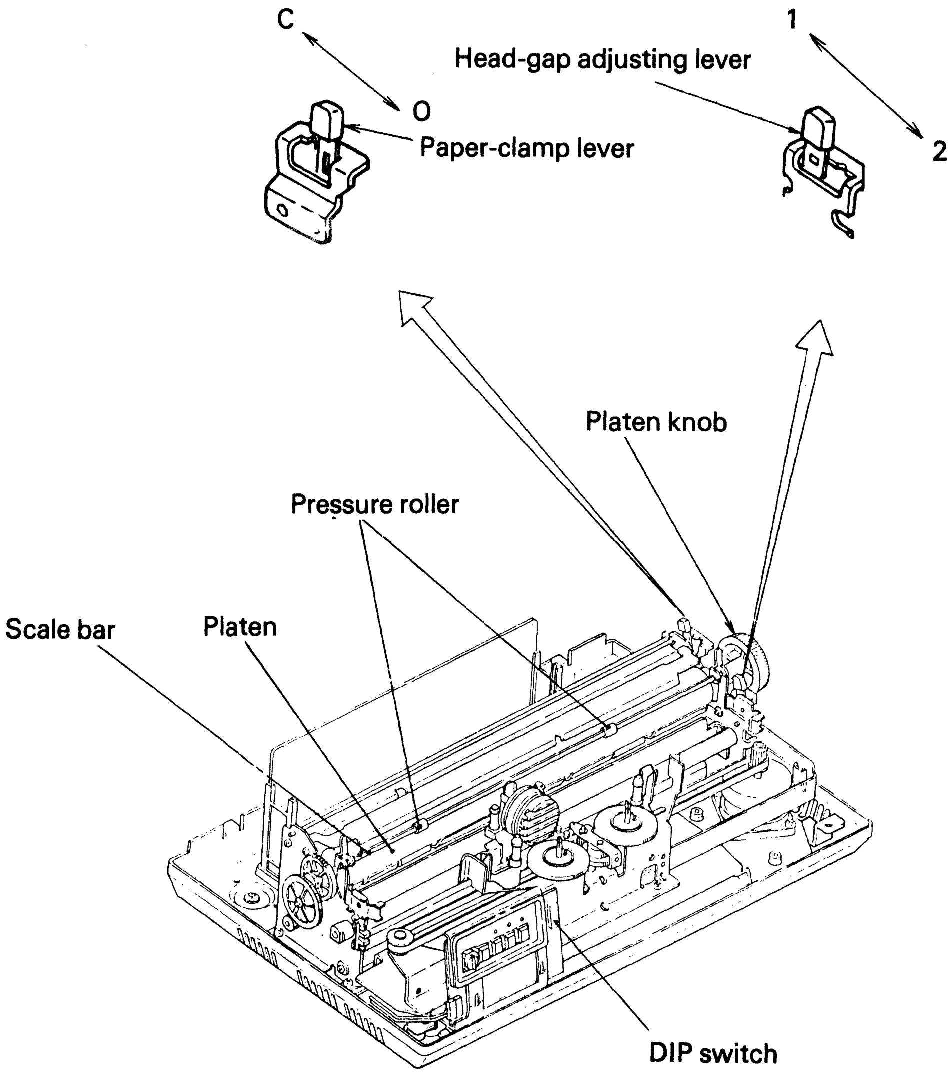


Figure 3-1 Locations of Controls and Indicators (2/2)

3.2 Functions of Controls and indicators

Table 3-1 Functions of Controls and Indicators

Name	Type	Description
AC POWER	Toggle switch	Switches AC power ON and OFF.
POWER	LED (red)	Lights when power is switched ON.
PAPER	LED (red)	Lights when paper out is detected.
FORM LENGTH	Rotary switch	Selects form length. (See table 3-2.)
TOF SET	Momentary switch	Valid when the printer is in deselect (offline) state. Depressing this switch sets the current paper position as the top-of-form (the first printing line).
SEL (SELECT)	Momentary switch	Changes the printer online/offline state: Depressing this switch when the printer is in deselect (offline) state changes the printer to select (online) state; depressing the switch when the printer is in select state changes the printer to deselect state.
SEL (SELECT)	LED (red)	When the LED is lighted, the printer is in select (online) state; when it is out the printer is in deselect (offline) state. The LED lights when the SEL switch is depressed or when the printer receives a DCI code; it goes out when the SEL switch is depressed again, when the printer receives a DC3 code, or when paper out is detected. The LED lights when power is turned on if paper is installed.
FORM FEED	Momentary switch	Valid when the printer is in deselect (offline) state. Depressing this switch causes the paper to be fed to the next top-of-form position.
LINE FEED	Momentary switch	Valid when the printer is in deselect (offline) state. Depressing this switch causes the paper to be fed one line. This switch is also used to start the local test printing.
Paper-clamp lever		Set this lever to the Close position for cut-sheet paper, and set it to the Open position for sprocket paper. When the lever is set to the Open position, the paper is free.
Head-gap adjusting lever		Adjusts the printing pressure according to paper type and thickness.
Platen knob		Feeds paper manually up or down.
DIP switch		Selects the printer functions. (See tables 3-3 and 3-4.)
Circuit breaker		Protects the printer from AC input over-current (Note 1).
Voltage-select switch	Slide switch	Selects the printer input AC voltage according to the AC voltage to be used. (Note 2) (220/240 V model only)
Jumper plug		Selects the data bit length: 7- or 8-bit code (Note 3).

Table 3-2 FORM LENGTH Rotary Switch

Switch position	FORM LENGTH	6 LPI	8 LPI
0	3 inches	18 lines	24 lines
1	3.5 inches	21 lines	28 lines
2	4 inches	24 lines	32 lines
3	5.5 inches	33 lines	44 lines
4	6 inches	36 lines	48 lines
5	7 inches	42 lines	56 lines
6	8 or 8.5 inches*	48 or 51 lines*	64 or 68 lines*
7	11 inches	66 lines	88 lines
8	12 inches	72 lines	96 lines
9	14 inches	84 lines	112 lines

*Selectable by DIP switch (See table 3-3.)

Table 3-3 DIP Switch Functions

SW No.	ON	OFF
SW1	Designate a character set. (See table 3-4.)	
SW2		
SW3		
SW4		
SW5	Designates the form length of 8.5 inches when the FORM LENGTH rotary switch is set to position 6.	Designates the form length of 8 inches when the FORM LENGTH rotary switch is set to position 6.
SW6	Designates that reception of a CR code causes data printing, auto carriage return, and one line feed.	Designates that reception of a CR code causes data printing and auto carriage return without line feed.
SW7	Designates that reception of DEL code causes printing of ■.	Designates that DEL code is ignored.
SW8	Designates an optional interface: RS-232C, IEEE 488, or current-loop interface.	Designates the standard interface: parallel interface only.

Notes: 1) *The circuit breaker is mounted on the power supply board at the rear right of the printer. When the breaker is tripped to open, all printer operations are stopped. Before resetting the breaker, turn OFF the AC POWER switch. (See figure 3-2.)*

2) *The voltage-select switch is mounted on the power supply board at the rear right of the printer (220/240 V model only). Set the switch according to the AC input voltage to be used. (See figure 3-2.)*

3) *The jumper plug is mounted on the control circuit board at the back of the printer. Set the jumper plug according to the data bit length (7- or 8-bit code) to be used. (See figure 3-2.)*

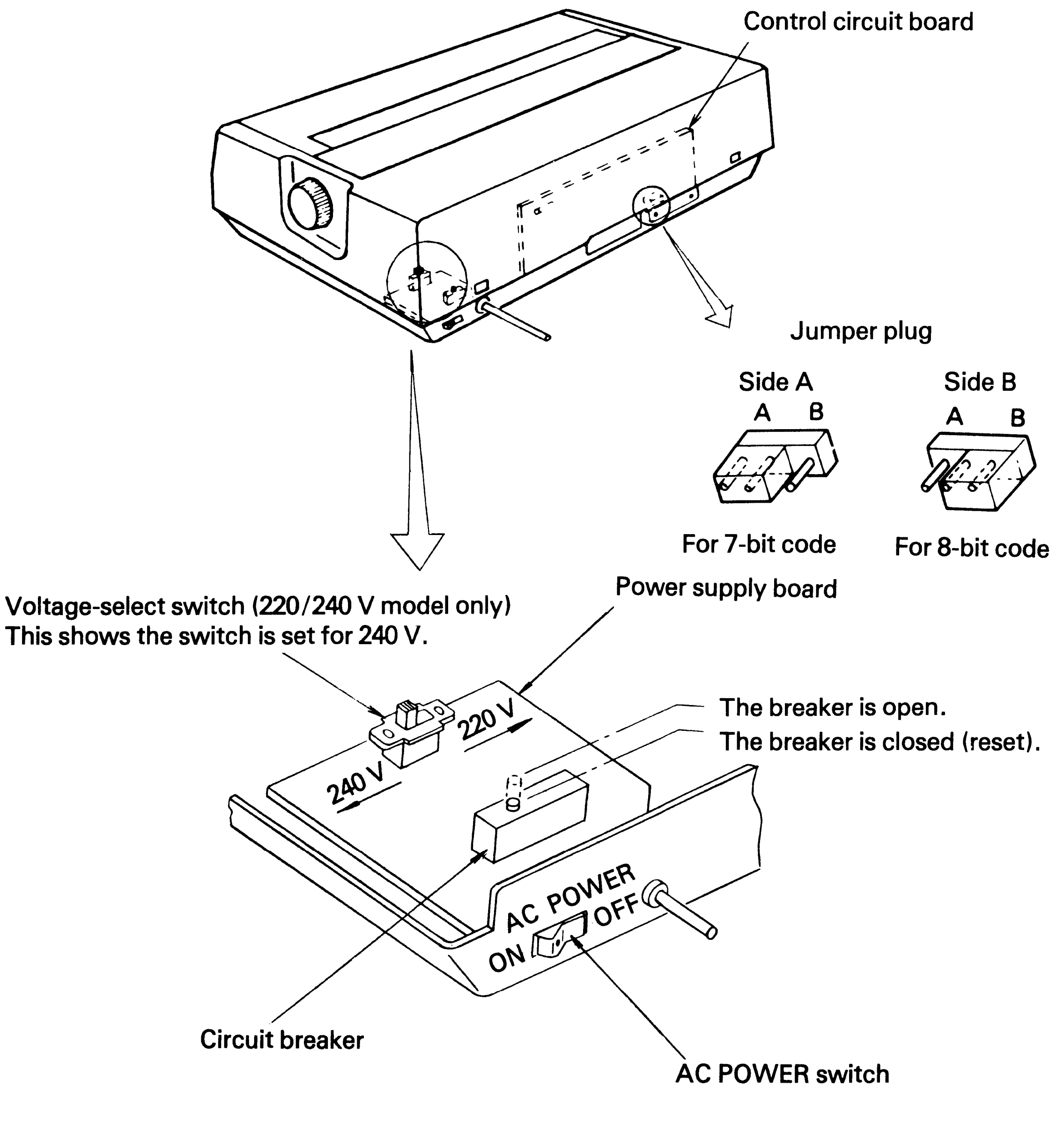


Figure 3-2 Circuit Breaker, Voltage-Select Switch, and Jumper Plug

Table 3-4 Character Set

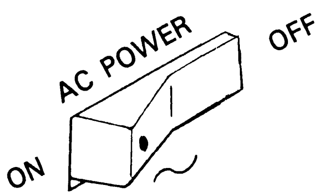
No.	DIP switch				Language
	SW4	SW3	SW2	SW1	
1					US ASCII
2	ON				Unused
3		ON			BRITISH
4	ON	ON			GERMAN
5			ON		FRENCH
6	ON		ON		SWEDISH
7		ON	ON		DANISH
8	ON	ON	ON		NORWEGIAN
9				ON	DUTCH
10	ON			ON	ITALIAN
11		ON		ON	TRS-80
12	ON	ON		ON	Unused
13			ON	ON	Unused
14	ON		ON	ON	Unused
15		ON	ON	ON	Unused
16	ON	ON	ON	ON	Unused

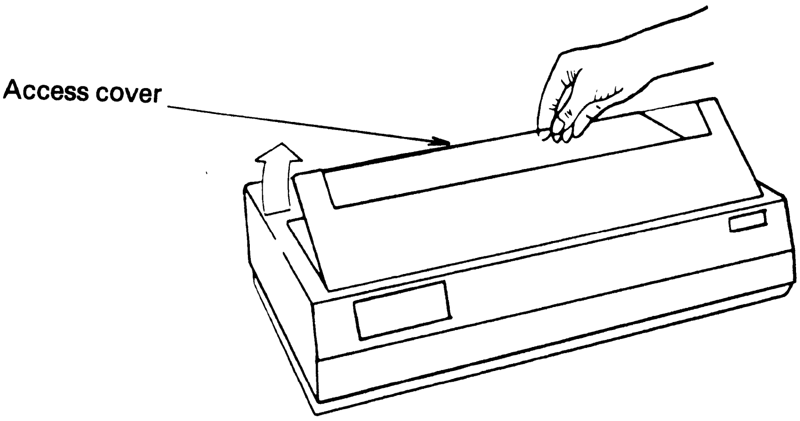
Notes: 1) "ON" means that the switch is at ON position.

2) For the character set of each language, see appendix D.

4. INSTALLATION OF RIBBON

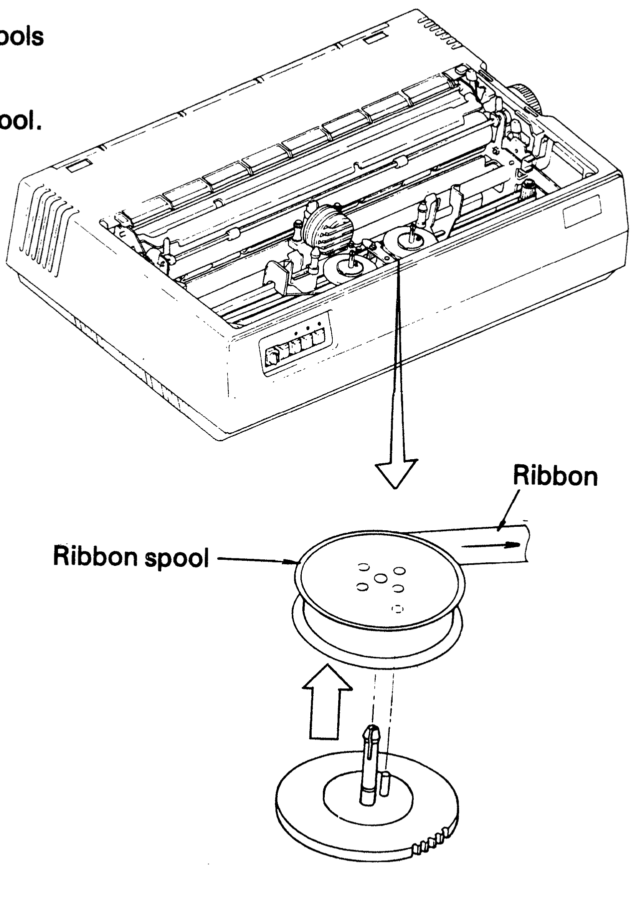
(1) Turn OFF the AC POWER switch and remove the access cover.



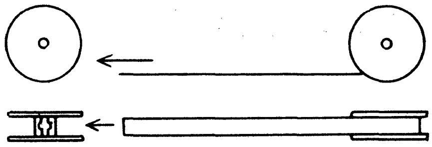


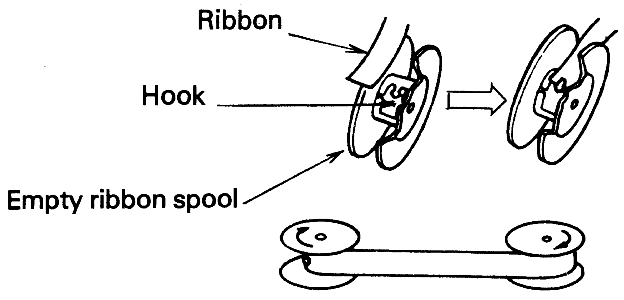
(2) Remove the left and right ribbon spools (to replace the used ribbon spool).

Remove the used ribbon on one spool. Save the empty spool.

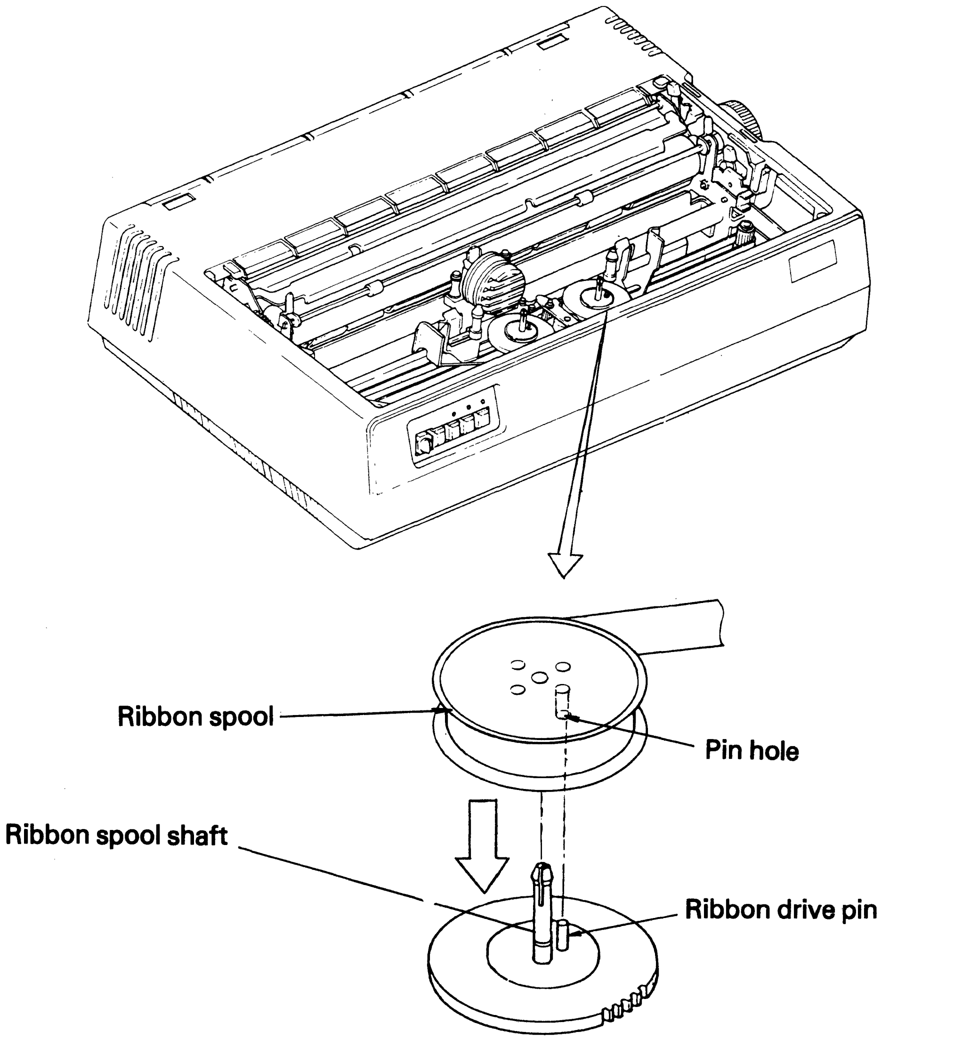


(3) Loosen the end of a new ribbon. Attach the end of the ribbon to the hook on the empty spool boss, and wind a few turns on the spool.





(4) Mount one ribbon spool on the spool shaft. Make sure that the winding direction is as shown in figure 4-1, and that the ribbon drive pin fits into the hole in the ribbon spool.



(5) Thread the ribbon as shown in figure 4-1. Be careful not to twist or fold the ribbon.

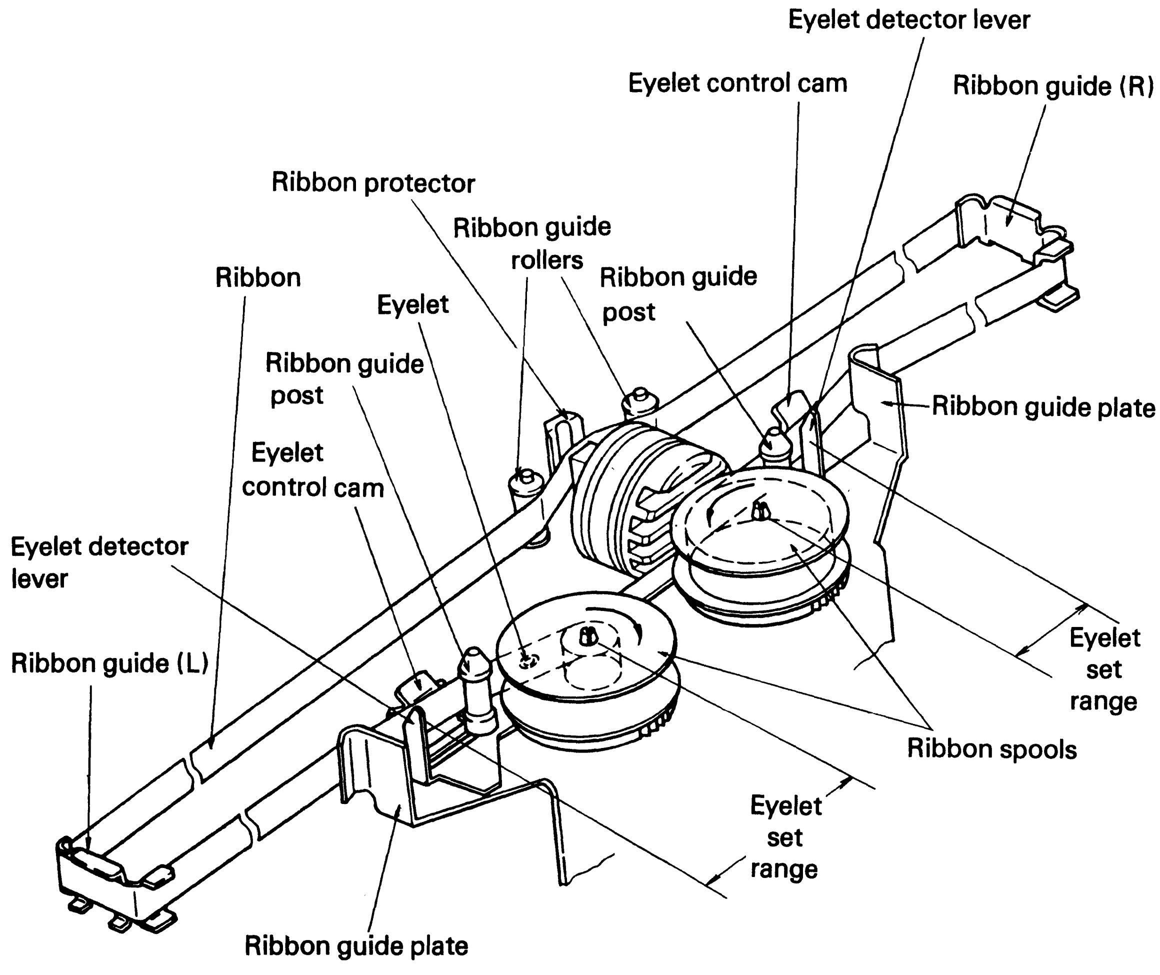
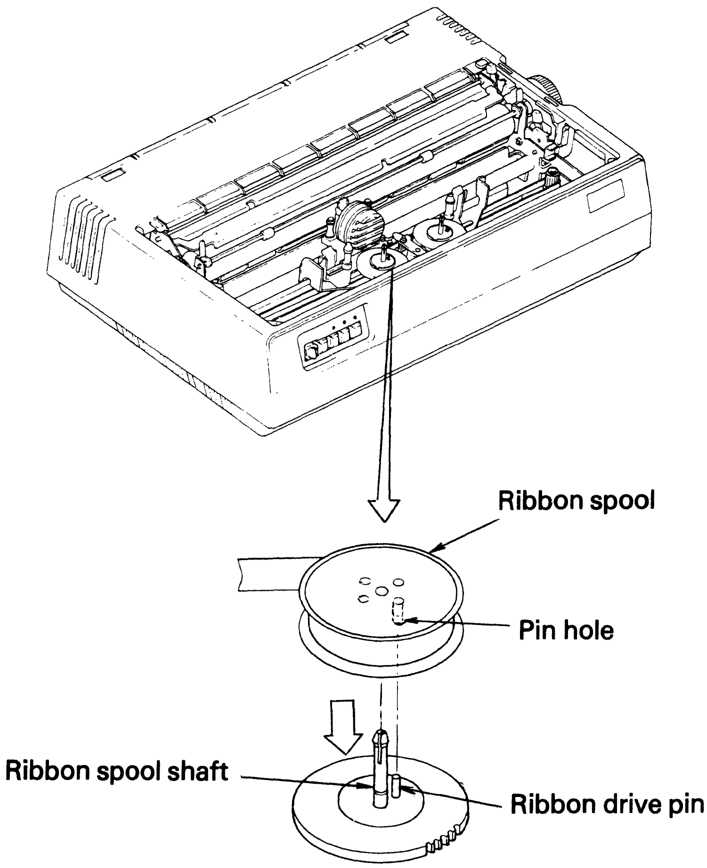


Figure 4-1 Installation of Ribbon

Notes:

1) *Be careful not to deform the ribbon protector.*
2) *Ensure that the ribbon is threaded on the ribbon guide rollers and ribbon guides.*
3) *Ensure that the eyelet is on the spool side of the eyelet detector lever.*
4) *Verify the ribbon winding direction.*

(6) Mount the other ribbon spool on the ribbon spool shaft, engaging the pin hole of ribbon spool with the ribbon drive pin.



(7) When ribbon installation is completed, turn the ribbon spool to take up the slack in the ribbon.

(8) Attach the access cover.

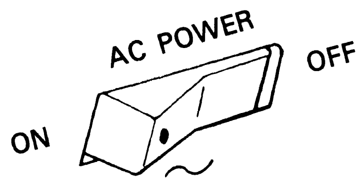
5. INSTALLATION OF PAPER

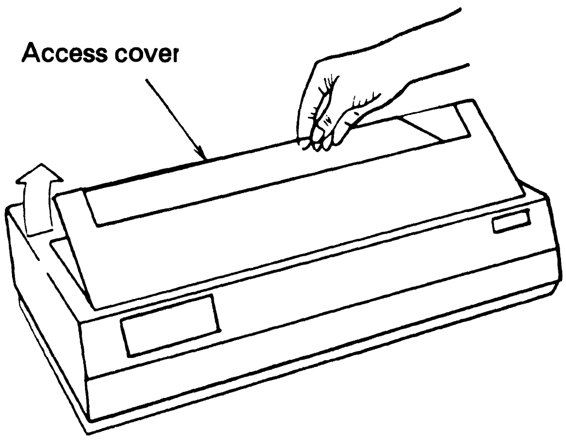
See appendix F for the kind of paper.

5.1 Installation of Cut-Sheet Paper

When cut-sheet paper is used, the tractor unit must be removed.

(1) Turn OFF the AC POWER switch and remove the access cover.

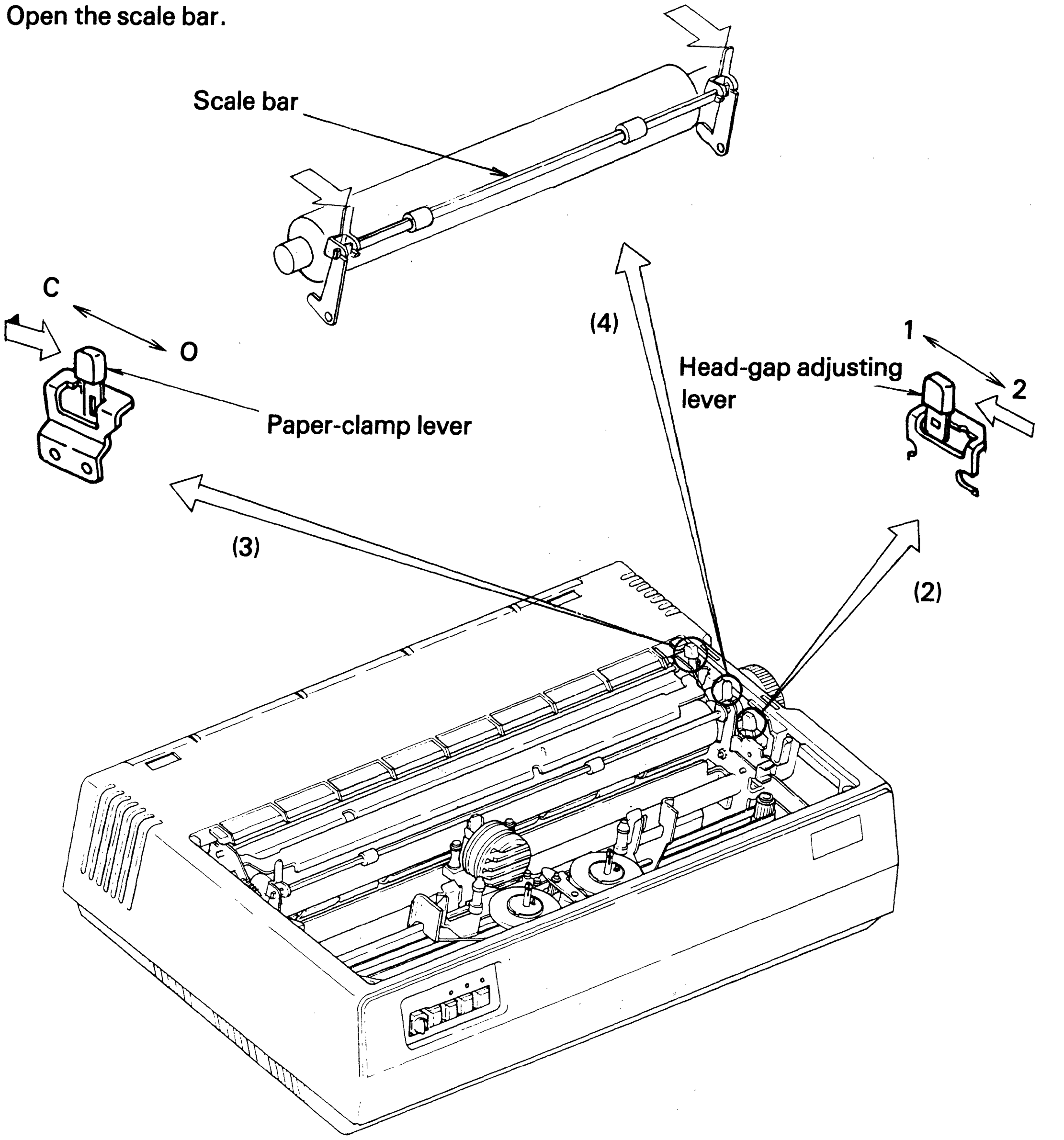




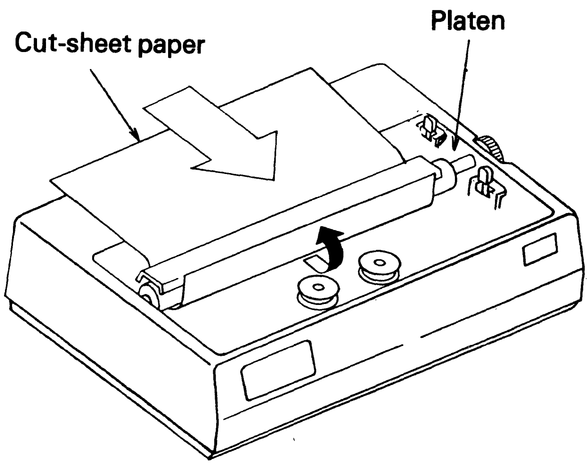
(2) Set the head-gap adjusting lever to position 1.

(3) Set the paper-clamp lever to position O (open).

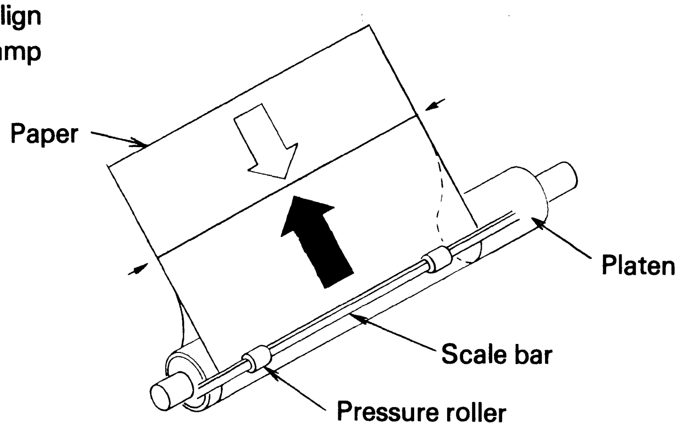
(4) Open the scale bar.

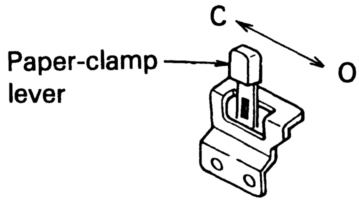


(5) Insert paper from the back of the platen until it reaches the front of the platen.



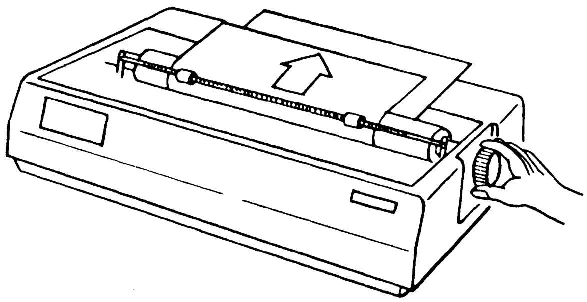
(6) Tuck the paper under the scale bar, align the paper, and set the paper-clamp lever to position C (close).





(7) Slide the pressure rollers of scale bar so that the rollers are on the paper, and put the scale bar down.

(8) Turn the platen knob to feed the paper to the first printing line.



(9) Attach the access cover.

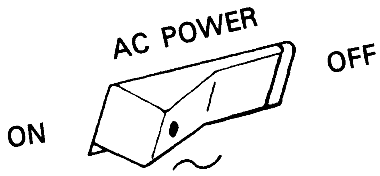
The cut-sheet paper installation is now complete.

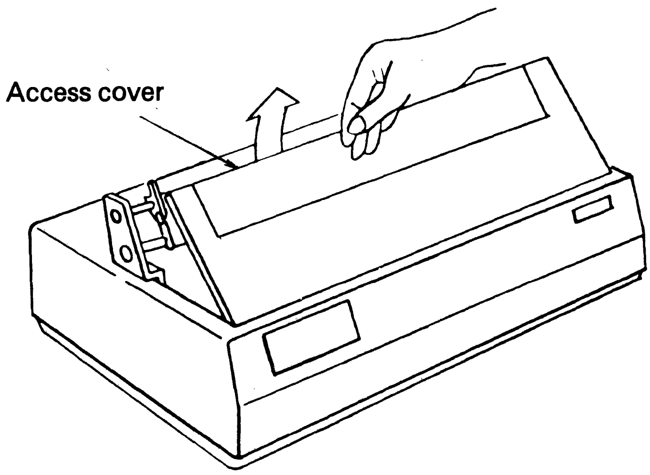
5.2 Installation of Sprocket Paper

Sprocket paper can be used when the tractor unit is installed. (Refer to section 2.3 for the tractor unit installation procedure.)

Put sprocket paper under the printer stand as shown in figure 5-1.

1) Turn OFF the AC POWER switch and remove the access cover.





(2) Set the head-gap adjusting lever to position 1 or 2 according to the type and thickness of the paper to be used. (See table 5-1; description is also given on the back of the access cover.)

(3) Open the scale bar.

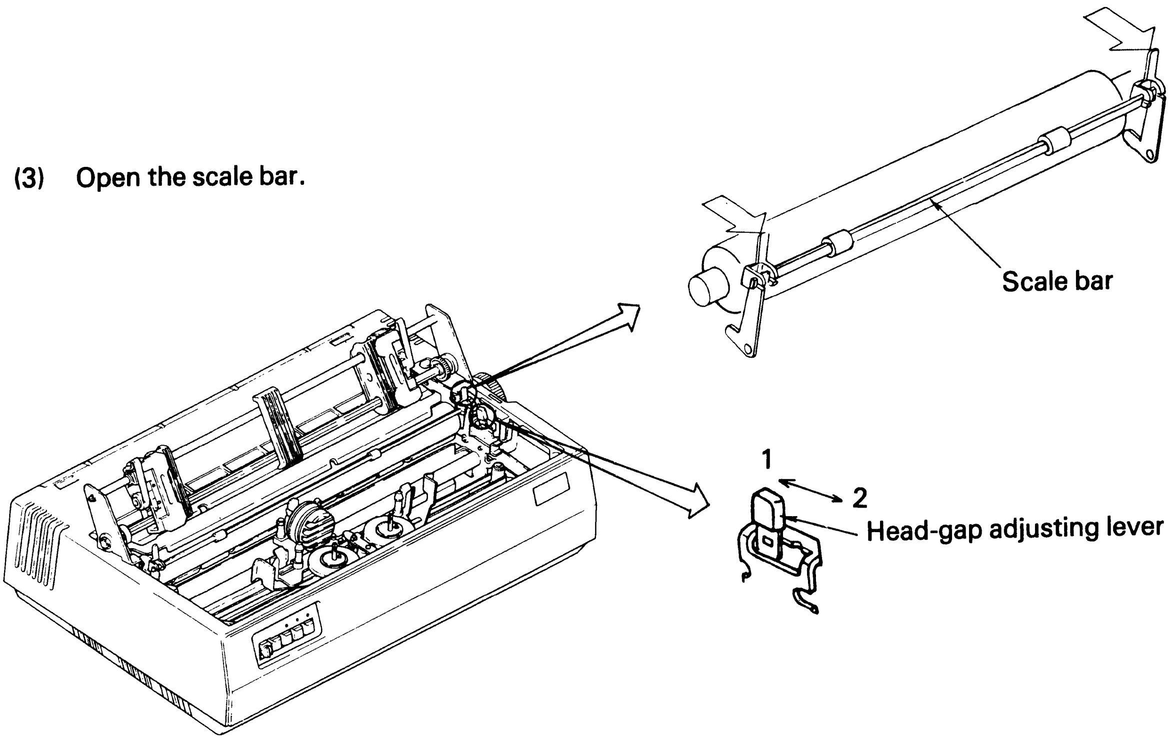
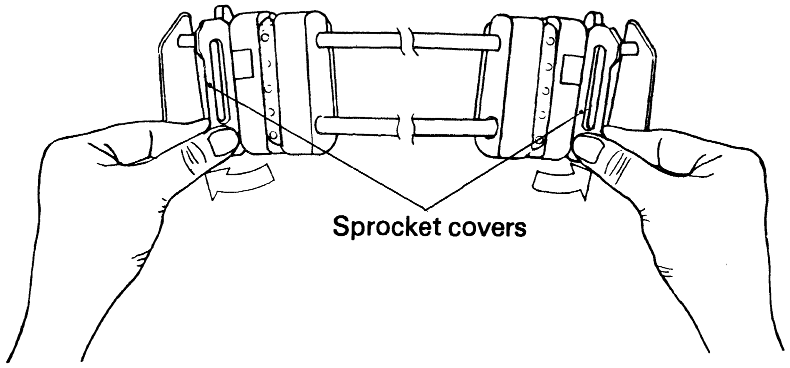


Table 5-1 Head-Gap Adjusting Lever Setting

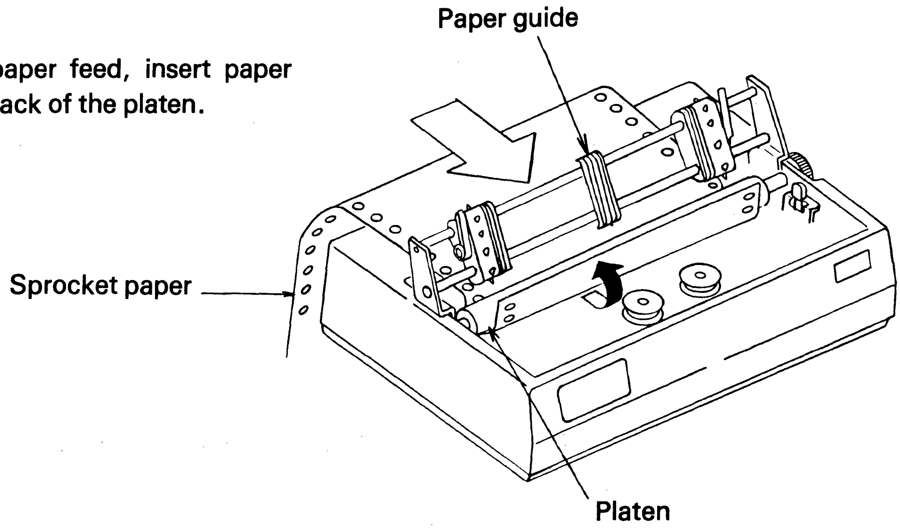
Head-gap adjusting lever position	Type of paper	No. of sheets
1 (Platen side: The gap between the platen and the print head is narrow.)	One-part paper	1
	Pressure-sensitive or carbon-lined paper	2 to 3
	Interleaf paper	2
2 (Front side: The gap between the platen and the print head is wide.)	Pressure-sensitive or carbon-lined paper	4
	Interleaf paper	3 to 4

(4) Open the sprocket covers of the tractor unit.

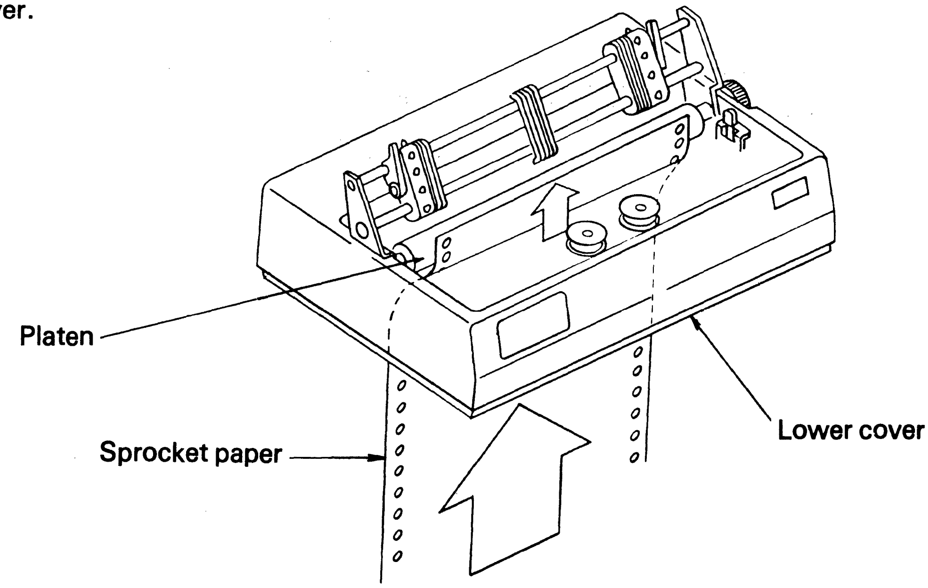


(5) Insert paper until it reaches the front of the platen.

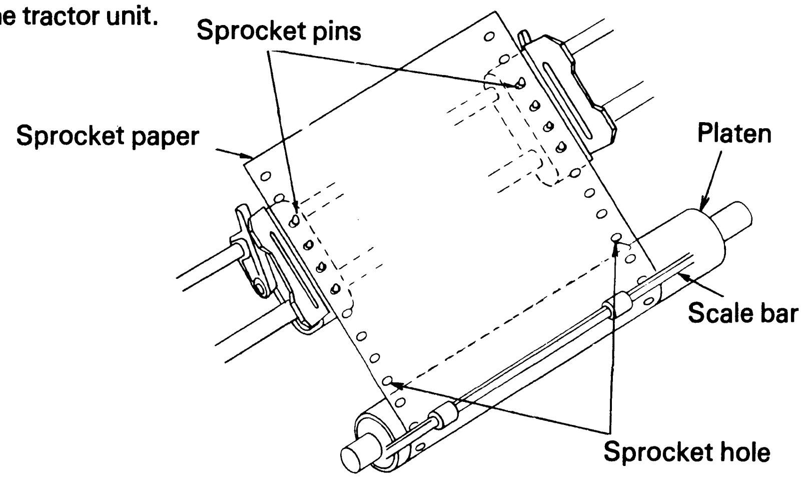
(a) For rear paper feed, insert paper from the back of the platen.



(b) For bottom paper feed, insert paper from the bottom of the printer lower cover.



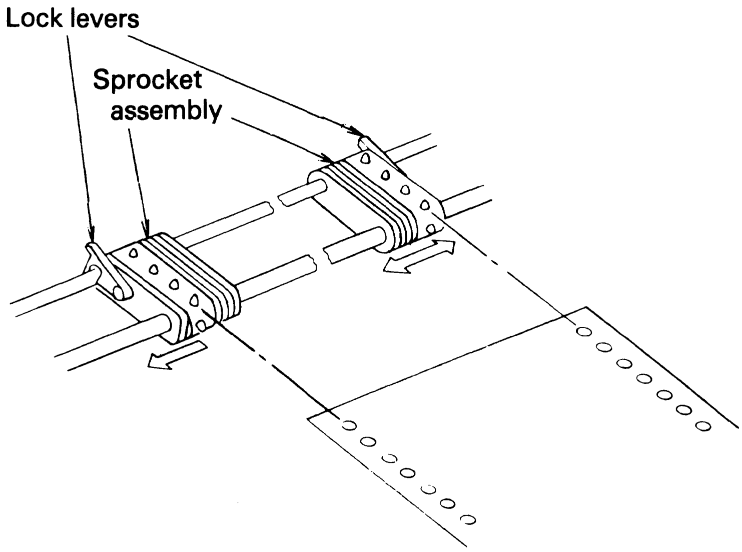
(6) Tuck the paper under the scale bar and engage the sprocket holes of the paper with the sprocket pins of the tractor unit.



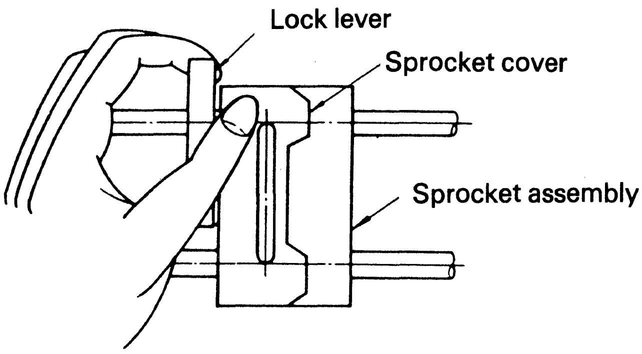
Notes: *1) Precautions for paper width change*

(a) Unlock the sprocket lock levers. Slide the left sprocket assembly to the left end and lock the sprocket lock lever.

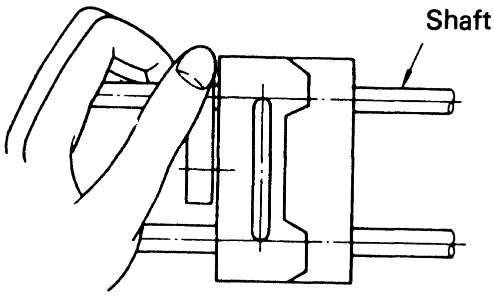
(b) Adjust the position of the right sprocket assembly to the paper width with no paper slack, and lock the sprocket assembly.



2) To unlock the sprocket lock lever, put your thumb on the sprocket cover and pull the lock lever with your index finger.

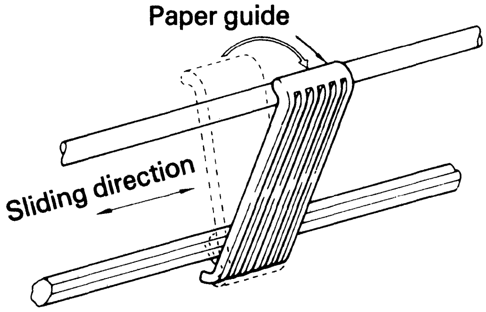


3) To lock the sprocket lock lever, push the lock lever with your thumb while holding the shaft with the other fingers.

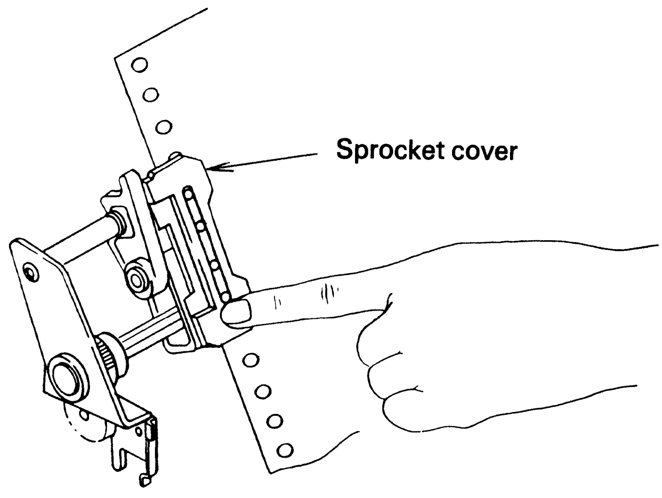


4) When narrow paper is used, the paper guide can be removed by snapping it off the shafts.

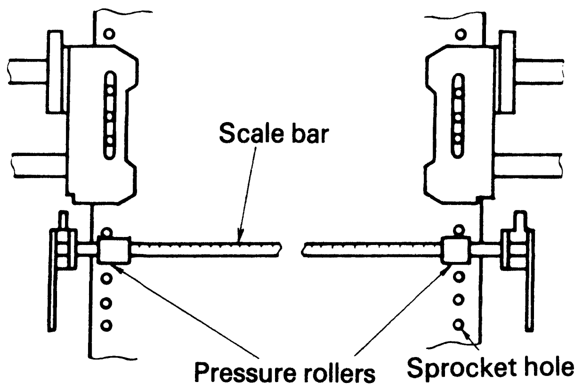
When using the paper guide, you may set it at the middle between two sprockets by sliding it along the shafts.



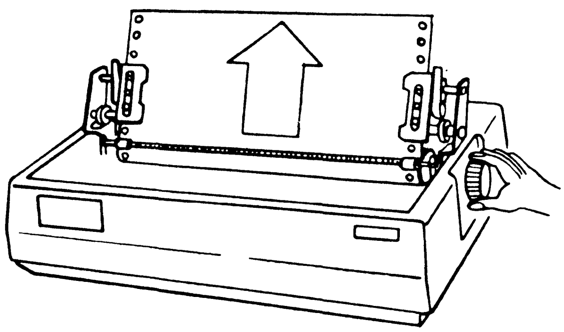
(7) Close the sprocket covers.



(8) Slide the pressure rollers of the scale bar so that they are on the sprocket hole at both ends, and put the scale bar down.



(9) Turn the platen knob to adjust the paper to the top-of-form position. Lightly pull the paper backward to remove slack.



(10) Attach the access cover.

The sprocket paper installation is now complete.

Notes: *1) When using the tractor unit, the paper clamp lever must be at position O (open).*

2) Figure 5-1 shows the positions of the sprocket paper carton for rear paper feed and for bottom paper feed.

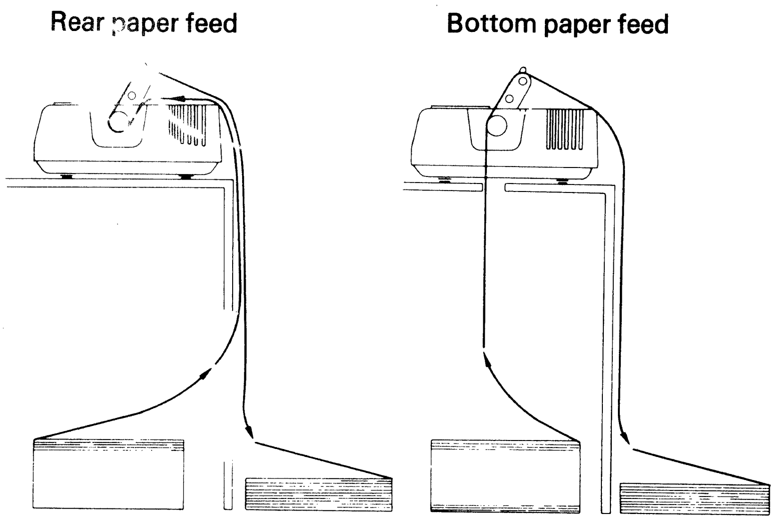


Figure 5-1 Sprocket Paper Positioning

6. OPERATION

The following operations can be performed when the printer is in offline state (when the SEL LED is off).

(1) Line feed (LF)

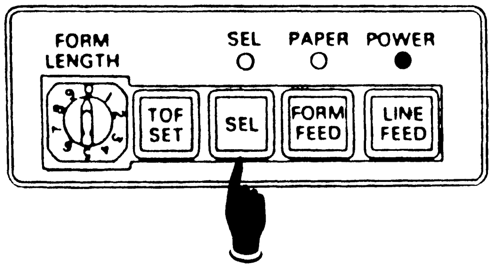
(2) Form length setting

(3) Form feed (FF)

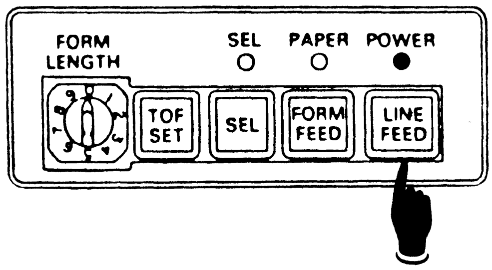
(4) Local test printing

6.1 Line Feed

(1) Press the SEL switch to change the printer to offline state (the SEL LED goes out).



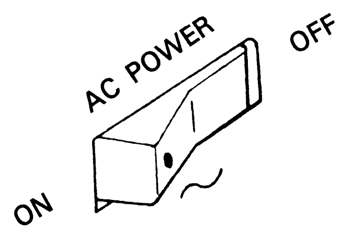
(2) Each time the LINE FEED switch is pressed, the paper is fed one line.



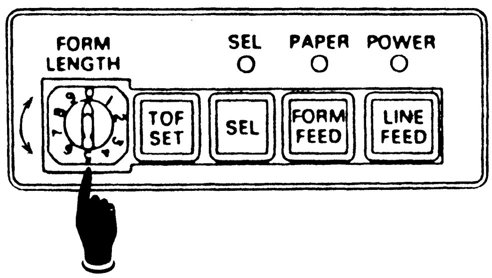
6.2 Form Length Setting

6.2.1 Form length setting by AC POWER switch

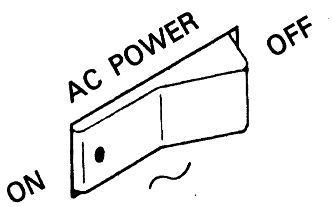
(1) Turn OFF the AC POWER swtich.



(2) Set the FORM LENGTH rotary switch to the desired position. (Refer to table 3-2.)

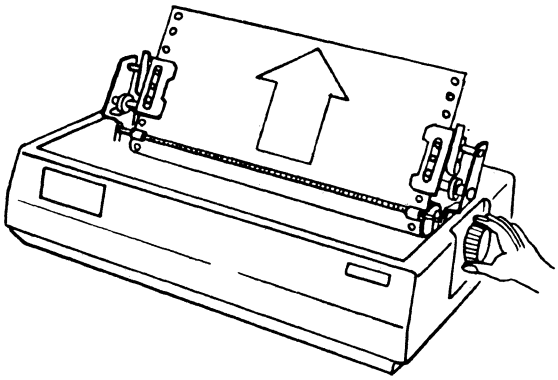


(3) Turn ON the AC POWER switch. (Both SEL and POWER LEDs light.)



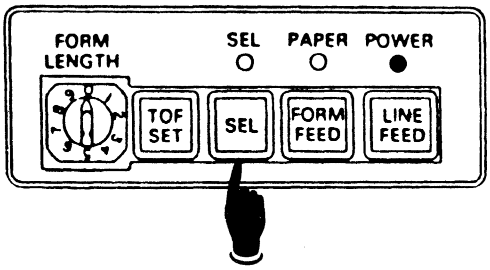
(4) Turn the platen knob to set the paper to the top-of-form position.

The form length is now set.

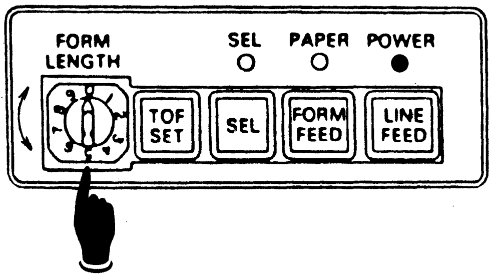


6.2.2 Form length setting by TOF SET switch

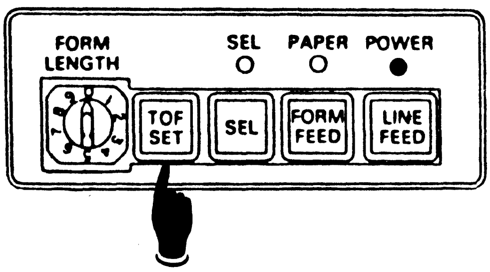
(1) Press the SEL switch to change the printer to offline state. (The SEL LED goes out.)



(2) Set the FORM LENGTH rotary switch to the desired position.

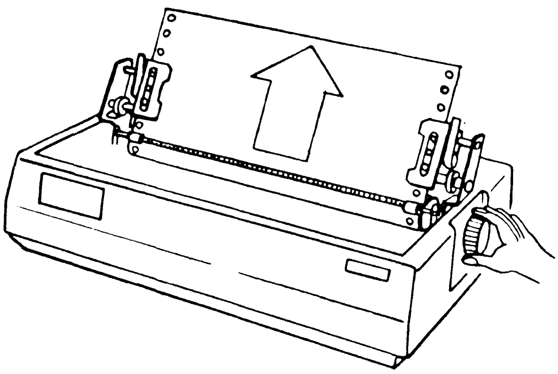


(3) Press the TOF SET switch.



(4) Turn the platen knob to set the paper to the top-of-form position.

The form length is now set.



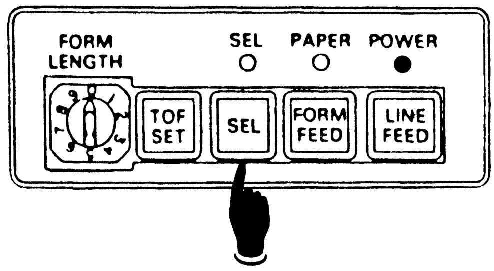
Notes: *1) When the printer is in online state, the form length can also be set by function code.*

2) A form length set by function code overrides that set by the FORM LENGTH rotary switch.

3) Do not set the FORM LENGTH rotary switch at any position between marks.

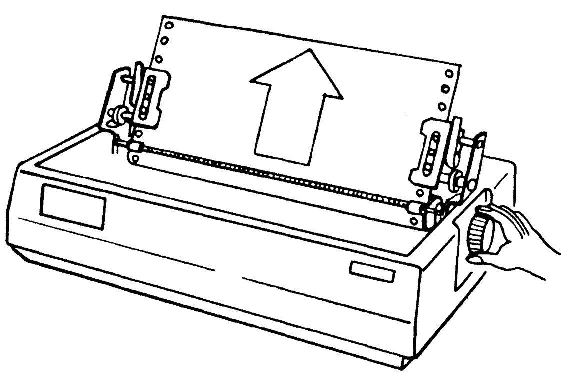
6.3 Form Feed

(1) Press the SEL switch to set the printer in offline state. (The SEL LED goes out.)

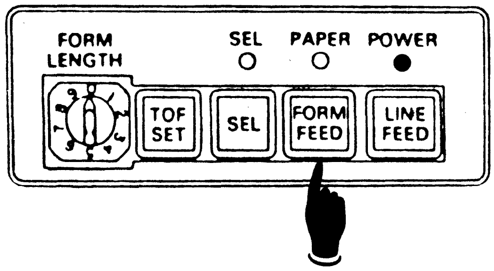


(2) Set the form length, if necessary. (See section 6.2.2, items (2) and (3).)

(3) Turn the platen knob to set the paper to the top-of-form position. In this case, do not use the LINE FEED switch.



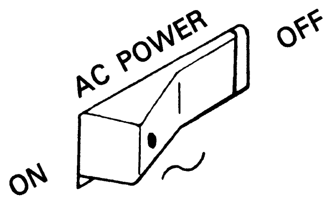
(4) Press the FORM FEED switch; the paper is fed to the next top-of-form position according to the predetermined form length.



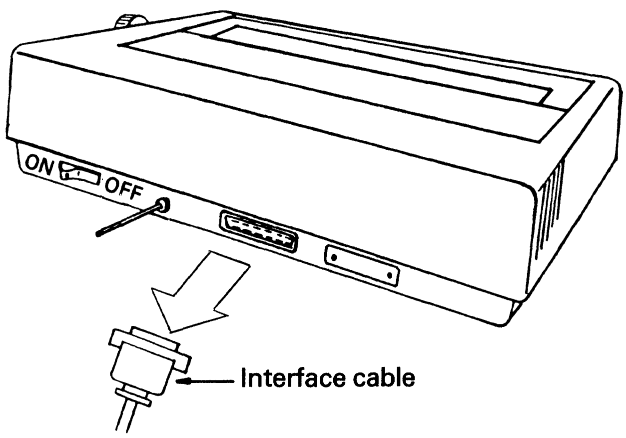
Note: When the printer is in online state, form feed can be performed by function code FF.

6.4 Local Test Printing

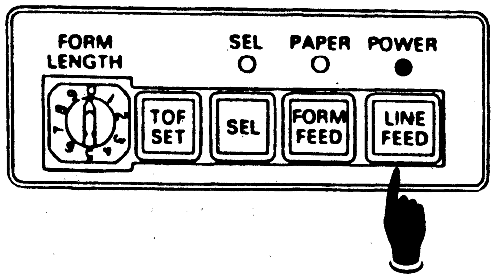
(1) Turn OFF the AC POWER switch.

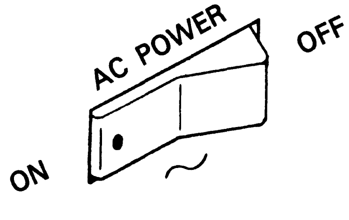


(2) Remove the interface cable from the printer.



(3) Holding the LINE FEED switch depressed, turn ON the AC POWER switch.





(4) Release the LINE FEED switch about 2 seconds later.

The above operation causes the rolling ASCII pattern to be printed out in one sequence only. To repeat the test printing, repeat the above procedure.

Rolling ASCII pattern

```
REVISION NO. = 1.4 1.2
 !"#$%&'()*+,-./0123456789:
!"#$%&'()*+,-./0123456789:;
"#$%&'()*+,-./0123456789:;<
#$%&'()*+,-./0123456789:;<=
$%&'()*+,-./0123456789:;<=>
%&'()*+,-./0123456789:;<=>?
&'()*+,-./0123456789:;<=>?@
'()*+,-./0123456789:;<=>?@A
()*+,-./0123456789:;<=>?@AB
)*+,-./0123456789:;<=>?@ABC
*+,-./0123456789:;<=>?@ABCD
+,-./0123456789:;<=>?@ABCDE
,-./0123456789:;<=>?@ABCDEF
-./0123456789:;<=>?@ABCDEFG
./0123456789:;<=>?@ABCDEFGH
/0123456789:;<=>?@ABCDEFGHI
```

(5) Press the SEL switch to return the printer to select (online) state.

6.5 Precautions

(1) Turn OFF the AC POWER switch before connecting the AC plug to an AC receptacle.

(2) Be sure to turn OFF the AC POWER switch before connecting the interface cable to the printer.

(3) Never print without paper.

(4) Never print without ribbon or with a wornout ribbon.

(5) When transporting the printer, take the ribbon spools out of the printer.

(6) When the printer is not in use or is stored for a long time, set the paper-clamp lever to position O (open.)

(7) When attaching the platen knob to the printer, make sure to engage it with the detent and lock it.

(8) Never use a fuse other than one of the specified ampere value.

(9) Be careful not to touch the print head after a long-time operation because of the high temperature.

(10) Should printing operation stop, check the PAPER LED for paper-out detection.

(11) Do not operate the voltage-select switch, jumper plug, or DIP switches unless it is necessary.

(12) Do not expose the printer to extremely high or low temperature, rapid temperature variations, dust, or shock.

(13) When cleaning the printer surfaces, use dry, soft cloth. Do not use an organic solvent or abrasive cleansers. You may use diluted detergent or a small amount of household cleanser, if necessary.

(14) Do not lean nor place anything on the printer. If something should drop into the printer, immediately turn OFF the AC POWER switch and carefully remove the foreign object from the printer.

7. TROUBLESHOOTING

7.1 Troubles and Remedies

Table 7-1 shows troubles that might occur with the printer and corresponding remedies. If the trouble causes cannot be identified, contact your dealer.

Table 7-1

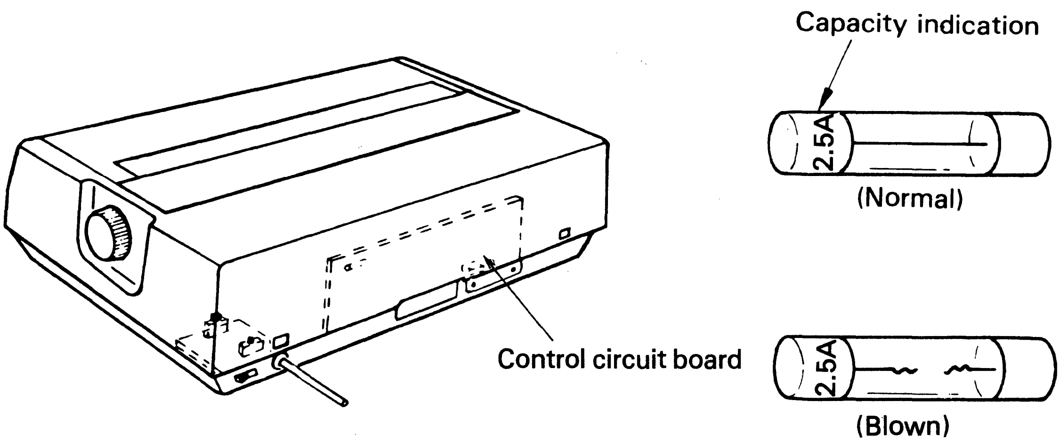
No.	Trouble	Possible cause	Remedy
1	The POWER LED does not light.	•The AC plug is not connected to an AC receptacle. •The circuit breaker is open. (The breaker pushbutton is up.)	•Connect the AC plug to an AC receptacle. •Turn OFF the AC POWER switch, remove the access cover, and press down the breaker pushbutton. (Refer to section 3, figure 3-2.) If the circuit breaker trips repeatedly, contact your dealer.
2	The PAPER LED lights.	•The paper has run out.	•Install new paper.
3	The paper is not fed.	•When using cut-sheet paper: The paper-clamp lever is at the Open position. •When using sprocket paper: The sprocket holes of the paper are not set properly on the sprocket pins of the tractor.	•Set the paper-clamp lever to the Close position. (Refer to figure 3-1.) •Install the paper properly. (Refer to section 5.2.)
4	The paper tears.	•Non-standard paper is used. •The paper is not installed properly. •The head-gap adjusting lever is not set at the correct position.	•Change to standard paper. •Install the paper properly. •Set the head-gap adjusting lever to the correct position. (Refer to section 5.2, table 5-1.)
5	The ribbon does not print any color.	•The ribbon has been used longer than the service life. •Trouble in ribbon feed mechanism. •The ribbon is not threaded properly.	•Change to a new ribbon. •Contact your dealer. •Install the ribbon properly. (Refer to figure 4-1.)
6	The printer does not operate.	•The fuse is blown. •Others (printer error, etc).	•Replace the fuse. (See section 7.2.) •If the fuse blows repeatedly, contact your dealer. •Turn OFF the AC POWER switch and then turn it ON again.

7.2 Replacement of Fuse

(1) Turn OFF the AC POWER switch and remove the AC plug from the AC receptacle.

(2) Remove the upper cover. (Refer to section 2.4.)

(3) Remove the blown fuse from the control circuit board.



(4) Install a new fuse on the circuit board. (Use a 2.5-A fuse approved by UL/CSA.)

(5) Attach the upper cover.

PART II Maintenance Manual

8. THEORY OF OPERATION

8.1 Operation of Mechanical Section

The mechanical section consists of:

(a) Print head

(b) Carriage assembly

(c) Ribbon drive assembly

(d) Paper feed mechanism

8.1.1 Mechanism and Operation of Print Head

The print head is spring-loaded, utilizing a permanent magnet, and can be easily removed or installed.

The print head is mounted on a carriage that runs parallel to the platen, and is connected to the control circuit through a cable.

The print head consists of:

(a) Wire guide

(b) Yoke

(c) Armature assembly

(d) Spacer

(e) Magnet assembly

(f) Thermistor

(1) Print head operation (see figure 8-1.)

When the print head is in the non-printing state, the armature is attracted by the permanent magnet, and spring holding the armature is compressed by the thickness of a spacer. Therefore, the print wire, which is fastened to the armature, is held retracted within the wire guide. When a signal corresponding to a character to be printed is detected by the control circuit, a current flows to the coil that corresponds to the particular print wire. When the coil is energized, the magnetic flux generated by the permanent magnet between the armature and pole is nullified and the attraction disappears. As a result, the print wire is driven toward the platen by the force of the armature spring; the print wire ejects from the tip of the wire guide and strikes the paper through the ribbon to print a dot on the paper.

After the character is printed, the magnetic flux of the permanent magnet attracts the armature again so the print wire is retracted into the wire guide.

The print head has a built-in thermistor to prevent the coil from overheating and burning due to continuous bi-directional printing over a long period. If the coil temperature exceeds the limit (90°C), the control circuit detects the thermistor signal and changes from bi-directional printing mode to uni-directional printing mode until the coil temperature cools below the limit. In this state, if the coil does not cool even after uni-directional printing of 64 lines, the printing operation is stopped until the coil cools below the limit.

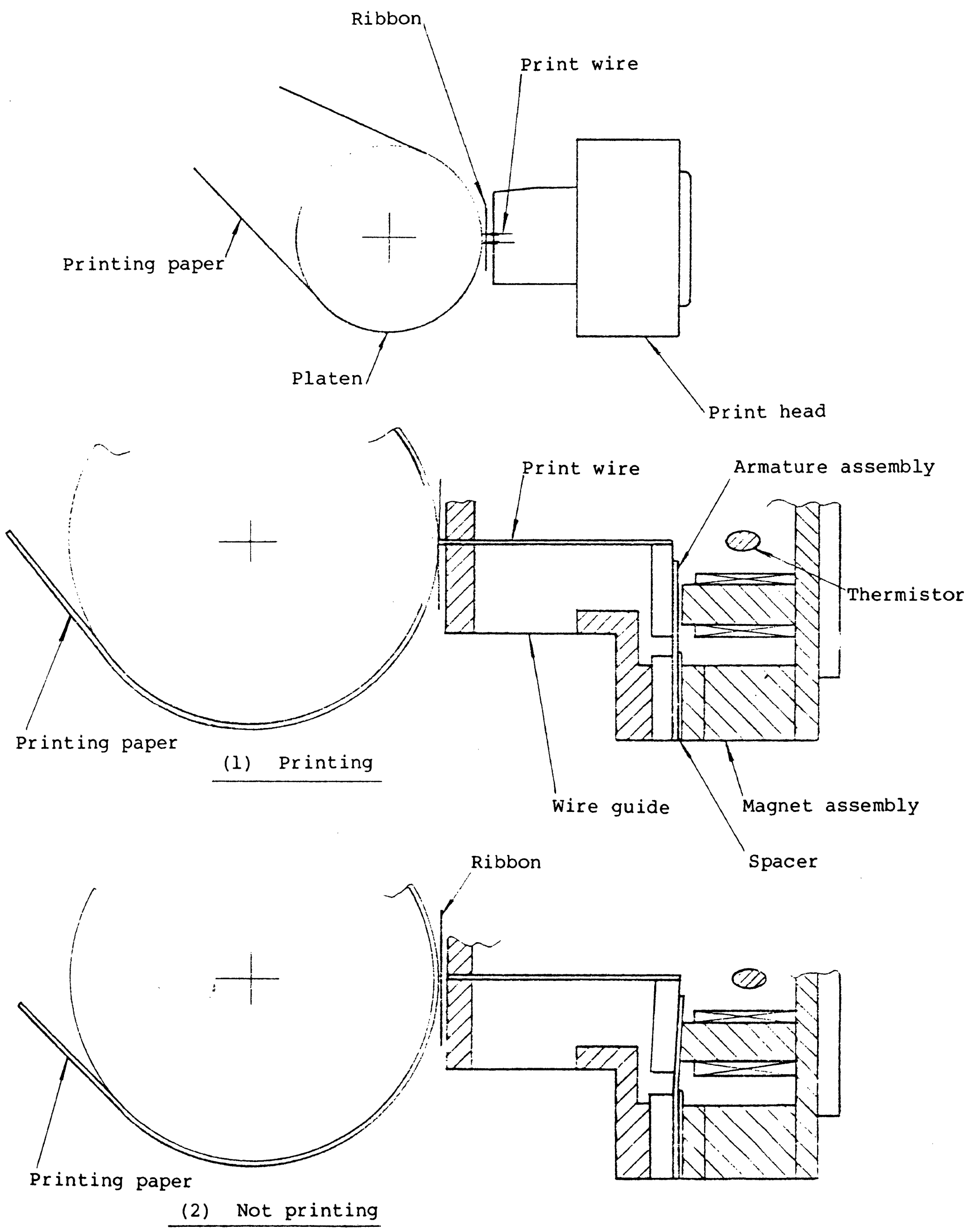


Figure 8-1 Printing Mechanism

8.1.2 Space Mechanism and Operation

Spacing and carriage return are performed by driving the carriage, which is guided by two carriage shafts mounted parallel to the platen, by a stepper motor.

The space mechanism consists of:

(a) Stepper motor with synchro belt pulley

(b) Synchro belt

(c) Two carriage shafts

(d) Carriage

(e) Home sensor

(f) Home sensor plate

(1) Spacing operation (See figure 8-2.)

The carriage, with the print head mounted on it, moves parallel to the platen along the upper and lower carriage shafts. One end of the carriage frame is attached to the synchro belt.

As the stepper motor rotates clockwise, the carriage is driven from left to right.

The spacing mechanism is so designed that when the stepper motor rotates 12 steps (21.6°), the carriage moves 2.54 mm (0.1 inch) (10 CPI).

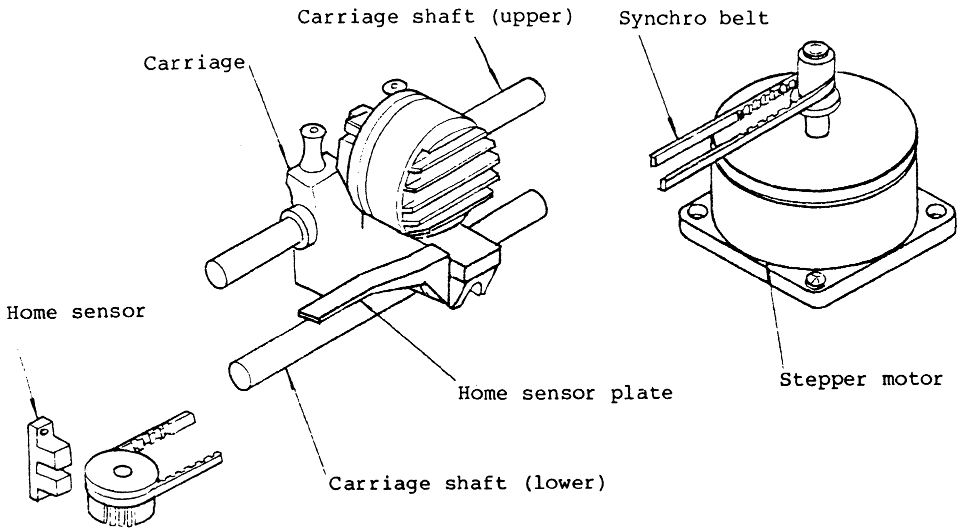


Figure 8-2 Space Mechanism

(2) Carriage return operation

When a CR (carriage return) code is received, the stepper motor is driven counterclockwise to move the carriage from right to left until the home sensor plate passes through the home sensor slit.

The home sensor is composed of a pair of light-emitting and photo diodes. When the home sensor plate passes through the slit, the light is intercepted, a motor stop control pulse is generated, and the motor is stopped. The carriage is positioned at the start position.

8.1.3 Ribbon Feed Mechanism and Operation

(1) Description

The driving force for ribbon feeding is supplied by the same stepper motor as for carriage movement.

The ribbon feed mechanism consists of:

(a) Ribbon drive gear

(b) Ribbon gear

(c) Ribbon spool gear

(d) Ribbon change lever

(e) Eyelet detector lever

(f) Ribbon bracket

(2) Ribbon feed operation (See figure 8-3.)

When the ribbon change lever is at the left, if the stepper motor rotates clockwise (the carriage moves from left to right), the ribbon drive gear rotates clockwise via the synchro belt. The ribbon gear, rotating around the ribbon drive gear, slides to the left and engages the left ribbon spool gear to rotate the left ribbon spool clockwise and thus feed the ribbon to the left.

If the stepper motor rotates counterclockwise (the carriage moves from right to left), the ribbon gear, rotating around the ribbon drive gear, slides to the right and idles so that the ribbon is not fed.

When the ribbon in the right ribbon spool runs short, the ribbon reverse eyelet on the right is caught between the eyelet control cam and the eyelet detector lever to shift the eyelet detector lever from left to right. The movement of the eyelet detector lever causes the ribbon change lever to turn from left to right, and the ribbon change lever is held at the right by the detent spring.

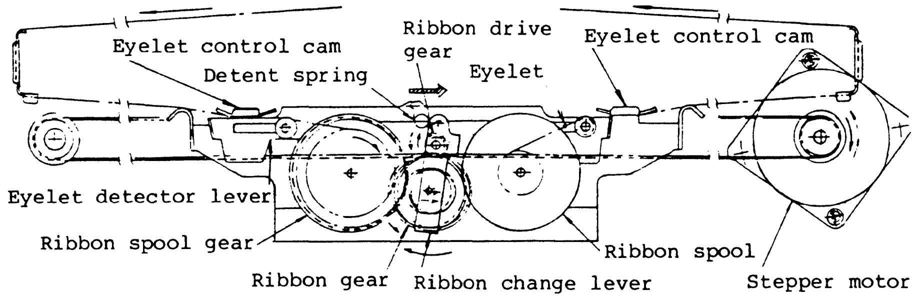
In this state, when the stepper motor rotates clockwise (the carriage moves from left to right), the ribbon gear, rotating around the ribbon drive gear, slides to the left and idles so that the ribbon is not fed.

When the stepper motor rotates counterclockwise (the carriage moves from right to left), the ribbon gear engages with the right ribbon spool gear to rotate the right ribbon spool counterclockwise and thus feed the ribbon to the right.

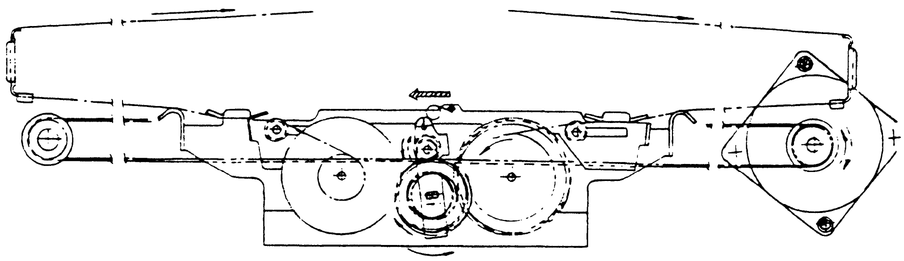
When the ribbon in the left ribbon spool runs short, the ribbon reverse eyelet on the left is caught between the eyelet control cam and the eyelet detector lever to shift the eyelet detector lever from right to left.

The movement of the eyelet detector lever causes the ribbon change lever to turn from right to left, and the ribbon change lever is held at the left by the detent spring.

Ribbon feed is performed by repeating the above operation.



(a) Ribbon feed to left



(b) Ribbon feed to right

Figure 8-3 Ribbon Feed Mechanism

8.1.4 Paper Feed Mechanism and Operation

(1) Description

Paper feed is carried out by rotating the fixed pin platen and the tractor unit, which are driven by the stepper motor.

The paper feed mechanism consists of:

(a) Stepper motor with gear

(b) Reduction gear

(c) Platen

(d) Tractor unit

(2) Paper feed operation (see figure 8-4.)

The paper feed stepper motor is mounted on the left side frame and its rotation is transmitted to the platen through the reduction gear. Platen rotation is also transmitted through the idle gear to the tractor unit.

The paper feed mechanism is so designed that when the stepper motor rotates 24 steps (180°), paper is fed 4.23 mm (6 LPI).

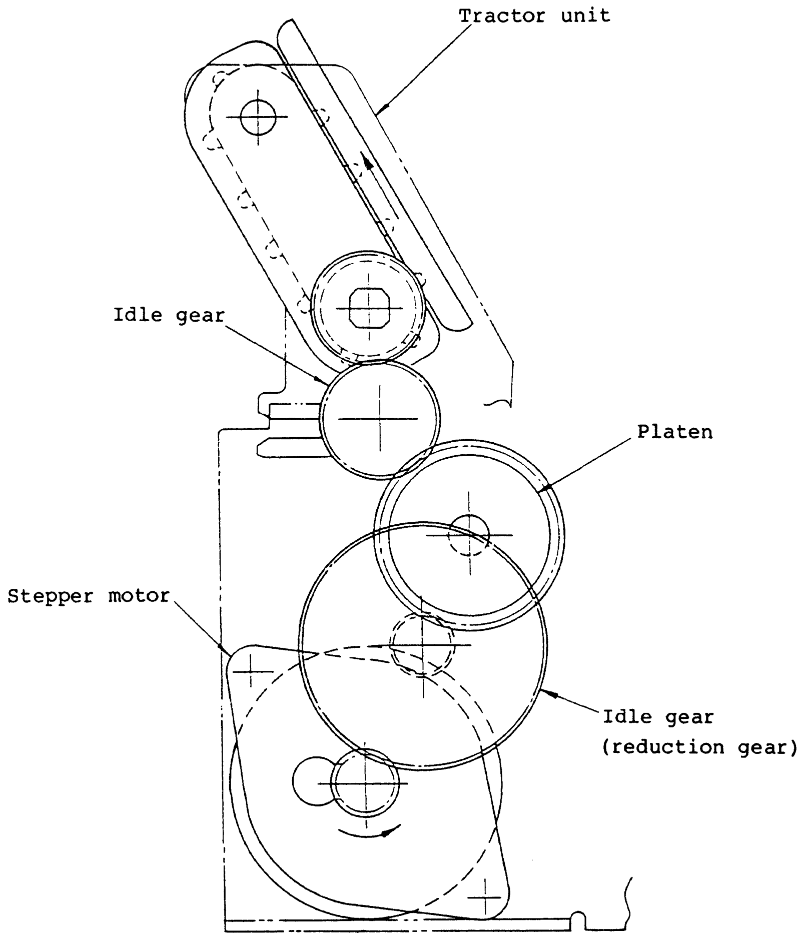


Figure 8-4 Paper Feed Mechanism

8.1.5 Paper Clamp Mechanism (See figure 8-5.)

When the paper clamp lever is set to the open position, the roller support shaft rotates counterclockwise and thus a gap is made between the friction rollers and the platen, allowing insertion of paper.

When the paper clamp lever is set to the closed position, the roller support shaft rotates clockwise and the friction rollers are pushed against the platen by the feed roller spring, so paper can be fed.

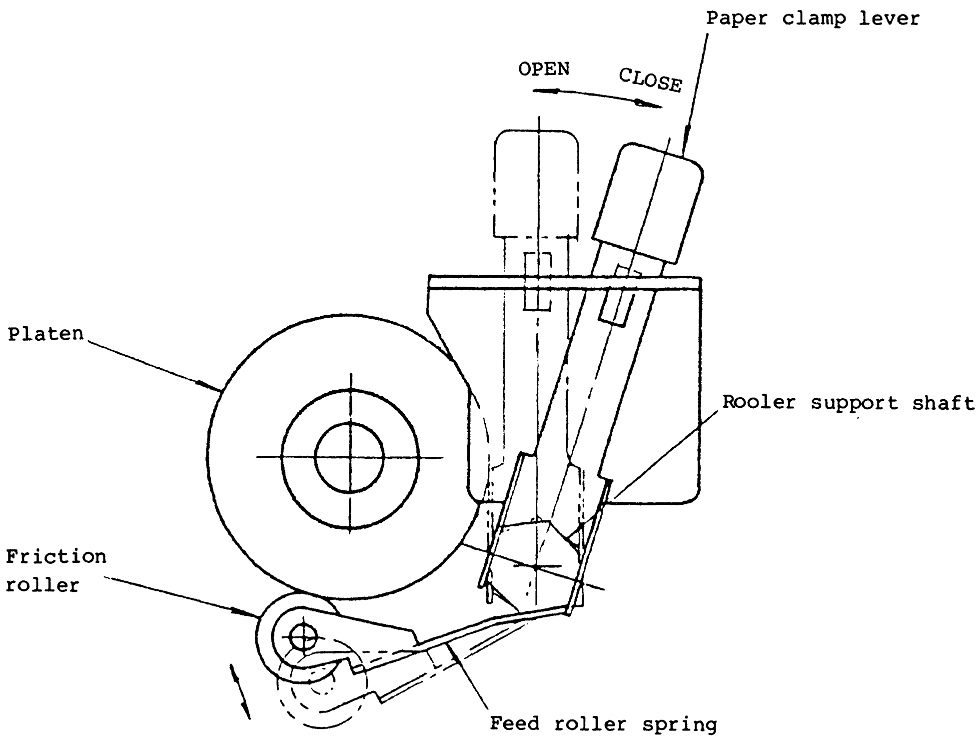


Figure 8-5 Paper Clamp Mechanism

8.1.6 Paper-Out Detection Mechanism (See figure 8-6.)

(1) Rear paper feed

When paper is present in the printer, the paper prevents the microswitch actuator from falling into the groove of the paper separator, and the microswitch is OFF (not depressed). When the printer runs out of paper, the actuator falls into the groove of the paper separator and the microswitch turns ON (depressed).

Paper-out is detected when the remaining paper length is about 50.8 mm (2 inches) from the printing position for rear paper feed.

(2) Bottom paper feed

When paper is present in the printer, the paper prevents the microswitch actuator from falling into the hole in the front paper guide, and the microswitch is OFF (not depressed). When the printer runs out of paper, the actuator falls into the hole in the front paper guide and the microswitch turns ON (depressed). Paper-out is detected when the remaining paper length is about 25.4 mm (1 inch) from the printing position for bottom paper feed.

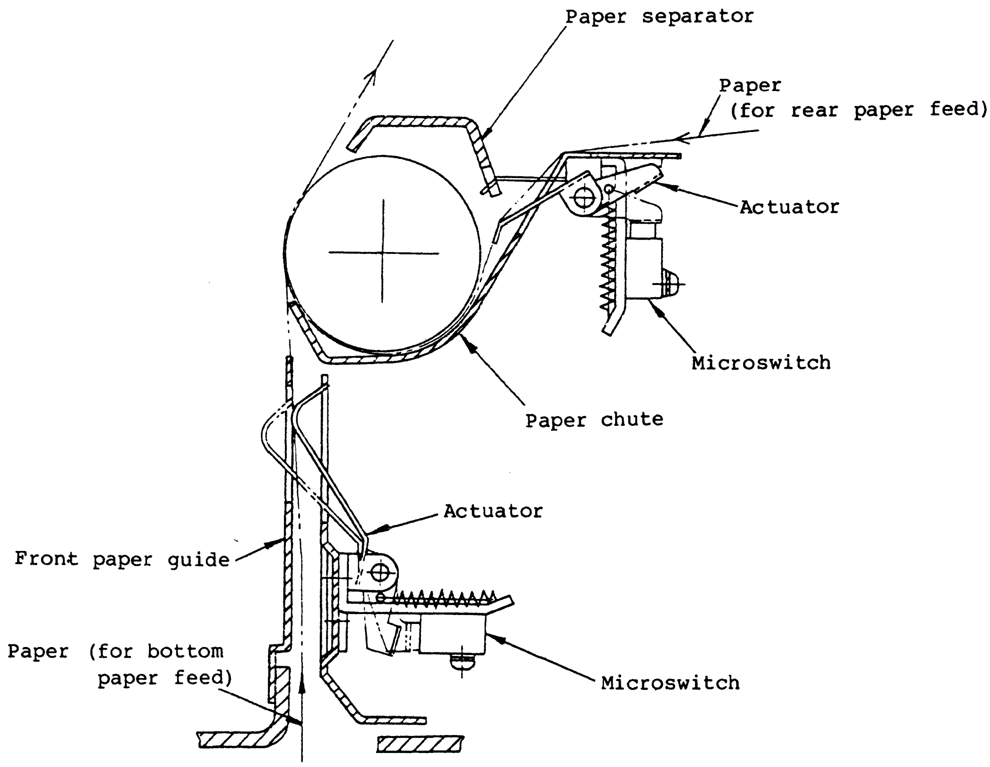


Figure 8-6 Paper-Out Detection Mechanism

8.1.7 Head-Gap Adjusting Mechanism (See figure 8-7.)

The head-gap adjusting mechanism changes the gap between the platen and print head by operating the head-gap adjusting lever (that is, by turning the eccentric collars attached to both sides of the upper carriage shaft).

The eccentric collars are fitted into holes in the side frames, and the upper carriage shaft is attached to the eccentric collars with the eccentric locking bolts. The head-gap adjusting lever is attached to the upper carriage shaft and can be locked in two grooves in the head-gap adjusting bracket.

Now if the eccentric collars are turned clockwise (as seen in the direction shown in figure 8-7), the upper carriage shaft moves closer to the platen. On the other hand, if the eccentric collars are turned counterclockwise, the upper carriage shaft moves away from the platen.

Therefore, the desired head-gap can be obtained by adjusting the relative position of the eccentric collars to the upper carriage shaft (that is, to the head-gap adjusting lever). This position can be adjusted using the eccentric locking bolts.

Mechanically, shifting of the head-gap adjusting lever changes the gap between the platen and the print head by 0.15 mm.

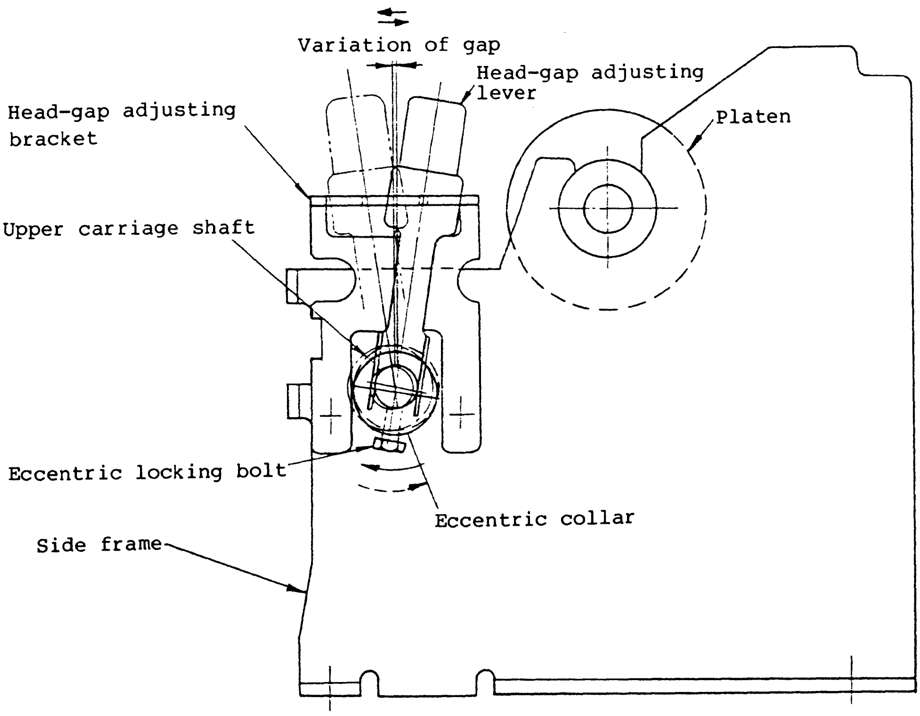


Figure 8-7 Head-Gap Adjusting Mechanism

8.2 Operation of Control Section

8.2.1 General

A block diagram of the printer is shown in figure 8-8.

The control section is equipped with two microprocessors and assembled on a single board, including a DC power supply.

As peripherals, the microprocessors employ two 8-kilobyte ROMs, one 2-kilobyte RAM, and one 256-byte RAM with I/O ports; ROMs are used for storage of the microprograms and character patterns, and RAMs, as data buffers and registers.

The printing operation starts after the printer receives one line of data through the interface. First, the space motor is driven to move the carriage. Synchronizing with the carriage movement, the head pins of the print head are driven to print dot patterns. When the printing of one line finishes, the line feed motor is driven to feed the paper.

The printing is performed in short-line seeking, bi-directional printing mode: Whether a line is printed forward or backward is determined so that the carriage moves the shorter distance.

8.2.2 Outline of Control Circuit

The printer is controlled by the microprocessors.

As shown in the circuit diagrams in chapter 16, Q1 and Q2 are single-chip 8-bit microprocessors. Q1 is an 8051, containing a 128-byte RAM and two 8-bit timers. Q2 is an 8741, containing a 1-kilobyte ROM, a 64-byte RAM, and an 8-bit timer.

Q4 and Q5 are 8-kilobyte ROMs; Q4 stores the control program, and Q5 stores the control program and character patterns. The control programs are initiated when power is supplied and the printer is reset.

Q1 is operated by the 12-MHz basic clock; it employs the 128-byte RAM as registers and the timers to generate timing signals. Q1 has 32 I/O lines, forming four 8-bit ports. Ports 0 and 3 are used to specify addresses of ROM and RAM through the data bus and Q13 and Q14. Nine lines (seven of port 1 and two of port 3) are used to control the print head and select the nine head pins.

Q2 is operated by the 6-MHz basic clock. Port 1 is used to control the space motor and the line feed motor. The timer is used to generate timing signals for the motors.

Q3 is a 256-byte RAM containing a timer and I/O ports, and is used to control the parallel interface.

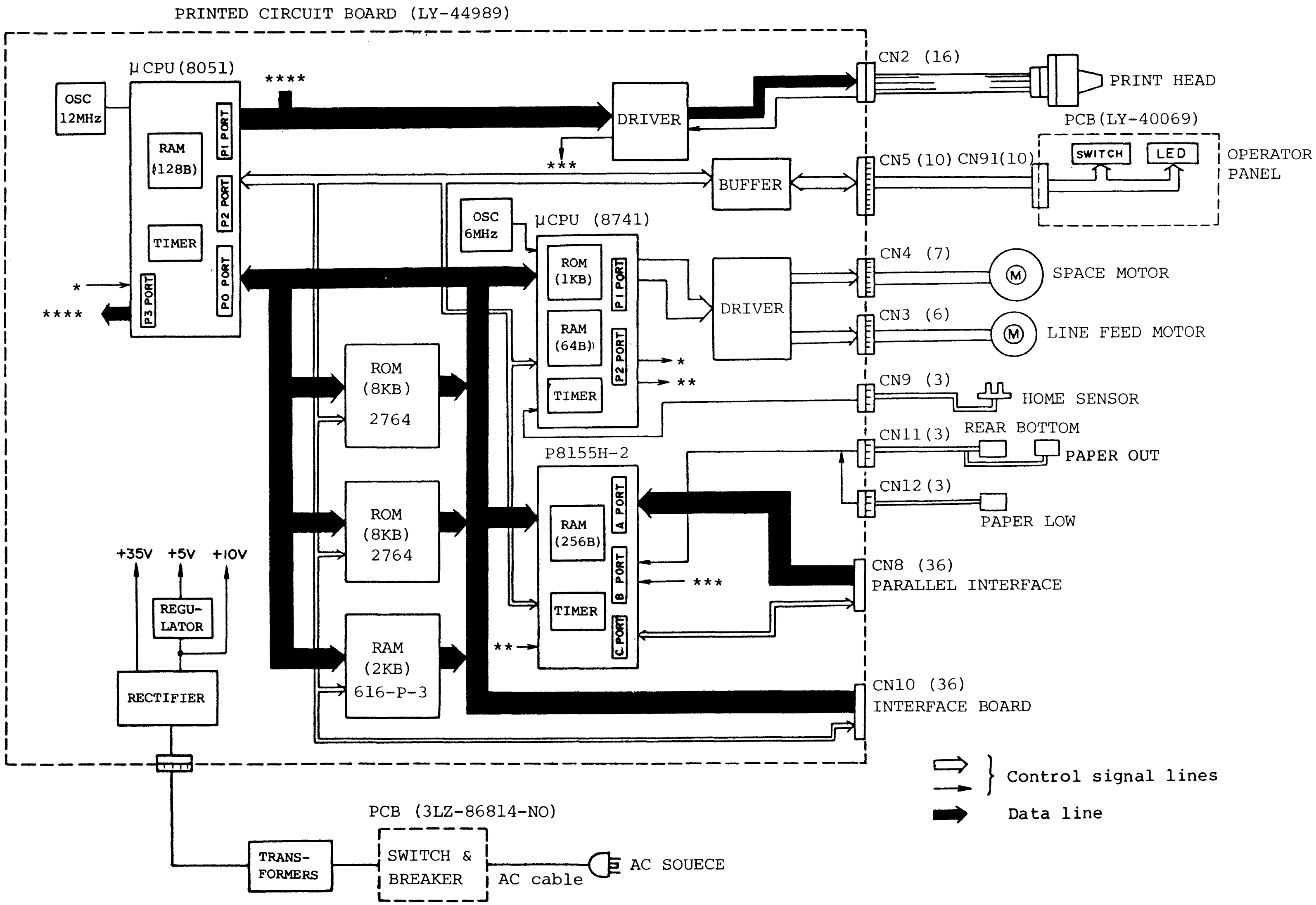


Figure 8-8 Block Diagram

8.2.3 Initializing (See figure 8-9, Timing chart (1).)

Initializing is performed to clear the circuitry and to set the carriage at the home position.

When the AC POWER switch is turned on, a RESET signal is sent to Q1 (microprocessor) to clear it. After the clearing, the program runs and the carriage is returned to home position. If the carriage is already at home position, the carriage moves a little to the right and returns to the home position. During initializing the BUSY signal of the interface is held at 1 so as not to accept print data.

When initializing is completed, the BUSY signal is returned to 0 and the printer goes to ready-for-input state.

8.2.4 Data Input Operation for Parallel Interface (See figure 8-9, Timing chart (1).)

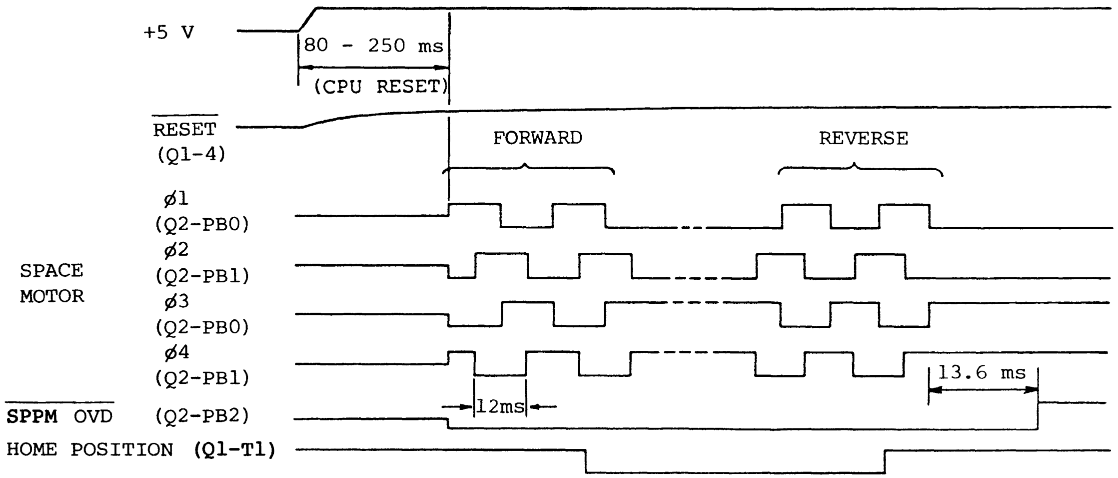
Data bits 1 to 8 are input to the I/O port (PA0 to PA7) of Q3 as eight-bit parallel data. When the BUSY signal is 0, a $\overline{\text{STROBE}}$ signal is sent from the host computer. At the rising edge of the $\overline{\text{STROBE}}$ signal, the parallel data are taken into the internal latch of Q3.

After the data latching, the BUSY signal is set to 1 and the microprocessor starts processing the data.

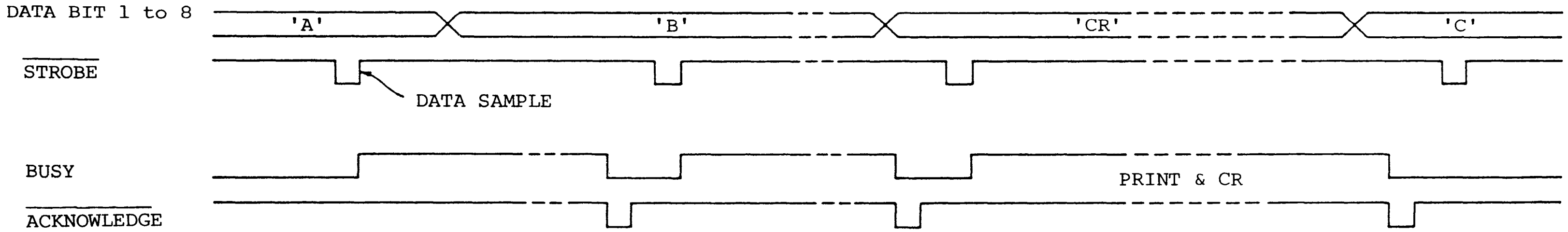
First, the microprocessor determines whether the current data item is print data or control data. If it is print data, it is written into the Q3 RAM. If it is a CR or LF code, the print data stored in RAM so far are printed out. When the input data amount to the quantity of one print line, they are printed out also.

When the processing is complete, the BUSY signal is set to 0 to send a pulse to the $\overline{\text{ACKNOWLEDGE}}$ terminal. If the receiving buffer is not full, it can accept print data for the next line even during the printing operation.

1. Initial Operation



2. Data Input Operation (with parallel interface)



Note: Voltage level

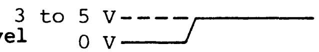


Figure 8-9 Timing Chart(1)

8.2.5 Printing Operation (See figure 8-10, Timing chart (2).)

During printing, the carriage is driven at a constant speed by the space motor, and pulses are applied to the print head according to character patterns to be printed. At non-printing time, the carriage stands at the home position (the position 2.5 characters left from the first printing column), and the space motor is locked by a weak force driven by +10 V via R8, R9, and D16.

When the printing operation starts, the phases of P14 and P15 of Q2 are changed over to drive the stepper motor. At the same time, the $\overline{\text{SPPM OVD}}$ signal of P16 of Q2 is set to 0. Transistor TR2 thus turns to drive the space motor with +35 V, and the motor starts rotating with a strong torque.

During the approach (between the home position and the first printing column), the space motor is driven at such a pulse rate that the carriage reaches the desired constant speed smoothly.

The space motor is a four-phase stepper motor having a step angle of 1.8°. When it advances 12 steps, the carriage moves 2.54 mm or 0.1 inch (character pitch in 10-CPI mode).

A two-phase exciting system is employed. The phase signal drives transistor TR13 to drive the stepper motor. Zener diodes D10 and D11 are used to suppress the counter electromotive force generated in the stepper motor.

When the printing starts, a trigger pulse ($\overline{\text{HEAD ON}}$) is sent to T1 of Q1; comparator Q19 generates a drive pulse width; transistors TR6, TR1, and TR3 turn on; and +35 V is applied to the print head. At this time, at P10 to P16 of Q1 and at RXD and TXD, the drive pins of the print head are selected according to the character pattern to be printed.

The trigger pulse ($\overline{\text{HEAD ON}}$) causes comparator Q20 to generate a pulse, which turns on TR8 to drive the head magnet for printing.

To return to the home position, the space motor is driven in reverse. The home sensor is composed of a light-emitting diode and a photo transistor, and the home position is detected when the home sensor plate of the carriage intercepts the light.

8.2.6 Carriage Return and Line Feed Operation (See figure 8-10, Timing chart (2).)

When the line feed operation is not performed, +10 V is applied to the line feed motor via R7 and D17 to lock it with a weak force.

When the line feed operation starts, the phases of P10 and P11 of Q2 are changed over to rotate the line feed motor. At the same time, P12 ($\overline{\text{LFPM OVD}}$) of Q2 is set to 0 so that transistor TR7 turns on to apply 350 V to the line-feed motor, and the motor starts rotating with a strong torque.

The line-feed motor is a four-phase stepper motor having a step angle of 7.5°. When the motor advances 24 steps, the paper is fed 4.23 mm or 0.17 inch (a line pitch in 6-LPI mode); an advance of 18 steps is 3.18 mm or 0.13 inch (a line pitch in 8-LPI mode).

8.2.7 Compensation of Supply Voltage Variation

The power supply is so designed that a constant current flows to the print head and space motor even if the 35-V line voltage changes due to variation of the input voltage or the load.

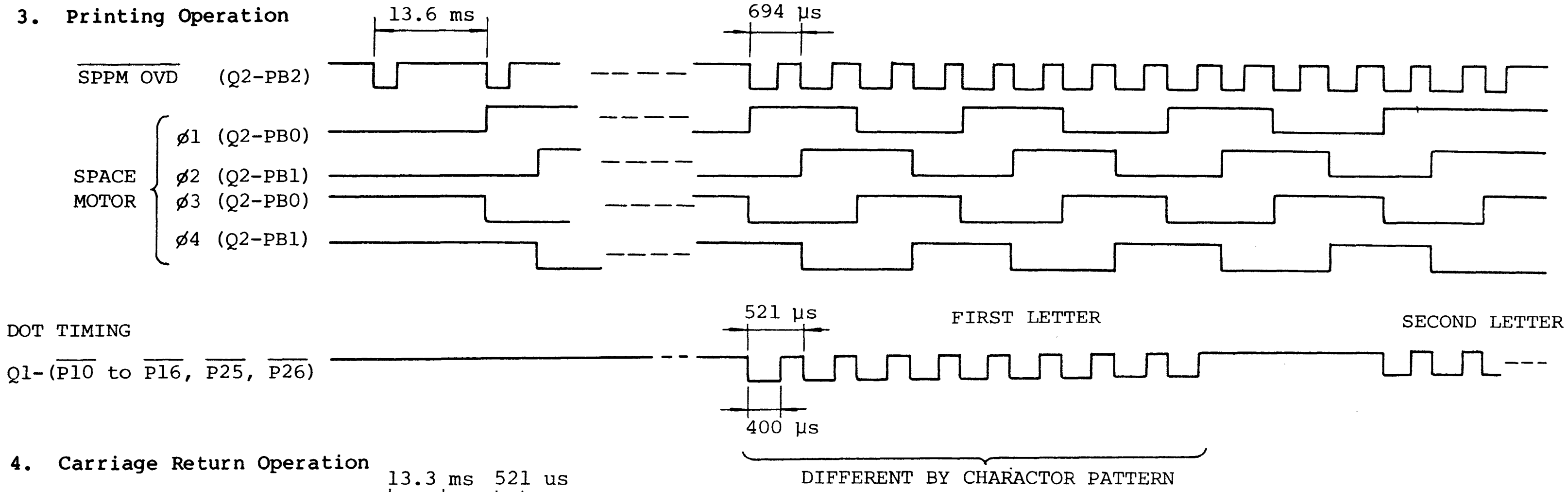
For the print head, the 35-V line level is detected by comparators Q19 and Q20 and resistors R16 and R60 to change the drive pulse width. For the space motor, the 35-V line level is detected by comparator Q19 and resistor R31 to change the drive pulse width.

8.2.8 Trouble Detection

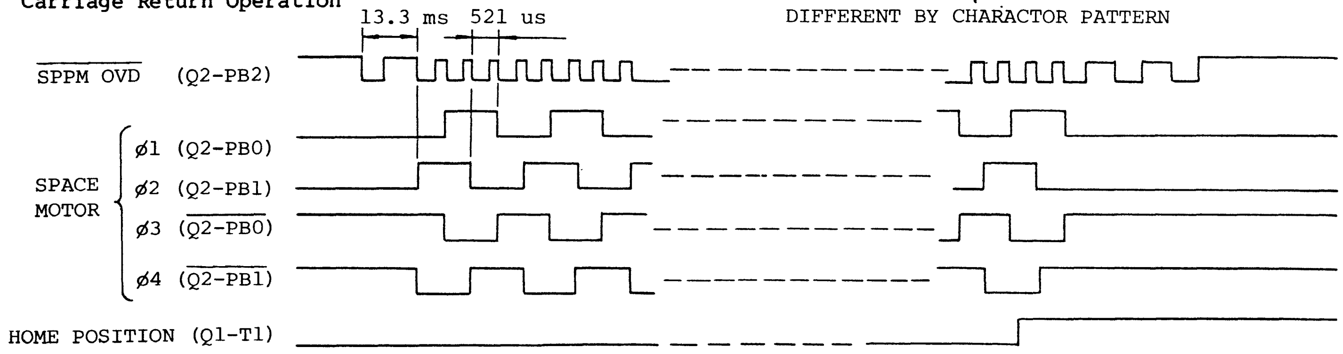
The printer has a protective circuit, which detects trouble in the peripheral circuits or drivers of the print head, space motor, and line-feed motor, and opens the breaker to prevent the other elements from being damaged due to the trouble.

The voltage applied to the motor is checked by comparator Q20. If a voltage greater than 3.7 V is applied continuously for about 3 seconds, an SCR (thyristor) is turned on to open the breaker.

3. Printing Operation



4. Carriage Return Operation



5. Line Feed Operation

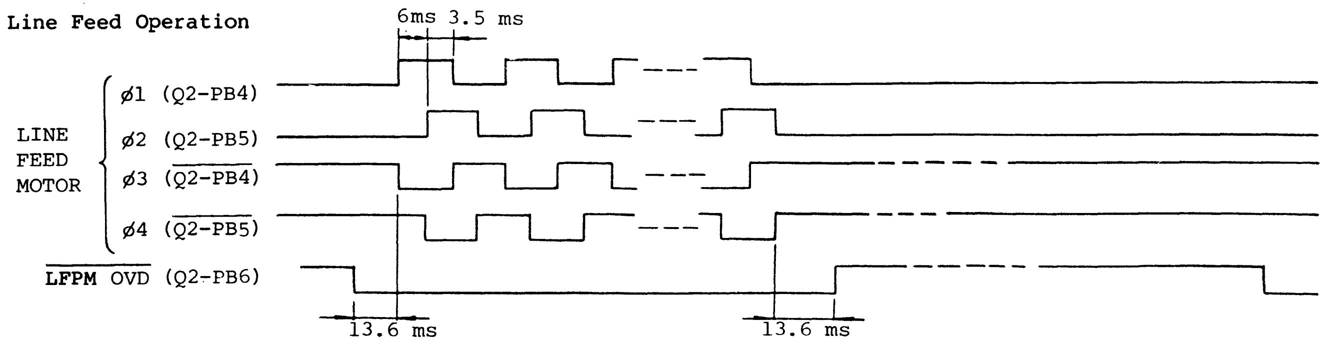


Figure 8-10 Timing Chart (2)

8.2.9 Paper-Out and SEL Switch Operation

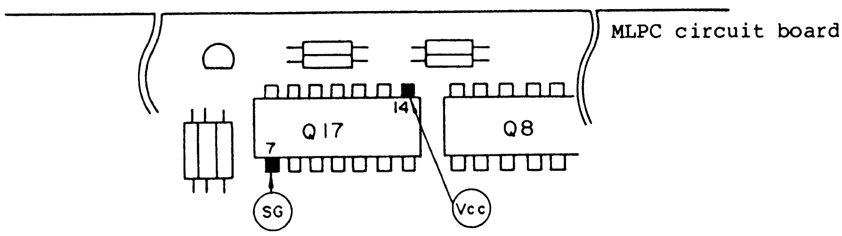
When the paper runs out, the paper-out detection microswitch turns on and paper-out is detected. Even after the detection, the printer can receive 0.5 inch of data (i.e., three lines of data in 6-LPI mode). Data, if any, are received; a paper-out signal is output to the interface; and the PAPER LED is turned on. Also, the SEL LED is turned off and the printer is set in deselect (offline) state so as not to accept data. In this state, one block of data can be received by depressing the SEL switch. When the SEL switch is depressed, the paper-out signal turns off for the time being. It turns on again after the one block of data is prined.

When the SEL LED is ON and the printer is in select (online) state, if the SEL switch is depressed, the printer is set in deselect state. Then, depressing the LF or FF switch causes printing of the data received before the SEL switch was depressed.

8.2.10 Power Supply

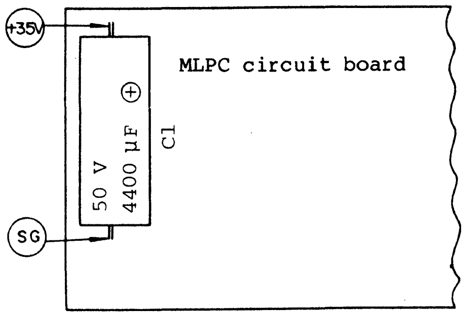
An AC input voltage is stepped down by two power transformers into 9 V and 28 V. They are converted into DC voltages and supplied to the circuitry. An AC input is led to the POWER switch, the LEPM circuit board where the breaker and AC noise filter are mounted, and then the primary sides of the transformers.

The 9 VAC stepped down by a transformer is full-wave-rectified by D6 to D9 and smoothed by capacitors C3 and C4 to +10 VDC. It is then regulated at +5 V, and supplied to the ICs. The +5 V line voltage must be in the range of 4.75 to 5.24 V when measured between pin 7 (SG) and pin 14 (Vcc) of IC Q17.



The 28 VAC stepped down by the other transformer is full-wave-rectified by D1 to D4 and smoothed by capacitor C1 (4400 µF) to +35 VDC (not regulated). This voltage is used to drive the print head, space motor, and line-feed motor.

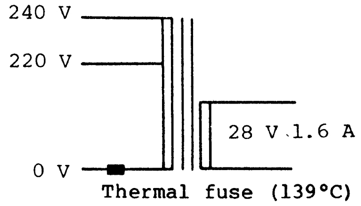
The +35 V line voltage must be in the range of 35 to 46 V when measured across C1 during non-printing, and in the range of 26 to 36 V during printing. (These values apply when the rated input voltage is maintained within ±10%.)



8.2.11 Power Transformer

The power transformer has a built-in thermal fuse, which prevents the transformer from being burned due to an abnormally high temperature rise.

Circuit diagram example (in the case of 4LP-45191-135-A)



9. MAINTENANCE TOOLS

The tools shown in table 9-1 are necessary for replacing the parts of the printed-circuit boards, unit, etc. in the field.

Table 9-1 Maintenance Tools

No.	Tool	Qty	Location	Remarks
1	Phillips screwdriver No. 1-100	1	2- to 2.6-mm screws	
2	Phillips screwdriver No. 2-200	1	3- to 5-mm screws	
3	Screwdriver No. 6-200	1	4-mm screws	
4	Cutters No. 5H	1		
5	Round pliers No. 1	1		
6	5.5-mm wrench	1		
7	11-mm wrench	1		
8	Thickness gauge set	1		
9	50-g force gauge	1		
10	500- to 600-g bar tension gauge	1		
11	Soldering iron (30 W)	1		
12	Volt-ohm-milliammeter	1		
13	Oscilloscope	1		
14	Pliers	1		

10. DISASSEMBLY AND REASSEMBLY

The printer may be disassembled and reassembled as described in section 10.2, if necessary.(Reffer to chapter 17 "Component Parts List".)

10.1 Precautions for Disassembly and Reassembly

(1) Do not disassemble or readjust the printer as long as it is in good operating condition. Be careful not to loosen the mounting screws unless necessary. Disassembly should be done within the minimum necessary range.

(2) Be sure to turn off the AC POWER switch and remove the AC plug from the AC receptacle before disassembly or reassembly.

(3) Use only the specified maintenance tools, and disassemble the printer in the specified order of disassembly procedures; otherwise, parts may be damaged.

(4) In the course of disassembly, it may be a good idea to keep the removed small parts such as screws, nuts, and collars by attaching them temporarily to their original places so as not to lose them.

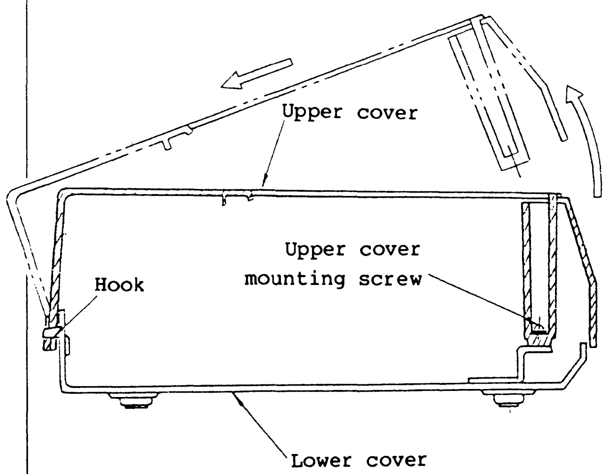
(5) ICs such as the microprocessor, RAM, and ROM can easily be damaged by static electricity. Do not wear gloves that are apt to produce static electricity when handling the circuit boards, and do not touch the lead wires of ICs or the window of ROM with bare hands. Do not place the circuit boards directly on the printer or the floor.

(6) When reassembly is completed, check the condition of the reassembled parts and the setting of the voltage select switch (see chapter 3, figure 3-2.) before switching power on.

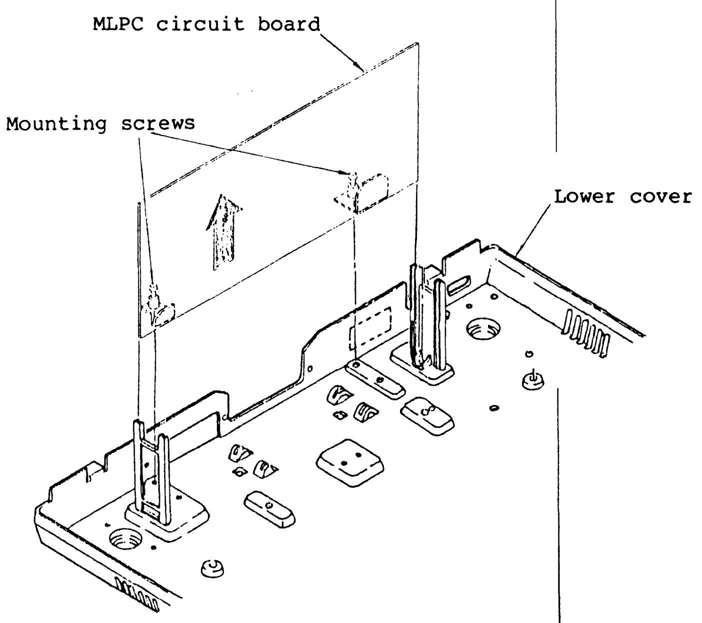
Note: The print head itself must not be disassembled.

10.2 Disassembly and Reassembly Procedures

(1) Upper cover (See figures 17-1 and 17-8)

Item	Procedure	Tool
Disassembly	(1) Remove the interface cable from the printer. (2) Remove the tractor unit. (See section 2.3.) (3) Remove the access cover by pulling it up. (4) Remove the platen knob. (5) Remove two mounting screws at the front inside of the upper cover. (6) Lift the front of the upper cover and push it toward the back to remove it from the lower cover hooks.	Phillips screw-driver No. 2-200
Reassembly	Reverse the disassembly procedure.	
Sketch		

(2) MLPC circuit board (See figures 17-1 and 17-13.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).) (2) Remove from the MLPC circuit board all those cables which can be removed at this stage. (3) Remove the MLPC circuit board mounting screws, slide up the board a little, and remove the rest of the cables from the board. (4) Remove the board. Note: When replacing ROMs on the MLPC circuit board, make sure of the identification of the ROM by referring to its parts number and location number.(See figure 17- 13,"Identification of ROM.")	 Screw-driver No. 6-200
Reassembly	Reverse the disassembly procedure.	
Sketch		

(3) Printer unit (See figures 17-1 and 17-2.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).) (2) Remove the MLPC circuit board. (See section 10.2 (2).) (3) Remove all cables of the printer unit from the cord clamp (A). (4) Loosen the "quite-tight" mounting screws until the "quite-tight" swelling is removed. (5) Pull up the printer unit and remove it from the "quite-tights" (Refer to 17-8-12)	Phillips screw-driver No. 2-200
Reassembly	Reverse the disassembly procedure. Notes: 1) Tighten the "quite-tight" mounting screw until the top of the screw comes out 1 to 1.5 mm above the "quite-tight." (Tightening torque: 4 to 5 kg.cm) 2) For routes of the cables, see figure 17-1.	
Sketch	See figure 10-1.	

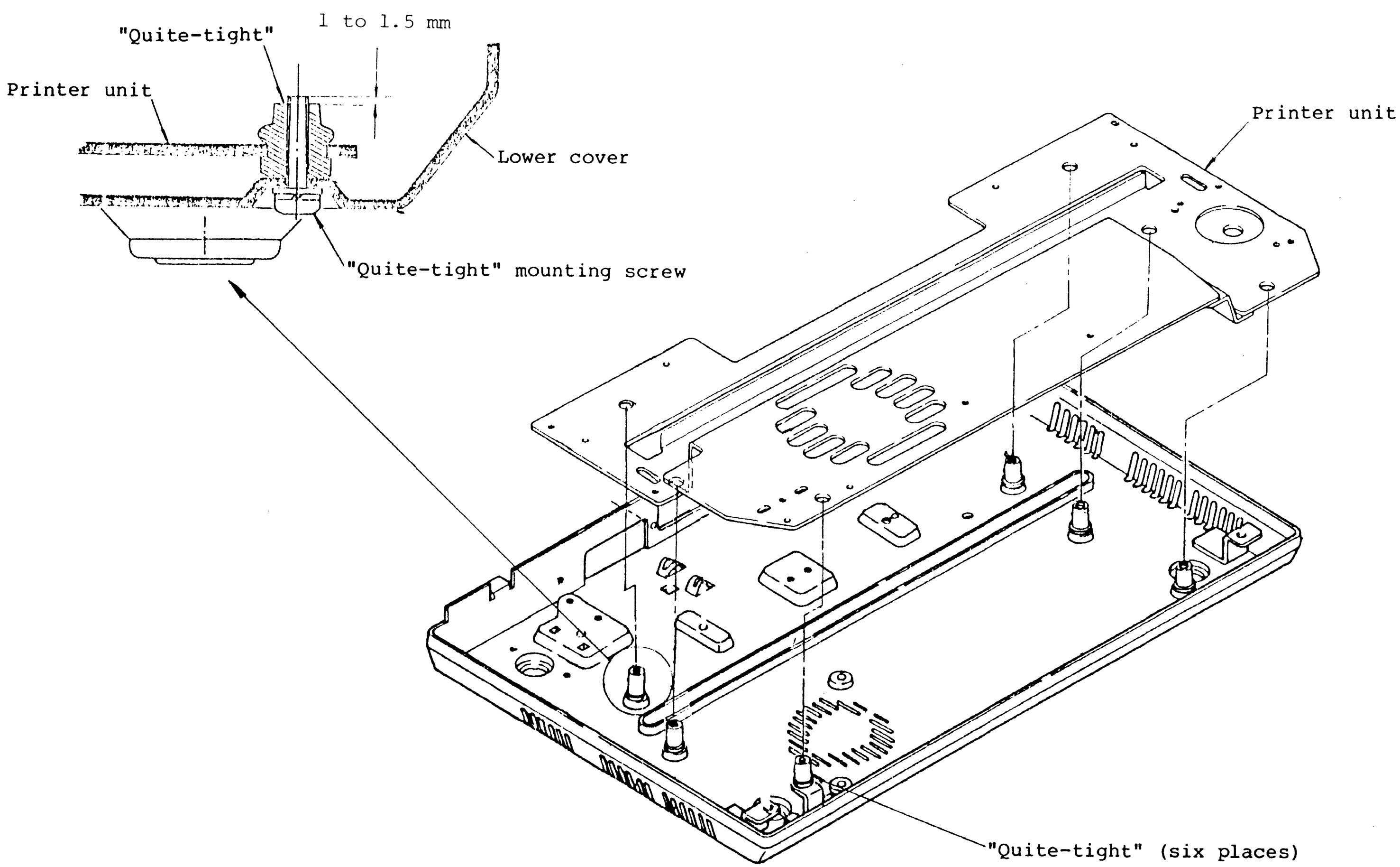


Figure 10-1 Print Unit

(4) Power supply assembly (See figures 17-8, 17-11 and 17-12.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).) (2) Remove the MLPC circuit board. (See section 10.2 (2).) (3) Remove the LEPM circuit board mounting screws, and remove the cord bushing from the lower cover. (4) Remove the transformer cables from the cord clamp (A). (5) Remove the transformer mounting screws and the transformers.	Phillips screw-driver No. 2-200; Pliers
Reassembly	Reverse the disassembly procedure. Note: For routes of the cables, see figure 17-1.	
Sketch	See figure 10-2.	

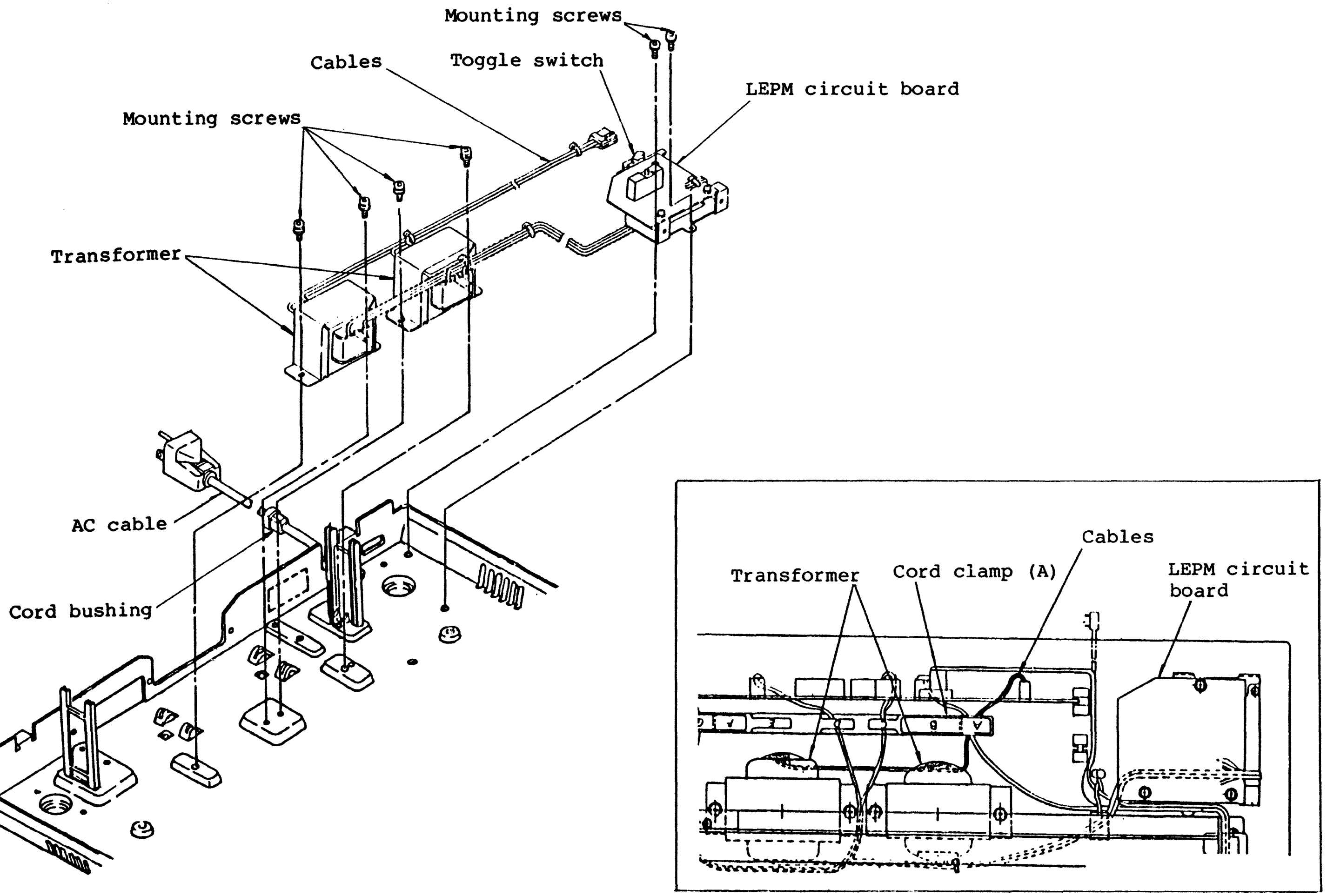
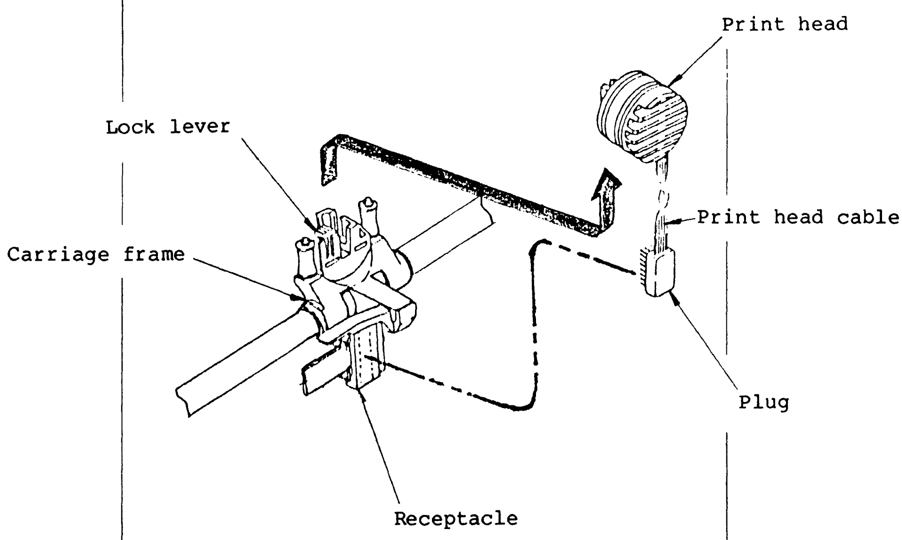


Figure 10-2 Power Supply Assembly

(5) Print head (See figures 17-1 and 17-2.)

Item	Procedure	Tool
Disassembly	(1) Remove the access cover by pulling it up. (2) Remove the print head cable plug (with a gray ground wire) from the receptacle. (3) Pull up the print head by holding it with the right hand, and the carriage frame with the left hand.	
Reassembly	Reverse the disassembly procedure. Note: Connect the print head cable plug to the receptacle with the cable twisted clockwise one turn.	
Sketch		



(6) Carriage frame (See figure 17-2 and 17-7.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).)	
	(2) Remove the print head. (See section 10.2 (5).)	
	(3) Remove the belt clamp by unscrewing its mounting screw.	Phillips screw-driver No. 2-200
	(4) Remove the adjusting lever by unscrewing its mounting screw.	
	(5) Loosen the eccentric locking bolts on both sides of the upper carriage shaft, and remove the eccentric collars.	5.5-mm wrench
	(6) Remove the upper carriage shaft from the left and right side-frames.	
	(7) Remove the print head cable receptacle from the carriage frame by unscrewing its mounting screw.	
	(8) Remove the carriage frame from the lower carriage shaft by pulling it up.	
Reassembly	Reverse the disassembly procedure.	
Adjustment	(1) Adjust the gap between the platen and the print head as described in chapter 12, item 2.1.	
	(2) Adjust the position of the belt clamp as described in chapter 12, item 1.2.	
Sketch	See figure 10-3.	

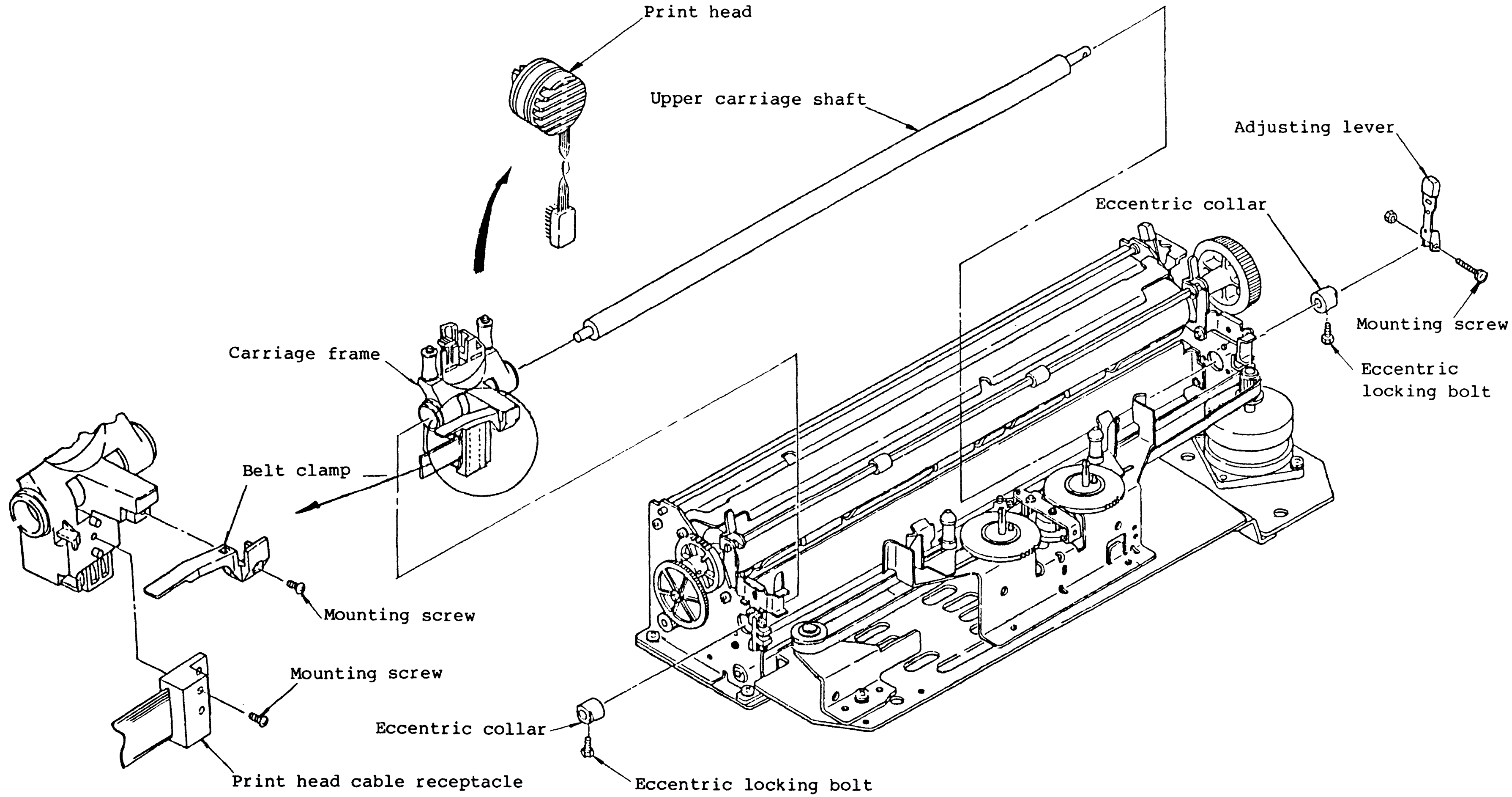


Figure 10-3 Carriage Frame

(7) Space motor (See figure 17-3.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).) (2) Remove the MLPC circuit board. (See section 10.2 (2).) (3) Remove the space motor cable from the cord clamps, (A) and (B). (4) Cut the tie-wrap fastening the space motor cable. (5) Remove the cable guide by pulling it sideways. (6) Remove the space belt from the space motor pulley. (7) Remove the space motor by unscrewing its mounting screws.	 Cutters No. 5H Phillips screw-driver No. 2-200
Reassembly	Reverse the disassembly procedure.	
Adjustment	Adjust the tension of the space belt as described in chapter 12, item 1.1.	
Sketch	See figure 10-4.	

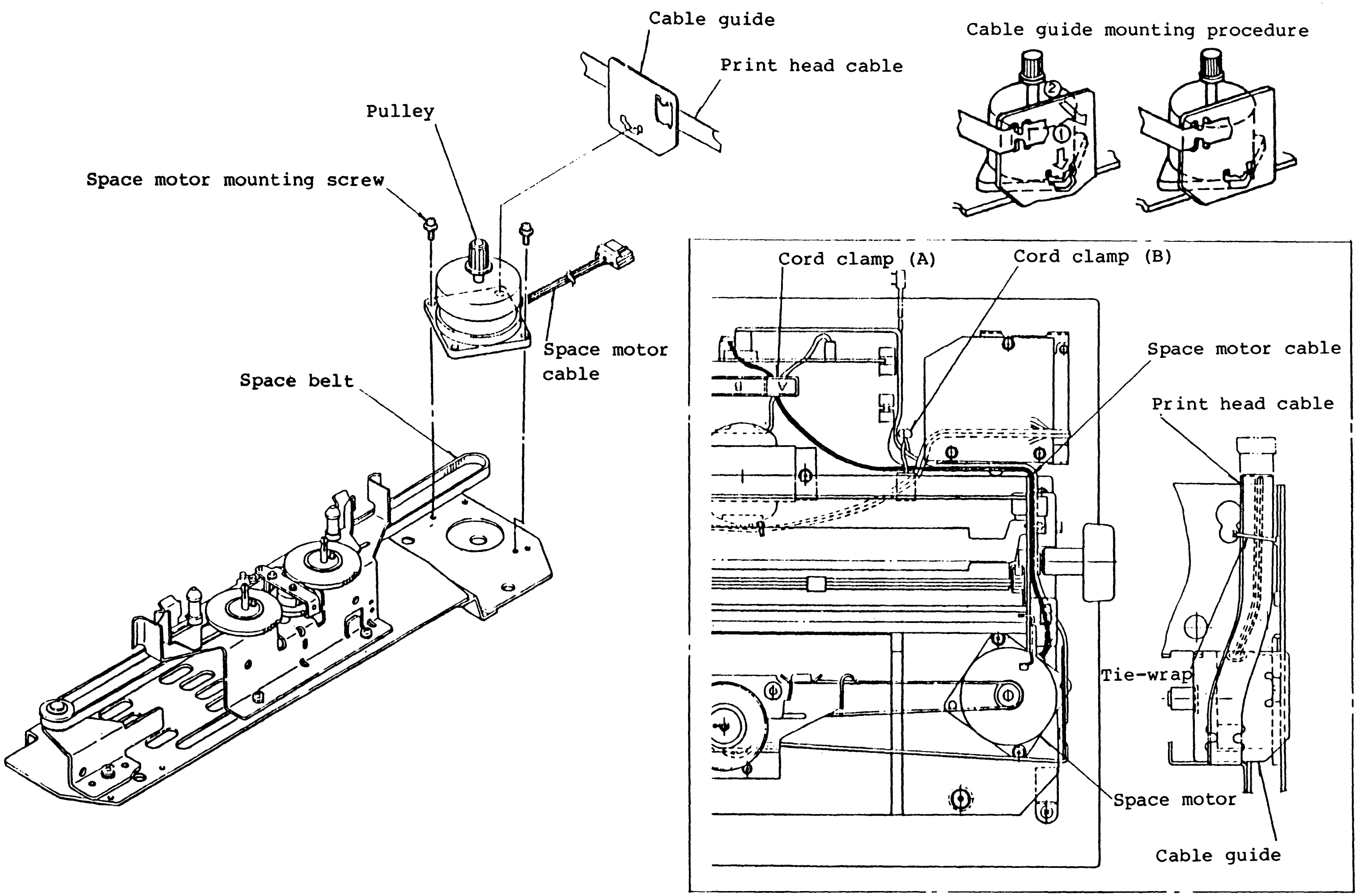


Figure 10-4 Space Motor

(8) Space belt (See figures 17-3 and 17-6.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).)	
	(2) Loosen the idle pulley bracket mounting screw and slide the bracket to the right to slacken the space belt.	Phillips screw-driver No. 2-200
	(3) Remove the belt clamp by un-screwing its mounting screw.	
	(4) Remove the E-snap ring of one ribbon spool gear, and remove the ribbon spool gear.	Round pliers No. 1
	Note: Be careful not to lose the plastic washer.	
	(5) Remove the detent spring.	
	(6) Remove the E-snap ring, ribbon change lever, and ribbon drive gear.	
	(7) Remove the space belt.	
Reassembly	Reverse the disassembly procedure.	
	Note: When assembling the ribbon drive gear, verify the engage-ment of the ribbon drive gear pulley and space belt.	
	Verify that the E-snap ring does not turn as the ribbon is fed.	
	It is recommended not to reuse a removed E-snap ring. If you have to reuse an E-snap ring because there is no new spare, narrow the mouth of the snap with pliers before using it.	
Adjustment	Adjust the tension of the space belt as described in chapter 12, item 1.1.	
Sketch	See figure 10-5.	

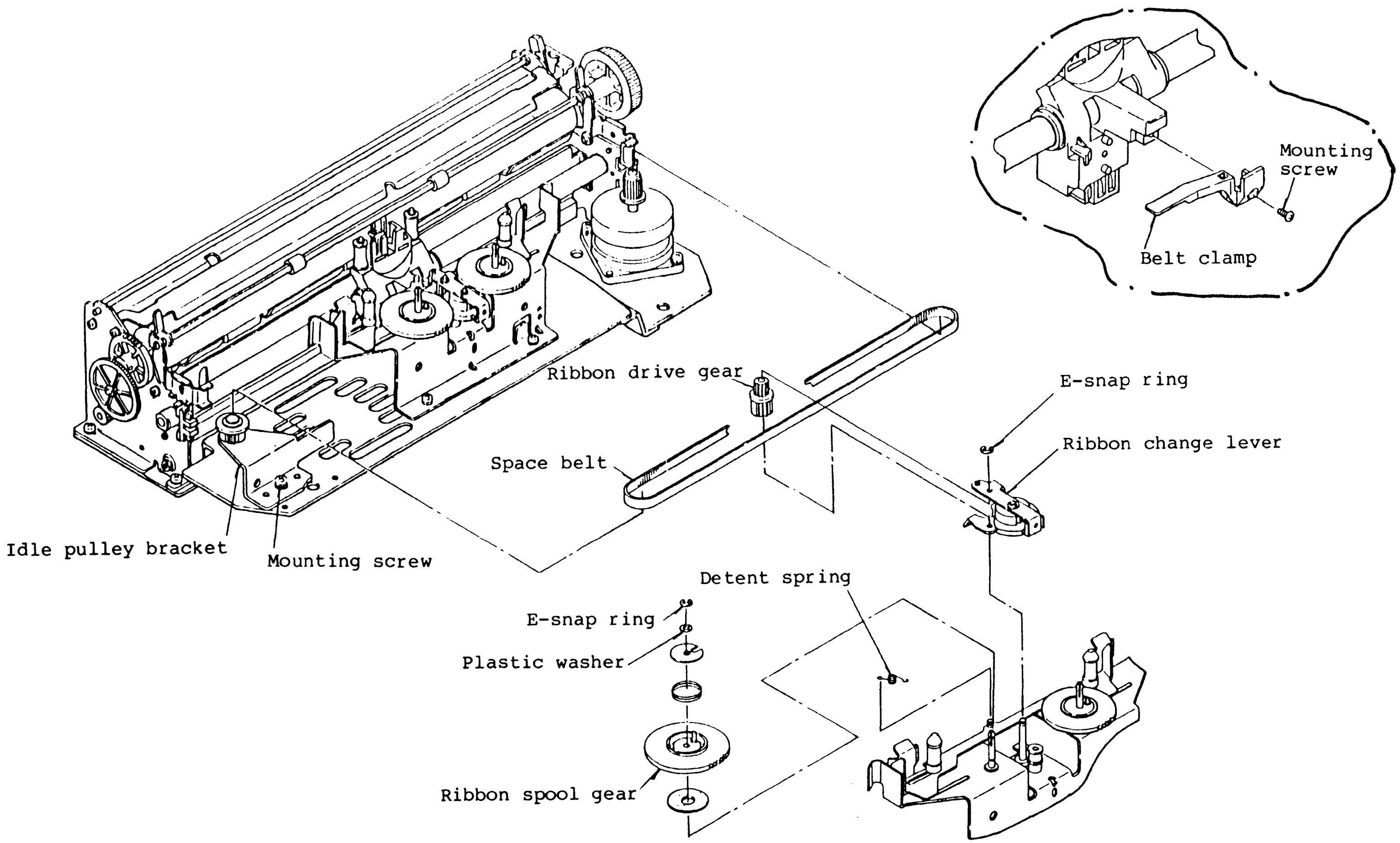


Figure 10-5 Space Belt

(9) Platen (See figures 17-3 and 17-4.)

Item	Procedure	Tool
Disassembly	(1) Remove the upper cover. (See section 10.2 (1).) (2) Open the scale bar. (3) Remove the paper separator by unscrewing its mounting screws. (4) Remove the E-snap ring wave-washer, and platen bearing from the right end of the platen. (5) Pull the left planten bearing sideways until its head comes out from the side plate; turn the platen 90°, and pull it up.	 Phillips screw-driver No. 2-200
Reassembly	Reverse the disassembly procedure.	
Adjustment	Adjust the gap bteween the paper separator and the platen as described in chapter 12, item 3.2.	
Sketch	See figure 10-6.	

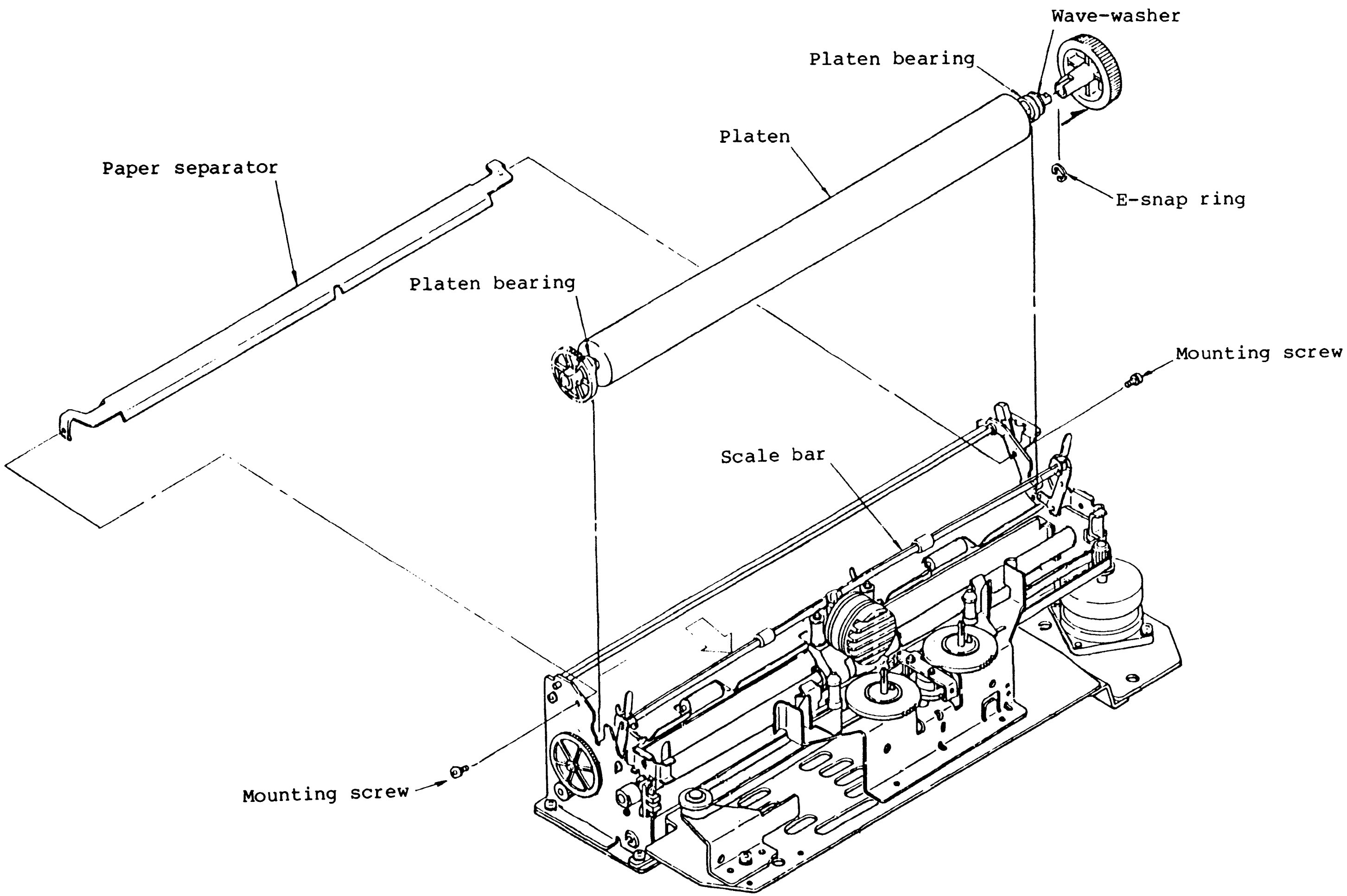


Figure 10-6 Platen

11. CLEANING

The printer should be cleaned periodically as follows.

Period: Either 6 months or 300 hours, whichever it comes first.

Time necessary for cleaning: About 10 minutes

Tool: Dry, soft cloth (such as gauze)

Parts to be cleaned: See table 11-1.

Table 11-1 Parts To Be Cleaned

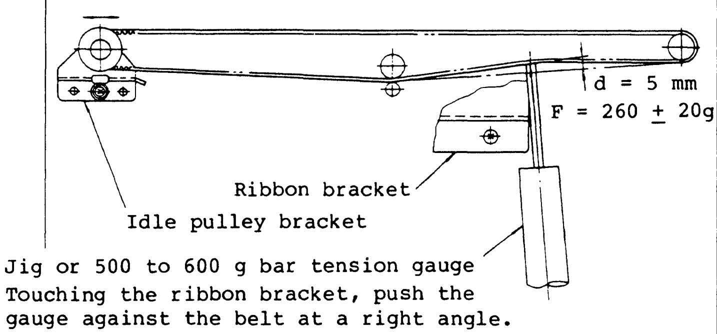
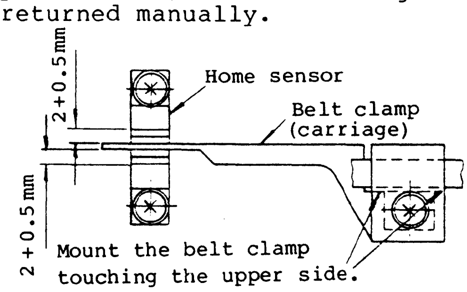
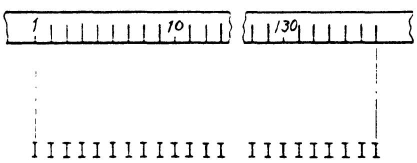
Part	Description
Ribbon path	Clean stains, dust, and ribbon lint along the ribbon path.
Paper path	Clean the paper lint along the paper path and around it.
Home sensor	Clean the paper lint and dust attached to the sensor.

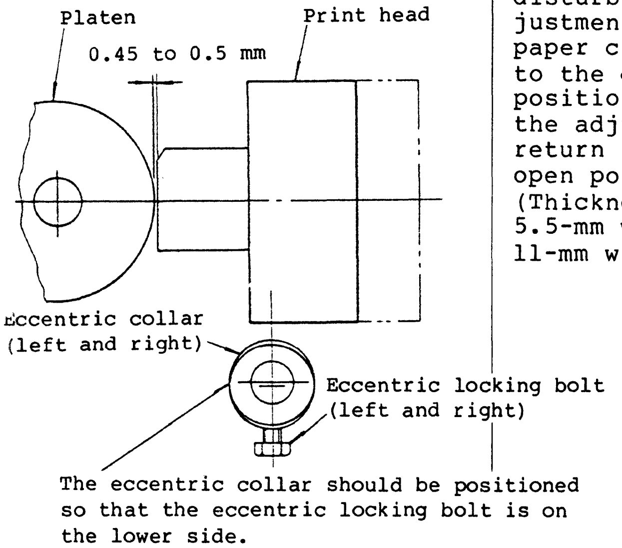
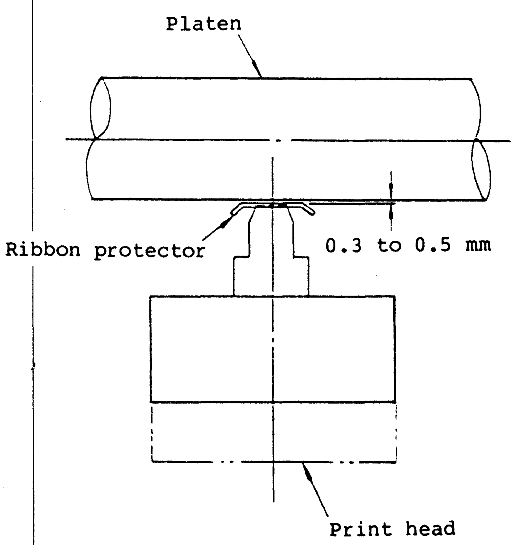
Notes: 1) Be sure to turn off the AC POWER switch before cleaning.

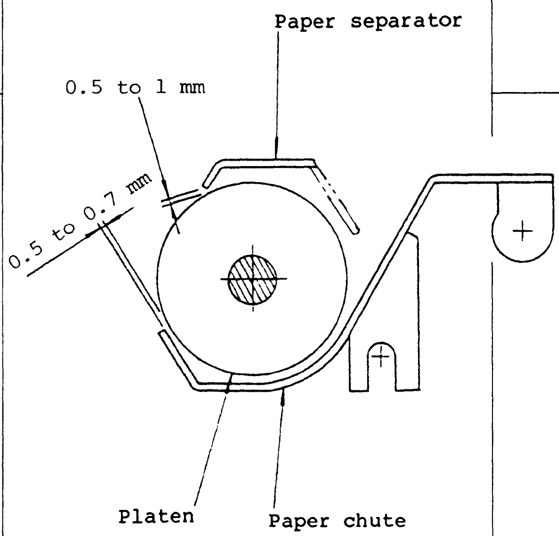
2) Be careful not to let the ribbon or paper lint get inside the mechanism.

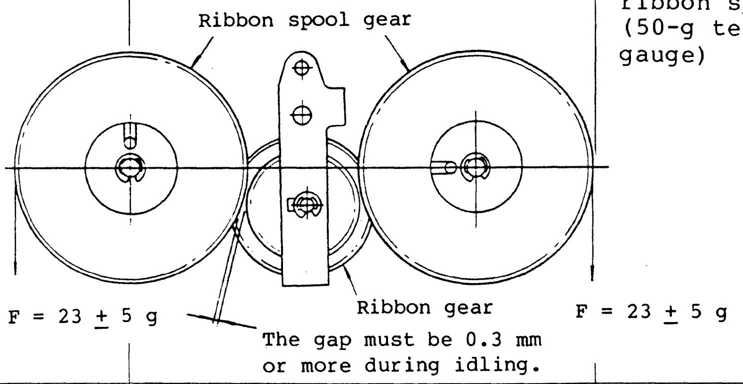
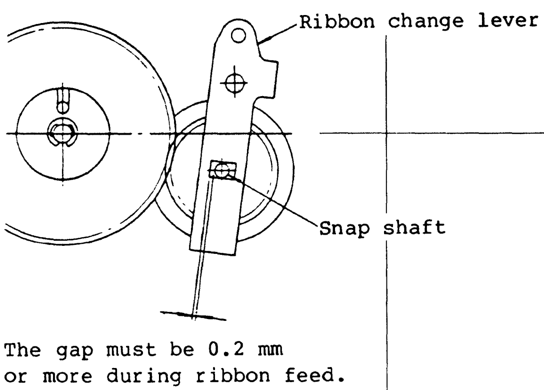
12. ADJUSTMENT

Table 12-1

Item No.	Item	Standard value	Description	Remarks/ tool
1.1	Tension of space belt	F = 260 ± 20 g at d = 5 mm	Adjust the position of the idle pulley bracket to obtain the correct tension.  	The carriage must be at the home position during adjustment. (500- to 600-g bar tension gauge; Phillips screw-driver No. 2-200).
1.2	Position of belt clamp	2 ± 0.5 mm	The belt clamp should be at the position shown below, against the home sensor, when power is on, or the carriage is returned manually.  	Verify that the position of the belt clamp is within the standard value when it is mounted with the upper side touched. If it is other than the standard, readjust the position of the belt clamp. (Thickness gauge)
1.3	Printing position	The dis-placement of the character center from the scale of the scale bar must be within ±0.5 mm	Verify the displacement over all column positions.  	If it is other than the standard, readjust the posi-tion of the home sensor and space motor.

Item No.	Item	Standard value	Description	Remarks/ tool
2.1	Gap between platen and print head	0.45 to 0.5 mm	Adjust the gap by turning the eccentric collars at both ends of the upper carriage shaft. Verify it at both ends of the platen using the thickness gauge.  	During adjustment, the head-gap adjusting lever must be at position 1. If the platen shakes and this disturbs the adjustment, set the paper clamp lever to the closed position. After the adjustment, return it to the open position. (Thickness gauge; 5.5-mm wrench; 11-mm wrench)
2.2	Gap between platen and ribbon protector	0.3 to 0.5 mm	 	(Thickness gauge)

Item No.	Item	Standard value	Description	Remarks/ tool
3.1	Gap between platen and paper chute	0.5 to 0.7 mm		(Thickness gauge; Phillips screw-driver No. 2-200)
3.2	Gap between platen and paper separator	0.5 to 1 mm		

Item No.	Item	Standard value	Description	Remarks/ tool
4.1	Friction tension of ribbon spool gear	F = 23 ± 5 g		Verify the friction tension of both ribbon spool gears. (50-g tension gauge)
4.2	Gap between ribbon spool gear and ribbon gear	The gap must be 0.3 mm or more when the ribbon gear is idling.		
4.3	Gap between ribbon change lever and snap shaft	The gap must be 0.2 mm or more during ribbon feed.		

13. OILING

The purposes of oiling are rust prevention and lubrication.

For rust prevention, do not apply a large quantity of oil, but rub the parts with an oily cloth. For lubrication, apply a suitable type of oil in an appropriate quantity, according to the operating condition of the parts.

Inadequate oil quantity may cause insufficient lubrication or troubles due to splash. When applying oil, remove contaminated old oil and dust before applying new oil. For rust prevention, do not use oil containing molybdenum disulfide.

13.1 Oil Types

(1) Motor oil 10W30 (or equivalent) .... PM

(2) ALBANIA grease #2EP (or equivalent) .... GEP

(3) Molybdenum disulfide oil (or equivalent) .... ML

13.2 Application Quantity

Large quantity ...... Ⓐ ...... A quantity of oil in which oil felt soaks thoroughly

Medium quantity ..... Ⓑ ...... Three to four drops
About 0.2 mm thick for grease

Small quantity ...... Ⓒ ...... One drop

13.3 Oiling Cycle

The ML93 is maintenance-free, and requires no oiling for everyday operation. Oiling is needed only at disassembly-reassembly time or cleaning time.

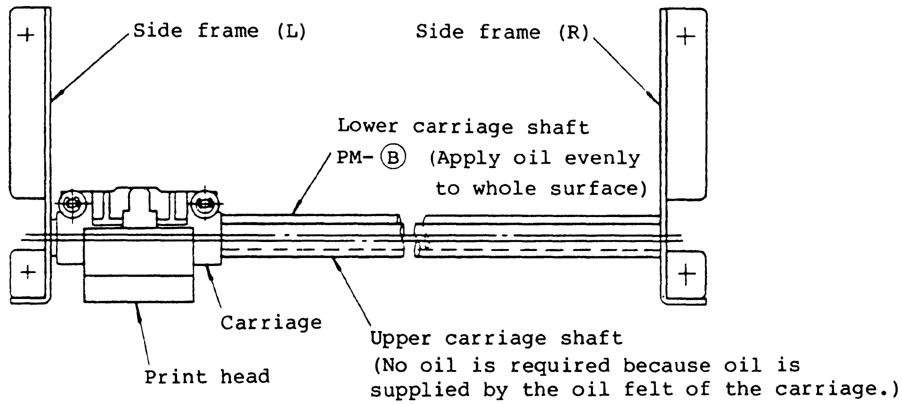
13.4 Parts Where Oil Is Prohibited

Table 13-1

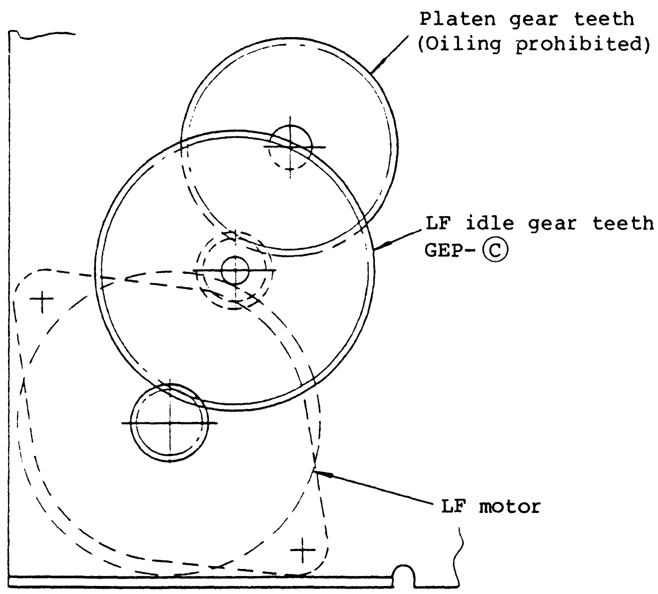
No.	Part	Reason	Remarks
1	Ribbon	Oil may blur the printing.	
2	Ribbon roller	Oil may blur the printing.	
3	Microswitch	Oil may cause faulty contact	
4	Home sensor	Oil may attract dust	
5	Platen (rubber face)	Oil may stain the paper	
6	Platen pressure roller	Oil may stain the paper	
7	Pin tractor	Oil may stain the paper	
8	Synchro belt	Oil may weaken the belt tension.	
9	Belt pulley teeth	Oil may weaken the belt tension.	
10	Ribbon drive assembly friction felt	Oil may weaken the friction	

13.5 Parts to Be Oiled

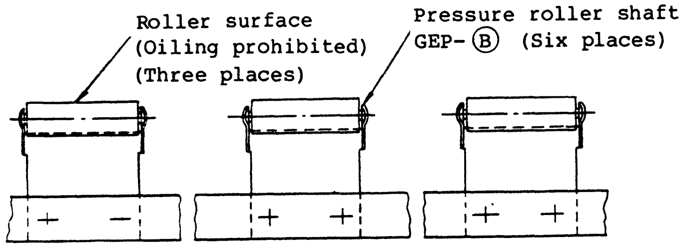
(1) Lower carriage shaft



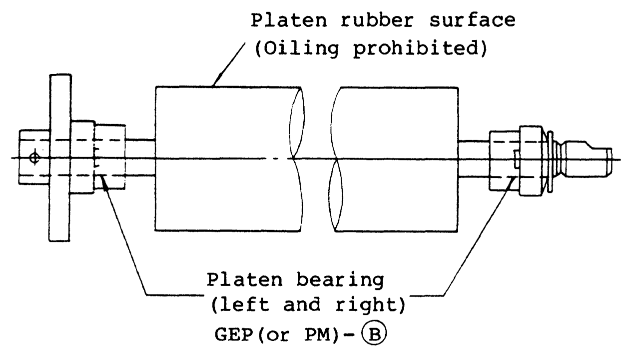
(2) LF idle gear



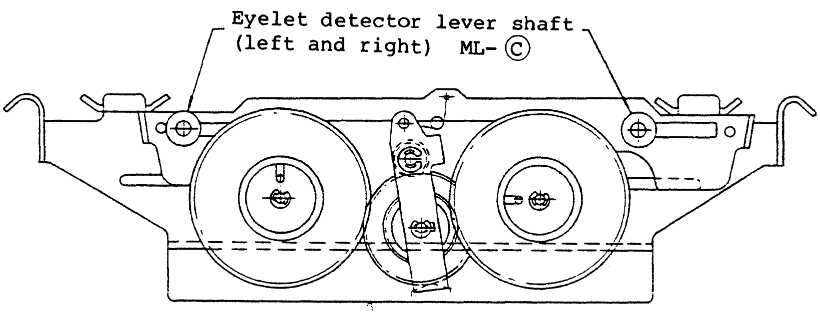
(3) Pressure roller

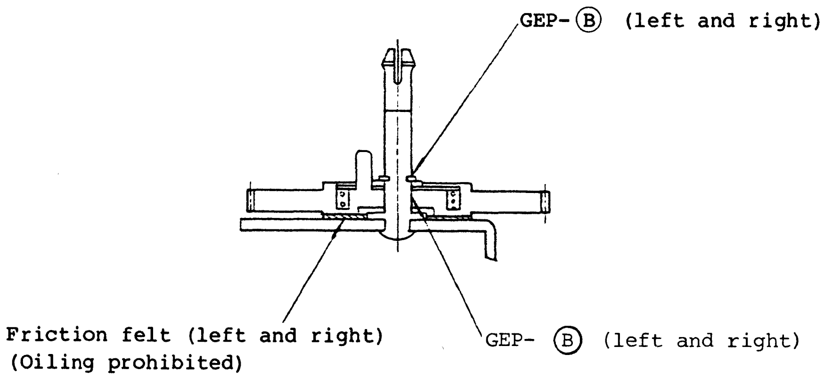


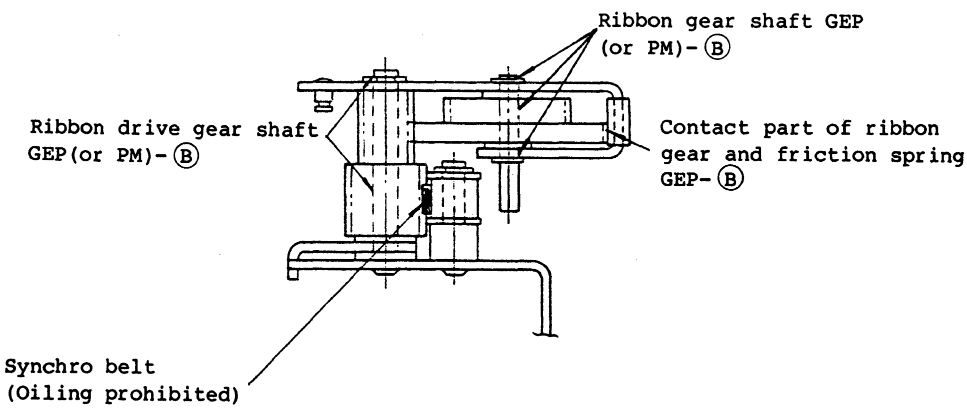
(4) Platen bearing



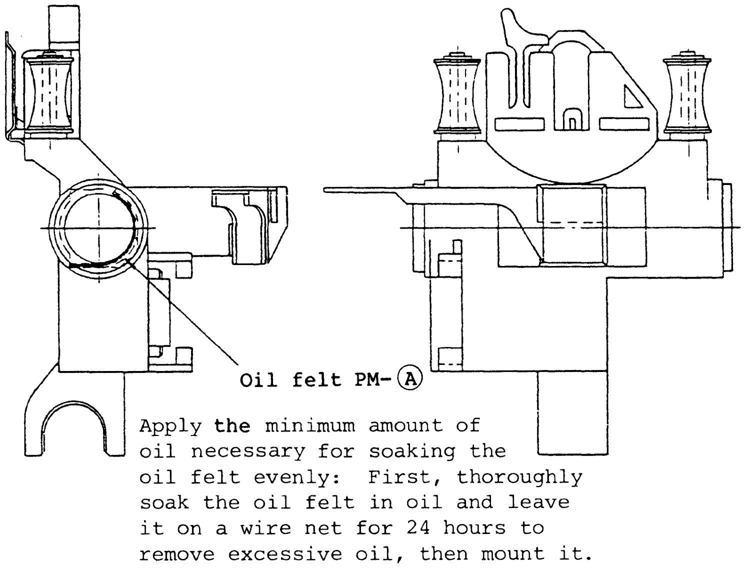
(5) Ribbon drive assembly



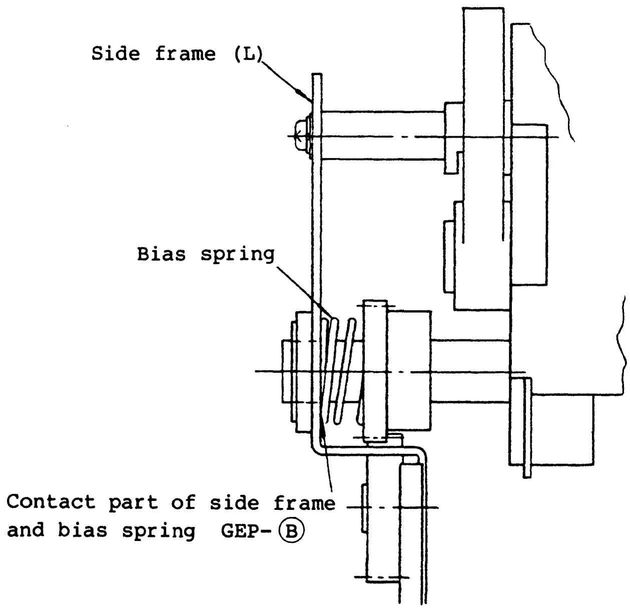




(6) Carriage assembly



(7) Tractor assembly



14. MAINTENANCE PARTS LIST

Table 14-1 shows the maintenance parts that are considered convenient for maintenance purposes by the OEM.

14.1 Parts Ordering Procedure

(1) Identify the desired part (part number) by referring to the Table of Component Parts in chapter 17.

(2) Specify the part number and name of the part.

(3) Each part has its own number, from which the compatibility of parts among different printers can be determined. (If the part numbers are the same, the parts are the same.)

14.2 Use of the List

(1) Ref. No.: Indicates the reference number in the Table of Component Parts in section 17.

(2) Quantity per year:

Indicates the recommended quantity of a maintenance part to be stocked for 1 year according to the number of printers purchased. The purchase unit is ranked as follows.

Rank	Purchase unit
A	Up to 500 units
B	Up to 1000 units
C	Up to 2000 units

Note: The compatibility symbols mean as follows:

82A: Compatible with MICROLINE 82A

83A: Comptabile with MICROLINE 83A

92: Compatible with MICROLINE 92

Table 14-1 Maintenance Parts List (1/5)

Ref. No.	Parts No.	Nomenclature	Quantity per year A B C	Compatibility
	(Printer unit)			
Fig. 17-2-1	LR-190990-10	Print head assembly	9 18 36	92
Fig. 17-2-4	LR-191870-3	Carriage assembly	3 5 10	
Fig. 17-7-3	LR-191873-2	Ribbon protector	5 10 20	
Fig. 17-3-28	LR-132233-1	Platen knob	3 5 10	82A 83A 92
Fig. 17-3-25	LR-129900-4	Platen assembly	3 5 10	83A
Fig. 17-3-16	LR-132488-2	Idle pulley bracket	1 2 4	83A
Fig. 17-3-10	LR-132475-1	LF idle gear	3 5 10	82A 83A 92
Fig. 17-3-9	LR-191854-3	Space motor	5 10 20	92
Fig. 17-3-8	LR-132473-4	LF motor	5 10 20	82A 83A 92
Fig. 17-3-27	LR-129847-3	Home sensor assembly	5 10 20	82A 83A 92
Fig. 17-3-26	LR-129907-1	Paper out assembly	3 5 10	82A 83A 92
Fig. 17-6-2	LR-129825-1	Ribbon change lever	1 2 4	82A 83A 92
Fig. 17-6-3	LR-129827-1	Ribbon gear	10 19 38	82A 83A 92
Fig. 17-6-4	LR-193461-1	Snap shaft	3 5 10	82A 83A 92
Fig. 17-6-5	LR-129876-1	Friction spring	5 10 20	82A 83A 92
Fig. 17-6-6	LR-191858-1	Ribbon drive gear	3 5 10	82A 83A 92
Fig. 17-6-7	LR-129837-1	Ribbon spool gear	10 20 40	82A 83A 92
Fig. 17-6-8	LR-129840-1	Compression spring	5 10 20	82A 83A 92
Fig. 17-6-9	LR-129841-1	Detent spring	3 5 10	82A 83A 92
Fig. 17-6-10	LR-1420-7	Synchro belt	5 10 20	
Fig. 17-6-11	LR-191859-1	Pressure roller	3 5 10	82A 83A 92
Fig. 17-6-12	LR-129842-1	Friction felt	5 10 20	82A 83A 92
Fig. 17-6-13	LR-129843-1	Special washer	5 10 20	82A 83A 92
Fig. 17-6-16	LR-132516-1	Plastic washer	5 10 20	82A 83A 92
Fig. 17-2-8	LR-132115-1	Adjusting lever	3 5 10	82A 83A 92
Fig. 17-3-11	LR-132480-1	Paper clamp lever	3 5 10	82A 83A 92
Fig. 17-7-2	LR-191857-1	Belt clamp	5 10 20	82A 83A 92

Table 14-1 Maintenance Parts List (2/5)

Ref. No.	Parts No.	Nomenclature	Quantity per year A	B	C	Compatibility
	(Cover unit)					
Fig. 17-8-1	LM-60106-1	Upper cover	3	5	10	83A
Fig. 17-8-3	LM-60112-1	Access cover	3	5	10	83A
Fig. 17-8-9	LM-61519-1	Ground board	2	3	5	82A 83A 92
Fig. 17-8-11	LP-6463-C-5	Cord bushing	2	3	5	83A
Fig. 17-8-12	LP-6726-2	Quite-tight	3	5	10	82A 83A 92
Fig. 17-8-13	LP-1416-1	Rubber foot	3	5	10	83A

Table 14-1 Maintenance Parts List (3/5)

Ref. No.	Parts No.	Nomenclature	Quantity per year A B C	Compatibility
	(Tractor feed assembly)			
Fig. 17-14-12	FMX-35100-2	Sprocket assembly (R)	3 5 10	82A 83A 92
Fig. 17-14-13	FMX-35150-2	Sprocket assembly (L)	3 5 10	82A 83A 92
Fig. 17-14-14	LR-194059-1	Clamp lever (L)	5 10 20	82A 83A 92
Fig. 17-14-15	LR-194060-1	Clamp lever (R)	5 10 20	82A 83A 92
Fig. 17-14-6	LR-129889-1	Tractor gear	3 5 10	82A 83A 92
Fig. 17-14-7	LR-129890-1	Idle gear	3 5 10	82A 83A 92
Fig. 17-14-10	LR-123498-1	Bushing	5 9 18	82A 83A 92
Fig. 17-14-11	LR-123467-1	Sheet guide	3 5 10	83A 92
Fig. 17-14-31	⊕ D3-5-23D	Bind screw	3 5 10	
Fig. 17-14-32	⊕ P(SW+2W) 3-8-23D	Small pan-head screw	3 5 10	
Fig. 17-14	LY-39702-1	Tractor unit	3 5 10	
	(Others)			
Fig. 17-7-6	⊕ T_2P_3-10-HH	Small tapping screw	11 21 42	92
Fig. 17-2-24	(-)B_3-6-HH	Bolt	5 10 20	

Table 14-1 Maintenance Parts List (4/5) (For 117 V)

Ref. No.	Parts No.	Nomenclature	Quantity per year A B C	Compati-bility
	(Electrical parts)			
Fig. 17-1-7	LP-38439-2	Head connection cable	3 5 10	
Fig. 17-1-6	LP-38774-1	Operation panel connection cable	3 5 10	92
Fig. 17-11	LP-37378-9	Transformer assembly	3 5 10	
Fig. 17-11-2	LP-45191-132-B	Transformer (For 5 V)	2 3 5	
Fig. 17-11-3	LP-45191-136-B	Transformer (For 35 V)	2 3 5	
Fig. 17-13	LYH-8024-1	EPROM, µCPU(Q2)	10 20 40	
Fig. 17-13	LYH-30093-1	EPROM, µCPU(Q4)	10 20 40	
Fig. 17-13	LYH-30094-1	EPROM, µCPU(Q5)	10 20 40	
Fig. 17-1-3	LY-44989-1	MLPC circuit board	10 20 40	92
Fig. 17-9-3	LY-40069-1	LEPF circuit board	3 5 10	82A 83A 92
Fig. 17-11-1	LX-86814-3	LEPM circuit board	3 5 10	
	(LEPM circuit board)			
Fig. 17-12	LP-3621-2	Seesaw switch	3 5 10	82A 83A 92
Fig. 17-12-2	LP-6740-160	Circuit breaker	3 5 10	82A 83A 92
Fig. 17-12	LP-8595-333	Ceramic capacitor	3 5 10	92
Fig. 17-12	LP-45025-2	Line chake	3 5 10	92

Table 14-1 Maintenance Parts List (4/5) (For 220/240 V)

Ref. No.	Parts No.	Nomenclature	Quantity per year A B C	Compatibility
	(Electrical parts)			
Fig. 17-1-7	LP-38439-2	Head connection cable	3 5 10	
Fig. 17-1-6	LP-38774-1	Operation panel connection cable	3 5 10	92
Fig. 17-11	LP-37378-11	Transformer assembly	3 5 10	
Fig. 17-11-2	LP-45191-134 -B	Transformer (For 5 V)	2 3 5	
Fig. 17-11-3	LP-45191-135 -B	Transformer (For 35 V)	2 3 5	
Fig. 17-13	LYH-8024-1	EPROM μCPU(Q2)	10 20 40	
Fig. 17-13	LYH-30093-1	EPROM μCPU(Q4)	10 20 40	
Fig. 17-13	LYH-30095-1	EPROM μCPU(Q5)	10 20 40	
Fig. 17-1-3	LY-44989-1	MLPC circuit board	10 20 40	92
Fig. 17-9-3	LY-40069-1	LEPF circuit board	3 5 10	82A 83A 92
Fig. 17-11-1	LX-86814-4	LEPM circuit board	3 5 10	
	(LEPM circuit board)			
Fig. 17-12	LP-3621-1	Seesaw switch	3 5 10	82A 83A 92
Fig. 17-12-2	LP-6740-80	Circuit breaker	3 5 10	82A 83A 92
Fig. 17-12	LP-3622-1	Slide siwtch	3 5 10	82A 83A 92
Fig. 17-12	LP-8555-1	Ceramic capacitor	3 5 10	82A 83A 92
Fig. 17-12	LP-45025-2	Line chalk	3 5 10	92

Table 14-1 Maintenance Parts List (4/5) (For USA, 220/240 V)

Ref. No.	Parts No.	Nomenclature	Quantity per year A	B	C	Compatibility
	(Electrical parts)					
Fig. 17-1-7	LP-38439-2	Head connection cable	3	5	10	
Fig. 17-1-6	LP-38774-1	Operation panel connection cable	3	5	10	92
Fig. 17-11	LP-37378-11	Transformer assembly	3	5	10	
Fig. 17-11-2	LP-45191-134 -B	Transformer (For 5 V)	2	3	5	
Fig. 17-11-3	LP-45191-135 -B	Transformer (For 35 V)	2	3	5	
Fig. 17-13	LYH-8024-1	EPROM μCPU(Q2)	10	20	40	
Fig. 17-13	LYH-30093-1	EPROM μCPU(Q4)	10	20	40	
Fig. 17-13	LYH-30094-1	EPROM μCPU(Q5)	10	20	40	
Fig. 17-1-3	LY-44989-1	MLPC circuit board	10	20	40	92
Fig. 17-9-3	LY-40069-1	LEPF circuit board	3	5	10	82A 83A 92
Fig. 17-11-1	LX-86814-4	LEPM circuit board	3	5	10	
	(LEPM circuit board)					
Fig. 17-12	LP-86814-4	Seesaw switch	3	5	10	82A 83A 92
Fig. 17-12-2	LP-6740-80	Circuit breaker	3	5	10	82A 83A 92
Fig. 17-12	LP-3622-1	Slide siwtch	3	5	10	82A 83A 92
Fig. 17-12	LP-8555-1	Ceramic capacitor	3	5	10	82A 83A 92
Fig. 17-12	LP-45025-2	Line chalk	3	5	10	92

Table 14-1 Maintenance Parts List (5/5)

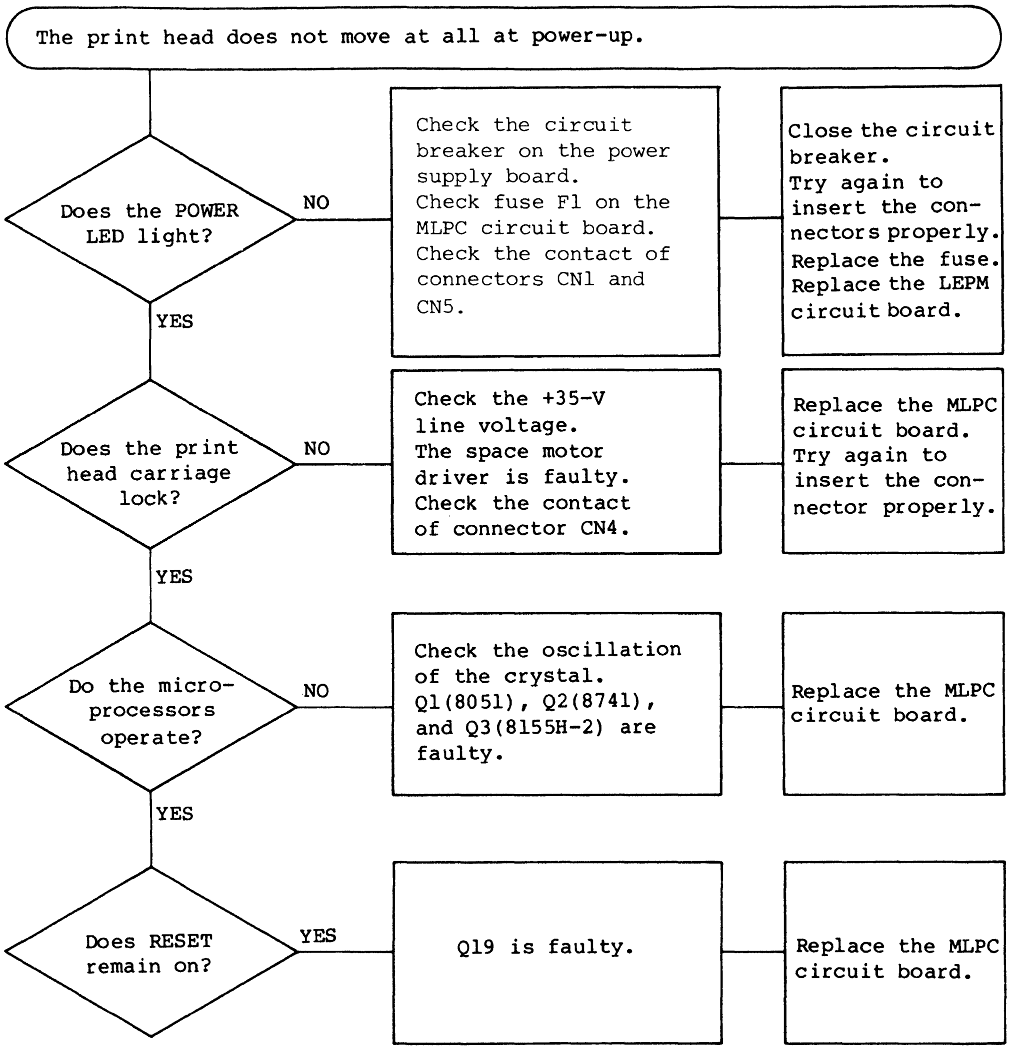
Ref. No.	Parts No.	Nomenclature	Quantity per year A B C	Compatibility
	(MLPC circuit board)			
Fig. 17-13	LP-9409-1	U05B diode	10 20 40	82A 83A 92
Fig. 17-13	LP-44156-16	AU01-20 Zenor diode	5 10 20	82A 83A 92
Fig. 17-13	LP-9300-1	1S2075 diode	10 20 40	92
Fig. 17-13	LP-44253-1	GU3SZ diode	5 10 20	82A 83A 92
Fig. 17-13	LP-44416-1	EM1Z diode	10 20 40	82A 83A 92
Fig. 17-13	LP-44251-1	2SB727 Transistor	10 20 40	82A 83A 92
Fig. 17-13	LP-44486-1	STA-403A Transistor	10 20 40	92
Fig. 17-13	LP-44419-1	STA-301A Transistor	10 20 40	92
Fig. 17-13	LP-44492-1-B	Thyrister CSM3B	3 5 10	82A 83A 92
Fig. 17-13	LP-44485-5	Regulator SI3052	5 10 20	92
Fig. 17-13	LP-8475-B-21	MGC2.5A Fuse	10 20 40	82A 83A 92
Fig. 17-13	LP-11737-09 -001	μCPU-8031	5 10 20	92
Fig. 17-13	LP-11726-09	P8155H-2	5 10 20	92
Fig. 17-13	LP-11389-02	HM6116P-3	3 5 10	92
	(LEPF circuit board)			
Fig. 17-10	LP-44373-1	SEL 103R light-emitting diode	8 15 30	82A 83A 92
Fig. 17-10-2	LP-3424-1	SRQV 101A rotary switch	3 5 10	82A 83A 92
Fig. 17-10-3	LK-50700-2	Key switch	10 20 40	82A 83A 92
Fig. 17-10-4	L-1370-49-A2	Nameplate "TOF SET"	3 5 10	82A 83A 92
Fig. 17-10-5	L-1370-50-A2	Nameplate "SEL"	3 5 10	82A 83A 92
Fig. 17-10-6	L-1370-51-A2	Nameplate "FORM FEED"	3 5 10	82A 83A 92
Fig. 17-10-7	L-1370-52-A2	Nameplate "LINE FEED"	3 5 10	82A 83A 92

15. TROUBLESHOOTING

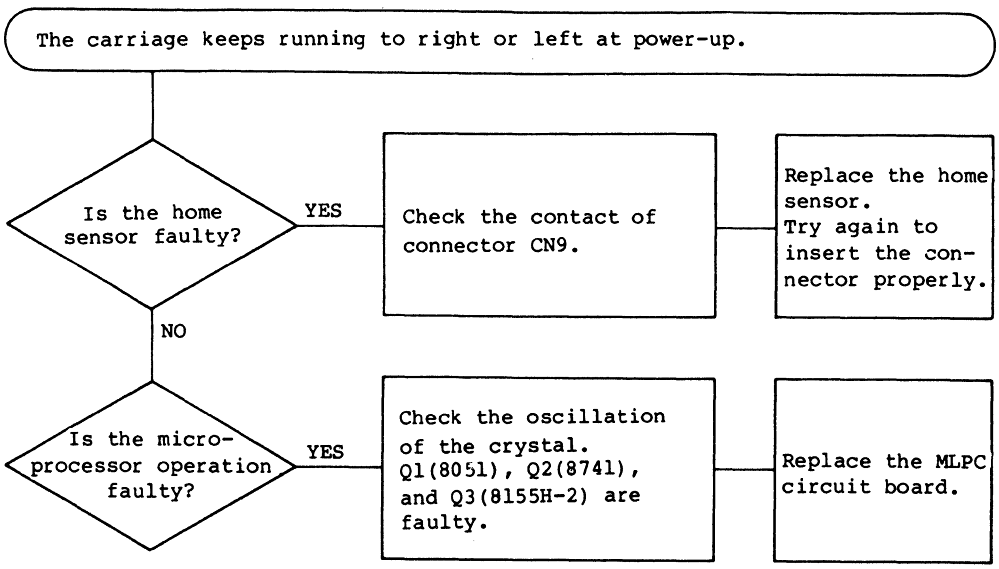
At troubleshooting time, first verify the trouble condition, then locate and remedy the trouble using the following troubleshooting flowcharts.

Trouble			
Division	Description		Item
Trouble at power-up	The print head does not return to the home position.	Does not move at all.	(1)
		Keeps running to right or left.	(2)
		Vibrates.	(3)
	The breaker opens.		(4)
Trouble after power-up	The spacing or printing operating does not start even when data are input.		(5)
	The printer performs the spacing operation but not the printing operation.		(6)
	The printer performs the printing operation but not the spacing operation.		(7)
	After printing, the print head does not return to the home position.		(8)
	The printer does not perform the line feed operation.		(9)
	The paper-out detection function does not work.		(10)
	Some characters are not printed or wrong characters are printed.		(11)
	Some dots are not printed.		(12)
	The breaker opens after a while.		(13)
	The circuit board fuse blows.		(14)
	The switches on the operation panel do not work.		(15)
	Print is not dark enough.		(16)

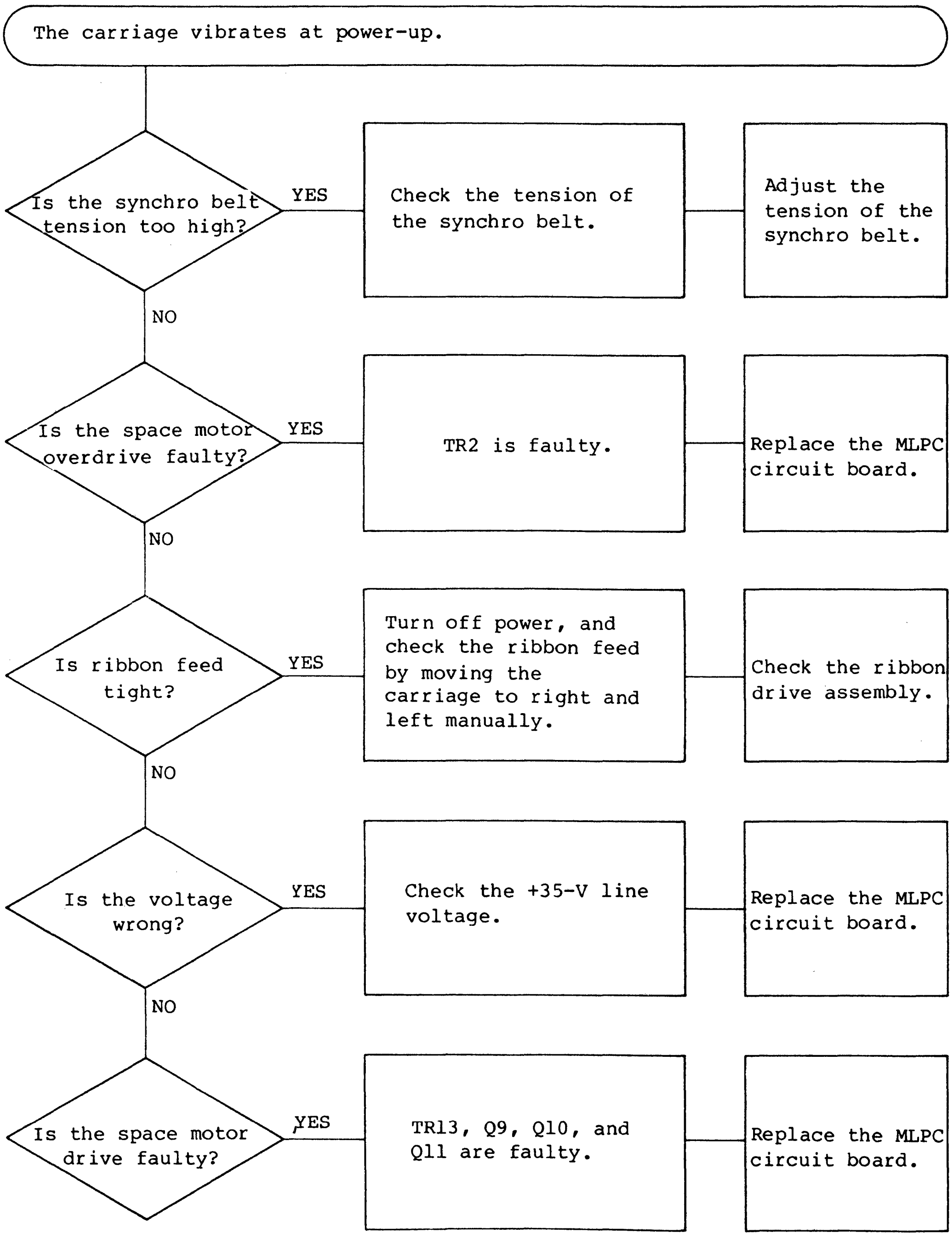
Item (1)


The print head does not move at all at power-up.
Does the POWER LED light?
NO
Check the circuit breaker on the power supply board. Check fuse F1 on the MLPC circuit board. Check the contact of connectors CN1 and CN5.
Close the circuit breaker. Try again to insert the connectors properly. Replace the fuse. Replace the LEPM circuit board.
YES
Does the print head carriage lock?
NO
Check the +35-V line voltage. The space motor driver is faulty. Check the contact of connector CN4.
Replace the MLPC circuit board. Try again to insert the connector properly.
YES
Do the microprocessors operate?
NO
Check the oscillation of the crystal. Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.
YES
Does RESET remain on?
YES
Q19 is faulty.
Replace the MLPC circuit board.

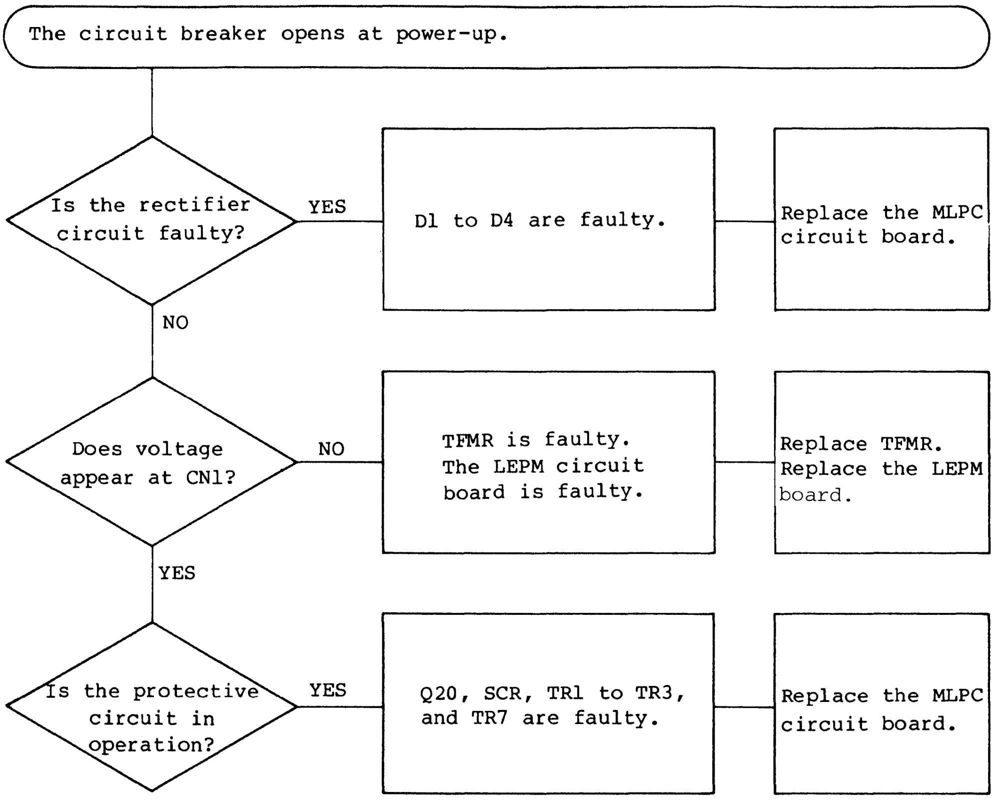
Item (2)


The carriage keeps running to right or left at power-up.
Is the home sensor faulty?
YES
Check the contact of connector CN9.
Replace the home sensor. Try again to insert the connector properly.
NO
Is the microprocessor operation faulty?
YES
Check the oscillation of the crystal. Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.

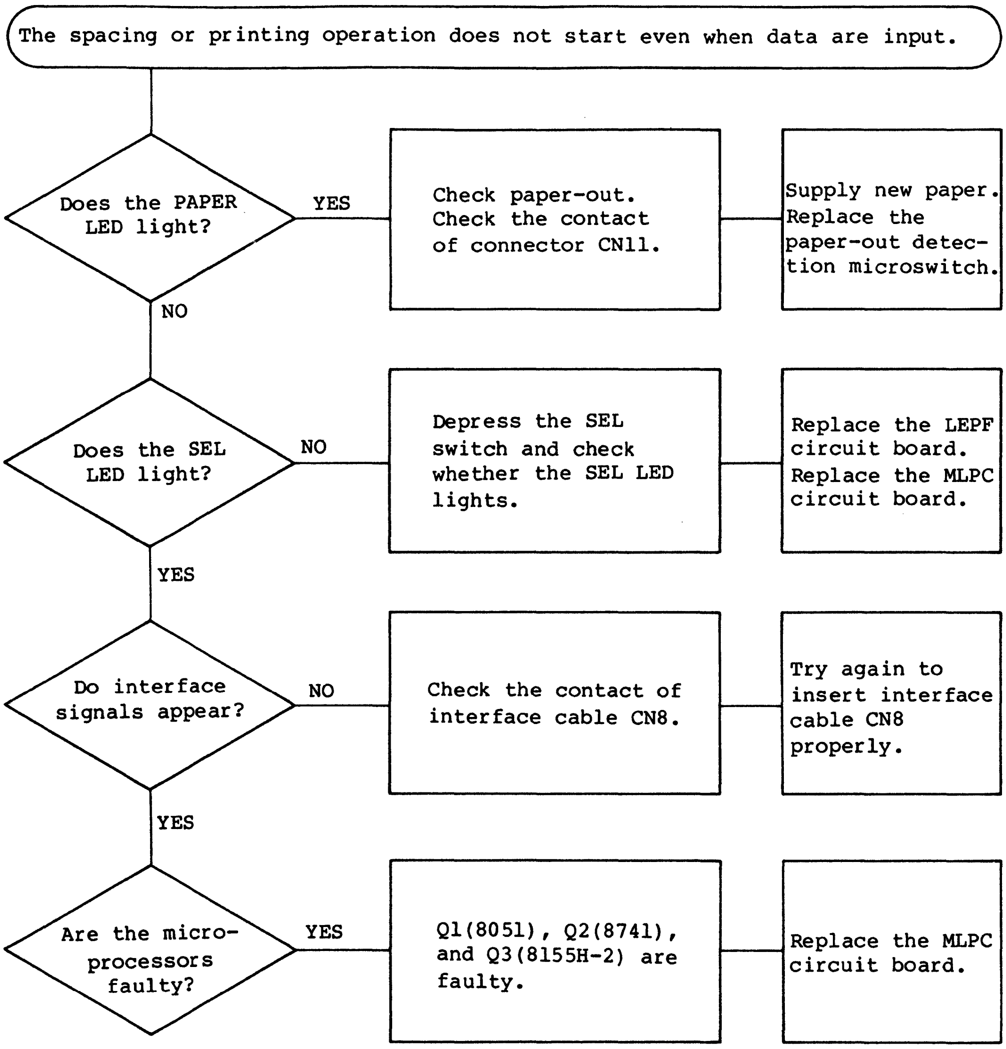
Item (3)


The carriage vibrates at power-up.
Is the synchro belt tension too high?
YES
Check the tension of the synchro belt.
Adjust the tension of the synchro belt.
NO
Is the space motor overdrive faulty?
YES
TR2 is faulty.
Replace the MLPC circuit board.
NO
Is ribbon feed tight?
YES
Turn off power, and check the ribbon feed by moving the carriage to right and left manually.
Check the ribbon drive assembly.
NO
Is the voltage wrong?
YES
Check the +35-V line voltage.
Replace the MLPC circuit board.
NO
Is the space motor drive faulty?
YES
TR13, Q9, Q10, and Q11 are faulty.
Replace the MLPC circuit board.

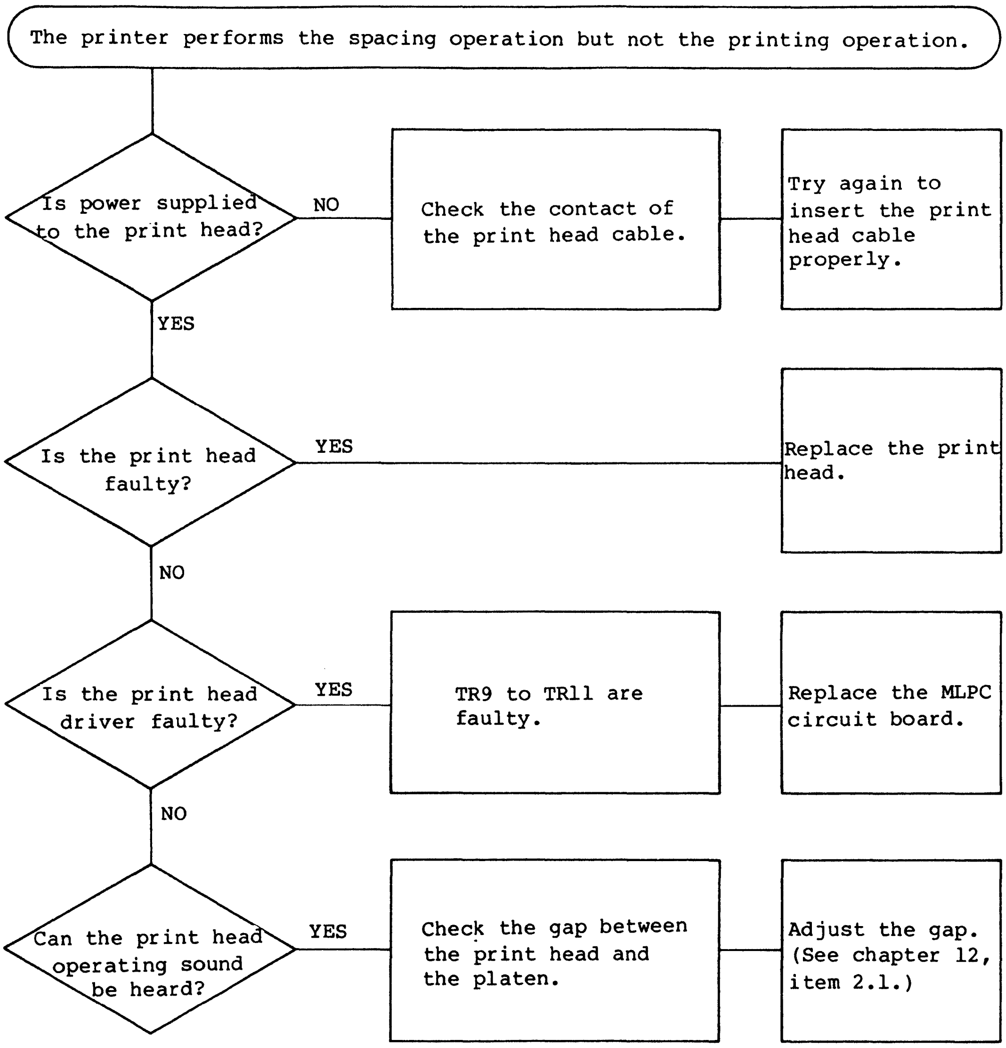
Item (4)


The circuit breaker opens at power-up.
Is the rectifier circuit faulty?
YES
D1 to D4 are faulty.
Replace the MLPC circuit board.
NO
Does voltage appear at CN1?
NO
TFMR is faulty. The LEPM circuit board is faulty.
Replace TFMR. Replace the LEPM board.
YES
Is the protective circuit in operation?
YES
Q20, SCR, TR1 to TR3, and TR7 are faulty.
Replace the MLPC circuit board.

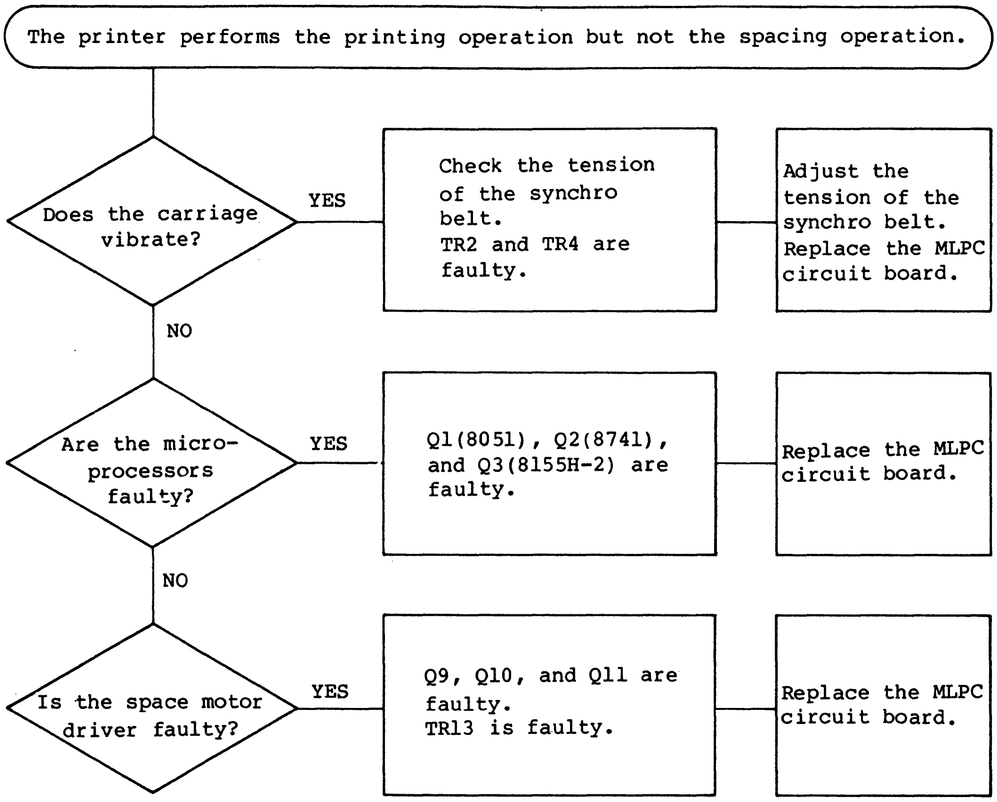
Item (5)


The spacing or printing operation does not start even when data are input.
Does the PAPER LED light?
YES
Check paper-out. Check the contact of connector CN11.
Supply new paper. Replace the paper-out detection microswitch.
NO
Does the SEL LED light?
NO
Depress the SEL switch and check whether the SEL LED lights.
Replace the LEPF circuit board. Replace the MLPC circuit board.
YES
Do interface signals appear?
NO
Check the contact of interface cable CN8.
Try again to insert interface cable CN8 properly.
YES
Are the microprocessors faulty?
YES
Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.

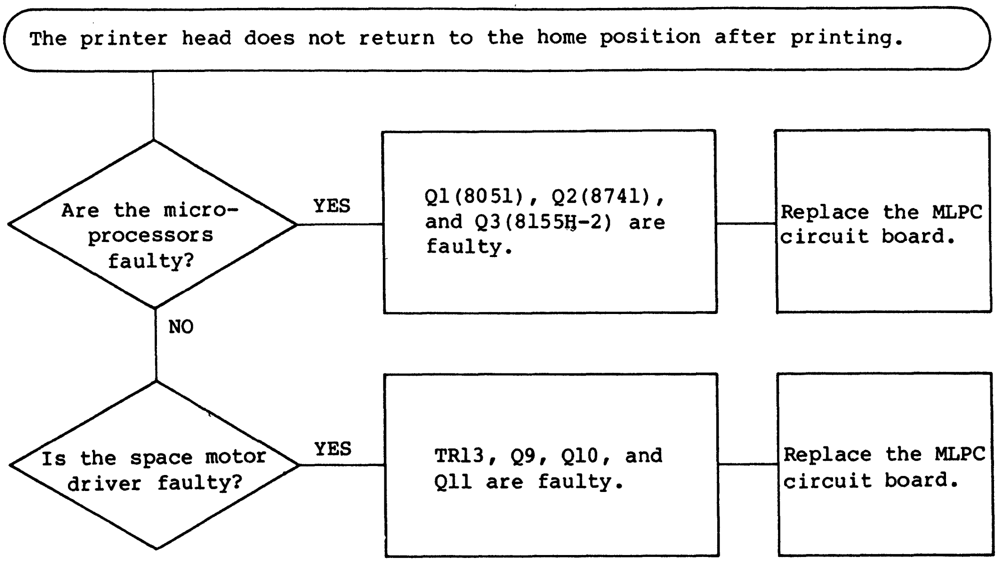
Item (6)


The printer performs the spacing operation but not the printing operation.
Is power supplied to the print head?
NO
Check the contact of the print head cable.
Try again to insert the print head cable properly.
YES
Is the print head faulty?
YES
Replace the print head.
NO
Is the print head driver faulty?
YES
TR9 to TR11 are faulty.
Replace the MLPC circuit board.
NO
Can the print head operating sound be heard?
YES
Check the gap between the print head and the platen.
Adjust the gap. (See chapter 12, item 2.1.)

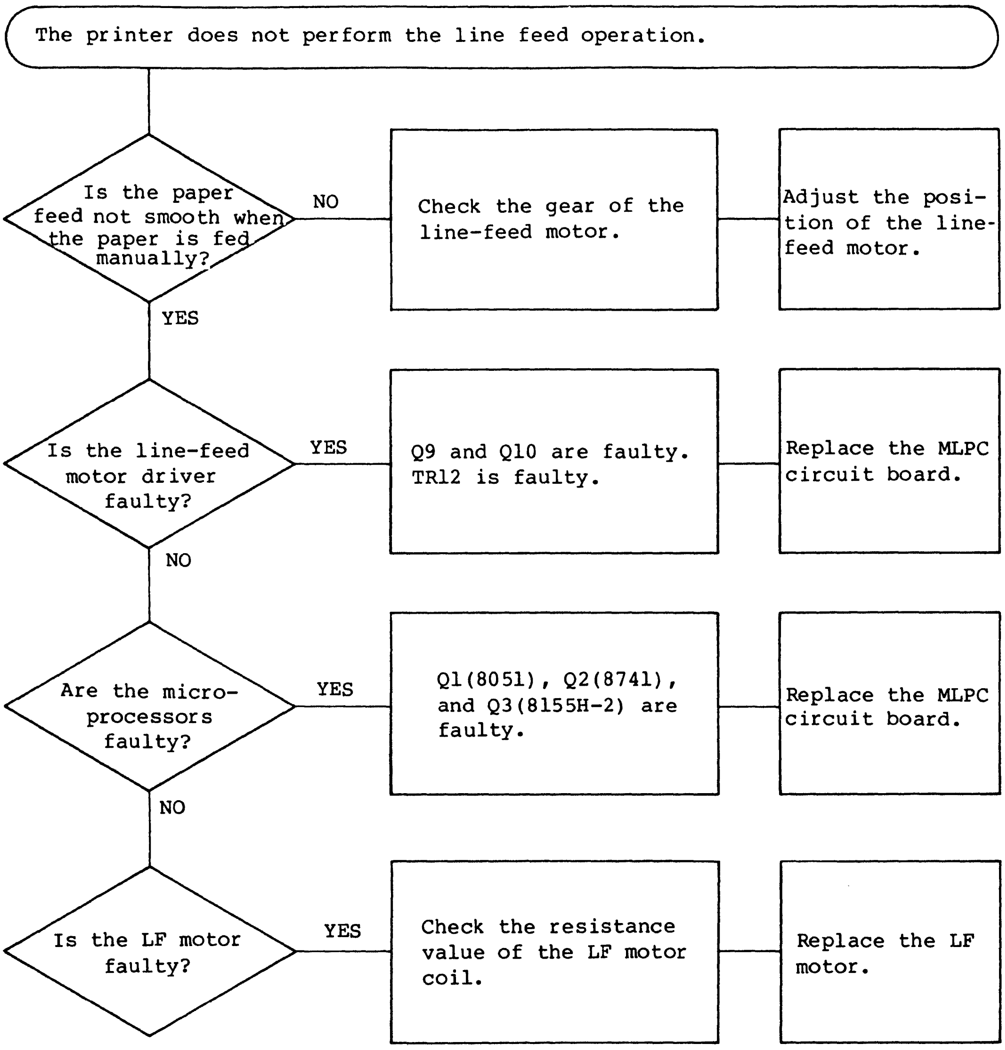
Item (7)


The printer performs the printing operation but not the spacing operation.
Does the carriage vibrate?
YES
Check the tension of the synchro belt.
TR2 and TR4 are faulty.
Adjust the tension of the synchro belt.
Replace the MLPC circuit board.
NO
Are the micro-processors faulty?
YES
Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.
NO
Is the space motor driver faulty?
YES
Q9, Q10, and Q11 are faulty.
TR13 is faulty.
Replace the MLPC circuit board.

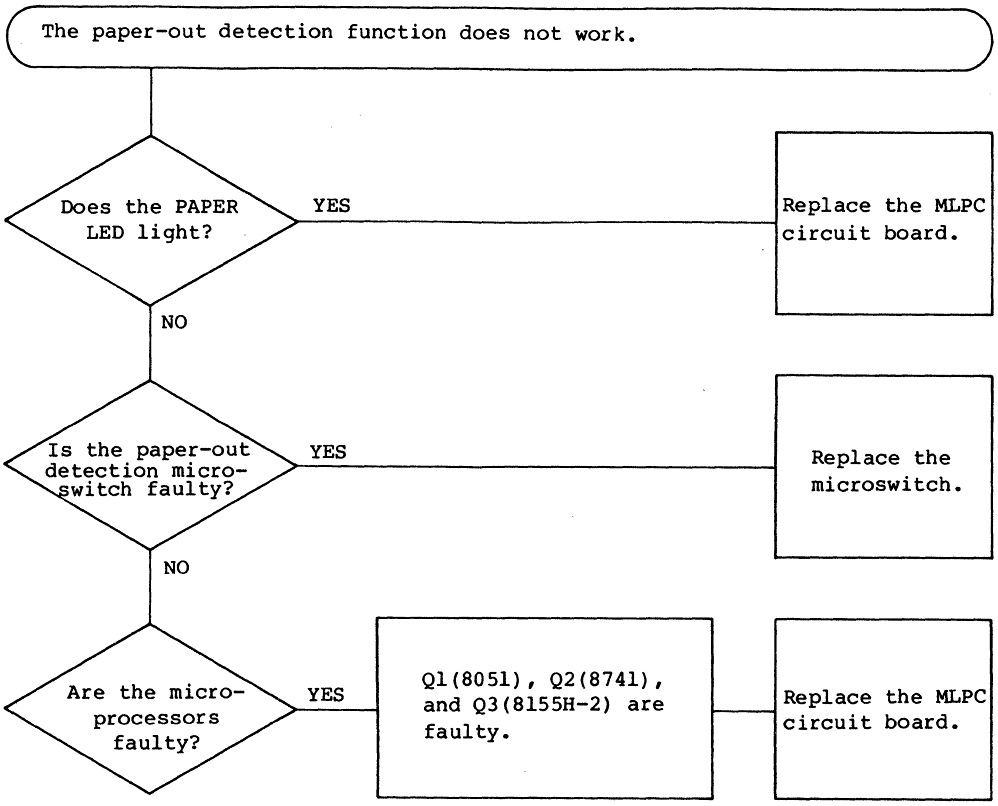
Item (8)


The printer head does not return to the home position after printing.
Are the micro-processors faulty?
YES
Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.
NO
Is the space motor driver faulty?
YES
TR13, Q9, Q10, and Q11 are faulty.
Replace the MLPC circuit board.

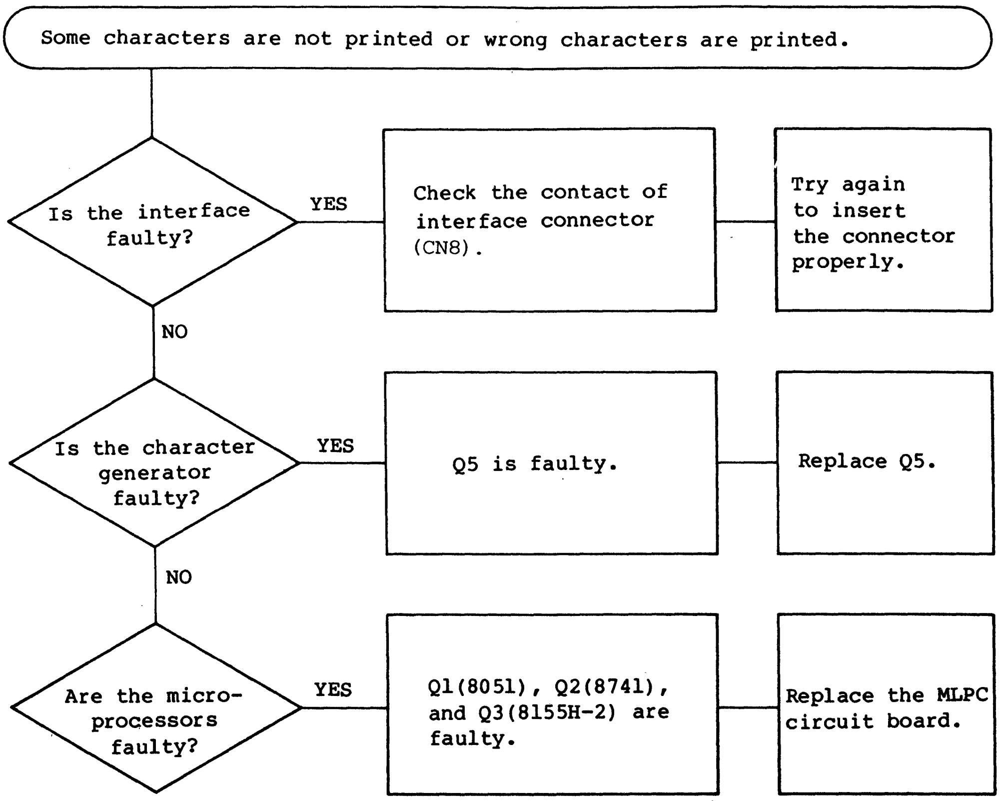
Item (9)


The printer does not perform the line feed operation.
Is the paper feed not smooth when the paper is fed manually?
NO
Check the gear of the line-feed motor.
Adjust the position of the line-feed motor.
YES
Is the line-feed motor driver faulty?
YES
Q9 and Q10 are faulty. TR12 is faulty.
Replace the MLPC circuit board.
NO
Are the microprocessors faulty?
YES
Q1(8051), Q2(8741), and Q3(8155H-2) are faulty.
Replace the MLPC circuit board.
NO
Is the LF motor faulty?
YES
Check the resistance value of the LF motor coil.
Replace the LF motor.

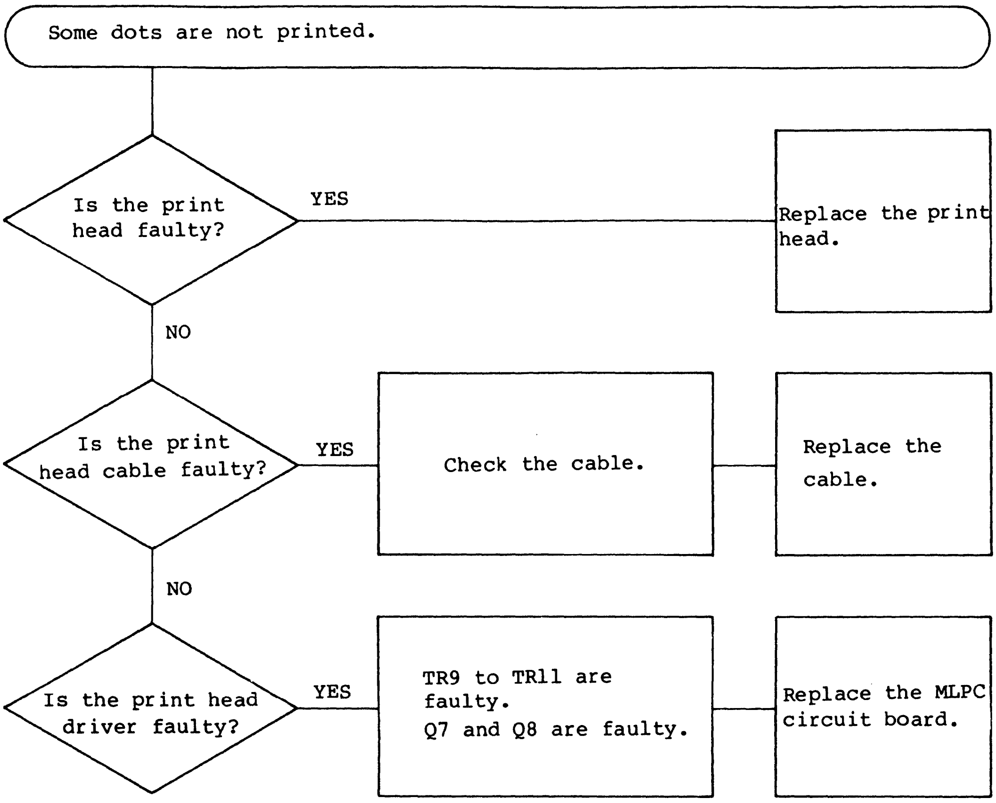
Item (10)



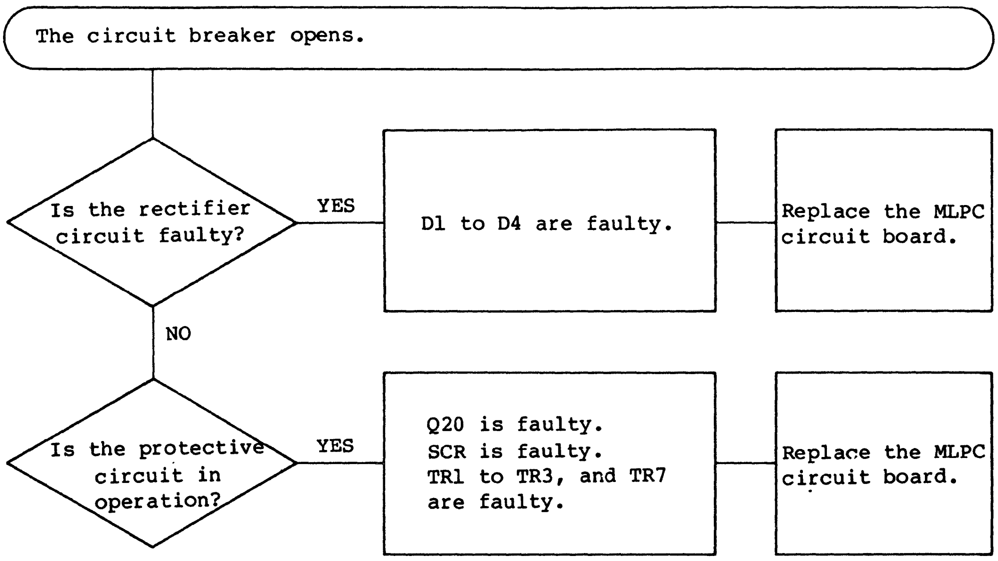
Item (11)



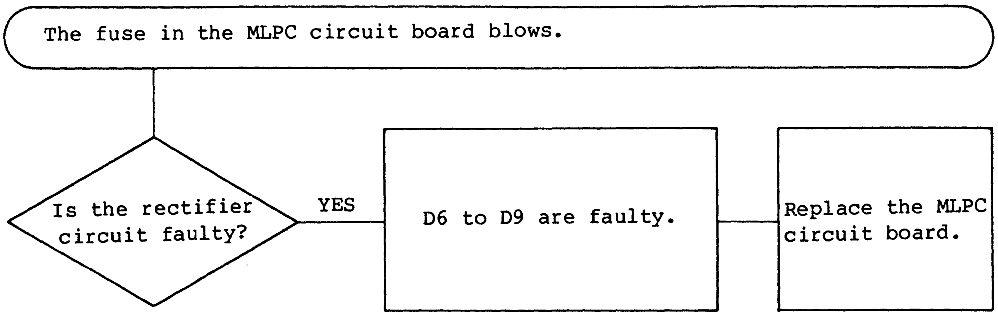
Item (12)



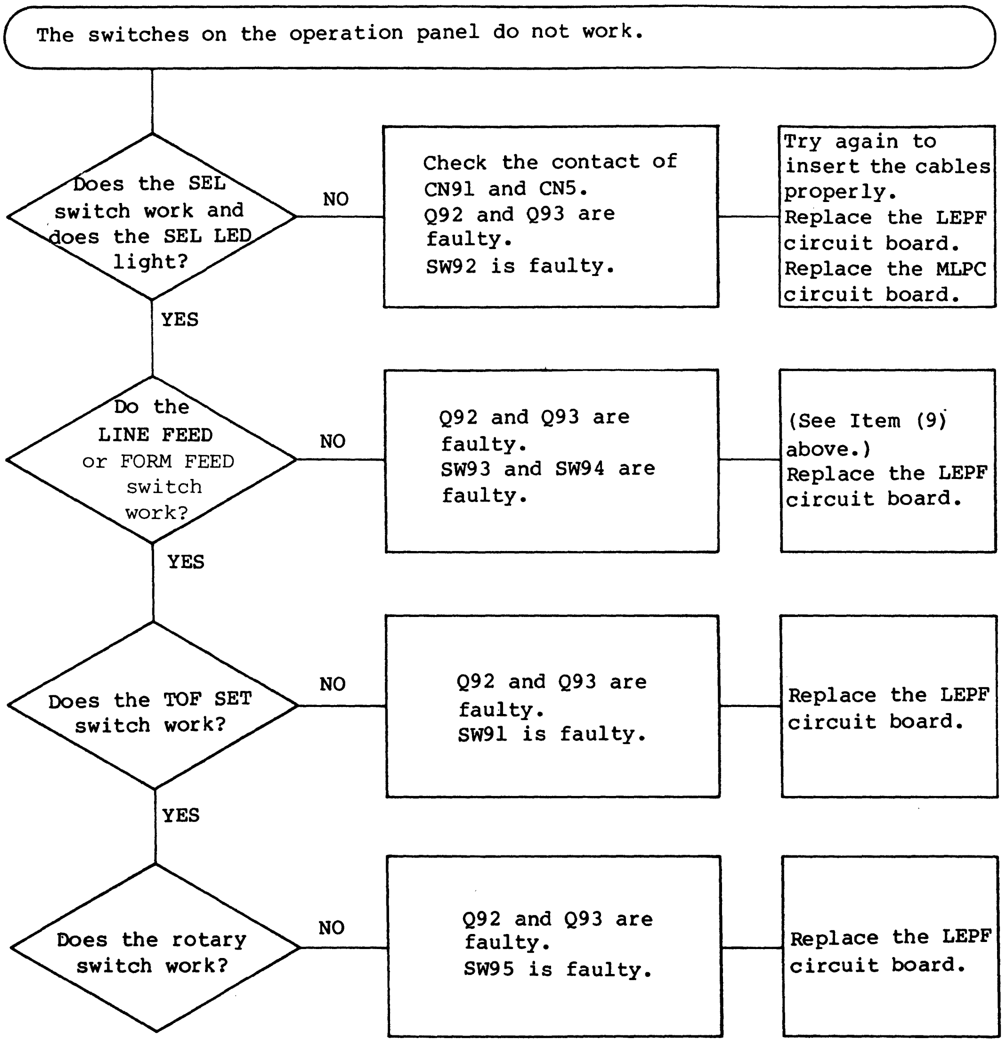
Item (13)



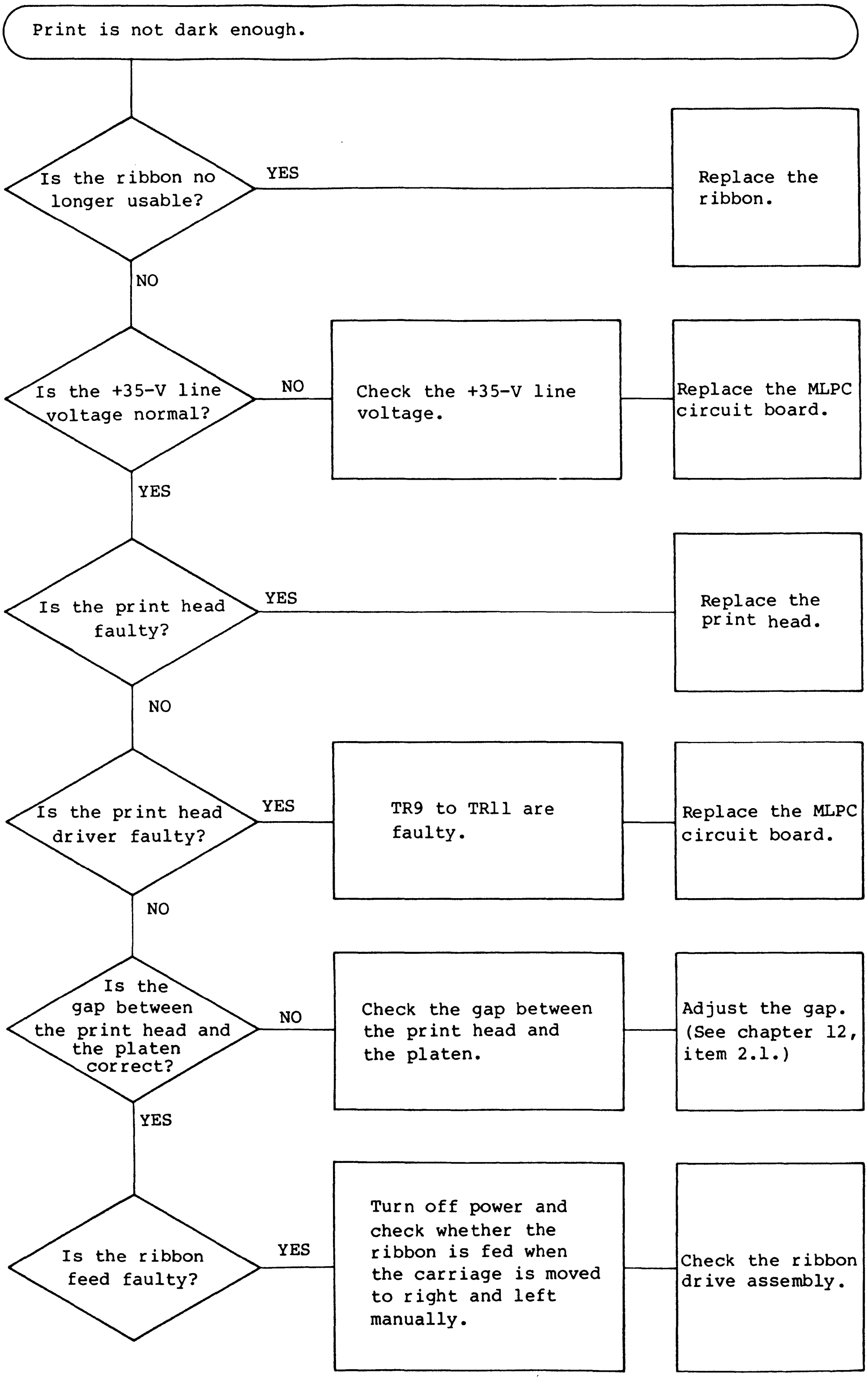
Item (14)



item (15)



Item (16)

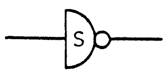
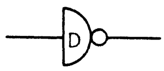
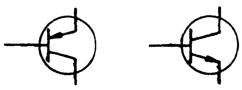
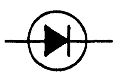
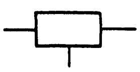


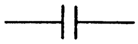
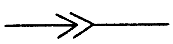
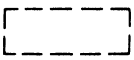
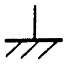
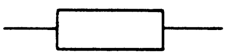
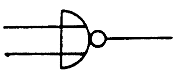
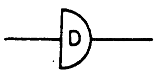
Print is not dark enough.
Is the ribbon no longer usable?
YES
Replace the ribbon.
NO
Is the +35-V line voltage normal?
NO
Check the +35-V line voltage.
Replace the MLPC circuit board.
YES
Is the print head faulty?
YES
Replace the print head.
NO
Is the print head driver faulty?
YES
TR9 to TR11 are faulty.
Replace the MLPC circuit board.
NO
Is the gap between the print head and the platen correct?
NO
Check the gap between the print head and the platen.
Adjust the gap. (See chapter 12, item 2.1.)
YES
Is the ribbon feed faulty?
YES
Turn off power and check whether the ribbon is fed when the carriage is moved to right and left manually.
Check the ribbon drive assembly.

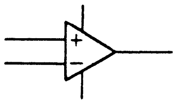
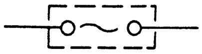
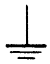
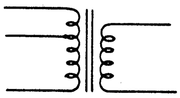
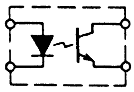
16. CIRCUIT DIAGRAM

This section describes the meanings of symbols used in the circuit diagrams, and provides circuit diagrams.

Table 16-1 Table of Symbols

Symbol	Mark	Description
	Q	SN 7405 N (SN 74 LS05) inverter (open collector)
	Q	SN 7406 inverter (open collector)
	OSC	Ceramic oscillator
	TR	Transistor
	TR	Thyristor
	D	Diode
	D	Zener diode
	D	Light-emitting diode
	TR	Regulator

Symbol	Mark	Description
	C	Capacitor
	C	Electrolytic capacitor
	R	Resistor
	SW	Switch
	S	Jumper wire or plug
	CN	Connector (terminal)
 (Reference)		Means a single part.
	FG	Frame ground
		Dot head (element)
	Q	SN74LS02 2NOR gate
	Q	SN7407 buffer (open collector)

Symbol	Mark	Description
	Q	339 Comparator
	BK	Circuit breaker
	THERMI- STOR	Thermistor
	SG	Signal ground
	TF	Transformer
		Home position detector
F 	F	Fuse

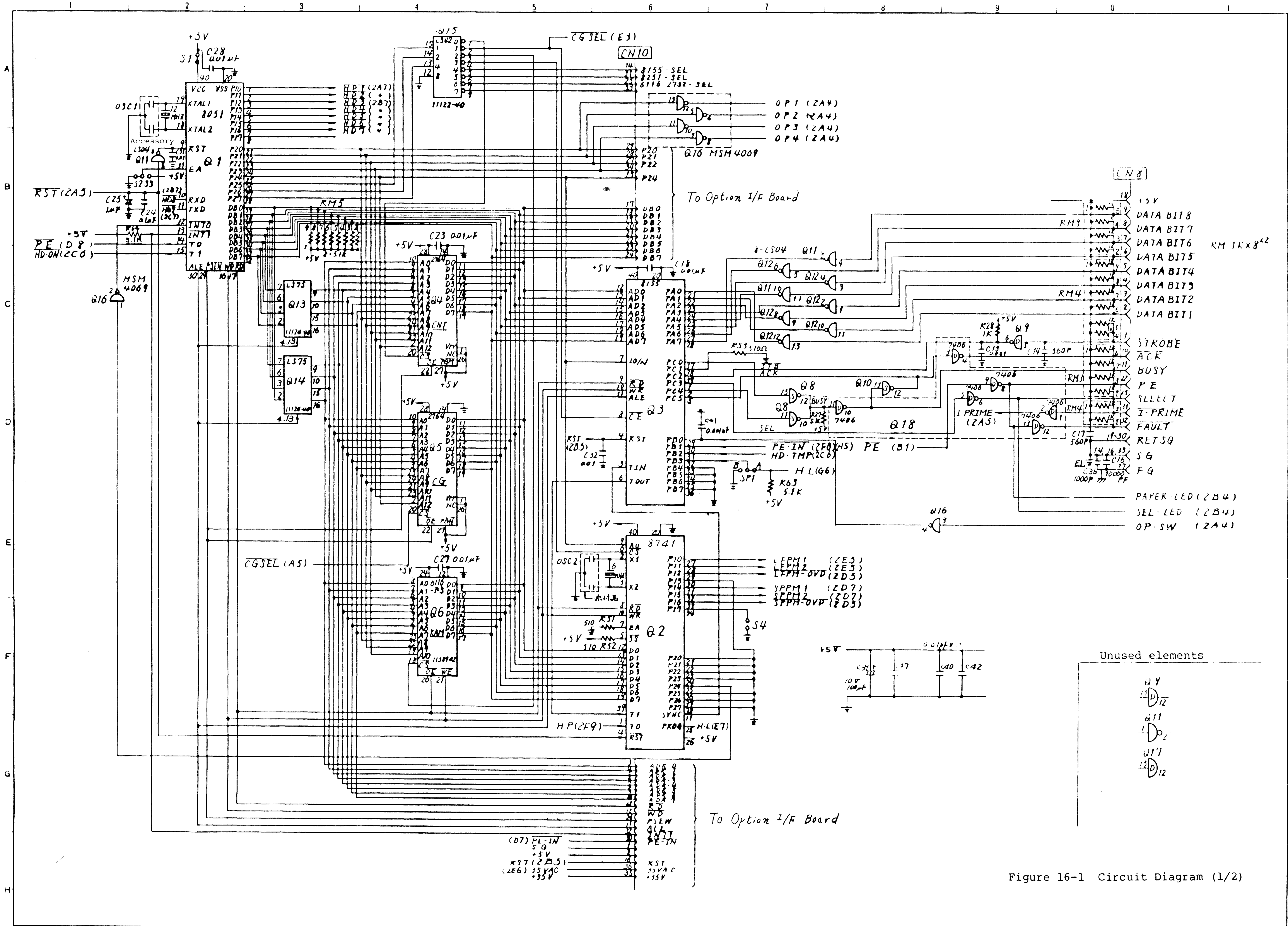
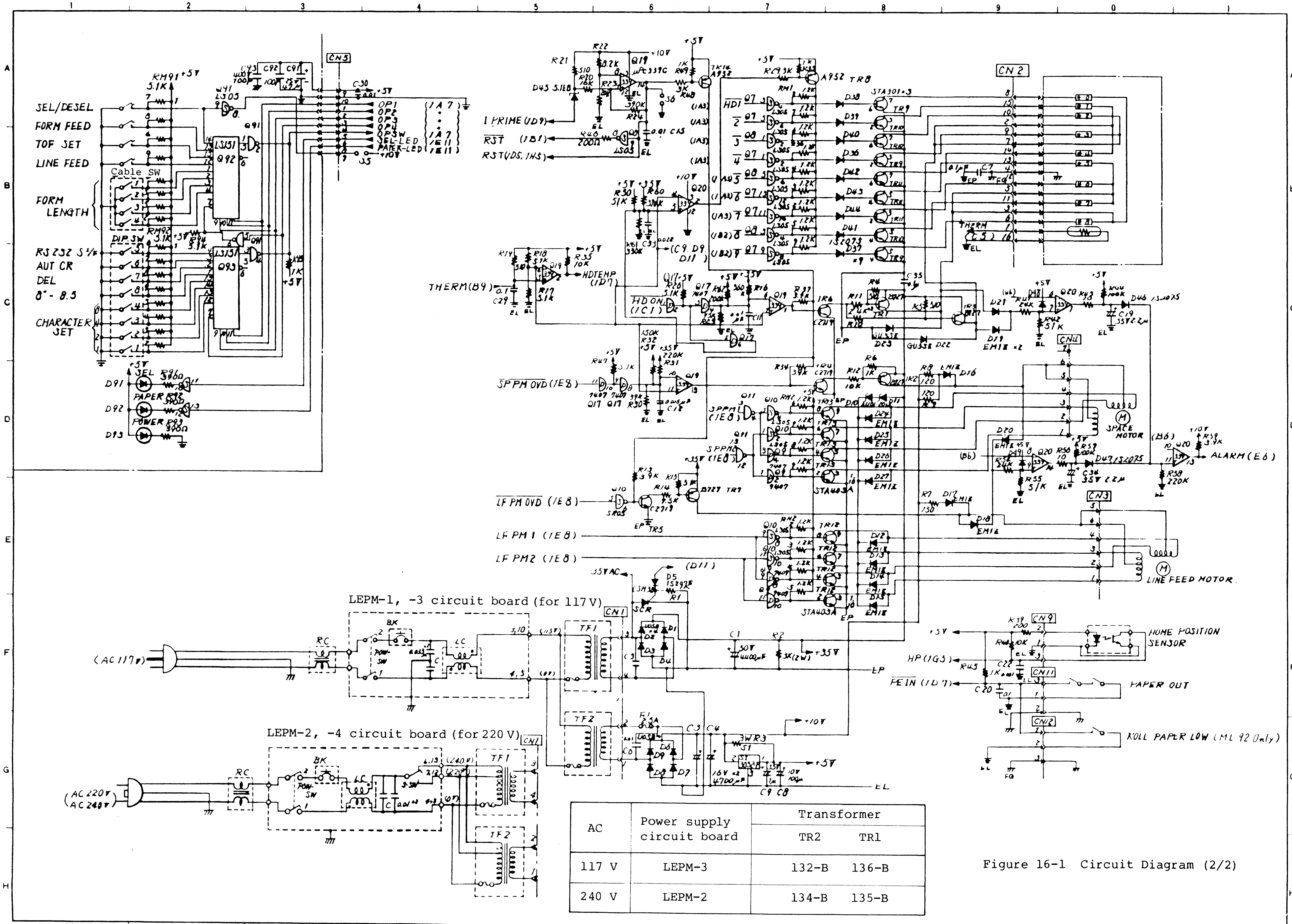


Figure 16-1 Circuit Diagram (1/2)



AC	Power supply circuit board	Transformer	
		TR2	TR1
117 V	LEPM-3	132-B	136-B
240 V	LEPM-2	134-B	135-B

Figure 16-1 Circuit Diagram (2/2)

17. COMPONENT PARTS LIST

This section lists the main component parts of the MICROLINE 93 in the order of the following schematic diagrams:

(1) For USA (117 V)

```
Figure 17-1   General Assembly Diagram (LY-44965-2)
 |
 |-Figure 17-2   Printer Unit (LR-1449-1)
 |  |
 |  |-Figure 17-3   Base Unit (LR-194276-1)
 |  |  |
 |  |  |-Figure 17-4   Platen Assembly (LR-129900-4)
 |  |  |
 |  |  └-Figure 17-5   Paper Out Assembly (LR-129907-1)
 |  |
 |  |-Figure 17-6   Ribbon Drive Assembly (LR-193456-6)
 |  |
 |  └-Figure 17-7   Carriage Assembly (LR-191870-3)
 |
 |-Figure 17-8   Cover Unit (LM-62052-2)
 |  |
 |  |-Figure 17-9   Operation Panel Assembly (LM-59688-1)
 |  |  |
 |  |  └-Figure 17-10   LEPF Circuit Board (LY-40069-1)
 |  |                   (LX-86707-1)
 |  |
 |  └-Figure 17-11   Power Supply Assembly (LR-104073-10)
 |     |
 |     └-Figure 17-12   LEPM Circuit Board (LX-86814-3)
 |
 |-Figure 17-13   MLPC Circuit Board (LY-44989-1) (WX-41117-1)
 |  |
 |  |-* Program ROM (Q4, EPROM) (LYH-30093-1)
 |  |
 |  |-* Program ROM and Character Generator (Q5, EPROM)
 |  |   (LYH-30094-1)
 |  |
 |  └-* Mechanism Control ROM (Q2, µCPU, and EPROM)
 |      (LYH-8024-1)
 |
 └-Figure 17-14   Tractor Unit (LY-39702-1)
    |
    |-Figure 17-15   Sprocket Assembly (R) (FMX-35100-2)
    |
    └-Figure 17-16   Sprocket Assembly (L) (FMX-35150-2)
```

Notes: (1) The parts marked with * are not included in the table of component parts. Any of them may be ordered by specifying parts numbers.

(2) The numbers (82A, 83A, and 92) in the "Remark" column in the following component parts lists indicate the compatibility of the part with MICROLINE 82A, 83A, and 92.

(2) For area other than USA (117 V)

Figure 17-1 General Assembly Diagram (LY-44965-3)

- Figure 17-2 Printer Unit (LR-1449-1)
  - Figure 17-3 Base Unit (LR-194276-1)
    - Figure 17-4 Platen Assembly (LR-129900-4)
    - Figure 17-5 Paper Out Assembly (LR-129907-1)
  - Figure 17-6 Ribbon Drive Assembly (LR-193456-6)
  - Figure 17-7 Carriage Assembly (LR-191870-3)
- Figure 17-8 Cover Unit (LM-62052-3)
  - Figure 17-9 Operation Panel Assembly (LM-59688-1)
    - Figure 17-10 LEPF Circuit Board (LY-40069-1) (3LX-86707-1)
  - Figure 17-11 Power Supply Assembly (LR-104073-12)
    - Figure 17-12 LEPM Circuit Board (LX-86814-4)
- Figure 17-13 MLPC Circuit Board (LY-44989-1) (2WX-41117-1)
  - * Program ROM (Q4, EPROM) (LYH-30093-1)
  - * Program ROM and Character Generator (Q5, EPROM) (LYH-30095-1)
  - * Mechanism Control ROM (Q2, μCPU, and EPROM) (LYH-8024-1)
- Figure 17-14 Tractor Unit (LY-39702-1)
  - Figure 17-15 Sprocket Assembly (R) (FMX-35100-2)
  - Figure 17-16 Sprocket Assembly (L) (FMX-35150-2)

Notes: (1) The parts marked with * are not included in the table of component parts. Any of them may be ordered by specifying parts numbers.

(2) The numbers (82A, 83A, and 92) in the "Remark" column in the following component parts list, indicate the compatibility of the part with the MICROLINE 82A, 83A, and 92.

(3) For USA (For 220/240 V)

Figure 17-1 General Assembly Diagram (LY-44965-4)

- Figure 17-2 Printer Unit (LR-1449-1)
  - Figure 17-3 Base Unit (LR-194276-1)
    - Figure 17-4 Platen Assembly (LR-129900-4)
    - Figure 17-5 Paper Out Assembly (LR-129907-1)
  - Figure 17-6 Ribbon Drive Assembly (LR-193456-6)
  - Figure 17-7 Carriage Assembly (LR-191870-3)
- Figure 17-8 Cover Unit (LM-62052-3)
  - Figure 17-9 Operation Panel Assembly (LM-59688-1)
    - Figure 17-10 LEPF Circuit Board (LY-40069-1) (LX-86707-1)
  - Figure 17-11 Power Supply Assembly (2LR-104073-12)
    - Figure 17-12 LEPM Circuit Board (3LX-86814-4)
- Figure 17-13 MLPC Circuit Board (LY-44989-1) (WX-41117-1)
  - * Program ROM (Q4, EPROM) (LYH-30093-1)
  - * Program ROM and Character Generator (Q5, EPROM) (LYH-30094-1)
  - * Mechanism Control ROM (Q2, μCPU, and EPROM) (LYH-8024-1)
- Figure 17-14 Tractor Unit (LY-39702-1)
  - Figure 17-15 Sprocket Assembly (R) (FMX-35100-2)
  - Figure 17-16 Sprocket Assembly (L) (FMX-35150-2)

Notes: (1) The parts marked with * are not included in the table of component parts. Any of them may be ordered by specifying parts numbers.

(2) The numbers (82A, 83A, and 92) in the "Remark" column in the following component parts lists indicate the compatibility of the part with MICROLINE 82A, 83A, and 92.

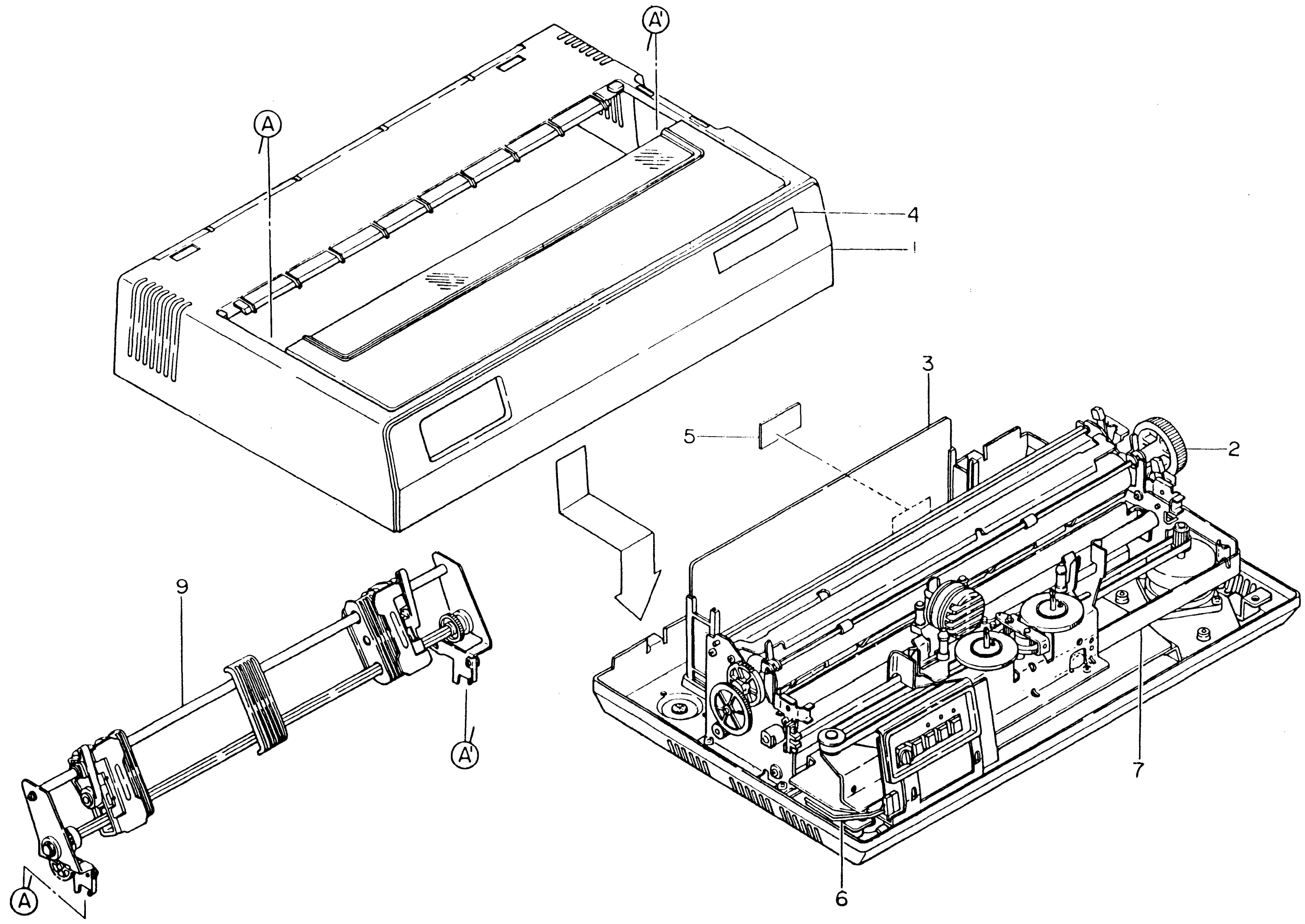


Figure 17-1 General Assembly Diagram (LY-44965-2, -3, -4) (1/2)

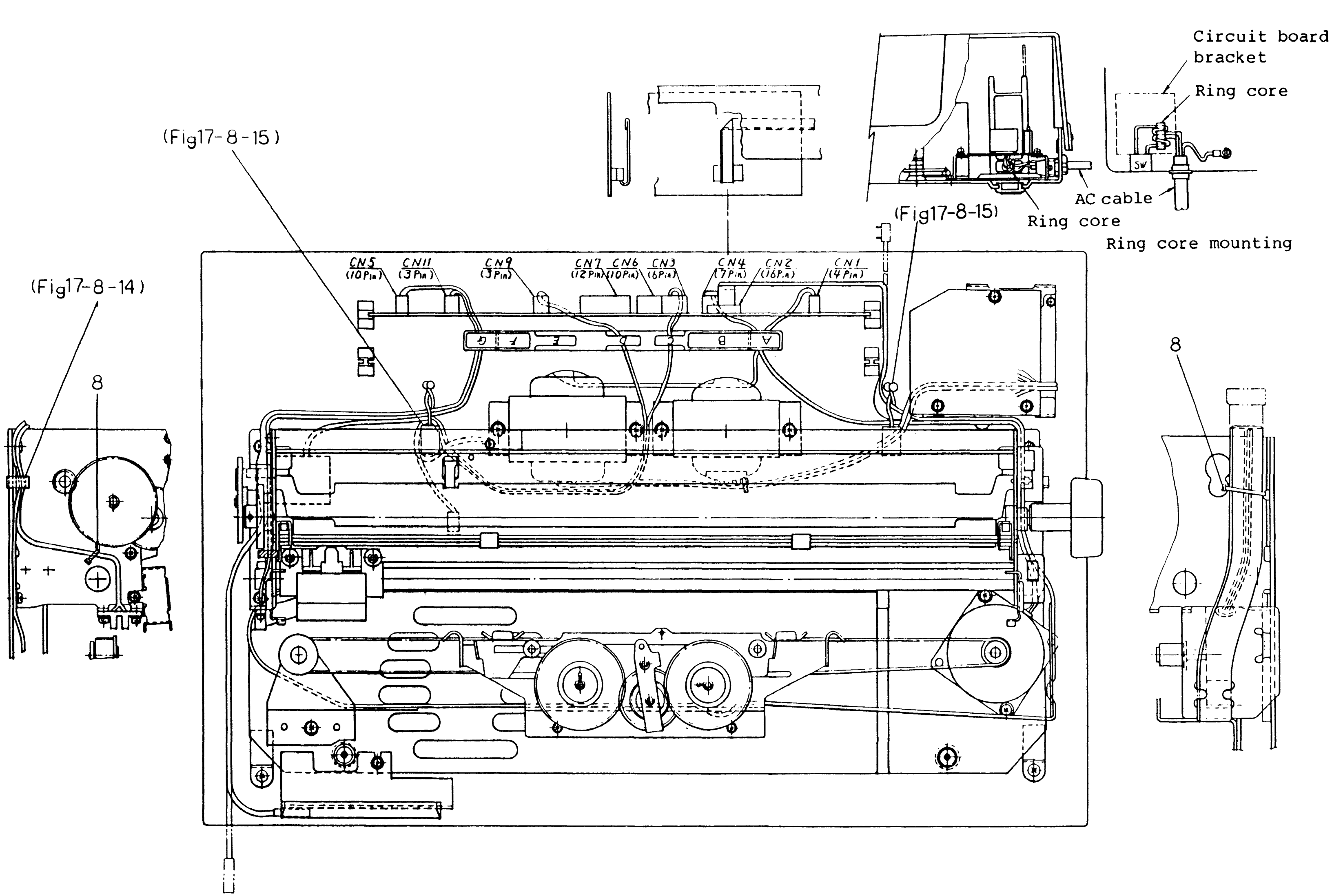


Figure 17-1 General Assembly Diagram (LY-44965-2, -3, -4) (2/2)

Figure 17-1 General Assembly Diagram (LY-44965-2) (for USA, 117 V)

Item No.	Part No.	Description	Qty	Remarks
1	LM-62052-2	Cover unit	1	
2	LR-1449-1	Printer unit	1	
3	LY-44989-1	MLPC circuit board	1	92
4	L-1738-5	Decorative nameplate	1	
5	L-1568-4	Machine nameplate	1	
6	LP-38774-1	Operation panel connection cable	1	92
7	LP-38439-2	Head connection cable	1	83A
8	LP-6401-bl	Tie-wrap	2	
9	LY-39702-1	Tractor unit	1	83A
11	L-1557-1	Caution for carriage tie down	1	82A 83A 92
12	LP-1457-6	Fastener (250 mm long, yellow)	1	82A 83A 92

Figure 17-1 General Assembly Diagram (LY-44965-3)
(for the area other than USA)

Item No.	Part No.	Description	Qty	Remarks
1	LM-62052-3	Cover unit	1	
2	LR-1449-1	Printer unit	1	
3	LY-44989-1	MLPC circuit board	1	92
4	L-1566-5	Decorative nameplate	1	
5	L-1569-6	Machine nameplate	1	
6	LP-38774-1	Operation panel connection cable	1	92
7	LP-38439-2	Head connection cable	1	83A
8	LP-6401-bl	Tie-wrap	2	
9	LY-39702-1	Tractor unit	1	83A
11	L-1557-1	Caution for carriage tie down	1	82A 83A 92
12	LP-1457-6	Fastener (250 mm long, yellow)	1	82A 83A 92

Figure 17-1 General Assembly Diagram (LY-44965-4)
(for USA, 220/240 V)

Item No.	Part No.	Description	Qty	Remarks
1	LM-62052-3	Cover unit	1	
2	LR-1449-1	Printer unit	1	
3	LY-44989-1	MLPC circuit board	1	92
4	L-1738-5	Decorative nameplate	1	
5	L-1569-6	Machine nameplate	1	
6	LP-38774-1	Operation panel connection cable	1	92
7	LP-38439-2	Head connection cable	1	83A
8	LP-6401-bl	Tie-wrap	2	
9	LY-39702-1	Tractor unit	1	83A
11	L-1557-1	Caution for carriage tie down	1	82A 83A 92
12	LP-1457-6	Fastener (250 mm long, yellow)	1	82A 83A 92

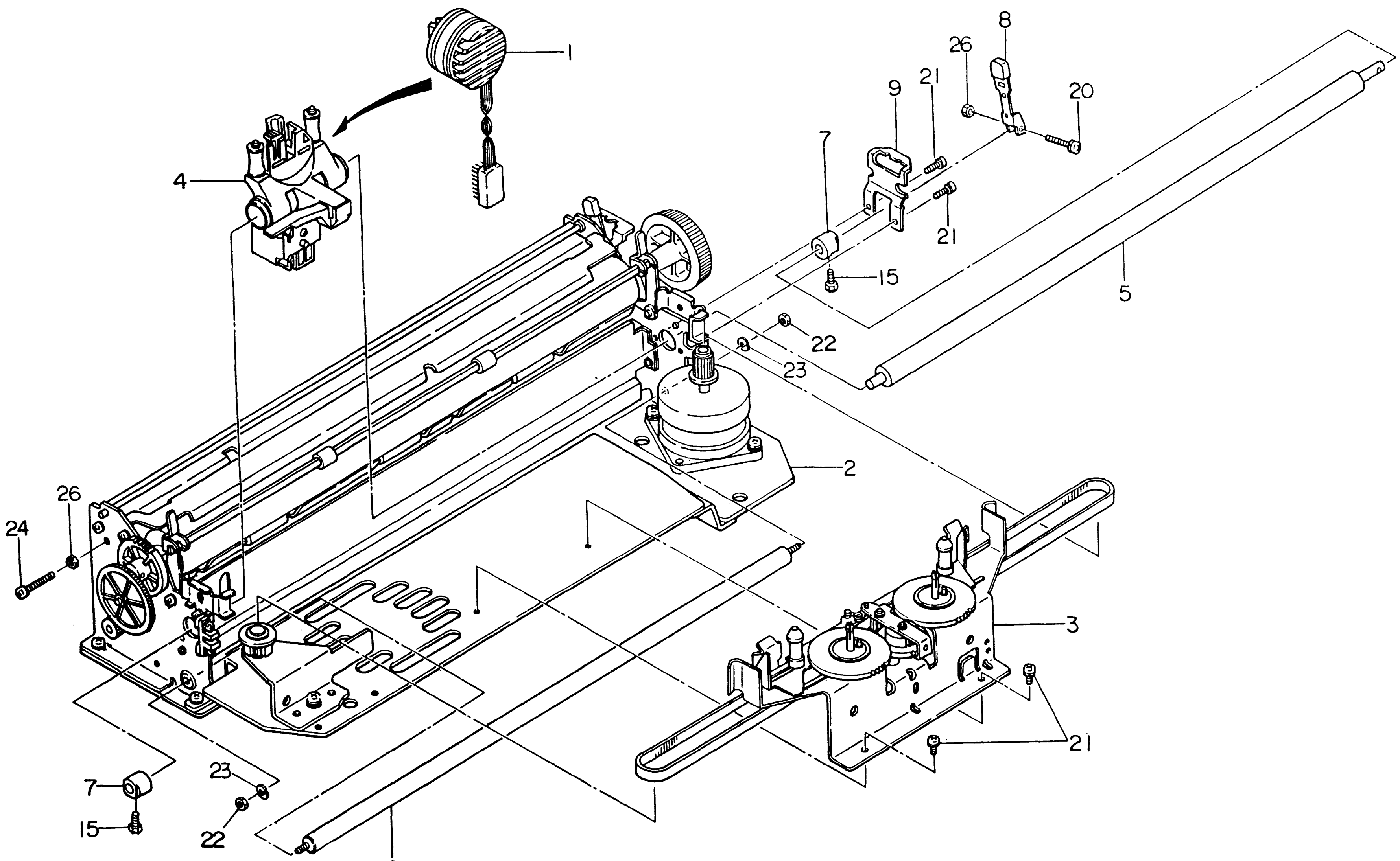


Figure 17-2 Printer Unit (LR-1449-1)

Figure 17-2 Printer Unit (LR-1449-1)

Item No.	Part No.	Description	Qty	Remarks
1	LR-190990-10	Print head assembly	1	92
2	LR-194276-1	Base unit	1	
3	LR-193456-6	Ribbon drive assembly	1	
4	LR-191870-3	Carriage assembly	1	
5	LR-132450-1	Carriage shaft (R)	1	83A
6	LR-193455-1	Carriage shaft (L)	1	83A
7	LR-132451-1	Eccentric collar	2	82A 83A 92
8	LR-132115-1	Adjusting lever	1	82A 83A 92
9	LR-132452-1	Adjusting bracket	1	82A 83A 92
15	(-)B3-6-HH	Bolt	2	
20	⊕ P(SW)3-14-HH	Small pan-head screw	1	
21	⊕ P(SW)3-6-HH	Small pan-head screw	4	
22	3N4-HH	Locknut	2	
23	SW4-HHC	Spring washer	2	
24	⊕ P3-30-HH	Small pan-head screw	1	
26	2N3-HH	Nut	2	

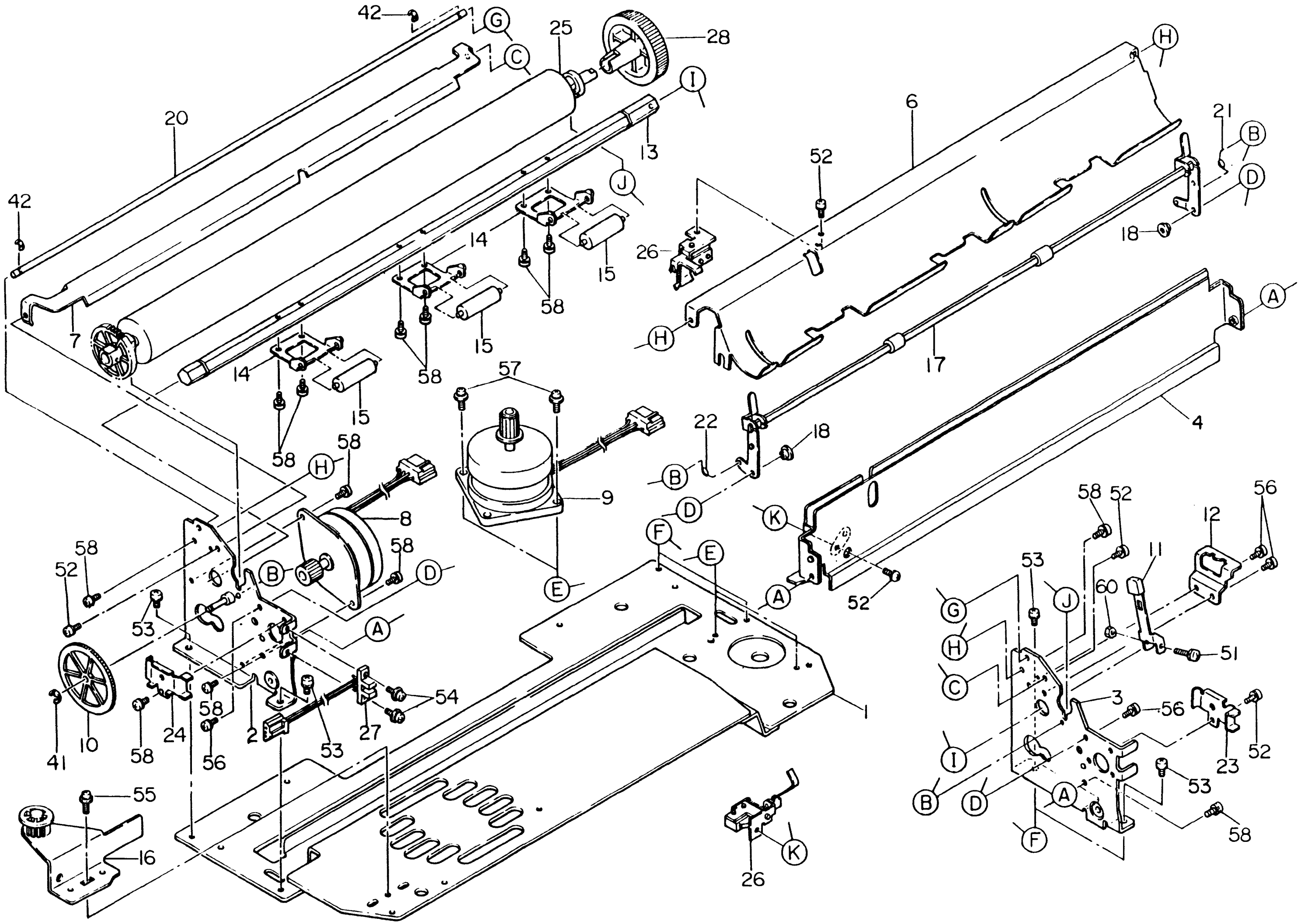


Figure 17-3 Base Unit (LR-194276-1)

Figure 17-3 Base Unit (LR-194276-1) 1/2

Item No.	Part No.	Description	Qty	Remarks
1	LR-132461-1	Base-frame	1	83A
2	LR-193450-1	Side frame (L)	1	82A 83A 92
3	LR-193452-1	Side frame (R)	1	82A 83A 92
4	LR-193462-4	Paper guide	1	83A
6	LR-132467-1	Paper chute	1	83A
7	LR-132468-1	Paper separator	1	83A
8	LR-132473-4	LF motor	1	82A 83A 92
9	LR-191854-3	Space motor	1	92
10	LR-132475-1	LF idle gear	1	82A 83A 92
11	LR-132480-1	Paper clamp lever	1	82A 83A 92
12	LR-132482-1	Paper clamp lever bracket	1	82A 83A 92
13	LR-132483-1	Roller support shaft	1	83A
14	LR-132484-1	Feed roller spring	3	82A 83A 92
15	LR-132485-1	Friction roller	3	82A 83A 92
16	LR-132488-2	Idle pulley bracket	1	83A
17	LR-192206-1	Scale bar assembly	1	
18	LR-132494-1	Shoulder nut	2	83A
20	LR-129808-2	Scale bar shaft	1	83A
21	LR-192198-1	Detent spring (R)	1	
22	LR-192198-2	Detent spring (L)	1	
23	LR-132222-1	Ribbon guide (R)	1	82A 83A 92
24	LR-132229-1	Ribbon guide (L)	1	82A 83A 92
25	LR-129900-4	Platen assembly	1	83A
26	LR-129907-1	Paper out assembly	1	82A 83A 92
27	LR-129847-3	Home sensor assembly	1	82A 83A 92
28	LR-132233-1	Platen knob	1	82A 83A 92

Figure 17-3 Base Unit (LR-194276-1) 2/2

Item No.	Part No.	Description	Qty	Remarks
41	KH-12050-1	E-snap ring (E3)	1	
42	KX-9057-1	E-snap ring (E3)	2	
51	⊕ P(SW)3-14-HH	Small pan-head screw	1	
52	⊕ P(SW)3-6-HH	Small pan-head screw	5	
53	⊕ P(SW)4-6-HH	Small pan-head screw	4	
54	⊕ P(SW+W)3-6-HH	Small pan-head screw	2	
55	⊕ P(SW+2W)4-8-HH	Small pan-head screw	1	
56	⊕ P(SW)3-5-HH	Small pan-head screw	4	
57	⊕ P(SW+2W)4-10-HH	Small pan-head screw	2	
58	⊕ P(SW)3-8-HH	Small pan-head screw	13	
60	2N3-HH	Nut	1	

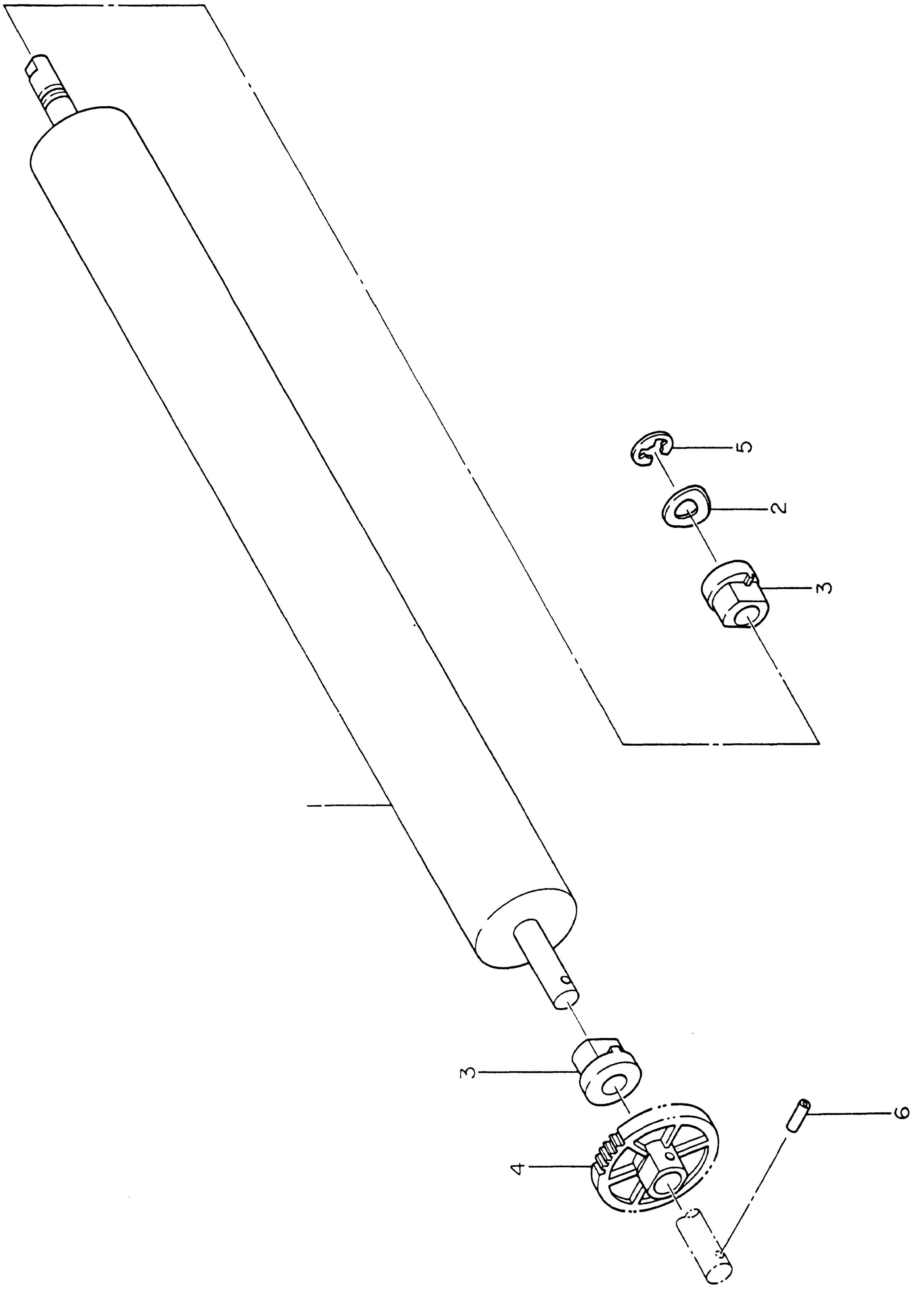


Figure 17-4 Platen Assembly (LR-129900-4)

Figure 17-4 Platen Assembly (LR-129900-4)

Item No.	Part No.	Description	Qty	Remarks
1	LR-129898-2	Plain platen	1	83A
2	LR-129906-1	Wave washer	1	82A 83A 92
3	LR-129855-1	Platen bearing	2	82A 83A 92
4	LR-129859-1	Platen gear	1	82A 83A 92
5	KX-9059-1	E-snap ring (E6)	1	82A 83A 92
6	SPP3-12-SUS	Spring pin	1	82A 83A 92

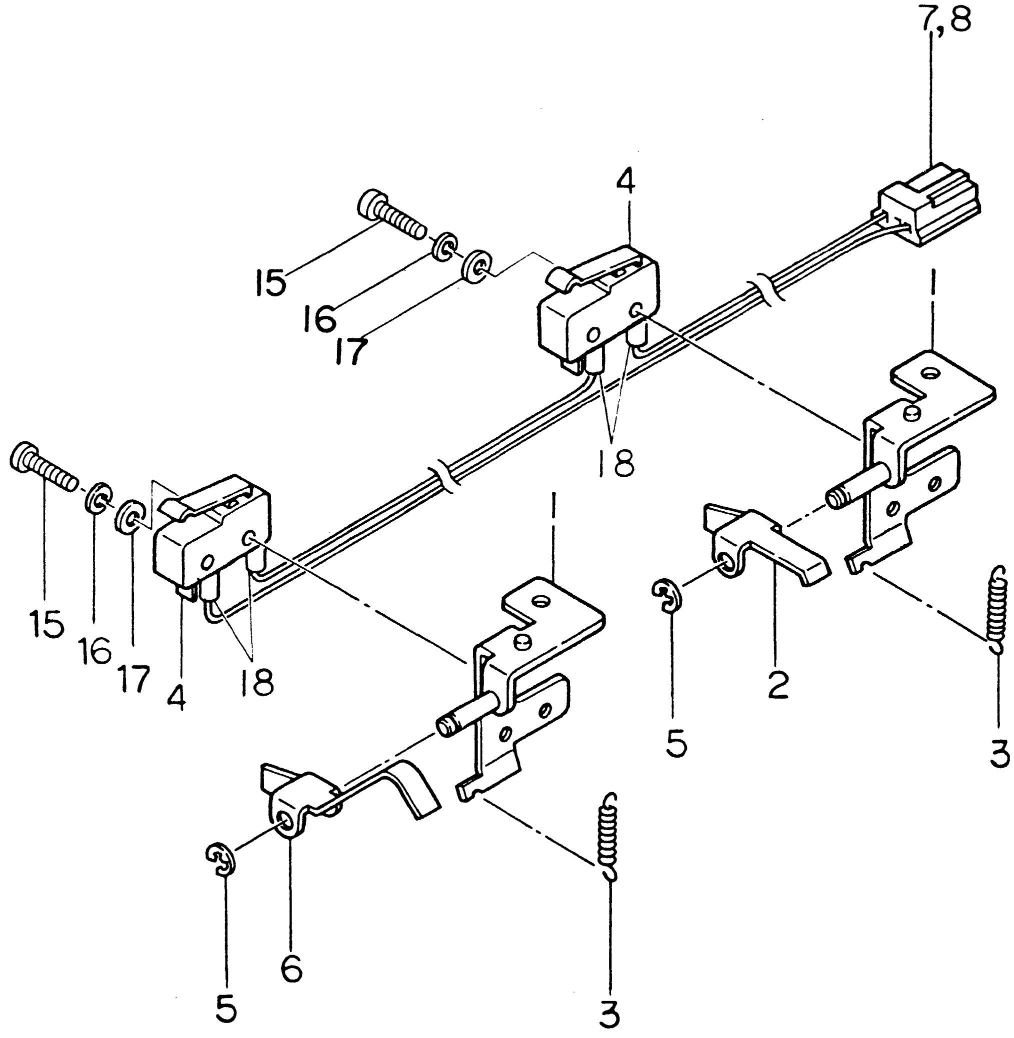


Figure 17-5 Paper Out Assembly (4LR-129907-1)

Figure 17-5 Paper Out Assembly (LR-129907-1)

Item No.	Part No.	Description	Qty	Remarks
1	LR-129863-1	Microswitch bracket	2	82A 83A 92
2	LR-129870-1	Microswitch actuator	1	82A 83A 92
3	LR-129844-1	Spring	2	82A 83A 92
4	LP-3378-4	Microswitch	2	82A 83A 92
5	KX-9057-1	E-snap ring	2	82A 83A 92
6	LR-132496-1	Paper out lever	1	82A 83A 92
7	LP-5525-3	3P receptacle housing	1	82A 83A 92
8	LP-5526-1	Receptacle contact	2	82A 83A 92
	LY-4658-3 "Black"	17/0.16 heat-resisting PVC wire (270 mm)	1	
	LY-4658-3 "Blue"	17/0.16 heat-resisting PVC wire (270 mm)	1	
	LY-4658-3 "Blue"	17/0.16 heat-resisting PVC wire (200 mm)	1	
15	⊕ P2.3-10-HH	Small pan-head screw	2	
16	SW2.3-HHC	Spring washer	2	
17	W2.3-HH	Washer	2	
18		SUMI-tube F (ø3 x 0.25 x 10)	4	

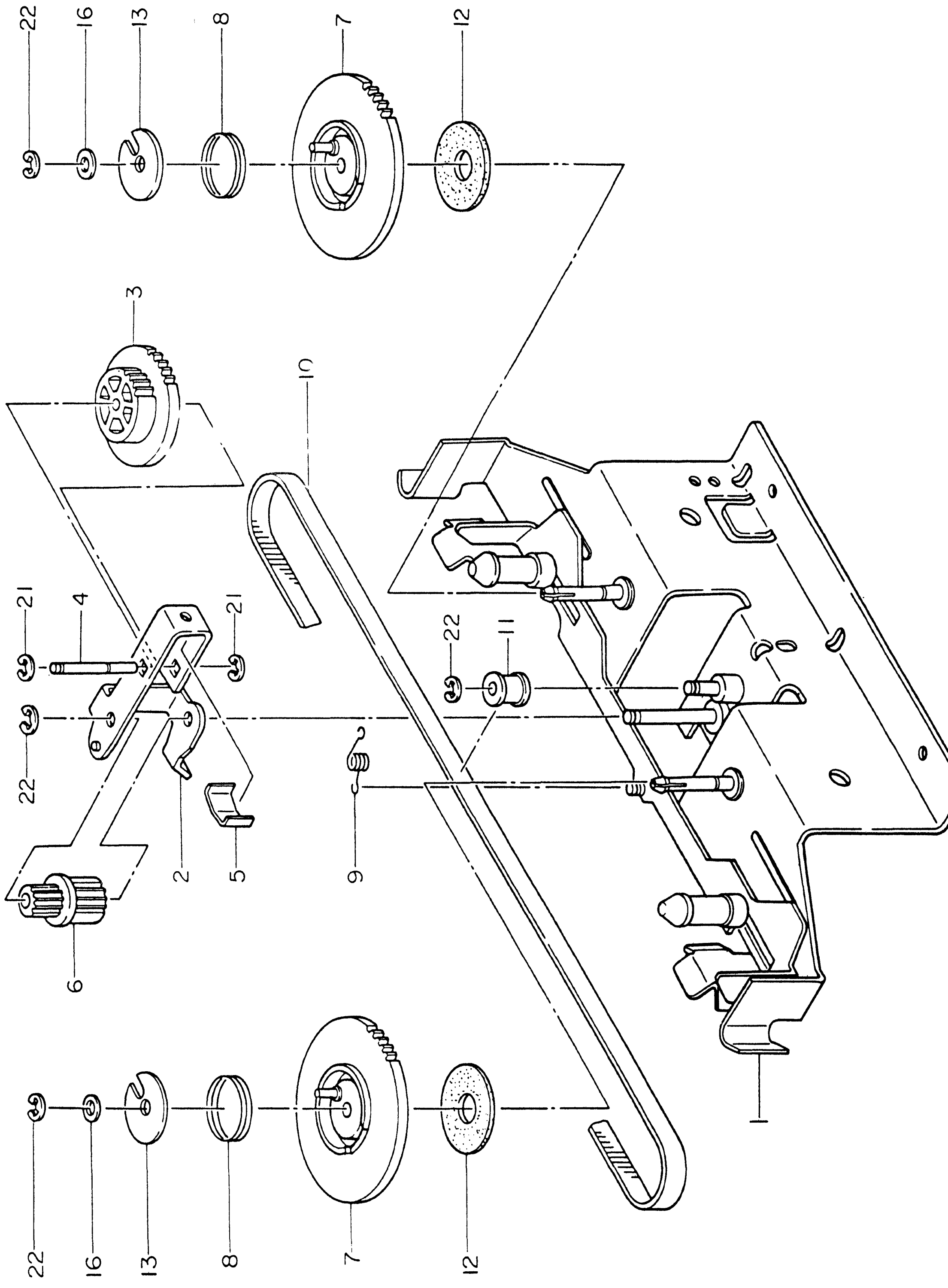
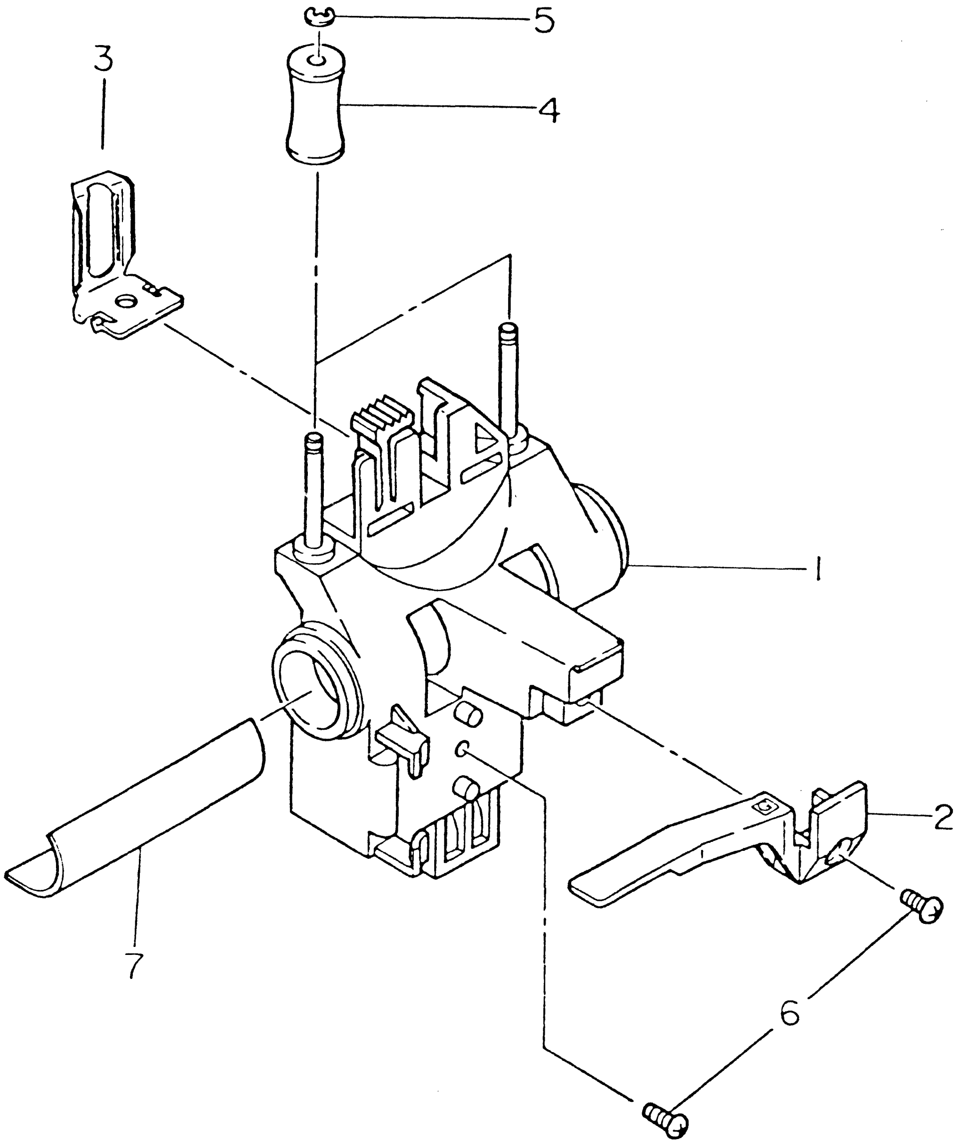


Figure 17-6 Ribbon Drive Assembly (LR-193456-6)

Figure 17-6 Ribbon Drive Assembly (LR-193456-6)

Item No.	Part No.	Description	Qty	Remarks
1	LR-193457-1	Ribbon bracket	1	82A 83A 92
2	LR-129825-1	Ribbon change lever	1	82A 83A 92
3	LR-129827-1	Ribbon gear	1	82A 83A 92
4	LR-193461-1	Snap shaft	1	82A 83A 92
5	LR-129876-1	Friction spring	1	82A 83A 92
6	LR-191858-1	Ribbon driver gear	1	82A 83A 92
7	LR-129837-1	Ribbon spool gear	2	82A 83A 92
8	LR-129840-1	Compression spring	2	82A 83A 92
9	LR-129841-1	Detent spring	1	82A 83A 92
10	LP-1420-7	Synchro belt	1	
11	LR-191859-1	Pressure roller	1	82A 83A 92
12	LR-129842-1	Friction felt	2	82A 83A 92
13	LR-129843-1	Special washer	2	82A 83A 92
16	LR-132516-1	Plastic washer	2	82A 83A 92
21	KX-9057-1	E-snap ring (E2)	2	
22	KH-12050-1	E-snap ring (E3)	4	



Note: The carriage assembly must be replaced as a unit.

Figure 17-7 Carriage Assembly (LR-191870-3)

Figure 17-7 Carriage Assembly (LR-191870-3)

Item No.	Part No.	Description	Qty	Remarks
1	LR-191871-3	Carriage frame	1	
2	LR-191857-1	Belt clamp	1	82A 83A 92
3	LR-191873-2	Ribbon protector	1	
4	LD-83139-1	Ribbon roller	2	82A 83A 92
5	KX-9057-1	E-snap ring (E2)	2	
6	⊕ T2P3-10-HH	Tapping screw	2	82A 83A 92
7	LR-191874-1	Oil felt	1	92

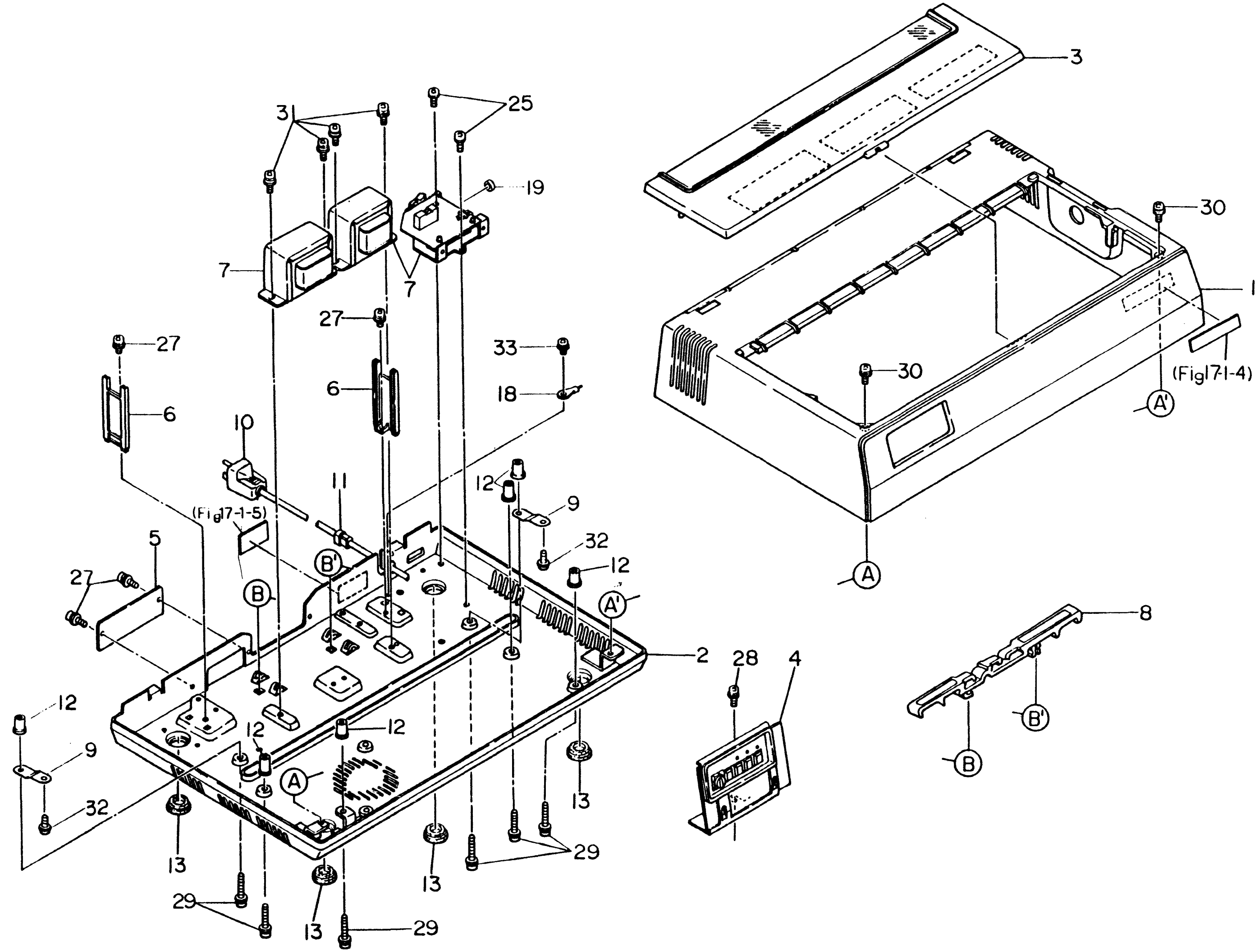


Figure 17-8 Cover Unit (LM-62052-2)
(for USA 117 V)

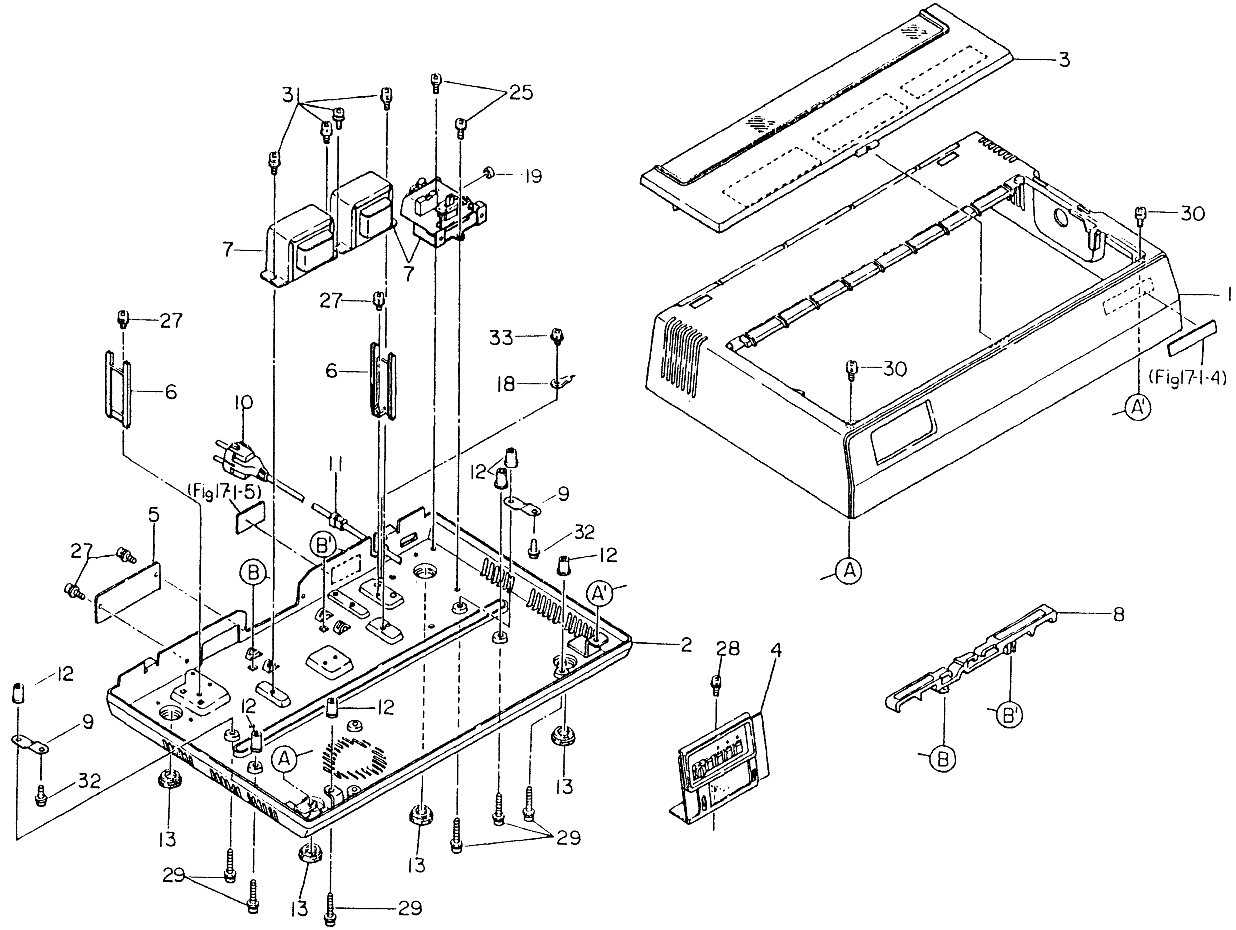


Figure 17-8 Cover Unit (LM-62052-3)
(for 220/240 V)

Figure 17-8 Cover Unit (LM-62052-2)
(for USA, 117 V)

Item No.	Part No.	Description	Qty	Remarks
1	LM-60106-1	Upper cover	1	83A
2	LM-60104-1	Lower cover	1	83A
3	LM-60112-1	Access cover	1	83A
4	LM-59688-1	Operation panel assembly	1	82A 83A 92
5	LM-59696-1	Blank plate	1	82A 83A 92
6	LM-60115-1	Circuit board support	2	82A 83A 92
7	LR-104073-10	Power supply assembly	1	
8	LM-60116-1	Cord clamp (A)	1	82A 83A 92
9	LM-61519-1	Ground board	2	82A 83A 92
10	LP-38462-1	3-pin AC cord	1	82A 83A 92
11	LP-6463-C-5	Cord bushing	1	83A
12	LP-6726-2	Quite-tight	6	82A 83A 92
13	LP-1416-1	Rubber foot	4	83A
14	LP-1492-1	Cord clamp (C)	1	82A 83A 92
15	LP-1489-1	Cord clamp (B)	2	82A 83A 92
18	LP-6364-2	Crimp terminal	1	82A 83A 92
19	LP-45371-1	Ring core	1	92
25	⊕ P(SW)3-5-HH	Small pan-head screw	2	
27	⊕ P(SW+W)3-8-HH	Small pan-head screw	4	
28	⊕ P(SW+2W)3-6-HH	Small pan-head screw	1	
29	⊕ P(SW+2W)4-18-HH	Small pan-head screw	6	
30	⊕ P(SW+W)4-12-HH	Small pan-head screw	2	
31	⊕ P(SW+2W)4-8-HH	Small pan-head screw	4	
32	⊕ P(W)3-5-HH	Small pan-head screw	2	
33	⊕ P(SW+2W)4-6-HH	Small pan-head screw	1	

Figure 17-8 Cover Unit (LM-62052-3)
(for 220/240 V)

Item No.	Part No.	Description	Qty	Remarks
1	LM-60106-1	Upper cover	1	83A
2	LM-60104-1	Lower cover	1	83A
3	LM-60112-1	Access cover	1	83A
4	LM-59688-1	Operation panel assembly	1	82A 83A 92
5	LM-59696-1	Blank plate	1	82A 83A 92
6	LM-60115-1	Circuit board support	2	82A 83A 92
7	LR-104073-12	Power supply assembly	1	
8	LM-60116-1	Cord clamp (A)	1	82A 83A 92
9	LM-61519-1	Ground board	2	82A 83A 92
10	LP-38463-1	3-pin AC cord	1	82A 83A 92
11	LP-6463-C-5	Cord bushing	1	83A
12	LP-6726-2	Quite-tight	6	82A 83A 92
13	LP-1416-1	Rubber foot	4	83A
14	LP-1492-1	Cord clamp (C)	1	82A 83A 92
15	LP-1489-1	Cord clamp (B)	2	82A 83A 92
18	LP-6364-2	Crimp terminal	1	82A 83A 92
19	LP-45371-1	Ring core	1	92
25	⊕ P(SW)3-5-HH	Small pan-head screw	2	
27	⊕ P(SW+W)3-8-HH	Small pan-head screw	4	
28	⊕ P(SW+2W)3-6-HH	Small pan-head screw	1	
29	⊕ P(SW+2W)4-18-HH	Small pan-head screw	6	
30	⊕ P(SW+W)4-12-HH	Small pan-head screw	2	
31	⊕ P(SW+2W)4-8-HH	Small pan-head screw	4	
32	⊕ P(W)3-5-HH	Small pan-head screw	2	
33	⊕ P(SW+2W)4-6-HH	Small pan-head screw	1	

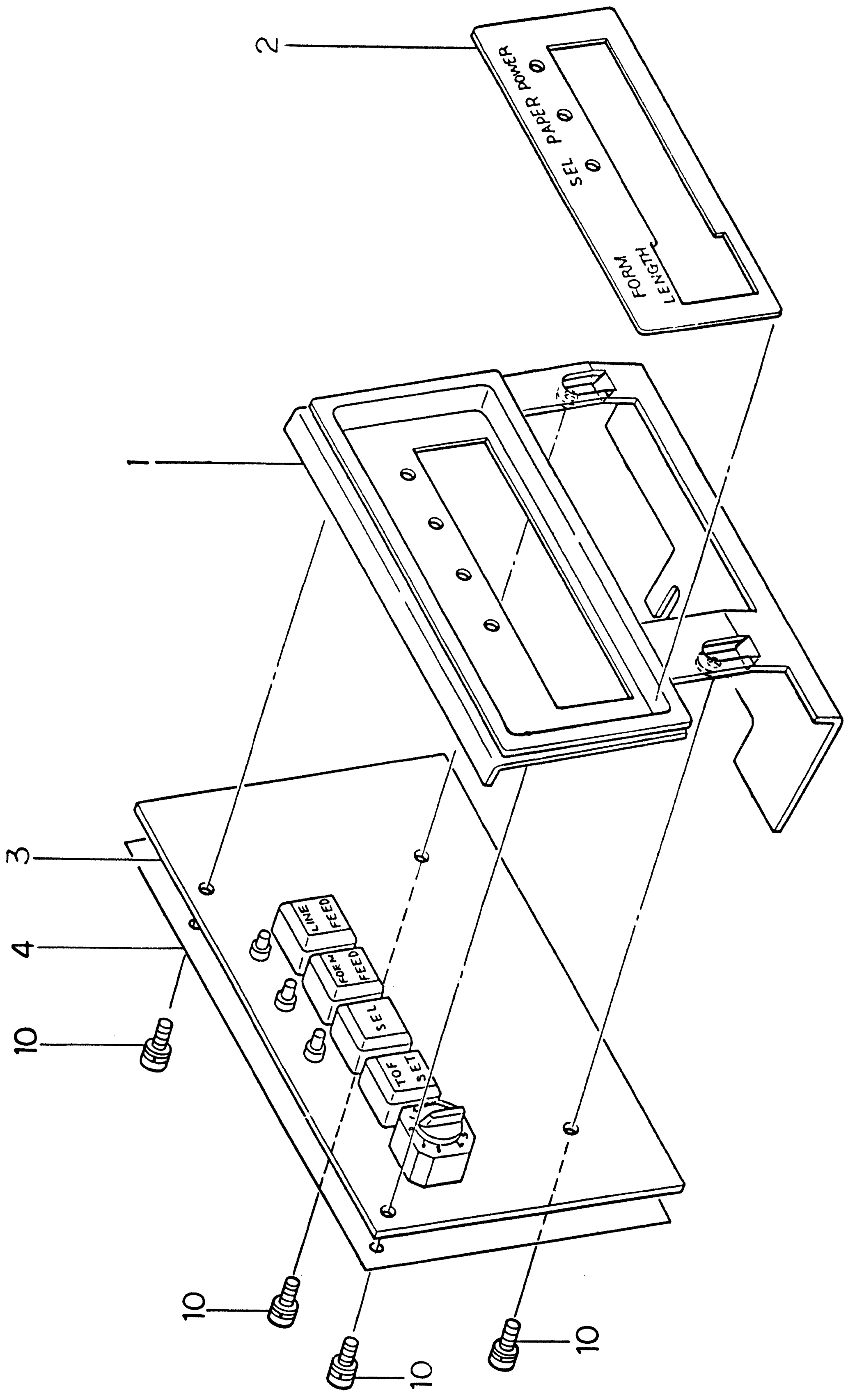


Figure 17-9 Operation Panel Assembly (LM-59688-1)

Figure 17-9 Operation Panel Assembly (LM-59688-1)

Item No.	Part No.	Description	Qty	Remarks
1	LM-59689-1	Circuit board bracket	1	82A 83A 92
2	LM-59693-A	Display panel	1	82A 83A 92
3	LY-40069-1	LEPF circuit board	1	82A 83A 92
4	LR-191908-1	Insulator	1	82A 83A 92
10	⊕ P(SW+W)3-6-HH	Small pan-head screw	4	

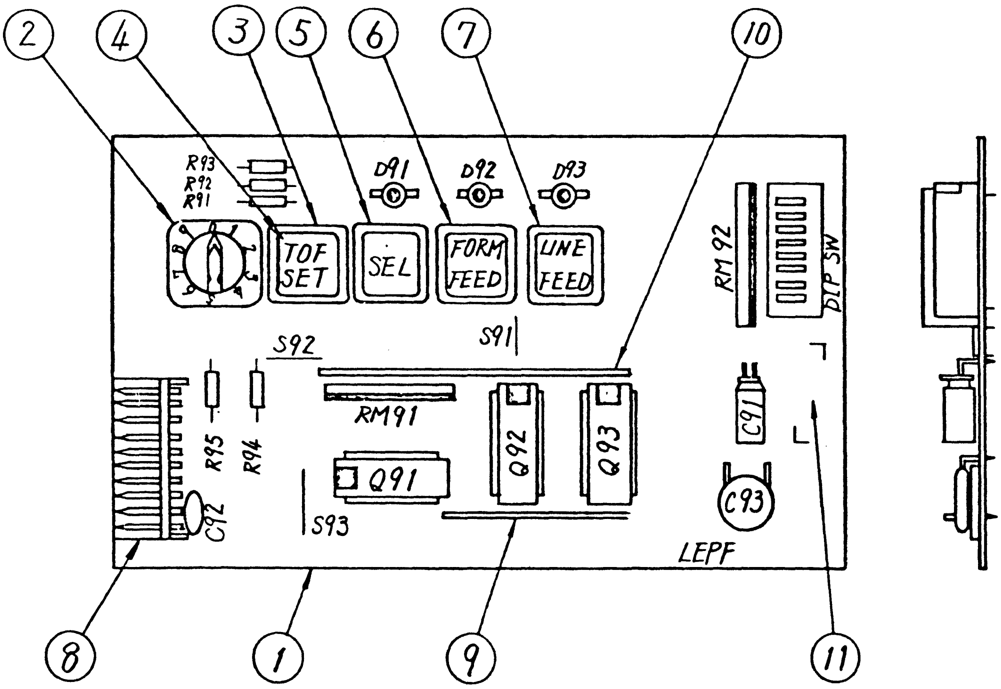


Figure 17-10 LEPF Circuit Board (LY-40069-1)

Figure 17-10 LEPF Circuit Board (LY-40069-1)

Item No.	Part No.	Description	Qty	Remarks
①	LP-16707-1	LEPF circuit board	1	82A 83A 92
D91-D93	LP-44373-1	Light-emitting diode SEL103R	3	82A 83A 92
R91-R93	LP-8446-391	Resistor 1/4W 390Ω	3	82A 83A 92
R94	LP-8446-512	Resistor 1/4W 5.1kΩ	1	82A 83A 92
R95	LP-8446-102	Registor 1/4W 1kΩ	1	82A 83A 92
RM1, RM2	LP-8396-512	8-element module resistor 1/4W 5.1kΩ	2	82A 83A 92
C91	LP-8519-12	Aluminum electrolitic capacitor 25V, 47μF	1	82A 83A 92
Q92, Q93	LP-11178-41	SN75LS151	2	82A 83A 92
Q91	LP-11136-40	SN74LS05	1	82A 83A 92
DIP SW	LP-3425-8	DIP switch (8P)	1	82A 83A 92
②	LP-3424-1	Rotary switch (SROV 101A)	1	82A 83A 92
③	LK-50700-2	Key switch	4	82A 83A 92
④	L-1370-49-A2	Nameplate "TOF SET"	1	82A 83A 92
⑤	L-1370-50-A2	Nameplate "SEL"	1	82A 83A 92
⑥	L-1370-51-A2	Nameplate "FORM FEED"	1	82A 83A 92
⑦	L-1370-52-A2	Nameplate "LINE FEED"	1	82A 83A 92
⑧	LP-5524-10	EI-Connector (10P)	1	82A 83A 92
⑨	LH-31313-12	Power supply bar	1	82A 83A 92
⑩	LH-31313-68	Power Supply bar	1	82A 83A 92
S91, S92,S93	KH-31017-8	⊔-shaped jumper wire	3	82A 83A 92
⑪	L-1481-1	No. indication panel	1	82A 83A 92
C92	LP-8452-101	Ceramic capacitor 100pF	1	82A 83A 92
C93	LP-8571-1	V-4SL capacitor 100pF	1	82A 83A 92

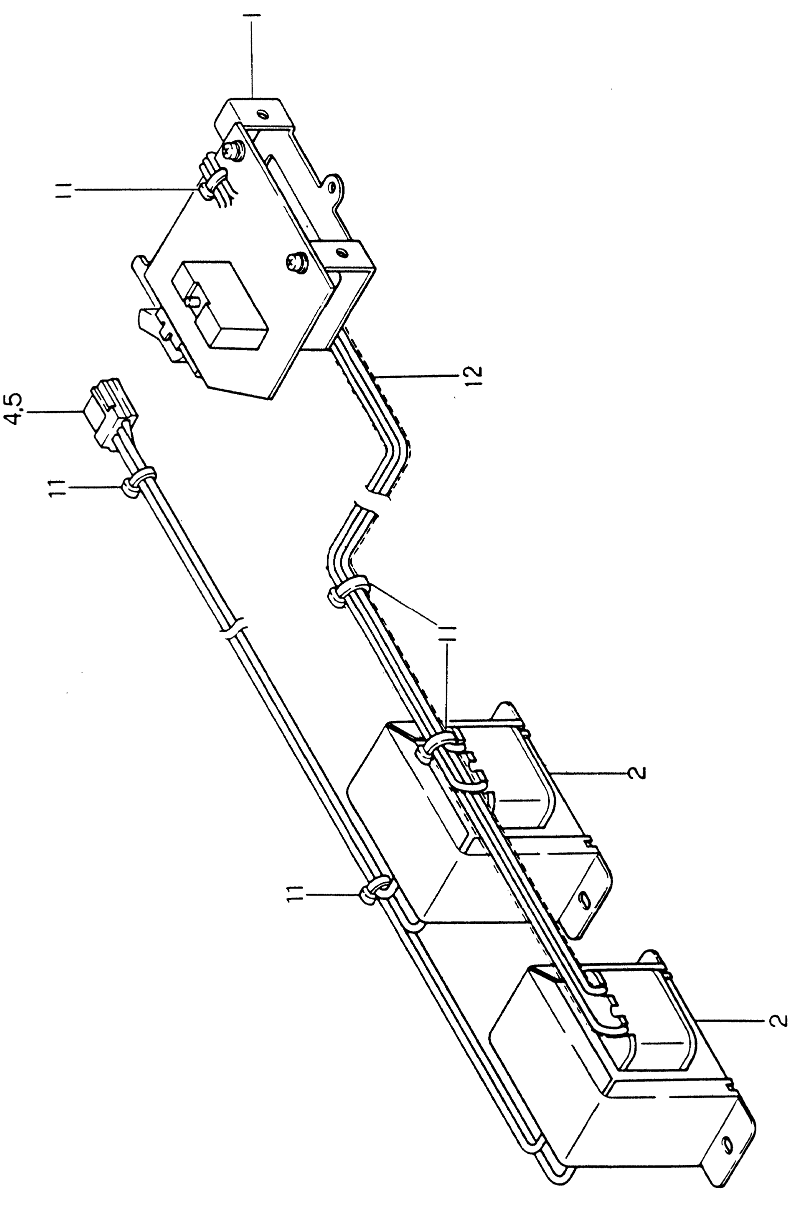


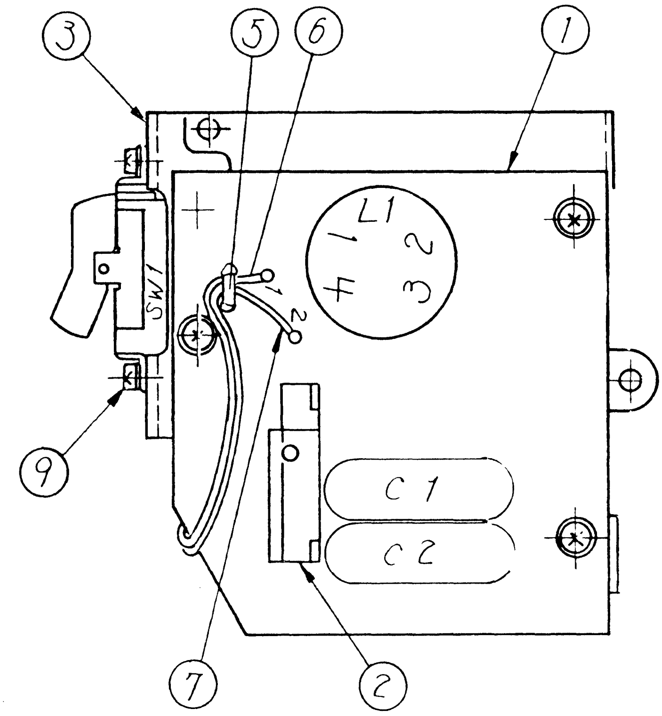
Figure 17-11 Power Supply Assembly (LR-104073-10, 12)

Figure 17-11 Power Supply Assembly (LR-104073-10)
(for USA, 117 V)

Item No.	Part No.	Description	Qty	Remarks
1	LX-86814-3	LEPM-3 circuit board	1	
2	LP-45191-132-B	Transformer	1	
3	LP-45191-136-B	Transformer	1	
4	LP-5524-4	EI-connector	1	
5	LP-5526-1	Contact	4	
11	LP-6401-bl	Tie-wrap	5	
12		Silicon flex tube (ø3 x 2100 mm A-rank)	1	

Figure 17-11 Power Supply Assembly (2LR-104073-12)
(for 220/240 V)

Item No.	Part No.	Description	Qty	Remarks
1	LX-86814-4	LEPM-4 circuit board	1	
2	LP-45191-134-B	Transformer	1	
3	LP-45191-135-B	Transformer	1	
4	LP-5525-4	EI-connector	1	
5	LP-5526-1	Contact	4	
11	LP-6401-bl	Tie-wrap	5	
12		Silicon flex tube (ø3 x 2100 mm A-rank)	1	



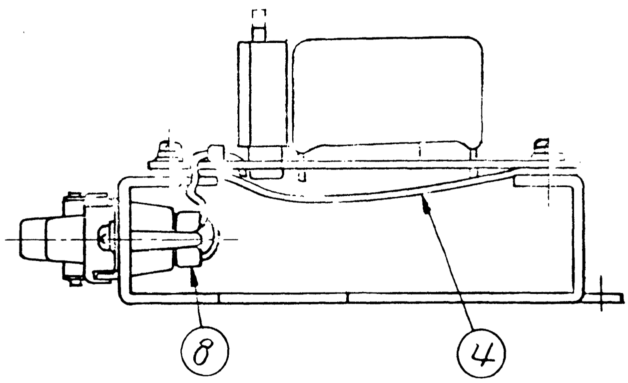


Figure 17-12 LEPM-3 Circuit Board (LX-86814-3)
(for USA, 117 V)

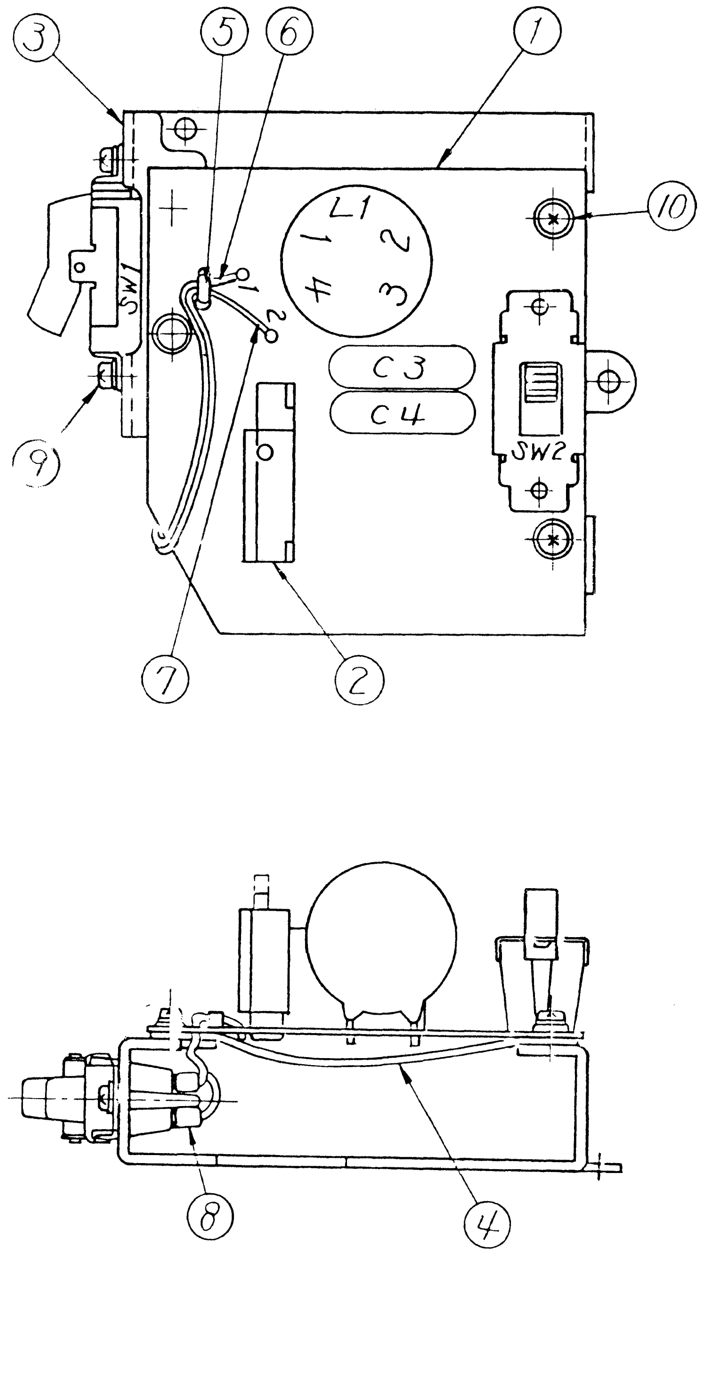


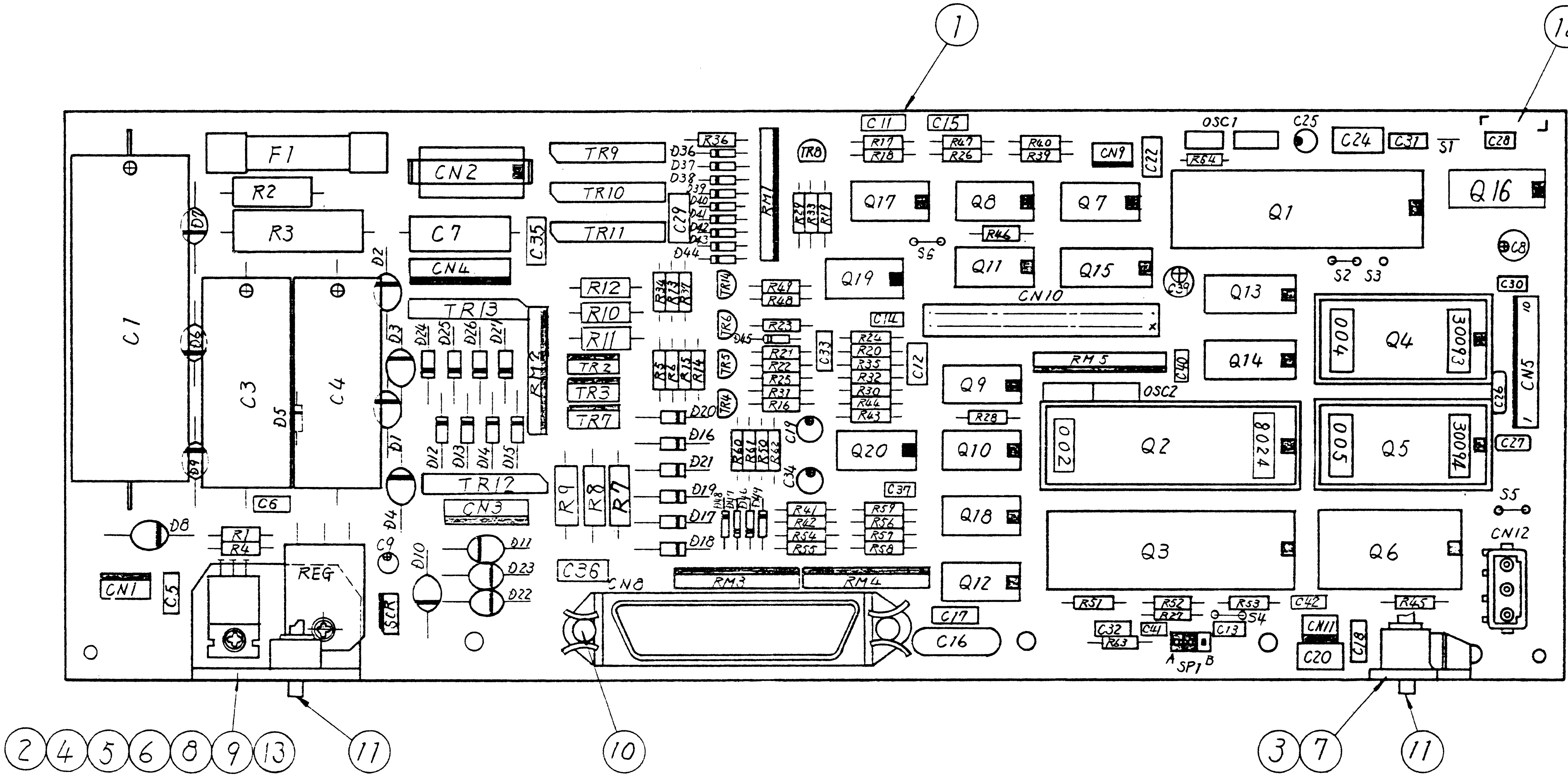
Figure 17-12 LEPM-4 Circuit Board (LX-86814-4)
(for 220/240 V)

Figure 17-12 LEPM-3 Circuit Board (LX-86814-3)
(for USA, 117V)

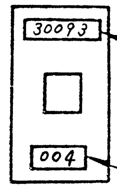
Item No.	Part No.	Description	Qty	Remarks
1	LP-16814-1	LEPM circuit board	1	92
SW1	LP-3621-2	Seesaw switch	1	82A 83A 92
L1	LP-45025-2	Line choke	1	92
C3, C4	LP-8595-333	Ceramic capacitor	2	92
2	LP-6740-160	Circuit breaker	1	82A 83A 92
3	LR-194633-1	Power supply circuit board bracket	1	
4	LR-194621	Insulator	1	92
5	LP-6401-bl	Tie-wrap	1	
6	LY-4658-3 "White"	Wire (ℓ=160mm)	1	
7	LY-4658-3 "Black"	Wire (ℓ=170mm)	1	
8		SUMI tube F (ø3 x 10)	2	
9	⊕ P(SW)3-5-HH	Small pan-head screw	2	
10	⊕ P(SW+2W)3-5-HH	Small pan-head screw	3	

Figure 17-12 LEPM-4 Circuit Board (LX-86814-4)
(for 220/240V)

Item No.	Part No.	Description	Qty	Remarks
1	LP-16814-1	LEPM circuit board	1	92
SW1	LP-3621-1	Seesaw switch	1	82A 83A 92
SW2	LP-3622-1	Sliede switch	1	82A 83A 92
L1	LP-45025-2	Line choke	1	92
C3, C4	LP-8555-1	Ceramic capacitor	2	82A 83A 92
2	LP-6740-80	Circuit breaker	1	82A 83A 92
3	LR-194633-1	Power supply circuit board bracket	1	
4	LR-194628-1	Insulator	1	92
5	LP-6401-b1	Tie-wrap	1	
6	LY-4658-3 "White"	Wire (ℓ=160mm)	1	
7	LY-4658-3 "Black"	Wire (ℓ=170mm)	1	
8		SUMI tube F (ø3 x 10)	2	
9	⊕ P(SW) 3-5-HH	Small pan-head screw	2	
10	⊕ P(SW+2W) 3-5-HH	Small pan-head screw	3	



Identification of ROM



Part No. indication panel (white background)

Mounting position indicating panel (white black ground)

Note: ROM mounting

		Q4	Q5		Q2
Mounting position	Indication on table of component parts		For USA	For the area other than the USA	
	Indication on panel	004	005	005	002
Part No.	Indication on table of component parts	LYH-30093	LYH-30094	LYH-30095	LYH-8024
	Indication on panel	30093	30094	30095	8024

Figure 17-13 MLPC Circuit Board Assembly (LY-44989-1)

Figure 17-13 MLPC Circuit Board (LY-44989-1) (1/4)

Item No.	Part No.	Description	Qty	Remarks
1	WU-41117-1	MLPC circuit board	1	92
D1-D4, D6-D9	LP-9409-1	U05B diode	8	82A 83a 92
D10, D11	LP-44156-16	AU01-20 diode	2	82A 83A 92
D12-D21, D24-D27	LP-44416-1	EMIZ diode	14	82A 83A 92
D22, D23	LP-44253-1	GU3SZ diode	2	82A 83A 92
D36-D44, D5, D46, D47, D48, D49	LP-9300-1	1S2075 diode	14	92
D45	LP-44171-8	RD5, 1EB Zener diode	1	82A 83A 92
R1, R6, R28, R33, R45, R49	LP-8446-102	Resistor 1/4W 1kΩ	6	82A 83A 92
R4, R5, R19, R21 R51-R53	LP-8446-511	Registor 1/4W 510Ω	7	82A 83A 92
R13, R34, R37, R59	LP-8446-392	Registor 1/4W 3.9kΩ	4	82A 83A 92
R14	LP-8446-752	Registor 1/4W 7.5kΩ	1	82A 83A 92
R15, R17, R18, R26, R27, R47, R63, R64	LP-8446-512	Registor 1/4W 5.1kΩ	8	82A 83A 92
R16	LP-8446-364	Registor 1/4W 360kΩ	1	92
R20	LP-8446-163	Registor 1/4W 16kΩ	1	82A 83A 92
R22	LP-8446-822	Registor 1/4W 8.2kΩ	1	82A 83A 92
R23	LP-8446-203	Registor 1/4W 20kΩ	1	82A 83A 92
R24, R60	LP-8446-394	Registor 1/4W 390kΩ	2	82A 83A 92
R25	LP-8446-753	Registor 1/4W 75kΩ	1	92
R29 R48	LP-8446-302	Registor 1/4W 3kΩ	2	82A 83A 92
R30	LP-8446-393	Registor 1/4W 39kΩ	1	92
R31, R58	LP-8446-224	Registor 1/4W 220kΩ	2	92
R32	LP-8446-154	Registor 1/4W 150kΩ	1	92
R35, R40	LP-8446-103	Registor 1/4W 10kΩ	2	82A 83A 92
R36	LP-8446-122	Registor 1/4W 1.2kΩ	1	92
R39, R46	LP-8446-201	Registor 1/4W 200kΩ	2	82A 83A 92
R41, R54	LP-8446-243	Registor 1/4W 24kΩ	2	92
R43, R56	LP-8446-100	Registor 1/4W 10kΩ	2	92
R44, R57	LP-8446-104	Registor 1/4W 100kΩ	2	92
R50, R42, R55	LP-8446-513	Registor 1/4W 51kΩ	3	92
R61	LP-8446-334	Registor 1/4W 330kΩ	1	92
R62	LP-8446-204	Registor 1/4W 200kΩ	1	92
R10, R11	LP-8447-242	NSA B-type 1/2W 2.4kΩ	2	82A 83A 92
R12	LP-8447-103	NSA B-type 1/2W 10kΩ	1	82A 83A 92

Figure 17-13 MLPC Circuit Board (LY-44989-1) (2/4)

Item No.	Part No.	Description	Qty	Remarks
R2	LP-8224-302	Meral film resitor 2W 3kΩ	1	82A 83A 92
R8, R9	LP-8224-121	Metal film resistor 120Ω	2	82A 83A 92
R7	LP-8224-151	Metal film resistor 150Ω	1	82A 83A 92
R3	LP-8225-510	Metal film resistor 3W 51Ω	1	92
RM1, RM2	LP-8396-122	8-element module resistor 1.2kΩ	2	92
RM3, RM4	LP-8396-102	8-element module resistor 1kΩ	2	82A 83A 92
RM5	LP-8396-512	8-element module resistor 5.1kΩ	1	82A 83A 92
OSC1	LP-12154-5	Ceramic oscillator 1.2MHz	1	92
OSC2	LP-12154-8	Ceramic oscillator 6MHz	1	92
C5, C6, C11, C15, C18, C26, C27, C28, C30, C31, C32, C37, C40, C42	LP-8449-103	Polyester film capacitor 100V 0.01μF	14	82A 83A 92
C12	LP-8449-153	Polyester film capacitor 100V 0.015μF	1	92
C13, C22, C41	LP-8449-102	Polyester film capacitor 100V 0.001μF	3	82A 83A 92
C20, C24, C29, C35	LP-8449-104	Polyester film capacitor 100V 0.1μF	4	82A 83A 92
C33	LP-8449-223	Polyester film capacitor 100V 0.022μF	1	82A 83A 92
C1	LP-8620-1	Aluminum electrolitic capacitor 50V 4400μF	1	92
C3, C4	LP-8550-28	Aluminum electrolitic capacitor 16V 4700μF	2	92
C8, C39	LP-8519-1	Aluminum electrolitic capacitor 10V 100μF	2	82A 83A 92
C25	LP-8519-40	Aluminum electrolitic capacitor 100V 1μF	1	82A 83A 92
C9	LP-8470-7	Tantalum electrolitic capacitor 35V 1μF	1	82A 83A 92
C19, C34	LP-8470-9	Tantalum electrolitic capacitor 35V 2.2μF	2	92
C7	LP-8383-2	0.1 μF metalized polyester film capacitor	1	82A 83A 92
C14, C17	LP-8611-561	Ceramic capacitor 560pF	2	82A 83A 92
C16	LP-8604-10	Ceramic capacitor 10,000pF	1	92
C36	LP-8469-102	Polyester film capacitor 1,000pF	1	82A 83A 92

Figure 17-13 MLPC Circuit Board (LY-44989-1) (3/4)

Item No.	Part No.	Description	Qty	Remarks
C36	LP-8469-102	Polyester film capacitor 1,000pF	1	82A 83A 92
TR1, TR2, TR3, TR7	LP-44251-1	Transistor 2SB727	4	82A 83A 92
TR4, TR5, TR6	LP-44335-1	Transistor 2SC2719	3	82A 83A 92
TR8, TR14	LP-44331-1	Transistor 2SA952	2	82A 83A 92
TR9, TR10, TR11	LP-44419-1	Transistor STA-301A	3	92
TR12, TR13	LP-44486-1	Transistor STA-403A	2	92
Q1	LP-11737-09-001	μCPU 8051	1	92
Q3	LP-11726-09	P8155H-2	1	92
Q6	LP-11389-02	HM6116P-3	1	92
Q7, Q8, Q10	LP-11136-40	SN74LS05N	3	82A 83A 92
Q9, Q17	LP-11146-00	SN-7407N	2	82A 83A 92
Q11, Q12	LP-11131-40	SN-74LS04N	2	82A 83A 92
Q13, Q14	LP-11124-40	SN-74LS75N	2	82A 83A 92
Q15	LP-11122-40	SN-74LS42N	1	92
Q16	LP-12469-03	MSM4069RS	1	92
Q18	LP-11145-01	SN-7406N	1	92
Q19, Q20	LP-11836-00	μPC339C	2	82A 83A 92
(Q2)	LP-5573-40	40-pin IC socket	1	82A 83A 92
(Q4)	LP-5573-28	28-pin IC socket	1	92
(Q5)	LP-9490-E-06	28-pin IC socket	1	92
SCR	LP-44492-1-B	Thyristor CSM3B	1	82A 83A 92
REG	LP-44485-5	Regulator SI3052 (2A)	1	92
CN1	LP-5523-4	AMPEI 4-pin connector	1	82A 83A 92
CN2	LP-9490-B-06	IC socket shaped connector	1	92
(CN2)	LP-5893-16	Lock plate	1	92
CN3	LP-5523-6	AMPEI 6-pin connector	1	82A 83A 92
CN4	LP-5523-7	AMPEI 7-pin connector	1	82A 83A 92
CN5	LP-5523-10	AMPEI 10-pin connector	1	82A 83A 92
CN8	LP-5663-1	DIP shaped 36-pin connector	1	92
CN9, CN11	LP-5523-3	AMPEI 3-pin connector	2	82A 83A 92
CN10	LP-5842-36	HKP-36 FD2 connector	1	92
CN12	LP-2887-1	3-pin nylon connector	1	82A 83A 92
S1, S2, S4, S5, S6	KH-31036-50	Jumper wire	5	82A 83A 92
F1	LP-8475-B-21	MGC25A Fuse	1	82A 83A 92
(F1)	L-90188-1	Fuse holder	2	82A 83A 92
SP1	LP-5591-1	Jumper plug Z128	1	82A 83A 92
SP1	LP-5592-3	Terminal Z149 3P	1	82A 83A 92

Figure 17-13 MLPC Circuit Board (LY-44989-1) (4/4)

Item No.	Part No.	Description	Qty	Remarks
2	LR-193468-1	Heat sink (transistor)	1	82A 83A 92
3	LR-193469-1	Circuit board mounting board	1	82A 83A 92
4	LP-44106-4	SERCON (TC-30AG)	1	82A 83A 92
5	LP-4967-8	Insulating bushing (TO-for 220)	1	82A 83A 92
6	⊕P(SW+W)2.6-14-HH	Small pan-head screw	1	92
7	⊕P(SW+2W)3-6-HH	Small pan-head screw	1	92
8	⊕P(SW+W)2.6-10-HH	Small pan-head screw	1	92
9	3N2.6-HH	Locknut	2	92
10	LR-191878-1	Clinched post	2	92
11	LP-6890-1	Set screw	2	82A 83A 92
12	L-1481-1	Number indication attaching nameplate	1	82A 83A 92
13	LP-44106-3	SERCON (30B-6001)	1	92

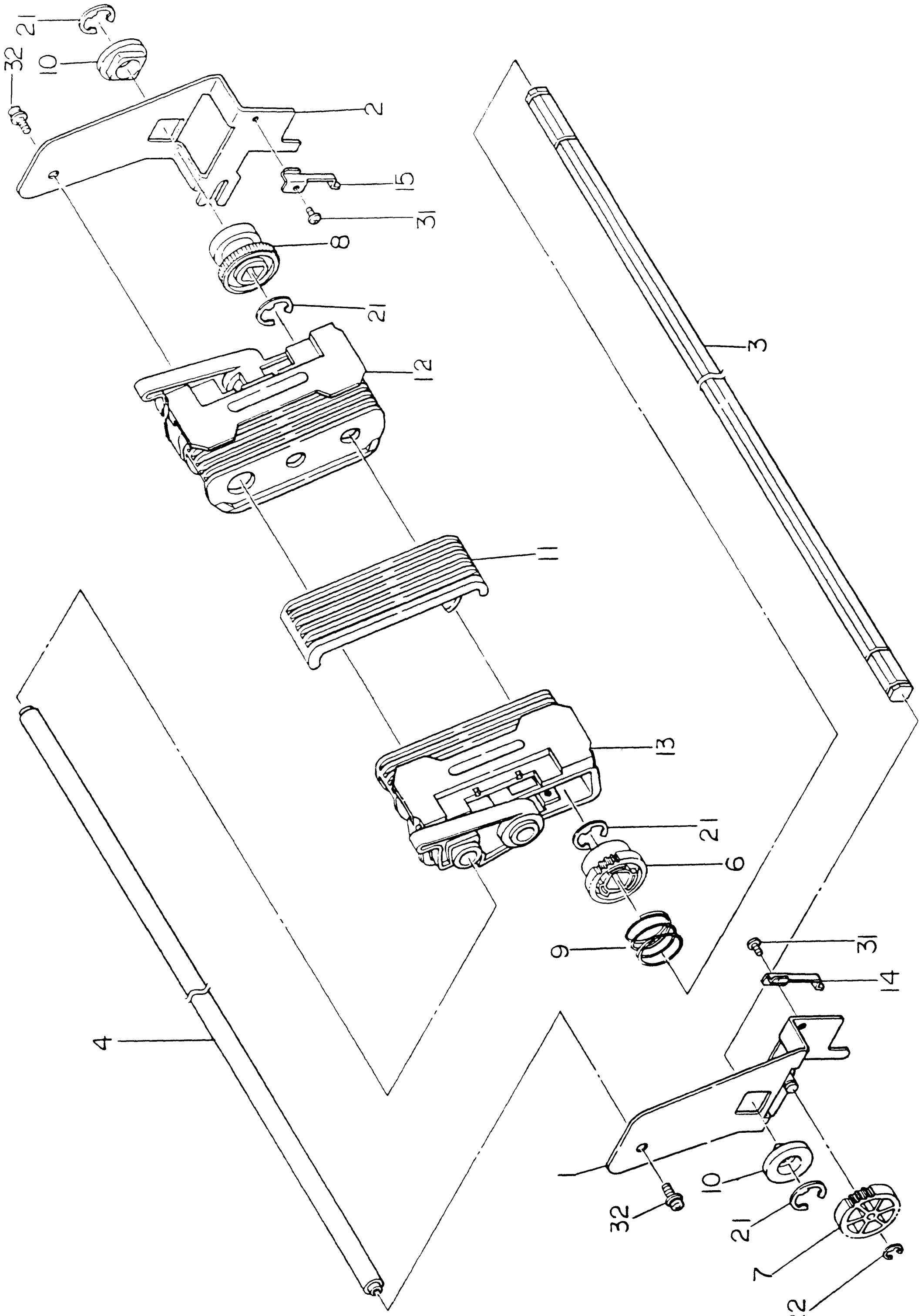


Figure 17-14 Tractor Unit (LY-39702-1)

Figure 17-14 Tractor Unit (LY-39702-1)

Item No.	Part No.	Description	Qty	Remarks
1	LR-129881-1	Side plate (L)	1	82A 83A 92
2	LR-129884-1	Side plate (R)	1	82A 83A 92
3	LR-129885-2	Tractor drive shaft	1	83A 92
4	LR-129886-2	Tractor shaft	1	83A 92
6	LR-129889-1	Tractor gear	1	82A 83A 92
7	LR-129890-1	Idle gear	1	82A 83A 92
8	LR-129891-1	Knob	1	82A 83A 92
9	LR-129895-1	Bias spring	1	82A 83A 92
10	LR-123498-1	Bushing	2	82A 83A 92
11	LR-123467-1	Sheet guide	1	83A
12	FMX-35100-2	Sprocket assembly (R)	1	82A 83A 92
13	FMX-35150-2	Sprocket assembly (L)	1	82A 83A 92
14	LR-194059-1	Clamp lever (L)	1	82A 83A 92
15	LR-194060-1	Clamp lever (R)	1	82A 83A 92
21	KD-50242-1	E-snap ring	4	
22	KH-12050-1	E-snap ring	1	
31	⊕ D3-5-23D	Bind screw	2	
32	⊕ P(SW+2W)3-8-23D	Small pan-head screw	2	

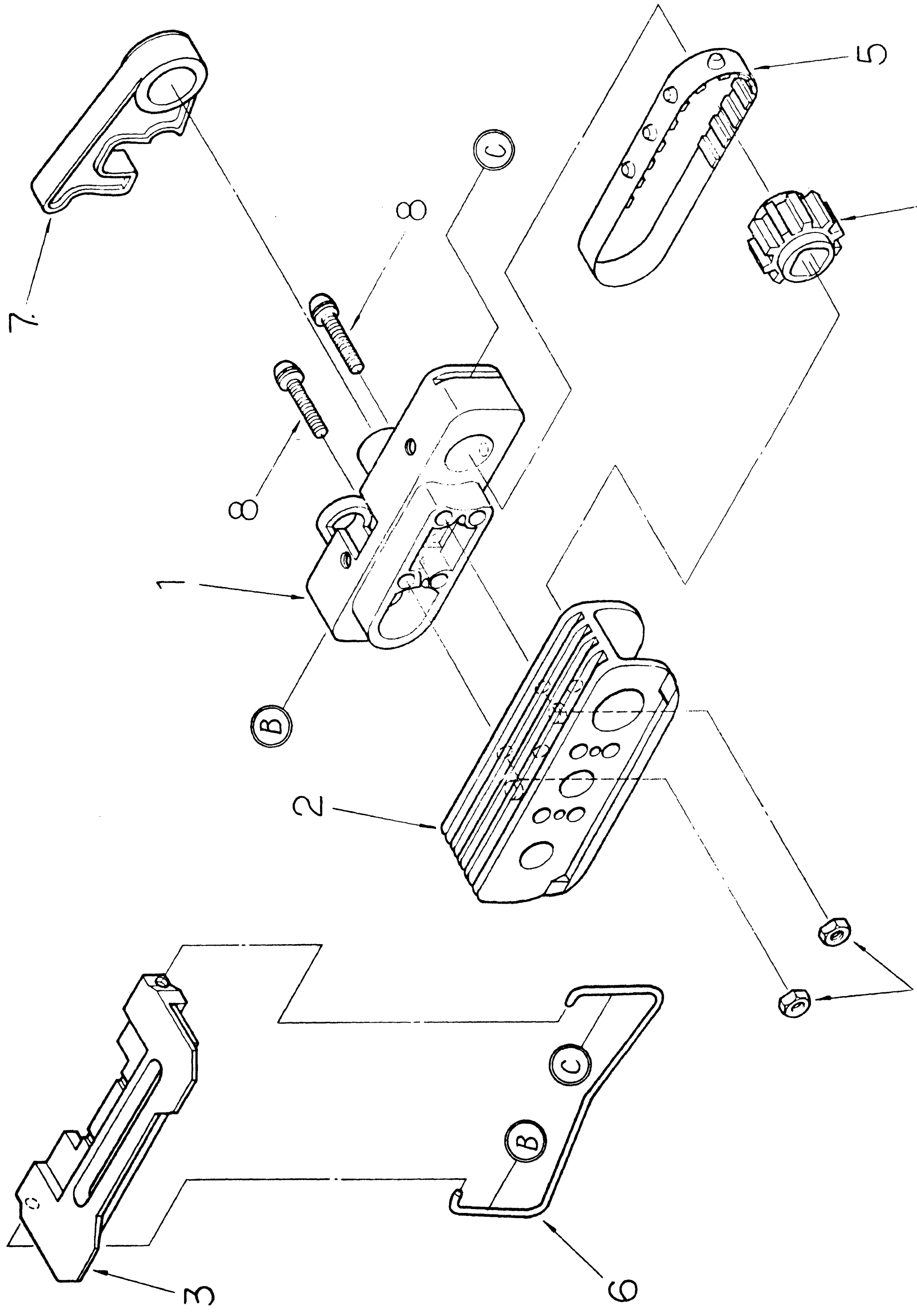


Figure 17-15 Sprocket Assembly (R) (FMX-35100-2)

Figure 17-15 Sprocket Assembly (R) (FMX-35100-2)

Item No.	Part No.	Description	Qty	Remarks
1	LR-123484-1	Sprocket frame (A)	1	82A 83A 92
2	LR-123485-1	Sprocket frame (B)	1	82A 83A 92
3	LR-123446-1	Sprocket cover	1	82A 83A 92
4	LR-129894-1	Sprocket wheel	1	82A 83A 92
5	LR-123487-1	Pin tractor (mold)	1	82A 83A 92
6	LR-123453-1	Pivot spring	1	82A 83A 92
7	LR-123458-1	Lock lever	1	82A 83A 92
8	⊕ P(SW+W)3-16-HH	Small pan-head screw	2	
9	2N3-HH	Nut	2	

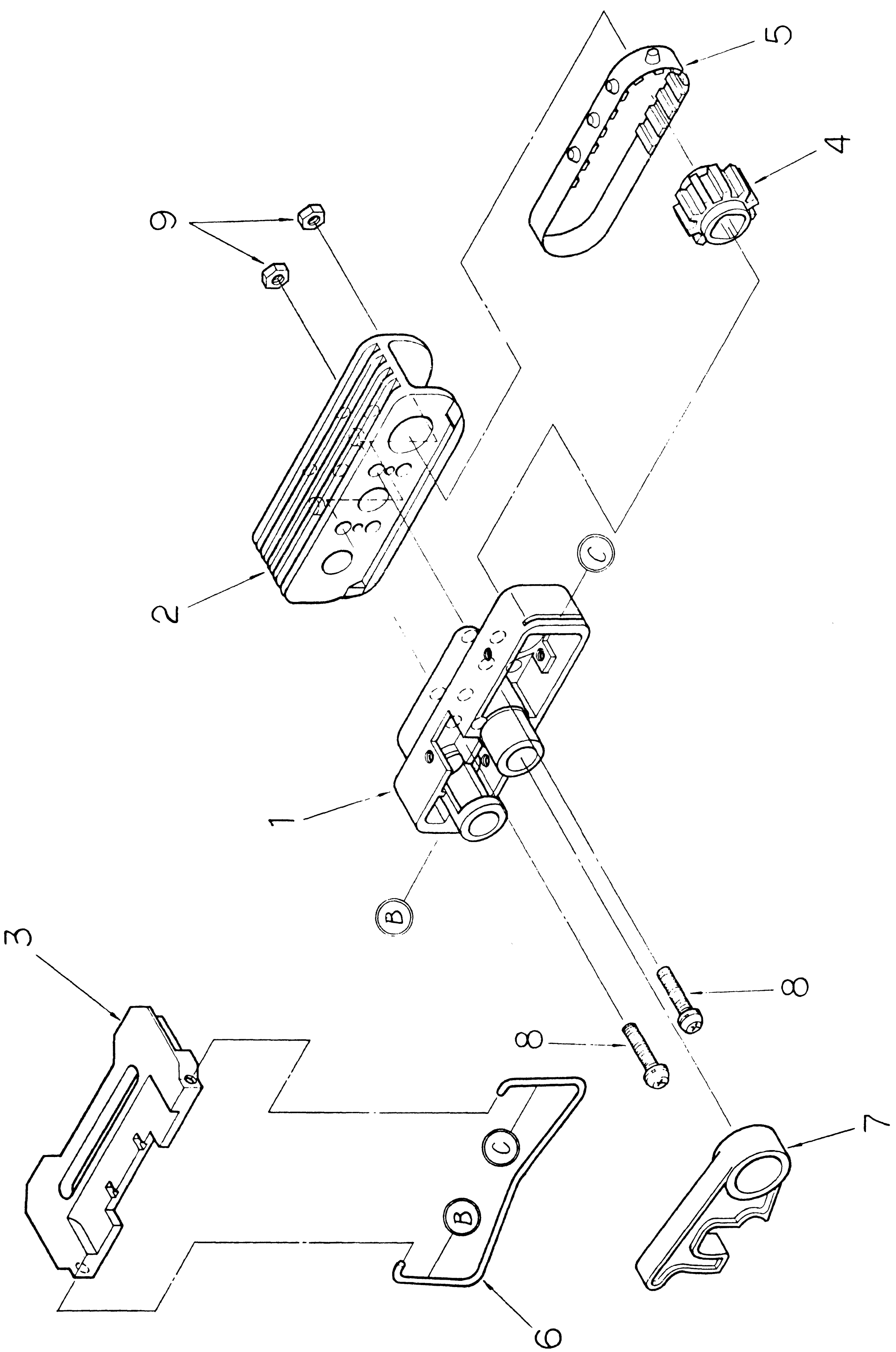


Figure 17-16 Sprocket Assembly (L) (FMX-35150-2)

Figure 17-16 Sprocket Assembly (L) (FMX-35150-2)

Item No.	Part No.	Description	Qty	Remarks
1	LR-123484-1	Sprocket frame (A)	1	82A 83A 92
2	LR-123485-1	Sprocket frame (B)	1	82A 83A 92
3	LR-123446-1	Sprocket cover	1	82A 83A 92
4	LR-129894-1	Sprocket wheel	1	82A 83A 92
5	LR-123487-1	Pin tractor	1	82A 83A 92
6	LR-123453-1	Pivot spring	1	82A 83A 92
7	LR-123458-1	Lock lever	1	82A 83A 92
8	⊕ P(SW+W)3-16-HH	Small pan-head screw	2	
9	2N3-HH	Nut	2	

PART III Appendixes

APPENDIX A EXTERNAL VIEW

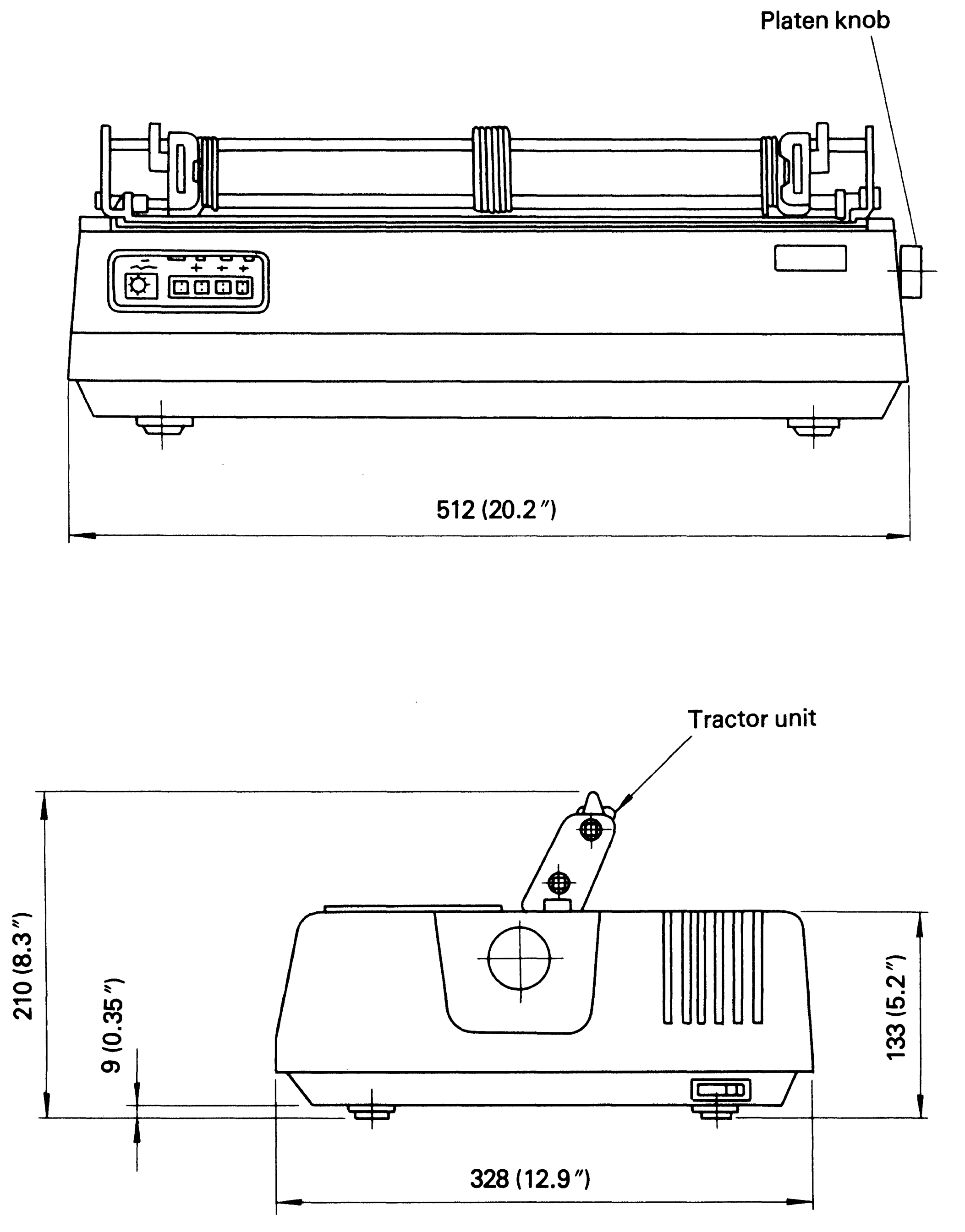


Figure A-1 External View

APPENDIX B BLOCK DIAGRAM

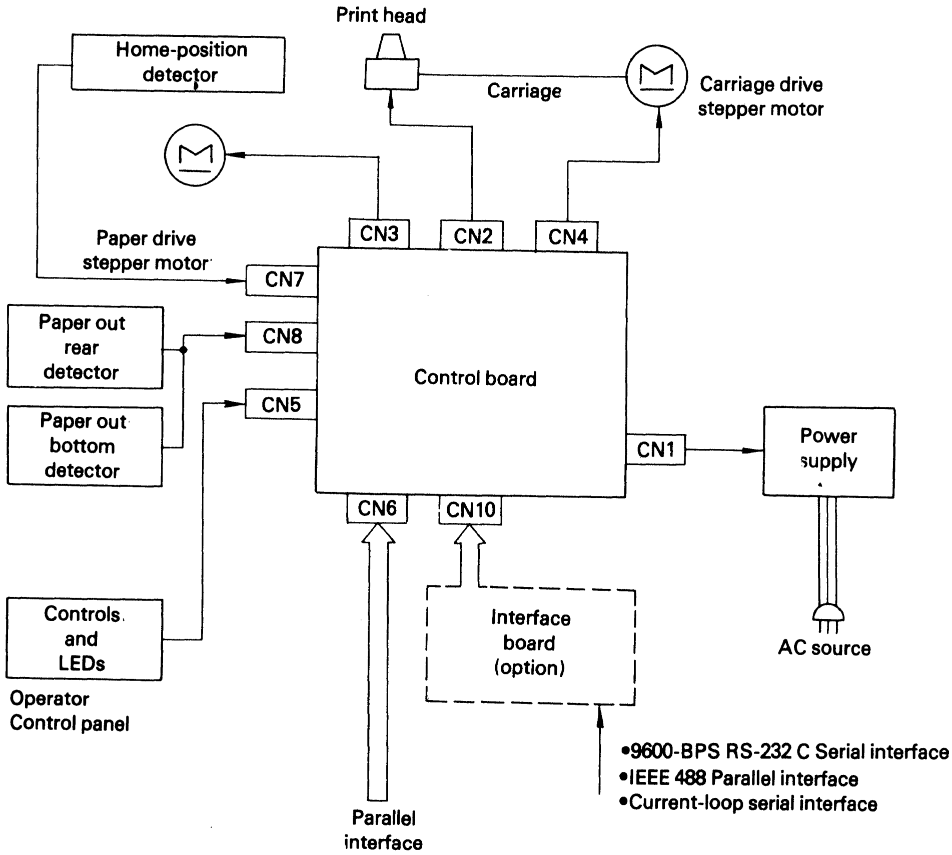


Figure B-1 Block Diagram

APPENDIX C FUNCTION CODES

Table C-1 Function Codes

Command	Function code		Description
	Decimal	Hexadecimal	
LF	10	0A	Prints data, performs carriage return, and feeds paper one line.
CR	13	0D	Prints data, and either performs carriage returns only or performs carriage return and feeds paper one line (if auto line feed is effective).
FF	12	0C	Prints data and feeds paper to the next top-of-form position (i.e., the first line of next form).
VT 31H to 3CH	11 49 to 60	0B 31 to 3C	Feeds paper to the tab position of the channel number set in VFU.
HT	9	09	Moves the print head to the next horizontal tab position.
DC1	17	11	Sets the printer in select state.
DC3	19	13	Sets the printer in deselect state.
DC4	20	14	A start code to load tab data to VFU.
RS	30	1E	Designates 10-CPI print mode.
GS	29	1D	Designates 17-CPI print mode.
FS	28	IC	Designates 12-CPI print mode.
US	31	1F	Designates expanded-character mode.
CAN	24	18	Clears the printer buffer, and resets print modes such as expanded-character mode.
ESC·DC2	27·18	1B·12	Prints data and feeds paper one line without carriage return.
ESC·HT·CR	27·9·13	1B·09·0D	Clears horizontal-tab memory.
ESC·0	27·48	1B·30	Designates standard character generator. This mode is also designated whenever the power is turned on or I-PRIME is received.
ESC·1	27·49	1B·31	Designates correspondence-quality print mode.
ESC·2	27·50	1B·32	Designates downline loadable character generator.
ESC·5	27·53	1B·35	Sets top-of-form or top-of-VFU.
ESC·6	27·54	1B·36	Designates 6-LPI line feed mode.
ESC·8	27·56	1B·38	Designates 8-LPI line feed mode.
ESC·C	27·67	1B·43	Designates underline print mode.
ESC·D	27·68	1B·44	Releases underline print mode.

Table C-1 Function Codes (con.)

Command	Function code		Description
	Decimal	Hexadecimal	
ESC·F 0·0 to 9·9	27·70 48·48 to 57·57	1B·46 30·30 to 39·39	Sets form length.
ESC·H	27·72	1B·48	Designates enhanced print mode.
ESC·I	27·73	1B·49	Releases emphasized/enhanced print mode.
ESC·J	27·74	1B·4A	Designates superscript print mode.
ESC·K	27·75	1B·4B	Releases superscript print mode.
ESC·L	27·76	1B·4C	Designates subscript print mode.
ESC·M	27·77	1B·4D	Releases subscript print mode.
ESC·N n	27·78 n	1B·4E n	Designates character-to-character clearance for proportional spacing; n is up to 11 (0BH).
ESC·T	27·84	1B·54	Designates emphasized print mode.
ESC·%·B n1·n2·n3·n4	27·37·59 n1·n2·n3·n4	1B·25·3B n1·n2·n3·n4	Designates the next print start position by dot column; n1 through n4 indicate a 4-digit decimal number.
ESC·%·9 n	27·37·57 n	1B·25·39 n	Designates line feed of n/144 (0.007 × n) inch; n is up to 127.
ESC·%·C n1·n2·n3	27·37·60 n1·n2·n3	1B·25·3C n1·n2·n3	Designates left margin by dot column; n1 through n3 are a 3-digit decimal number.
ESC·%·A n0.n1 to n11	27·37·65 n0. n1 to n11	1B·25·41 n0. n1 to n11	Loads the dot pattern data of a character code n0 as an ascender into the downline loadable character generator; n0 is a hexadecimal code between 20 and 7F and n1 to n11 are hexadecimal values.
ESC·%·D n0. n1 to n11	27·37·68 n0. n1 to n11	1B·25·44 n0. n1 to n11	Loads the dot pattern data of a character code n0 as a descender into the downline loadable character generator; n0 is a hexadecimal code between 20 and 7F and n1 to n11 are hexadecimal values.
ESC·VT 0·0 to 9·9	27·11 48·48 to 57·57	1B·0B 30·30 to 39·39	Performs direct skip of the specified number of lines.
ESC·HT·n1 n2·n3·CR	27·9·n1 n2·n3·13	1B·09·n1 n2·n3·0D	Sets tab data by character into horizontal-tab memory; n1 through n3 are a 3-digit decimal number.
ESC·ETX·n1·n2 n3·n4·CR	27·3·n1·n2 n3·n4·13	1B·03·n1·n2 n3·n4·0D	Sets tab data by dot column into horizontal-tab memory; n1 through n4 are a 4-digit decimal number.
ETX	3	03	Designates dot-addressable graphics mode.
ETX·STX	3·2	03·02	Releases dot-addressable graphics mode.

Table C-1 Function Codes (con.)

Command	Function code		Description
	Decimal	Hexadecimal	
ETX·SO	3·14	03·0E	Prints data in dot-addressable graphics mode, feeds paper 14/144 (0.097) inch, and performs carriage return.
ETX·DC4	3·20	03·14	Prints data in dot-addressable graphics mode, and feeds paper 14/144 (0.097) inch without carriage return.
ETX·LF	3·10	03·0A	Prints data in dot-addressable graphics mode, feeds paper one line, and performs carriage return.
ETX·DC2	3·18	03·12	Prints data in dot-addressable graphics mode, and feeds paper one line without carriage return.

APPENDIX D CHARACTER SET

		b8 = X							
	b7	0	0	0	0	1	1	1	1
	b6	0	0	1	1	0	0	1	1
	b5	0	1	0	1	0	1	0	1
b4 b3 b2 b1	R \ C	0	1	2	3	4	5	6	7
0 0 0 0	0			SP	Ø/0	②	P	⑦	p
0 0 0 1	1		DC1	!	1	A	Q	a	q
0 0 1 0	2			"	2	B	R	b	r
0 0 1 1	3		DC3	①	3	C	S	c	s
0 1 0 0	4		DC4	$	4	D	T	d	t
0 1 0 1	5			%	5	E	U	e	u
0 1 1 0	6			&	6	F	V	f	v
0 1 1 1	7			'	7	G	W	g	w
1 0 0 0	8		CAN	(	8	H	X	h	x
1 0 0 1	9	HT		)	9	I	Y	i	y
1 0 1 0	A	LF		*	:	J	Z	j	z
1 0 1 1	B	VT	ESC	+	;	K	③	k	⑧
1 1 0 0	C	FF	FS	,	<	L	④	l	⑨
1 1 0 1	D	CR	GS	–	=	M	⑤	m	⑩
1 1 1 0	E		RS	.	>	N	⑥	n	⑪
1 1 1 1	F		US	/	?	O	_	o	DEL

Notes: 1) For TRS-80, DEL code is processed as space when printing.

2) For the font of figure zero, "Ø" is used for the USA model, and "0" is used for the other models.

Language	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
US ASCII	#	@	[	\	]	^	`	{	|	}	~
BRITISH	£										
GERMAN		§	Ä	Ö	Ü			ä	ö	ü	ß
FRENCH	£	à	°	ç	§			é	ù	è	ê
SWEDISH		É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
DANISH			Æ	Ø	Å	Ü		æ	ø	å	ü
NORWEGIAN			Æ	Ø	Å		˙	æ	ø	å	
DUTCH	£			IJ					ij		
ITALIAN	£	§	°	ç	é		ù	à	ò	è	ì
ASCII standard (TRS-80)			↑	↓	→	←					

Differences among languages (Same as US ASCII if blank)

Figure D-1 Standard Character Set

	b8 = 0								
	b7	0	0	0	0	1	1	1	1
	b6	0	0	1	1	0	0	1	1
	b5	0	1	0	1	0	1	0	1
b4 b3 b2 b1	R \ C	0	1	2	3	4	5	6	7
0 0 0 0	0			SP	Ø/0	②	P	⑦	p
0 0 0 1	1		DC1	!	1	A	Q	a	q
0 0 1 0	2			"	2	B	R	b	r
0 0 1 1	3		DC3	①	3	C	S	c	s
0 1 0 0	4		DC4	$	4	D	T	d	t
0 1 0 1	5			%	5	E	U	e	u
0 1 1 0	6			&	6	F	V	f	v
0 1 1 1	7			'	7	G	W	g	w
1 0 0 0	8		CAN	(	8	H	X	h	x
1 0 0 1	9	HT		)	9	I	Y	i	y
1 0 1 0	A	LF		*	:	J	Z	j	z
1 0 1 1	B	VT	ESC	+	;	K	③	k	⑧
1 1 0 0	C	FF	FS	,	<	L	④	l	⑨
1 1 0 1	D	CR	GS	–	=	M	⑤	m	⑩
1 1 1 0	E		RS	.	>	N	⑥	n	⑪
1 1 1 1	F		US	/	?	O	_	o	DEL

Notes: 1) For TRS-80, DEL code is processed as space when printing.

2) For the font of the zero, "Ø" is used for the USA model, and "0" is used for the other models.

Language	1	2	3	4	5	6	7	8	9	10	11
US ASCII	#	@	[	\	]	^	`	{	|	}	~
BRITISH	£										
GERMAN		§	Ä	Ö	Ü			ä	ö	ü	ß
FRENCH	£	à		ç	§			é	ù	è	ê
SWEDISH		É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
DANISH			Æ	Ø	Å	Ü		æ	ø	å	ü
NORWEGIAN			Æ	Ø	Å		'	æ	ø	å	
DUTCH	£			IJ					ij		
ITALIAN	£	§	°	ç	é		ù	à	ò	è	ì
ASCII standard (TRS-80)			↑	↓	→	←					

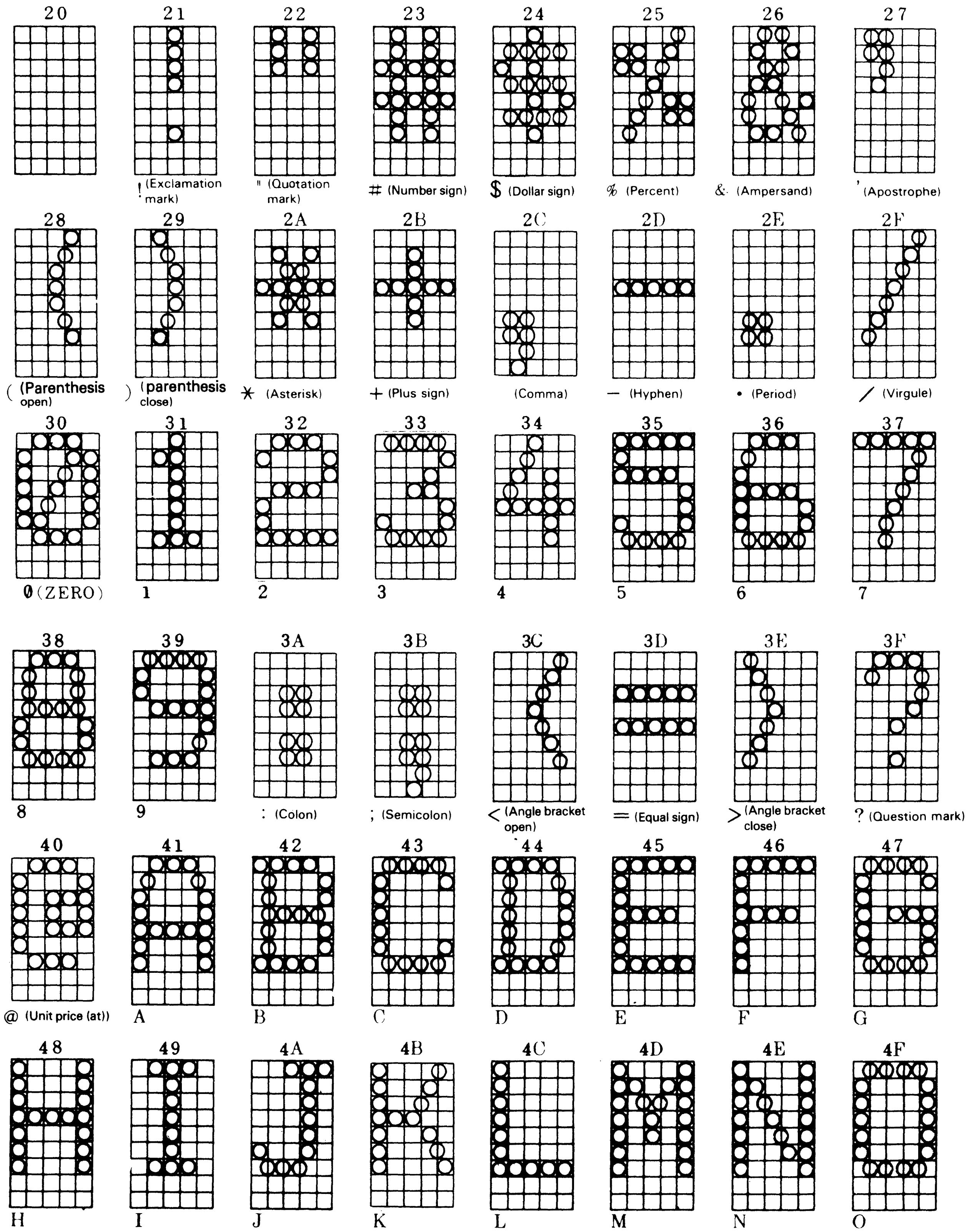
Differences among languages (Same as U.S. ASCII if blank)

Figure D-2 CQP Character Set

	b8	b8 = X							
	b7	0	0	0	0	1	1	1	1
	b6	0	0	1	1	0	0	1	1
	b5	0	1	0	1	0	1	0	1
b4 b3 b2 b1	R \ C	0	1	2	3	4	5	6	7
0 0 0 0	0								
0 0 0 1	1		DC1						
0 0 1 0	2								
0 0 1 1	3		DC3						
0 1 0 0	4		DC4						
0 1 0 1	5								
0 1 1 0	6								
0 1 1 1	7			Downline loadable font character set					
1 0 0 0	8		CAN						
1 0 0 1	9	HT							
1 0 1 0	A	LF							
1 0 1 1	B	VT	ESC						
1 1 0 0	C	FF	FS						
1 1 0 1	D	CR	GS						
1 1 1 0	E	SO	RS						
1 1 1 1	F	SI	US						

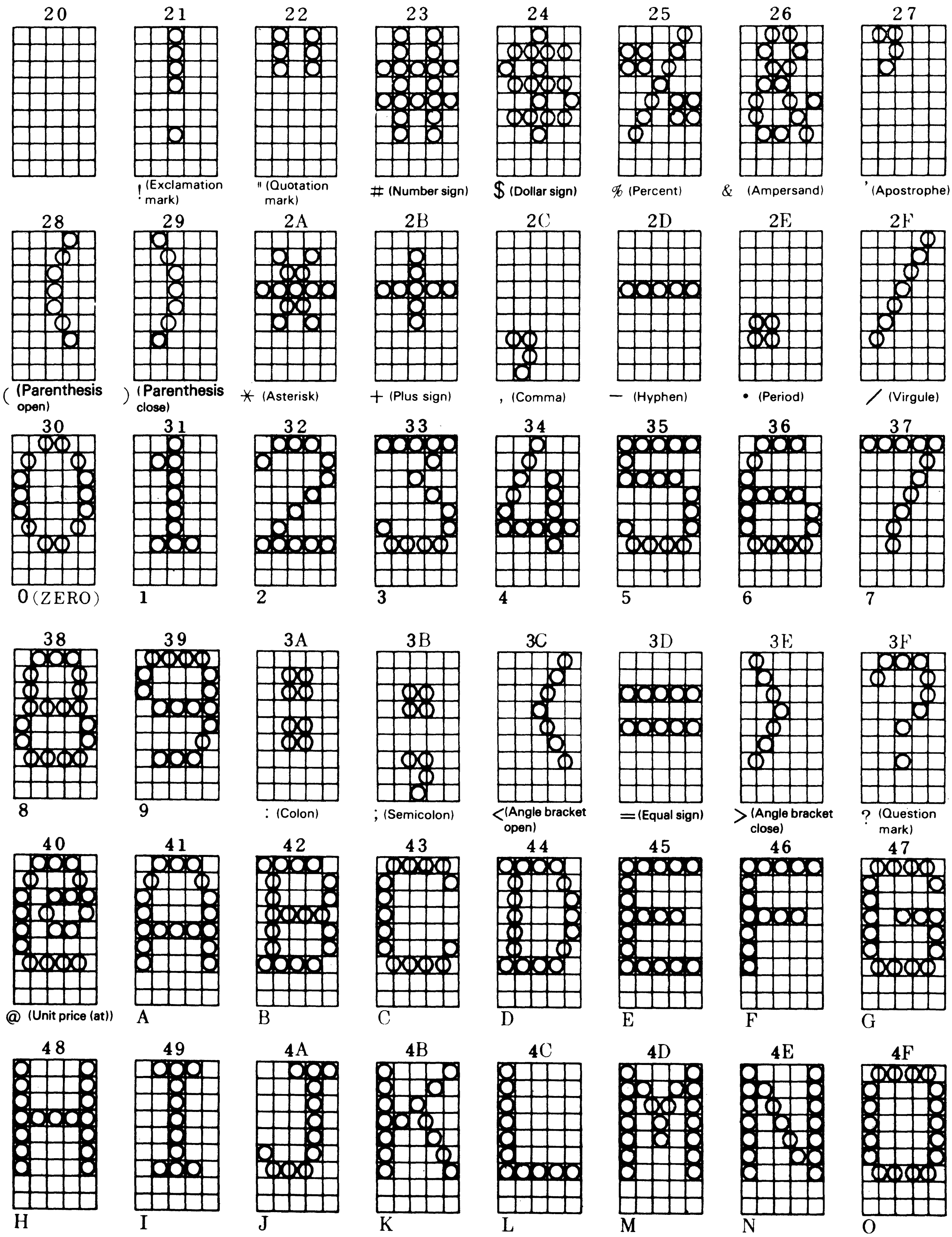
Figure D-3 Downline Loadable Character Set

APPENDIX E DOT PATTERNS



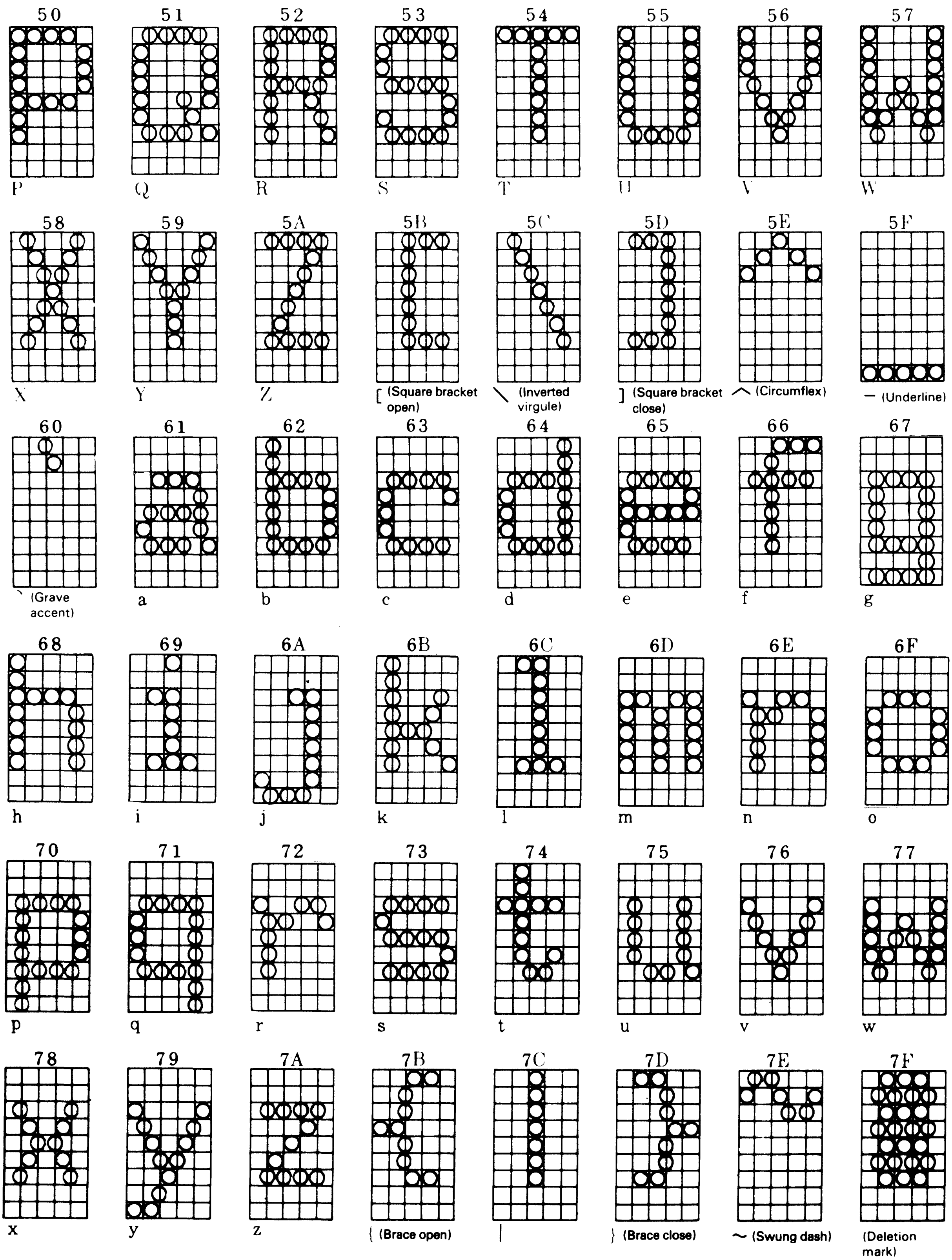
Note: The character code given at the top of each pattern is in hexadecimal.

Figure E-1 (1/3) Dot Patterns (for USA model)



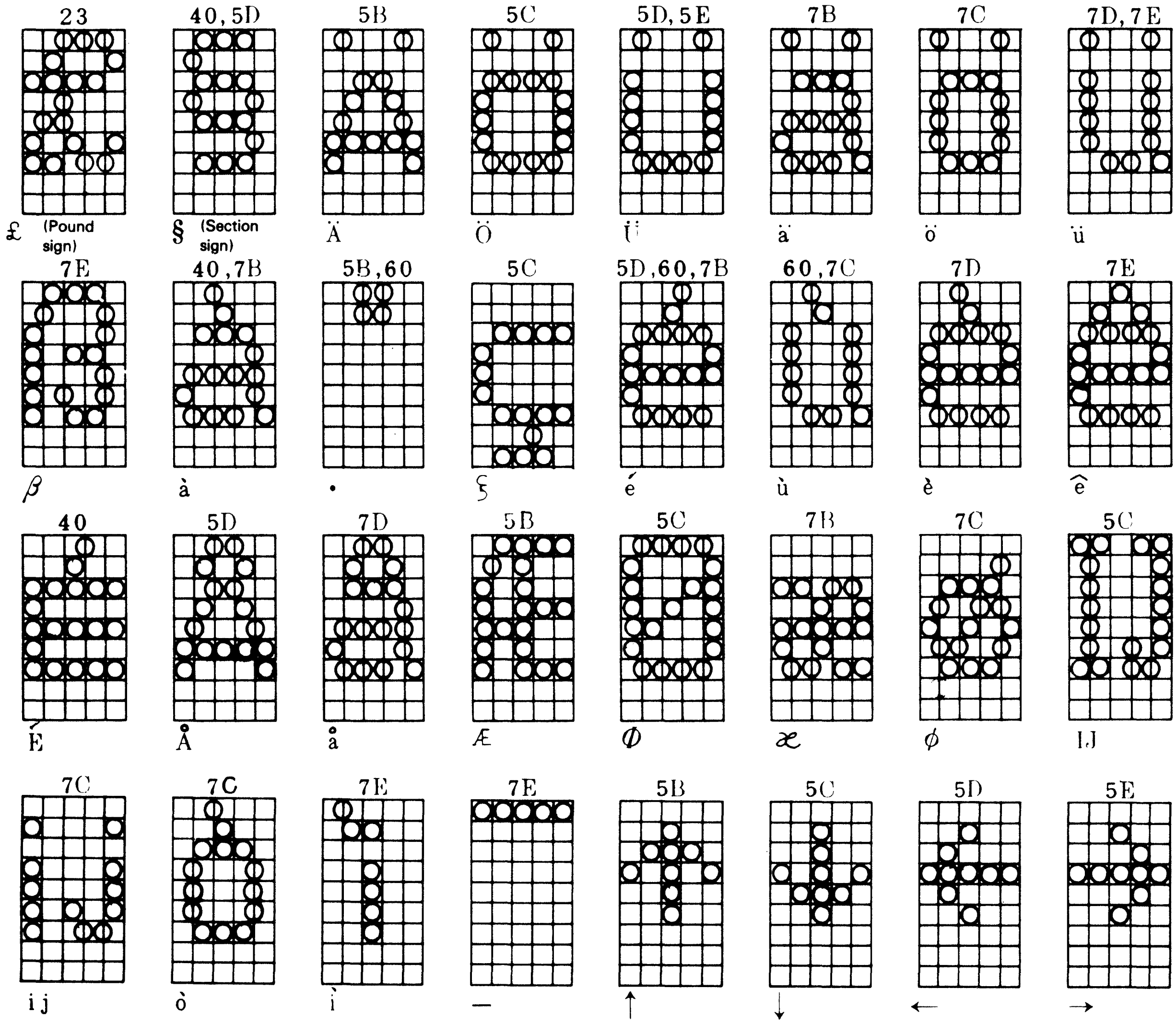
Note: The character code given at the top of each pattern is in hexadecimal.

Figure E-1 (1/3) Dot Patterns (for the area other than USA model)



Note: *The character code given at the top of each pattern is in hexadecimal.*

Figure E-1 (2/3) Dot Patterns



Note: The character code given at the top of each pattern is in hexadecimal.

Figure E-1 (3/3) Dot Patterns

APPENDIX F PRINTING FORMAT

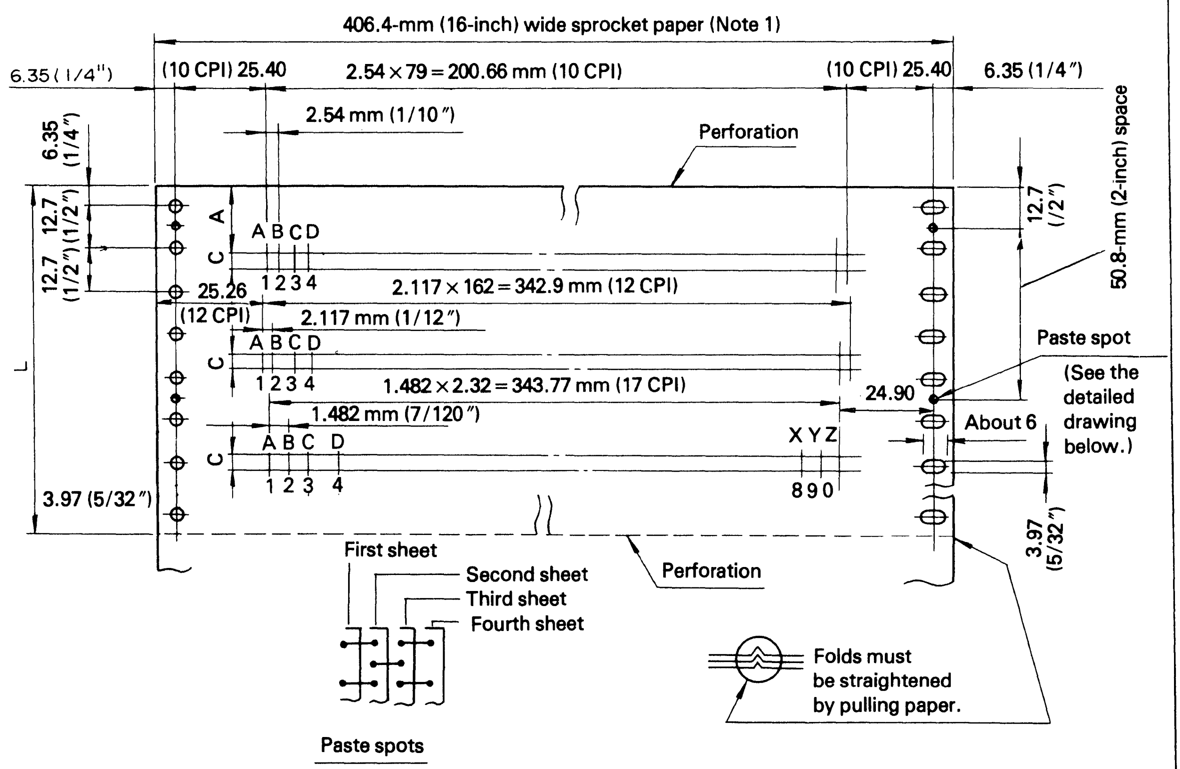


Figure F-1 Printing Format (Sprocket Paper) Unit: mm

Notes:

1) *The tractor unit can handle sprocket paper 76.2 mm (3 inches) to 406.4mm (16 inches) wide.*

2) *L: A multiple of 25.4 mm (1 inch)*

   A: Set a margin of 16.9 mm (four lines in 6-LPI mode) before and after perforations to prevent printout from being affected by perforations.

   B: 25.4 mm (1 inch). This may be 12.7 mm (0.5 inch) when using paper that is 381 mm (15 inches) wide or narrower.

3) *C: Line feed of 4.23 mm (6 LPI) or 3.18 mm (8 LPI) is selectable.*

4) *Ream weight*

   (a) One-part paper
   45 to 55 kg (52 to 64 g/m²)

   (b) Multiple-part paper

   i) Carbon-backed paper or pressure-sensitive paper of 30 to 34 kg (35 to 40 g/m²) ream weight:

   Up to four sheets including original can be used.

ii) Interleaf paper of 45 kg (52 g/m^2) or less ream weight:

Up to three sheets including original can be used.

iii) Interleaf paper of 30 kg (35 g/m^2) ream weight:

Up to four sheets including original can be used.

5) Multiple-part paper should be fastened by spot-pasting or crimping on both sides, and should be free of wrinkles.

6) The thickness of multiple-part paper should be 0.28 mm (0.01 inch) or less.

7) Right margin sprocket holes may be horizontally oval.

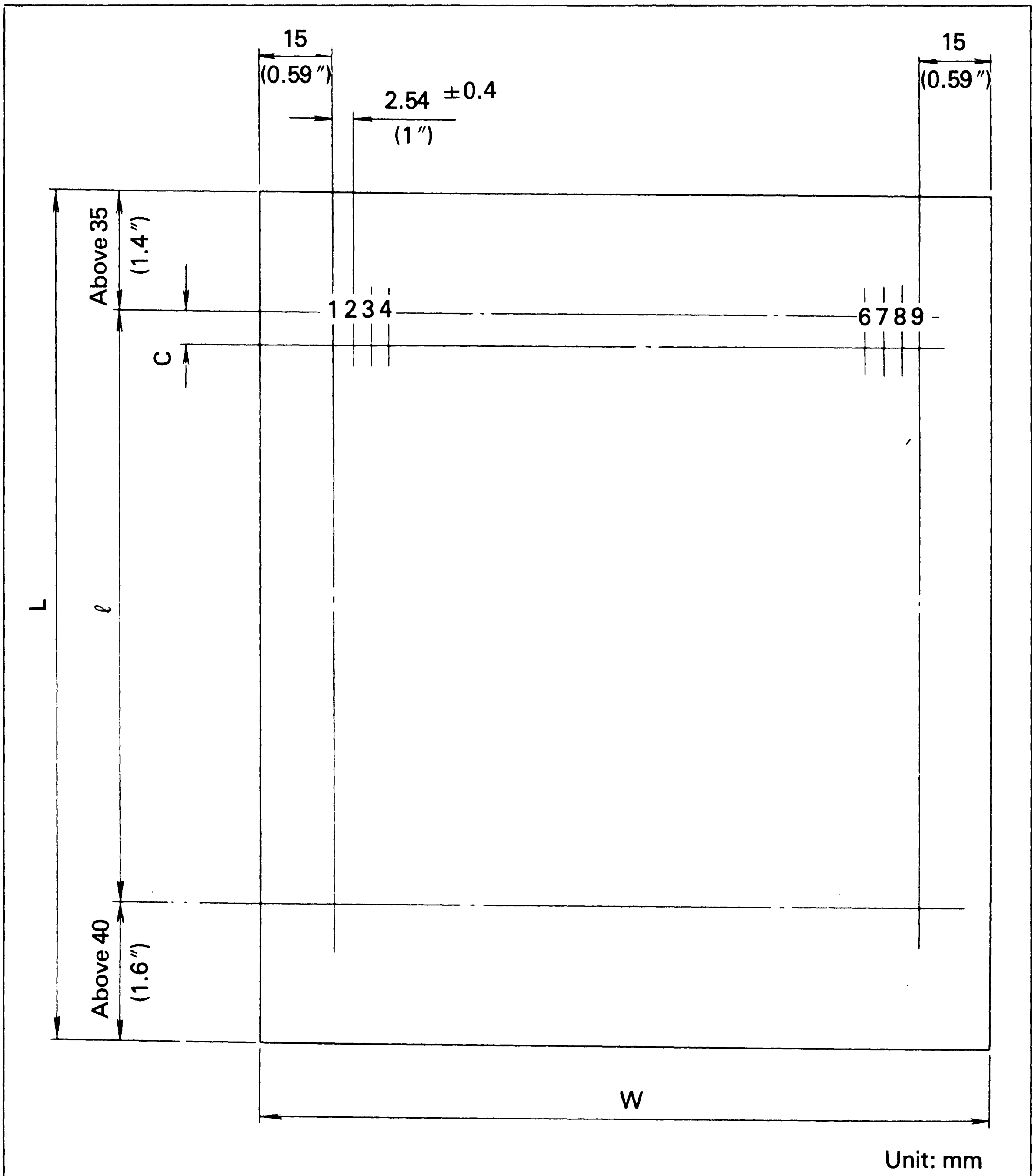


Figure F-2 Printing Format (Cut-Sheet Paper)

Notes:

1) *Standard paper size: A4 (210 × 297 mm) (8.27 × 11.7 inches)*
2) *Paper width: 210 to 381 mm (15 inches)*
3) *Paper length (L): 300 mm (11.8 inches) or less*
4) *Ream weight: 45 to 55 kg (52 to 64 g/m²)*
5) *Line feed pitch (C): 4.23 mm (6 LPI) and 3.18 (8 LPI) selectable*
6) *Paper must be free of folds and bends.*
7) *No multiple-part cut-sheet paper can be used.*

APPENDIX G SPECIFICATIONS

1. Introduction

1.1 General

The MICROLINE 93 (ML 93) is a desk-top, receive-only, serial-type, dot matrix printer designed for use with personal computers.

The ML93 printer receives data line-by-line and prints the received data.

Standard features include:

(1) High-speed printing at 160 characters/second

(2) Printing with true descenders

(3) Underline printing

(4) Superscript and subscript printing

(5) Enhanced printing

(6) Expanded printing

(7) Emphasized printing

(8) Dot-addressable graphics printing

(9) Downline loadable character set

(10) High throughput resulting from bidirectional, short-line seeking printing

(11) 12-channel VFU function

(12) 6/8 LPI pitch selection

(13) Special line feed function for dot-addressable graphics

(14) Left margin set function

(15) Two-mode (dot/character) horizontal-tab function

(16) Mixed printing of 10/12/17 CPI characters

(17) Dot column addressable horizontal positioning function

(18) Top-of-form function

(19) Direct skip function

(20) Small size and light weight

(21) Low power consumption

(22) Easy-to-use design

(23) Proportional spacing, correspondence-quality printing

(24) Paper override function

(25) DC1/DC3 print suppress function

1.2 Construction

1.2.1 Standard printer construction

The ML93 printer consists of a printer unit, control unit, operation panel, power supply unit, and covers.

1.2.2 Options

The printer can contain the following optional interface board:

(1) RS-232C serial interface (9600 BPS) with 7 protocols

(2) Current-loop interface

(3) IEEE 488 interface

2. Specifications

2.1 Printer specifications

(1) Print method: Impact dot matrix

(2) Number of dot wires: 9

(3) Dot wire diameter: 0.34 mm (0.013 inch)

(4) Print direction: Bidirectional

(5) Print speed: 160 characters/second (for 10/12/17 CPI)
80 characters/second (for 5/6/8.5 CPI)

(6) Print speed per line: See table 2-1.

Table 2-1 (Unit: lines/minute)

Characters/line	5 CPI	6 CPI	8.5 CPI	10 CPI	12 CPI	17 CPI
233	—	—	—	—	—	35
163	—	—	—	—	49	48
136	—	—	—	57	57	56
116	—	—	36	64	64	62
81	—	50	48	84	84	82
68	57	57	55	96	96	91

(7) Character set: 96 characters (alphanumerics and symbols)

Note: The character set includes descenders.

(8) Character matrix: Basic matrix: 9 (W) × 9 (H) dots
Characters: 9 (W) × 7 (H) dots
Descenders: g j p q y , ; _

(9) Character pitch: Selectable by function code
5 CPI—5.08 mm (0.200 inch)
6 CPI—4.23 mm (0.167 inch)
8.5 CPI—2.96 mm (0.118 inch)
10 CPI—2.54 mm (0.100 inch)
12 CPI—2.12 mm (0.083 inch)
17 CPI—1.48 mm (0.059 inch)

(10) Characters per line: Selectable by function code

Mode	5 CPI	6 CPI	8.5 CPI	10 CPI	12 CPI	17 CPI
Maximum characters per line	68	81	116	136	163	233
Function code	US			RS	FS	GS

(11)	Line feed pitch:	6 LPI—4.32 mm (0.167 inch) 8 LPI—3.175 mm (0.125 inch)
(12)	Line feed time:	124 ms (for 6 LPI) 103 ms (for 8 LPI)
(13)	Line feed speed:	2 inches/second (for vertical tab and top-of-form)
(14)	Paper feed control:	a) With TOF (top-of-form) function b) With TV (vertical tab) function
(15)	Paper feed direction:	Rear paper feed and bottom paper feed (Rear paper feed only for friction feed)
(16)	Paper feed method:	a) Friction feed (for cut-sheet paper) b) Tractor feed The tractor unit accepts any paper width between 76.2 mm (3 inches) and 406.4 mm (16 inches).

(17) Scale

A 2.54-mm (0.100-inch) pitch scale bar with pressure rollers is provided.

(18) Paper out detection

Paper out is detected when the remaining paper length is about 50 mm (2 inches) from the printing position for rear paper feed, and about 25 mm (1 inch) for bottom paper feed.

(19) Paper override function

When paper out is detected, the printing operation is stopped after printing about another 13 mm (0.5 inch) and the printer is set in deselect (offline) state. At this time, if the SEL switch is pressed, the printer is returned to select (online) state, the SEL LED lights, and the printer prints one more line. When carriage return is performed, paper out is detected again, the printing operation is stopped, and the SEL LED goes out. When the SEL switch is pressed again, the above operation is repeated.

(20) Character set

The following ten character sets are selectable by DIP switch:

(a) US ASCII	(b) British	(c) German
(d) French	(e) Swedish	(f) Danish
(g) Norwegian	(h) Dutch	(i) Italian
(j) TRS-80		

(21)	Outside dimensions:	(See appendix A.) 512 mm (20.16 inches) wide × 328 mm (12.91 inches) deep × 133 mm (5.24 inches) high (Not including the platen knob and the tractor unit)
(22)	Weight:	Printer—About 14 kg (30.9 lb) Tractor—About 0.7 kg (1.5 lb)

(23) Input power: Single-phase AC

a) 117 V ±10% – (50/60 Hz ±2%)

b) 220/240 V ±10% – (50/60 Hz ±2%)

The above a) and b) are different models, but 220/240 V is selectable by an internal switch.

(24) Power consumption: About 90 VA (during operation)

About 45 VA (during idling)

(25) AC power cable: About 2.3 meters (7.7 feet) long

The plug and cable are approved by UL, CSA, and European standard.

(26) Insulation resistance

5 megohms or more when measured between the AC input line and the frame using a 500-V DC megohmmeter.

(27) Dielectric strength

No damage will result when the following voltage is applied between the AC input line and the frame for 1 minute:

a) 1000 VAC (50/60 Hz) for 117 V model

b) 1500 VAC (50 Hz) for 220/240 V model

(28) Safety device

A circuit breaker is provided in the power supply unit to protect the printer from AC input overcurrent.

(29) Ambient temperature and relative humidity:

	During operation	During non-operation	During storage
Temperature	5°C to 40°C	–10°C to 43°C	–40°C to 70°C
Humidity	20% to 90% RH	5% to 95% RH	5% to 95% RH

Notes: 1) The equipment must be packaged during storage.

2) Avoid condensation.

(30) Vibration: During operation: Less than 0.3 g (10 Hz)

(31) Shock: During non-operation: Less than 3 g

(32) Noise

Less than 67 dB (average) when measured under the following conditions:

- The printer is operated on a table 64 cm high.
- Measuring position: 1 meter in front of the printer and 1 meter above the floor.
- Measuring range: Range A, FAST

- Continuous printing of built-in test pattern (80 characters per line) on sprocket one-part paper.
- 10-CPI and 6-LPI modes
- No graphics included
- Rear paper feed

(33) Interface

(a) Standard:	Parallel interface (Centronics-compatible)
(b) Options:	i) High-speed serial interface (RS-232C compatible; up to 9600 BPS; various communications protocols provided) ii) Current-loop serial interface iii) IEEE-488 parallel interface The above optional interface boards can be installed in the printer at any time.

(34) Reliability

(a) MTBF:	4000 hours of power-on time (page density of 35%; duty cycle of 25%)
(b) Print head life:	200 million characters
(c) Ribbon life:	1.5 to 2 million characters (When both upper and lower bands of the ribbon are used.)
(d) Printer life:	12000 hours of power-on time (page density of 35%; duty cycle of 25%) or 5 years

(35) Industrial standards

(a) VDE 0871:	Expected in 1983
(b) FCC Class-B:	Expected in 1983
(c) U/L:	Expected in 1983
(d) CSA:	Expected in 1983

(36) Self-check function

(a) ROM and RAM check function

(b) Local test printing function

(c) Print head temperature check function

2.2 Paper specifications

(a) Roll paper

Outside diameter:	128 mm (5.04 inches) maximum
Paper width:	208 to 216 mm (8.2 to 8.5 inches)
Core inside diameter:	25 mm (1 inch)
Ream weight:	45 to 55 kg (52 to 64 g/m^2)

Multiple-part paper cannot be used.

(b) Cut-sheet paper

Standard size: A4 (210 mm wide, 297 mm long)

Paper width: Up to 381 mm (15 inches)

Ream weight: 45 to 55 kg (52 to 64 g/m^2)

Multiple-part paper cannot be used.

(c) Sprocket paper

The tractor unit can handle any paper width between 76.2 mm (3 inches) and 406.4 mm (16 inches).

(i) One-part paper

Ream weight: 45 to 55 kg (52 to 64 g/m^2)

(ii) Multiple-part paper

Kind	Ream weight	No. of sheets
Carbon-lined paper	30 to 34 kg	Up to four including
Pressure-sensitive paper	(35 to 40 g/cm^2)	original
Interleaf paper	45 kg (52 g/m^2)	Up to three including original
	30 kg (35 g/m^2)	Up to four including original

Note: The paper thickness must be 0.28 mm (0.01 inch) or less.

2.3 Ribbon specifications

Genuine OKI ribbons are recommended. Other ribbons must meet the following specifications:

(1) Spool: 2-inch standard spool (Underwood type)

(2) Ribbon length: 11.5 meters maximum

(3) Ribbon width: 12.7 mm (0.5 inch)

(4) Ribbon thickness: 0.1 mm maximum (fabric), nylon (40 denier × 40 denier)

(5) Ink color: Single color (black)

(6) Eyelet: With reversing eyelets (2.4 ±0.3 mm thick; diameter of 7.8 mm)

(7) Ink viscosity: Low viscosity (about 500 ±100 CP at 25°C (77°F))

2.4 Parallel interface

2.4.1 Connectors and cable

(1) Connectors

Printer side: 36-pin receptacle 57-40360-12-D56 (Amphenol or Daiichi Electronics or equivalent)

Cable side: 36-pin plug 57-30360 (Amphenol or Daiichi Electronics or equivalent), or plug 552274-1; cover 552073-1 (Amphenol or equivalent)

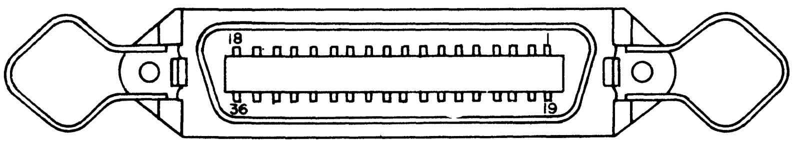
(2) Cable

Use a cable less than 5 meters (10 feet) in overall length. (A shielded cable composed of twisted-pair wires is recommended for noise prevention.)

2.4.2 Parallel interface signals

Pin No.	Signal	Direction	Description
1	$\overline{\text{DATA STROBE}}$	TO PRINTER	When this signal changes from low to high level, input data are sampled.
2	DATA BIT 1	TO PRINTER	Data lines. The high level represents 1, and the low level represents 0.
3	DATA BIT 2		
4	DATA BIT 3		
5	DATA BIT 4		
6	DATA BIT 5		
7	DATA BIT 6		
8	DATA BIT 7		
9	DATA BIT 8		
10	$\overline{\text{ACKNOWLEDGE}}$	FROM PRINTER	The low level of this signal indicates completion of data input or function operation.
11	BUSY	FROM PRINTER	The high level of this signal indicates that the printer cannot receive data. The low level of this signal indicates that the printer is ready for receiving data.
12	PAPER END	FROM PRINTER	The high level of this signal indicates that the paper has run out.
13	SELECT	FROM PRINTER	The high level of this signal indicates that the printer is in select (online) state.
14,16 33	0V	—	Signal ground
17	CHASSIS GROUND	—	Frame ground
18	+5V	FROM PRINTER	+5 V supply (50 mA maximum)
19 ~ 30	0V		Return for the twisted-pair wires of pins 1 to 11
31	$\overline{\text{INPUT PRIME}}$	TO PRINTER	When this signal goes to low level, the printer controller is initialized. The low level should be held for more than 0.5 ms.
32	$\overline{\text{Fault}}$	FROM PRINTER	When the printer runs out of paper, this signal changes from high to low level.
15,34 35,36		—	Not used.

Note: Connector pin arrangement



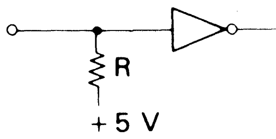
2.4.3 Parallel interface levels

Low level should be in the range: 0.0 V to +0.8 V

High level should be in the range: +2.4 V to +5.0 V

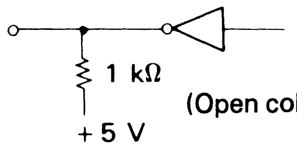
2.4.4 Parallel interface circuits

(1) Receiver



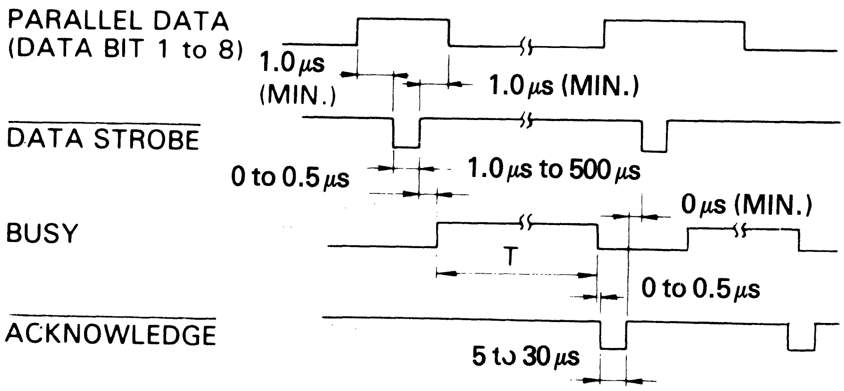
R = 1 kΩ (for data lines, and $\overline{\text{I-PRIME}}$ line)
R = 470 Ω (for data strobe line)

(2) Driver



(Open collector)

2.4.5 Parallel interface timing chart



Note: The minimum value of T is 150 μs, and the maximum value is the time spent for printing + carriage return + line feed.

APPENDIX H PRINTING FUNCTIONS

1. Data Receiving and Printing System
2. Vertical Tab Function
3. Top-of-Form (TOF) Function
4. Horizontal Tab Function
5. Left Margin Setting
6. Positioning Function
7. Character Pitch Selection
8. Expanded Printing Function
9. Line Feed Pitch Selection
10. Dot-Addressable Graphics Function
11. CQP Function
12. Downline Loadable Character Generator
13. Underline Function
14. Superscript and Subscript Printing
15. Emphasized and Enhanced Printing
16. Select and Deselect
17. CAN Command
18. Paper Out Detection
19. Initial Reset Condition
20. Self Check Function

1. Data Receiving and Printing System

The ML93 printer is a receive-only printer, and receives and prints data line-be-line. Data for the next print line can be received during printing; this allows bidirectional printing with shortest-distance seeking logic.

If one line of data is received segmented into blocks, printing is performed block-by-block. Printing of data, carriage return, and line feed are perfrmed by the following print control codes:

(1) When only CR is received: CR code is ignored.

(2) When only LF is received: Only line feed is performed.

(3) When data and LF are received: Data are printed, paper is fed one line, and auto carriage return is performed.

(4) When data and CR are received:

DIP SW6 on operation panel	Operation
ON	Data are printed, auto carriage return is performed, and paper is fed one line.
OFF	Data are printed and auto carriage return is performed without line feed.

(5) When data,+ CR, and LF are received:

DIP SW6 on operation panel	Operation
ON	Data are printed, auto carriage return is performed, and paper is fed two lines.
OFF	Data are printed, auto carriage return is performed, and paper is fed one line.

(6) When data, LF, and CR are received: Data are printed, paper is fed one line, and auto carriage return is performed.

(7) When only FF is received: Only form feed is performed.

(8) When VT and channel no. are received: Vertical tab operation is performed.

(9) When data and FF are received: Data are printed and form feed is performed.

(10) When data, VT, and channel no. are received: Data are printed and form feed is performed.

(11) When data and ETX are received in text mode: Data are printed and the printer is set in dot-addressable graphics mode.

(12) When data and GS are received in 10- or 12-CPI mode: Data are printed in 10- or 12-CPI mode and the printer is set in 17- CPI mode.

(13) When data and FS are received in 10- or 17-CPI mode: Data are printed in 10-or 17-CPI mode and the printer is set in 12- CPI mode.

(14) When data and RS are received in 12- or 17-CPI mode: Data are printed in 12- or 17-CPI mode and the printer is set in 10-CPI mode.

(15) When data, ETX, STX are received in dot-addressable graphics mode: Graphics data are printed and the printer is set in text mode.

Notes: *1) Any code not provided in the currently specified character set is ignored.*

2) Maximum number of characters per line is:

136 characters in 10-CPI mode

163 characters in 12-CPI mode

233 characters in 17-CPI mode

3) Character data that are not confined to one line are automatically printed on the next line.

4) When dot-addressable graphics data are printed, data that exceed the right margin are aborted.

2. Vertical Tab Function

The printer ML93 has an electronic VFU (vertical format unit), which can store up to 12 different formats of tab setting into internal RAM. This setting is cleared when the power is turned off.

2.1 Specification of vertical tab

Code: VT and channel number

When this code string is received, the paper is fed to the tab position of the specified channel number according to the format loaded (see section 2.2).

The channel number is between 1 and 12, and is specified by the following code:

Channel number	Code	Channel number	Code
1	1	7	7
2	2	8	8
3	3	9	9
4	4	10	:
5	5	11	;
6	6	12	<

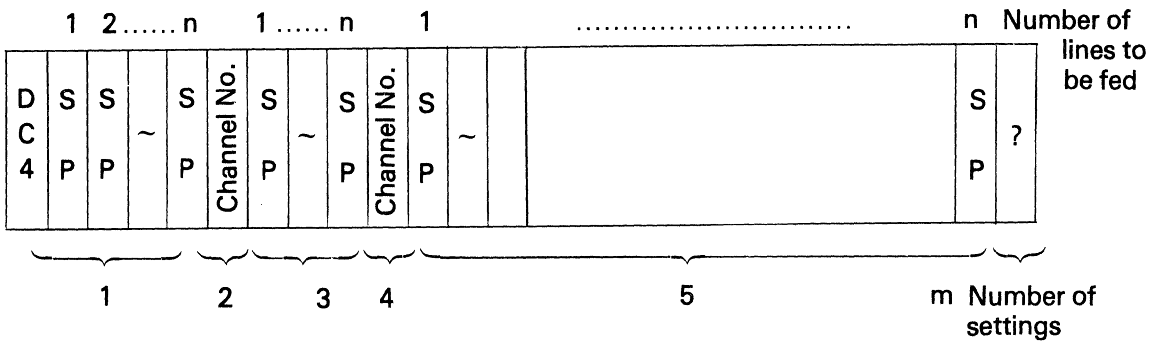
Notes: *1) If no format has been loaded or if an illegal channel number code is specified, reception of VT and channel number code string causes nothing.*

2) If an unestablished channel number is specified, reception of VT and channel number code string causes nothing.

3) Even if the bottom of form is encountered during vertical tab operation, the paper is fed to the first vertical tab position (specified by the channel number) of the next page.

2.2 Loading of format

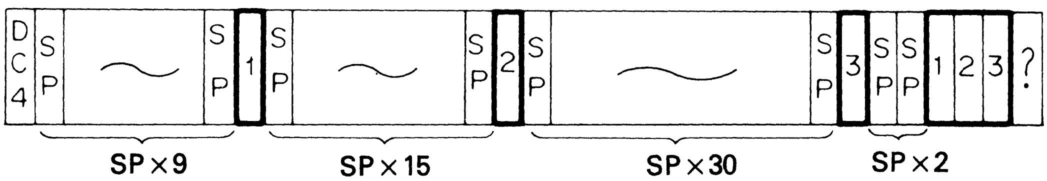
Input codes in the following format to set vertical tab positions.



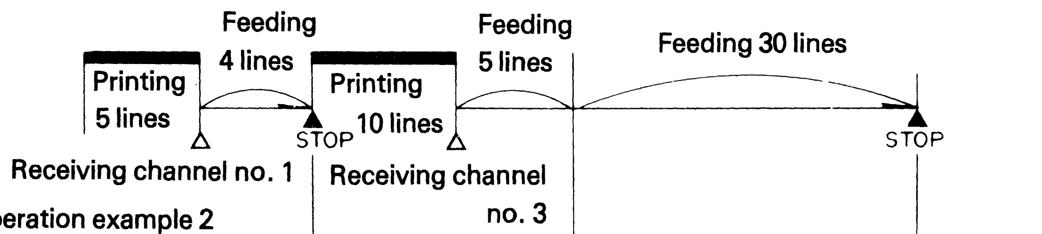
DC: Start code ?: End code

Input as many SP codes as the space lines (n) to be fed and a channel number code (tab position). The number of settings (m) must be 54 or less because of the RAM capacity.

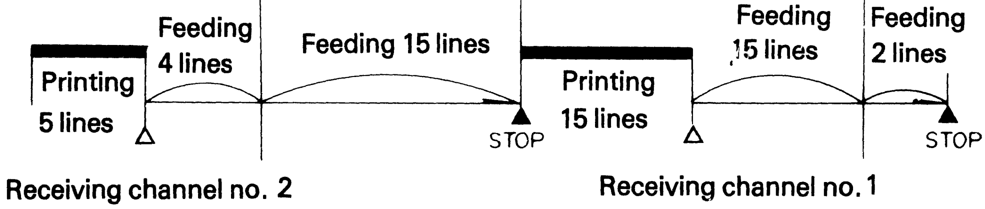
Format example



Operation example 1



Operation example 2



(1) Explanation of operation example 1

First, the printer prints five lines. Receiving the channel no. 1 code, the printer feeds the paper four (=9−5) lines and stops. The printer then prints ten lines. Receiving the channel no. 3 code, the printer feeds the paper 35 (= 15 − 10 + 30) lines and stops.

(2) Explanation of operation example 2

First, the printer prints five lines. Receiving the channel no. 2 code, the printer feeds the paper 19 ($= 9 - 5 + 15$) lines and stops. The printer then prints 15 lines. Receiving the channel no. 1 code, the printer feeds the paper 17 ($= 30 - 15 + 2$) lines and stops.

Notes: *1) Upon loading of the format, the value of each vertical tab length is set in inches converted according to the currently specified line feed pitch (LPI). Once this value is loaded, it does not change even when the line feed pitch is changed later.*

2) Upon loading of the format, the current print position is set as the start line for vertical tab and form feed.

2.3 Direct skip function

When the following function code string is received, the paper is fed by the specified number of lines.

Function code: ESC·VT·X1·X2

Where X1 and X2 are respectively the tens digit and units digit of a decimal number that specifies the number of lines to be fed. That is, any number between 00 and 99 can be specified.

3. Top-of-Form (TOF) Function

When an FF code is received, the paper is fed to the next top-of-form position.

3.1 Setting of form length

Form length can be specifed by either the rotary switch on the operation panel or function code.

(1) Setting by rotary switch

Ten form lengths can be specifed using the rotary switch as shown in section 3, table 3-2.

(2) Setting by function code

Form length can also be specifed by inputting the following code string:

ESC·F·X1·X2

Where X1 and X2 are respectively the tens digit and units digit of a decimal number that specifies the form length (the number of lines per page). Any number between 00 and 99 can be specified.

The value of the form length is set in the register in inches converted according to the currently specified line feed pitch.

Notes: *1) Setting by function code overrides setting by the rotary switch.*

2) Upon this setting, the current print position is set as the start line for vertical tab and form feed.

3) Inputting of ESC·F·0·0 makes the setting of form length by the rotary switch valid.

4) When the power is turned on, the form length is assumed to be that specified by the rotary switch.

3.2 Setting of top-of-form position

The top-of-form positions for both form length and vertical tab are set either by depressing TOF SET switch after setting the rotary switch to the desired position or by inputting the function code string: ESC·5.

At this time, the form length is also set and this setting is held until the TOF SET swtich is depressed or the function code string is input again.

Therefore, form length does not change only by changing the setting of the rotary switch.

Notes: 1) *When the power is turned on, form length is set according to the set position of the rotary switch, and the current print position is set as the top-of-form position.*

2) *If the line feed pitch is changed in the middle of a page, line feed is performed according to the newly specifed line feed pitch, but the form length does not change.*

4. Horizontal Tab Function

There are two modes of horizontal tab setting: dot column tab mode and character tab mode.

(1) Unit tab length and maximum tab set number

		10 CPI	12 CPI	17 CPI
Unit tab length (inch)	Dot column tab mode	1/120 (0.008)	1/144 (0.007)	1/206 (0.005)
	Character tab mode	1/10 (0.100)	1/12 (0.083)	1/17 (0.059)
Maximum tab set number	Dot column tab mode	960	1152	1632
	Character tab mode	80	96	136

(2) Loading format

(a) Setting of dot column mode

ESC·ETX·X1·Y1·Z1·W1, ____, ____, Xm·Ym·Zm·Wm·CR

Where, $1 \leq m \leq 16$; m indicates the m-th tab position of a line.

xm: the thousands digit

Ym: the hundreds digit

Zm: the tens digit

Wn: the units digit

respectively of a decimal number that specifies a tab stop position.

Zero suppress mode.

(b) Setting of character tab mode

ESC·HT·X1·Y1·Z1, ____, ____, Xm·Ym·Zm·CR

Where, $1 \leq m \leq 16$; m indicates the m-th tab position of a line.

Xm: the hundreds digit

Ym: the tens digit

Zm: the units digit

respectively of a decimal number that specifies a tab stop position.

Zero suppress mode.

(c) Tab set clear

ESC·HT·CR

Notes: 1) *When CPI mode changes, the absolute tab positions change but the relative tab positions in both dot column and character tab modes do not.*

2) *Tab positions should be specified from left to right upon loading. If there are reversely specified tab positions, they are ignored, but included in the number of tab positions when the maximum number of tab positions is checked.*

3) *Upon loading, no partial tab position change can be accepted: the entire tab positions should be newly loaded.*

4) *Reception of an HT code is ignored in the following cases:*

•*If the current print position is beyond the rightmost tab position.*

•*If the current print position is in the right margin.*

5) *Up to 16 tab positions can be set.*

6) *If an invalid code is detected during loading, the ESC sequence mode is cleared, and the command is made invalid. The following characters are printed normally.*

7) *When the power is turned on, horizontal tab is automatically set to the default value of 8-character pitch: character column positions, 1, 9, 17, 25,..., and 129.*

5. Left Margin Set Function

Left margin can be changed by the following code:

ESC·%·C·X1·X2·X3

where, X1: the hundreds digit

X2: the tens digit

X3: the units digit

respectively of a decimal number.

Not zero suppress mode.

The left margin position is specified as X1X2X3/120 inch. The maximum left margin position is 999/120 (= 8.325) inches scaled from the home position of print head.

6. Positioning Function

The print start position can be specifed in dot column pitch scaled from the home position of print head using the following code:

ESC·%·B·X1·X2·X3·X4

where, X1: the thousands digit

X2: the hundreds digit

X3: the tens digit

X4: the units digit

respectively of a decimal number specifying a dot column position.

Not zero suppress mode.

Note: The print start position cannot be specifed beyound the left or right margin; such a command is ignored.

7. Character Pitch Selection

The character pitch can be selected by using the following function codes. This applies to both characters and dot-addressable graphics.

(1) RS: 10 CPI

(2) FS: 12 CPI

(3) GS: 17 CPI (unassignable to dot-addressable graphics and CQ printing)

The character pitch can be changed in the middle of a line. When the character pitch is changed in the middle of a line, the previous block is printed. Superscipts contained in the following blocks of that line are printed as normal script. The following blocks are printed from the next multiple of 1/120-inch position (scaled from the left margin).

8. Expanded Printing Function

Double-width characters are printed when the following function code is received.

US: Start code for expanded printing

(a) 5 CPI (from 10 CPI)

(b) 6 CPI (from 12 CPI)

(c) 8.5 CPI (from 17 CPI)

The expanded printing mode is released when one of the following codes is received:

(1) RS: back to 10-CPI mode

(2) FS: back to 12-CPI mode

(3) GS: back to 17-CPI mode

The expanded printing mode can be assigned character-by-character.

Notes:

1) In the expanded printing mode, if the last character of a line exceeds the right margin, that character is printed at the first print position of the next line.

2) The expanded printing mode is held until the release code (RS, FS, or GS) is encountered.

9. Line Feed Pitch Selection

The line feed pitch is specified by the following codes:

(1) ESC·6: 6 LPI (0.167 inch)

(2) ESC·8: 8 LPI (0.125 inch)

(3) ESC·%·9·n: Arbitrary LPI (n/144 inch)

Note: The line feed pitch is held until another pitch is specified.

10. Dot-Addressable Graphics Function

(1) Setting and resetting of graphics mode

The graphics mode is set when an ETX code is received.

The graphics mode is reset when an ETX·STX code is received.

Notes:

1) When ETX×2N·STX is received, the graphics mode is not reset, but a dot pattern of ETX is printed by N dot columns and a dot pattern of STX is printed by one dot column.

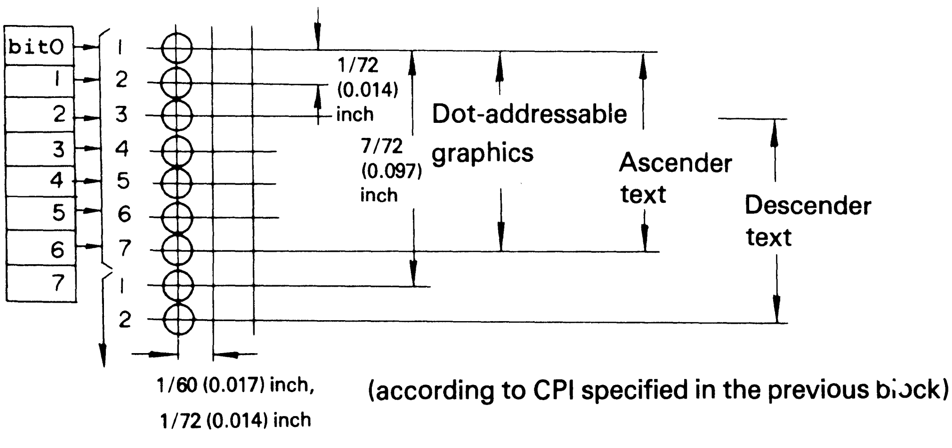
2) When ETX×(2N+1)·STX is received, a dot pattern of ETX is printed by N dot columns, and the graphics mode is reset.

3) In the graphics mode, when ETX·A is received, for instance a dot pattern of A is printed by one dot column, and the graphics mode is not reset.

ETX is aborted.

(2) Relationship between graphics data and printing dots

Dot-addressable graphics data are printed at the ascender position of normal script, and bits 0 to 6 of received data correspond respectively to bits 1 to 7 (bit 7 is not printed).



(3) Polarity of dot data

Logic 1: dot is printed.

Logic 0: blank

(4) Line feed command in dot-addressable graphics mode

Kind	Receiving code	Line feed	Carriage return
Graphics with CR	ETX·SO	14/144 (0.097) inch	Performed
Graphics without CR	ETX·DC4	14/144 (0.097) inch	Not performed
Text with CR	ETX·LF	Specified value	Performed
Text without CR	ETX·DC2	Specified value	Not performed

Notes: 1) Those graphics data that exceed the end of a line are aborted.

2) Dot-addressable graphics data are treated as blocks every 768 dot columns.

(5) Line height command

Command code: ESC·%·9·N

where N is any number between 00H and 7FH.

Quantity of line feed is given as N/144 inch (0/144 to 127/144 inch).

Notes: 1) If N=0, then the quantity of line feed is 0.

2) This command is valid only in text mode. If this command is received in dot-addressable graphics mode, a dot pattern of (ESC·%·0·N) is printed at each dot column.

(6) Printing speed

1/60- (0.017-) inch resolution (10 CPI)	1/72- (0.014-) inch resolution (12 CPI)
Equivalent to 133 CPI	Equivalent to 112 CPI
10 inches/second	7 inches/second

(7) Maximum dot columns per line

1/60- (0.017-) inch resolution (10 CPI)	1/72- (0.014-) inch resolution (12 CPI)
816 columns	979 columns

(8) Printing direction

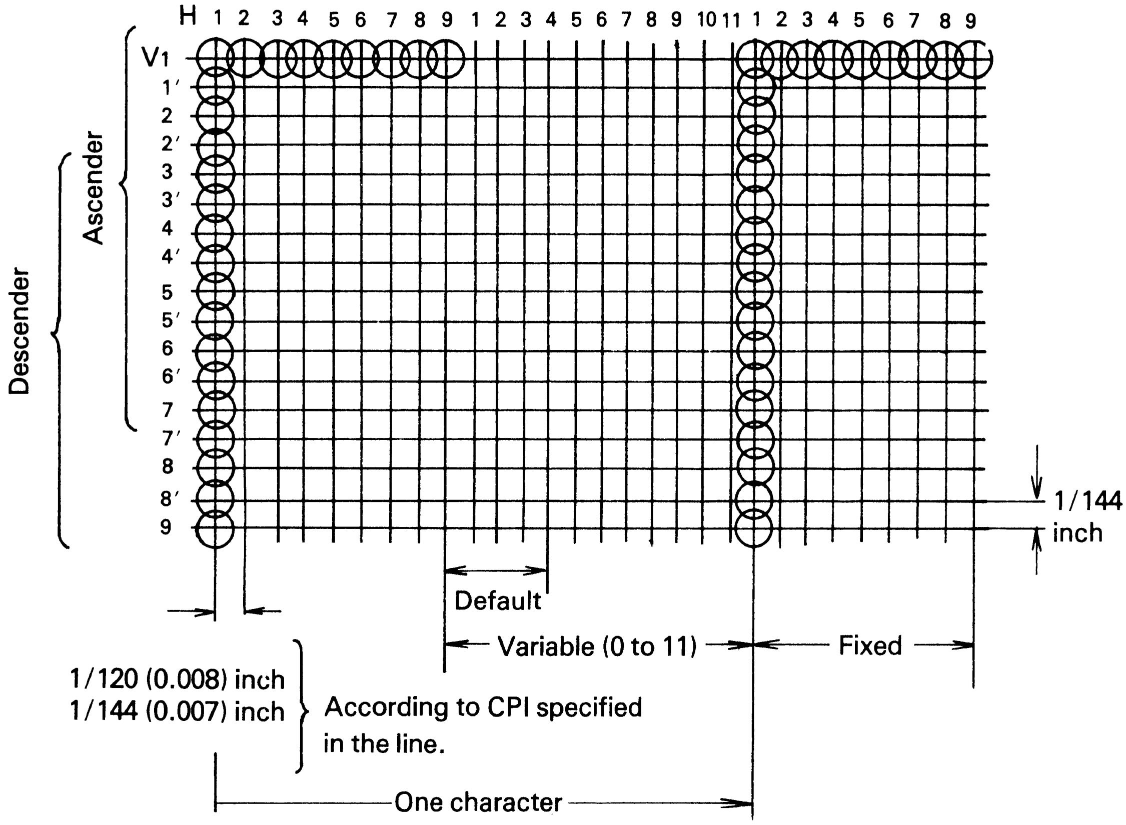
Those lines containing dot-addressable graphics data are always printed unidirectionally, from left to right.

(9) Dot-addressable graphics data in 17-CPI mode

In 17-CPI mode, dot-addressable graphics data (those data enclosed by ETX and ETX·STX) area aborted.

11. Correspondence-Quality (CQ) Printing Function

(1) Font



(2) Setting and resetting of CQ printing

Setting of CQ printing: ESC·1

Resetting of CQ printing: ESC·0 or ESC·2

(3) Printing direction

CQ printing is carried out in unidirectional, two-pass printing mode. However, a block as a whole can be printed bidirectionally (two-pass printing at 80 CPS).

(4) Character-to-character clearance command

ESC·N·n

where n is a hexadecimal number between 00H and 0BH, specifying the dot column table.

This command is valid only in CQ printing mode, and the specified clearance value is held until another value is specified.

Notes: *1) The block next to a CQ printing block in the same line is shifted down 1/144 (0.007) inch.*

2) Number of characters:

ASCII: 96 characters (including SP and DEL)

Foreign language: 32 characters

3) *CQ printing mode cannot be applied to the downline loadable font.*

12. Downline Loadable Character Generator

(1) Loading method

Ascender command

ESC·%·A·X (11 dot-column data)

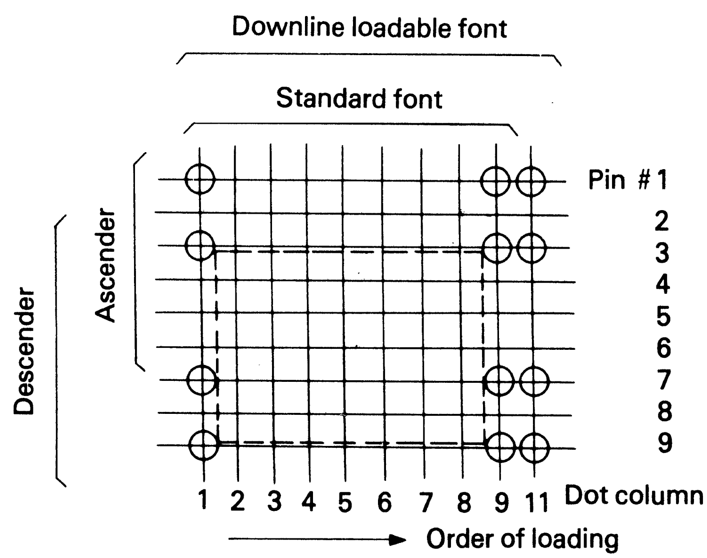
Descender command

ESC·%·D·X (11 dot-column data)

where X is a character code between 20H and 7FH.

(2) Font

bit	Ascender	Descender
bit 0	Pin #1	Pin #3
〃 1	2	4
〃 2	3	5
〃 3	4	6
〃 4	5	7
〃 5	6	8
〃 6	7	9
〃 7	(Not used)	(Not used)



(3) Setting and resetting of downline loadable CG

Setting code: ESC·2

Resetting code: ESC·0 or ESC·1

Notes: 1) *Psuedo 11 × 7 dots*

Head pins # 1 to # 7 for ascender

Head pins # 3 to # 9 for descender

2) *Upon loading, the input format check of adjacent dots is performed. If dots are adjacent, the latter dot is stored as null in RAM. (No error display.)*

3) *RAM for downline loadable font is cleared when the power is turned on. If any code to which no dot pattern data has been loaded is received, the code is processed as an SP code.*

4) *Character code 20H is not necessarily dedicated to the SP code. Any dot pattern can be loaded to 20H. Any codes to which space has been loaded are treated as SP function codes.*

5) *IF the DEL code (7FH) is made invalid by DIP switch, code 7FH of the downline loadable font is also made invalid.*

6) *No different fonts of the same code can be printed in the same line. The most recently specified font is used.*

13. Underline Function

ESC·C: Specifies underline printing for the following data.

ESC·D: Terminates underline printing.

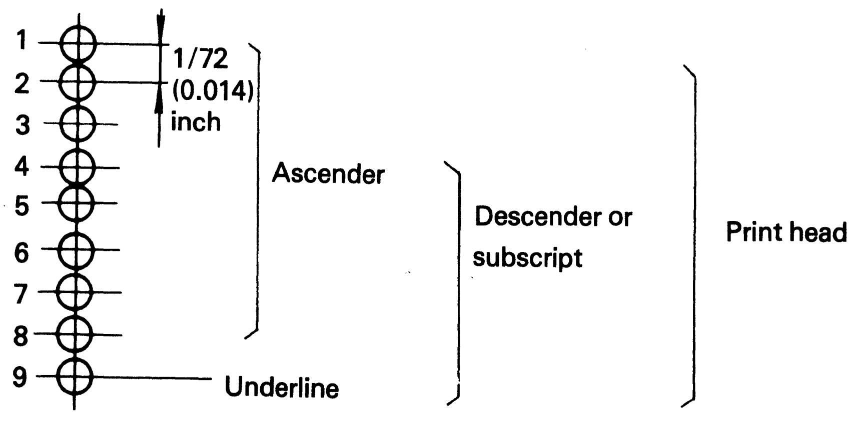
Notes: 1) *Underline is printed using head pin # 9, however, underline cannot be applied to dot-addressable graphics mode.*

2) *Underline for superscript is printed at the head pin # 9 position of normal script.*

3) *Underline is not printed during HT or POS.*

4) *Underline for subscript or descender is printed with the head pin # 9 position overlapped.*

6 LPI/8 LPI



5) *Underline can be applied to the following fonts:*

•Standard font

•Downline loadable font

•CQ font

14. Superscript and Subscript Printing

ESC·J: Specifies superscript printing for the following data.

ESC·K: Terminates superscript printing.

ESC·L: Specifies subscript printing for the following data.

ESC·M: Terminates subscript printing.

Notes: 1) *If superscript is specified in 8-LPI mode, the superscript characters overlap with the previous line.*

2) *When subscript is specified together with underline, subscript is printed using pins 3 to 9 and underline is printed using pin 9.*

3) *When superscript is specified together with underline, underline is printed at the pin 9 position of normal script.*

4) *Superscript and subscript printing can be applied to the following fonts:*

•Standard font

•Downline loadable font

•CQ font

5) *Superscript is printed as normal script in the following cases:*

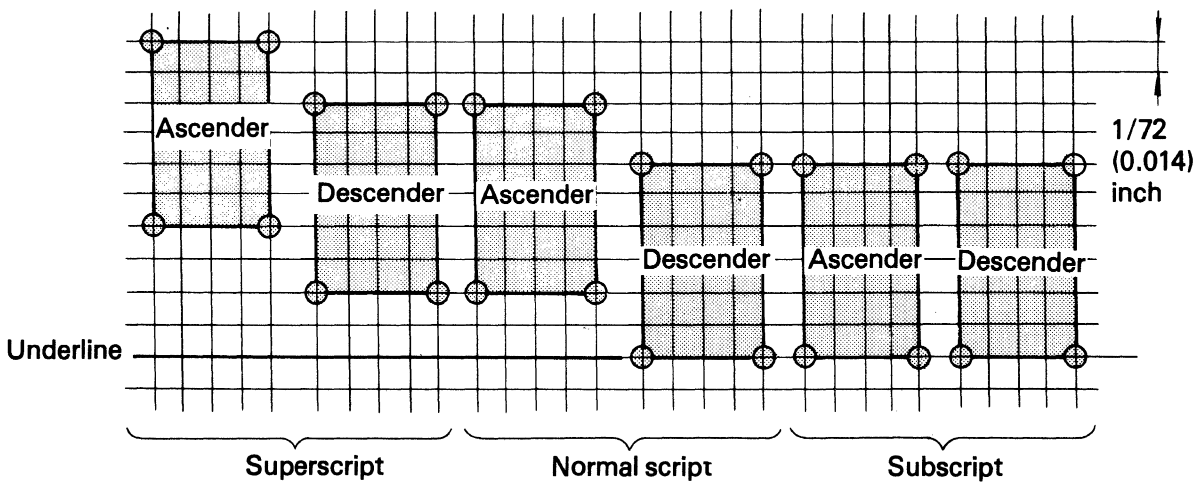
a) *When superscript printing is specified after graphics block.*

b) *When superscript printing is specified after graphics mode line feed (ETX·SO or ETX·DC4).*

c) *When superscript printing is specified after a line height command (ESC·%·9·n) that specifies line feed of 4/144 (0.028) inch or less.*

d) *When superscript printing is specified after the second overprinting by CR.*

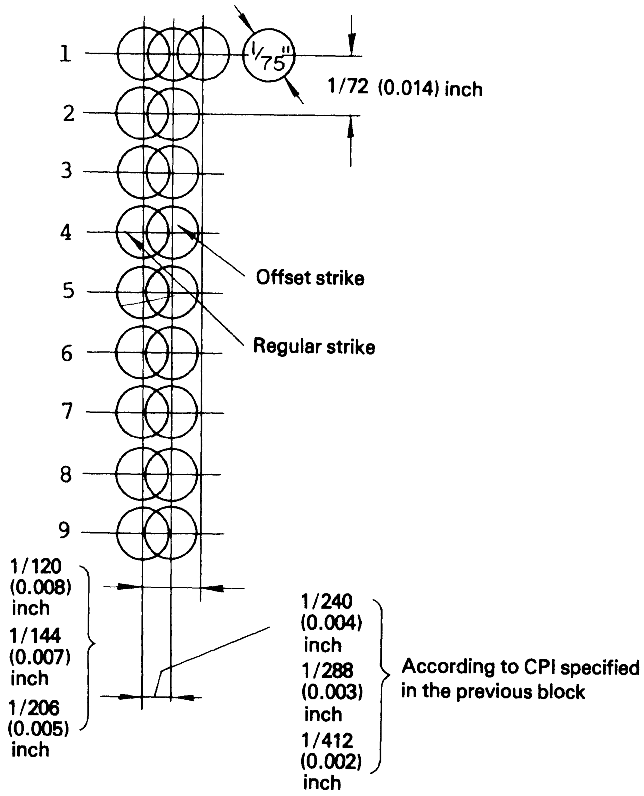
6) *Relationship of printing positions*



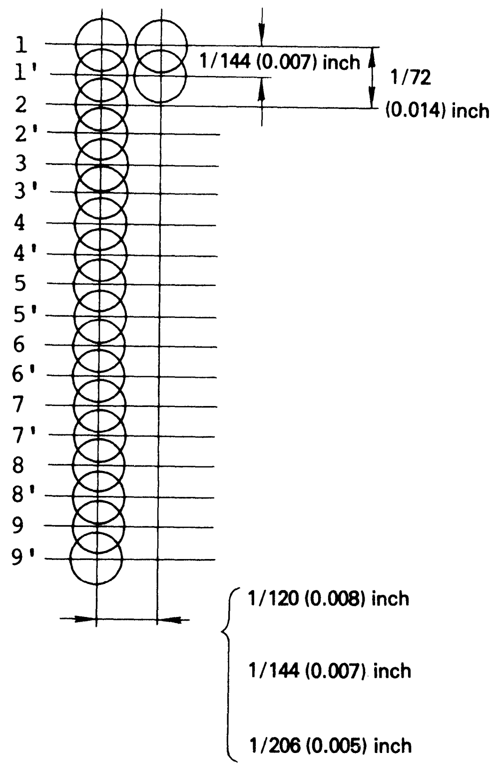
15. Emphasized and Enhanced Printing

(1) Printing method

Emphasized printing



Enhanced printing



(2) Setting and resetting of emphasized and enhanced printing

ESC·T: Specifies emphasized printing.

ESC·H: Specifies enhanced printing.

ESC·I, CR, LF, auto carriage return, VT, or FF: Terminates emphasized/enhanced printing.

Notes: 1) *The printing speed of a block containing emphasized characters is reduced to approximately half.*

2) *Enhanced characters are printed in unidirectional, two-pass printing mode, but the line as a whole can be printed bidirectionally.*

3) *The block next to a block containing enhanced characters is shifted down 1/144 (0.007) inch.*

16. Select/Deselect Function

When the SEL LED is off, depressing the SEL switch or reception of DC1 code turns the SEL LED on, and sets the printer in select (online) state. In select state, the printer can receive and print data line-by-line.

When the SEL LED is on, depressing the SEL switch or reception of DC3 code turns the SEL LED off, and sets the printer in deselect (offline) state. In deselect state, the printer does not accept any input codes other than DC1 code.

Note: The printer is set in select (online) state when the power is turned on.

17. CAN Command

(1) When CAN code is received, data of the block that contains this CAN code are cleared.

(a) If the data in the buffer contains CPI changes, the block starting from the last CPI change is cleared.

(b) If the data in the buffer contains dot-addressable graphics data, the block after the end of the previous graphics data is cleared.

(c) For other than the above two cases, the block starting from the beginning of the line (i.e., all data in the buffer) is cleared.

(2) When CAN code is received, the following print modes are set to the default values:

- Expanded mode—Normal character mode
- CPI mode—~~10 CPI~~
- LPI mode—6 LPI
- Downline loadable font—Standard font
- CQ printing mode—OFF
- Underline mode—OFF
- Superscript mode—OFF
- Subscript mode—OFF
- Enhanced mode—OFF
- Emphasized mode—OFF
- Character-to-character clearance—OFF (three dot columns)

(3) When CAN code is received, the following print control data are not cleared:

- Horizontal tab set data
- Vertical tab set data
- Form feed set data
- Left margin data

18. Paper-Out Detection

Paper out is detected by microswitch when the remaining paper length is about 50 mm (2 inches) from the printing position for rear paper feed, and about 25 mm (1 inch) for bottom paper feed.

Due to input speed differences, etc, 3 to 5 lines can be printed after paper-out detection. After printing of the last line, the paper-out signal is output to the interface, the PAPER LED lights, and the printer stops.

The paper-out state is released by depressing the SEL switch after installing new paper.

19. Initial Reset Condition

When power is turned on or when the $\overline{\text{I-PRIME}}$ signal is received from the parallel interface, the printer is set in the following initial state:

(1) Character pitch: 10 CPI

(2) Line feed pitch: 6 LPI

(3) Select/deselect: Select (online) (Deselect if in paper-out state)

(4) Form length: Form length set by the rotary switch

20. Self Check Function

20.1 ROM/RAM check function

When power is turned on, a ROM/RAM check is performed in the initial processing. If a fault is found in the checking, the PAPER LED lights and all operations are made invalid. A hash total is checked for both the program area and character generator area.

20.2 Local test printing

The following test printing is performed by turning on the power switch with the LF key depressed:

(1) Firmware revision printout

(2) Rolling ASCII pattern printout

The test printing is terminated after printing one pattern (17 lines). When the test printing completes, the usual initial processing is performed.

Note: Remove the external interface cable prior to local test printing.

20.3 Print head temperature check function

If the print head temperature exceeds about 100°C during continuous printing, the bidirectional printing mode is changed to unidirectional printing mode. When the print head cools below 100°C, the unidirectional printing mode is changed back to bidirectional printing mode. However, if the print head temperature is still over 100°C after unidirectional printing of 66 print blocks, the printing operation is halted until the print head cools below 100°C.

SINCE 1881

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