

**Radio Shack®**

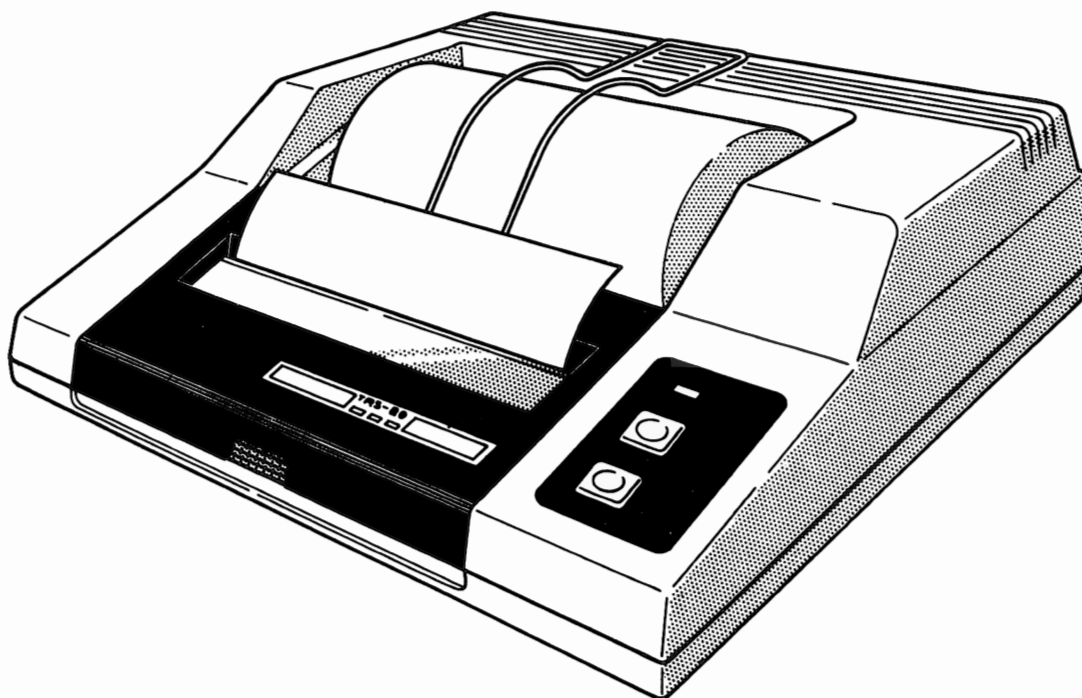
# **ServiceManual**

**26-1192**

## **TRS-80**

### **COLOR GRAPHIC PRINTER**

**Catalog Number : 26-1192**



CUSTOM MANUFACTURED FOR RADIO SHACK , A DIVISION OF TANDY CORPORATION

## **IMPORTANT NOTICE:**

This Service Manual is written for Service Technicians who have a thorough understanding of electronics and computer circuitry. It is not written at comprehension level for the beginner.

Radio Shack will not be liable for any damage caused, or alleged to be caused, by the customer or any other person using this Service Manual to repair, modify, or alter any TRS-80® computer in any manner.

Many parts of the computer electronics are very sensitive and can be easily damaged by improper servicing. We strongly suggest that for proper servicing, the computer be returned to Radio Shack®.

While this SERVICE manual has been carefully prepared, Radio Shack® will not be responsible for any errors or omissions and will not be liable for damages resulting therefrom.

Opening the TRS-80® computer housing, breaking the housing seal, or altering or modifying the computer will void the warranties given at time of purchase.



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## 1. SPECIFICATIONS

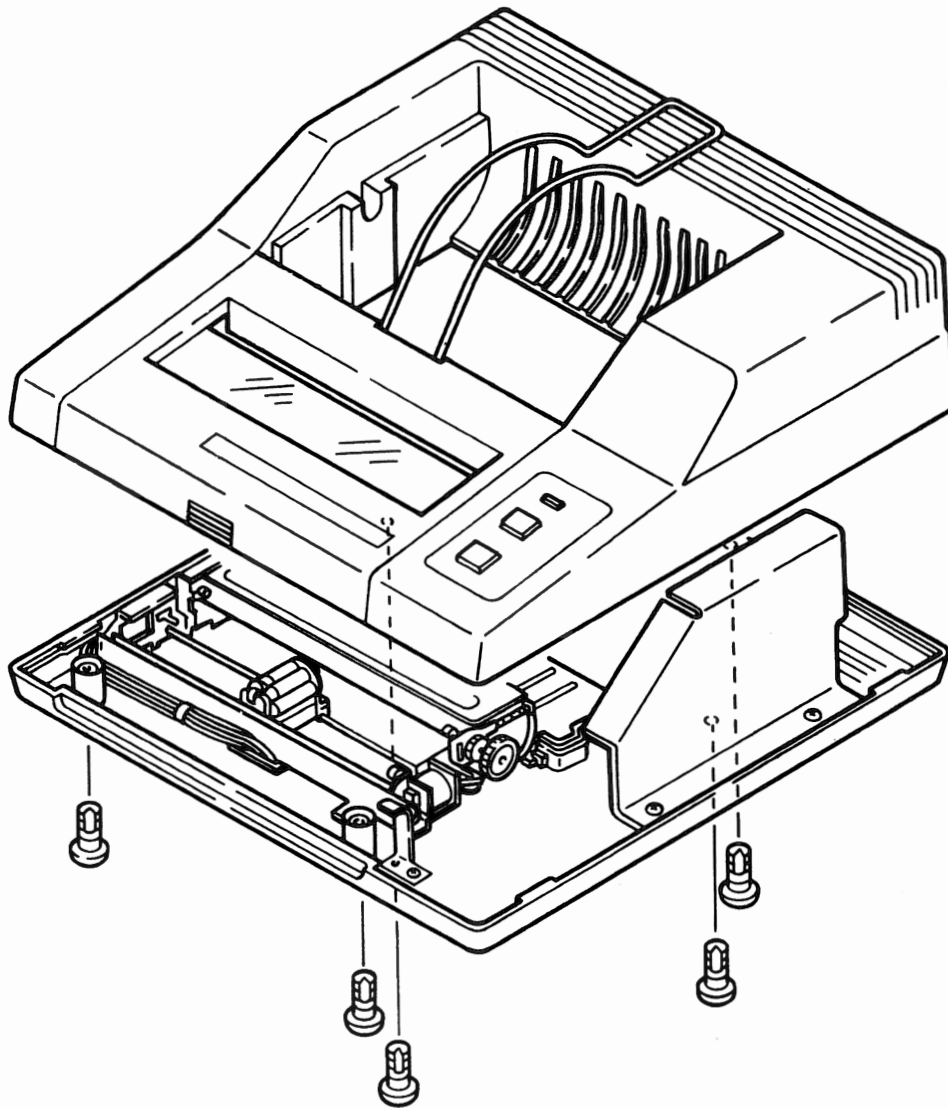
- (1) Plotting/Printing system  
Ball point Pen, four colors, rotary selection
- (2) Plotting speed  
In horizontal direction : Approx. 52 mm/sec. (2.05 inches/sec.)  
At 45° to horizontal : Approx. 73 mm/sec. (2.87 inches/sec.)
- (3) Printing speed  
Approx. 12 characters/sec.  
(96 ASCII characters, average speed when printing 1.2 × 0.8 mm characters.)
- (4) Resolution  
0.2 mm/step (0.00787 inches)
- (5) Effective plotting range  
X axis: 96 mm (3.78 inches) Y axis: no limit (determined by software input)
- (6) Characters per line  
Determined by size of characters (80, 40, 26 characters/line etc.)  
Character per line =  $\text{INT} (480 / (1 + n) * 6)$        $n = 0 \text{ to } 15$
- (7) Accuracy  
Repetition : 0.2 mm max.  
Movement : 0.3 mm max.  
Distance : X axis 0.5% max.  
                 Y axis 1.0% max.
- (8) Dimensions  
210 (W) × 216 (D) × 75 (H) mm (8.2 × 8.5 × 2.9 inches) (With-out roll paper)
- (9) Weight  
0.8 kg (1.7 lbs) (printer only)
- (10) Pens  
Special ball point pens (black, blue, red, green) Life : approx. 250 meter
- (11) Paper  
Roll paper width : 114.5 ± 0.2 mm (4.5 inches)  
Diameter : 70 mm max.  
Weight : 52.3 gr (1,000 mm \* 1,000 mm) : Equivalent to 14 lbs bond
- (12) Interfaces  
8 bit parallel interface (handshake system using STROBE, BUSY, ACKNOWLEDGE)  
RS-232C serial interface (600 bps, using DATA, BUSY)
- (13) Selectable modes  
Self check mode : 96 ASCII characters printed in four colours  
Text mode : Normal serial printer operation  
Graphic mode : Images plotted using the various commands
- (14) Operating conditions  
Temperature : Meet specifications between 18.3°C/35°C (64.9°F/95°F)  
Operate (need not meet specs) 0°C/43°C (32°F/109°F)  
Storage without damage -40°C/71°C (-14°F/160°F)
- (15) Life  
300 hour (at 70% duty)
- (16) Power Supply (AC Adapter DAG-2301)  
input : AC 120V 60Hz  
output: DC 9.8V 1.2A  
Power Consumption: 23W



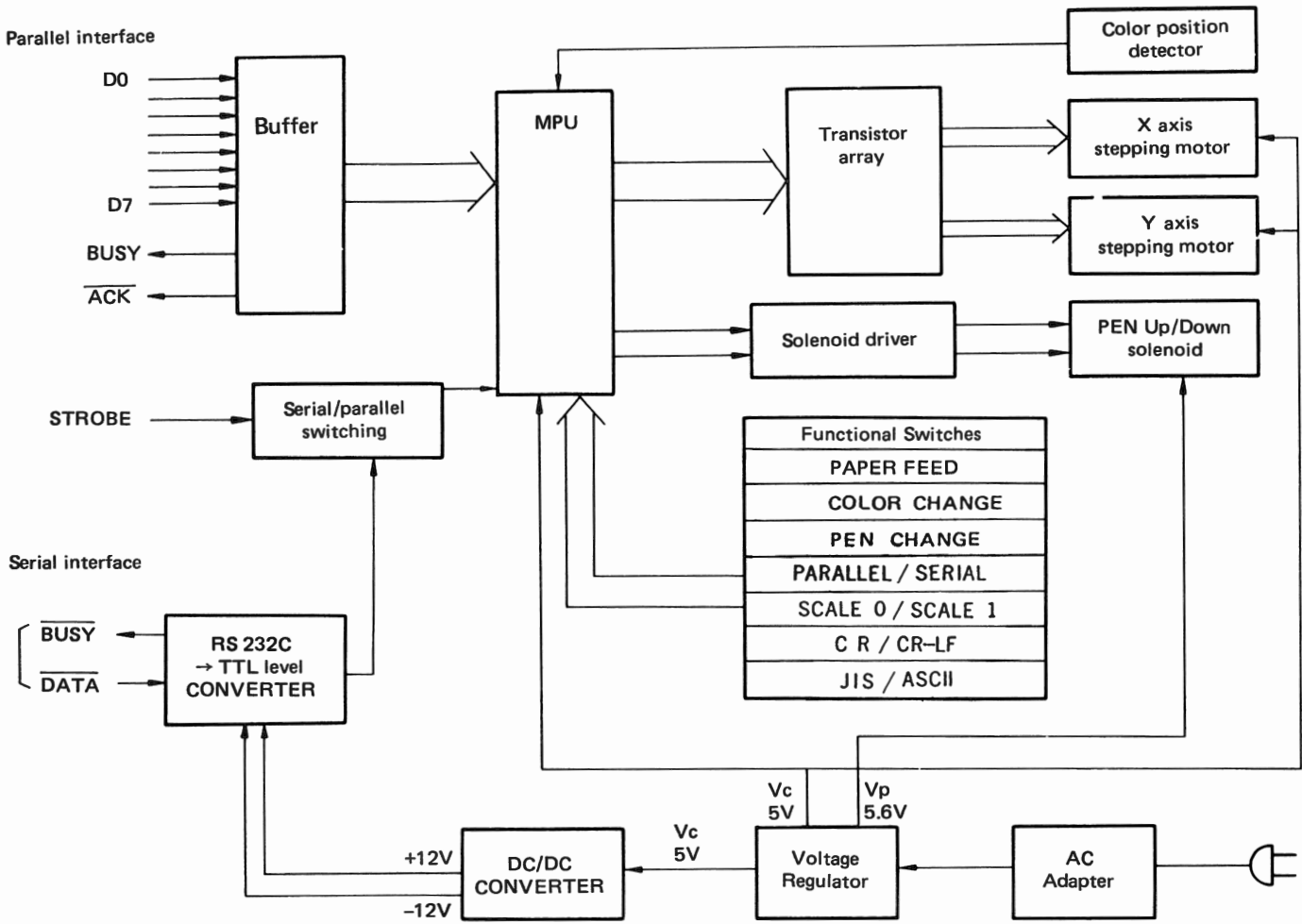
## 2. DISASSEMBLY INSTRUCTION

Take off the upper case after removing the five screws from the bottom.

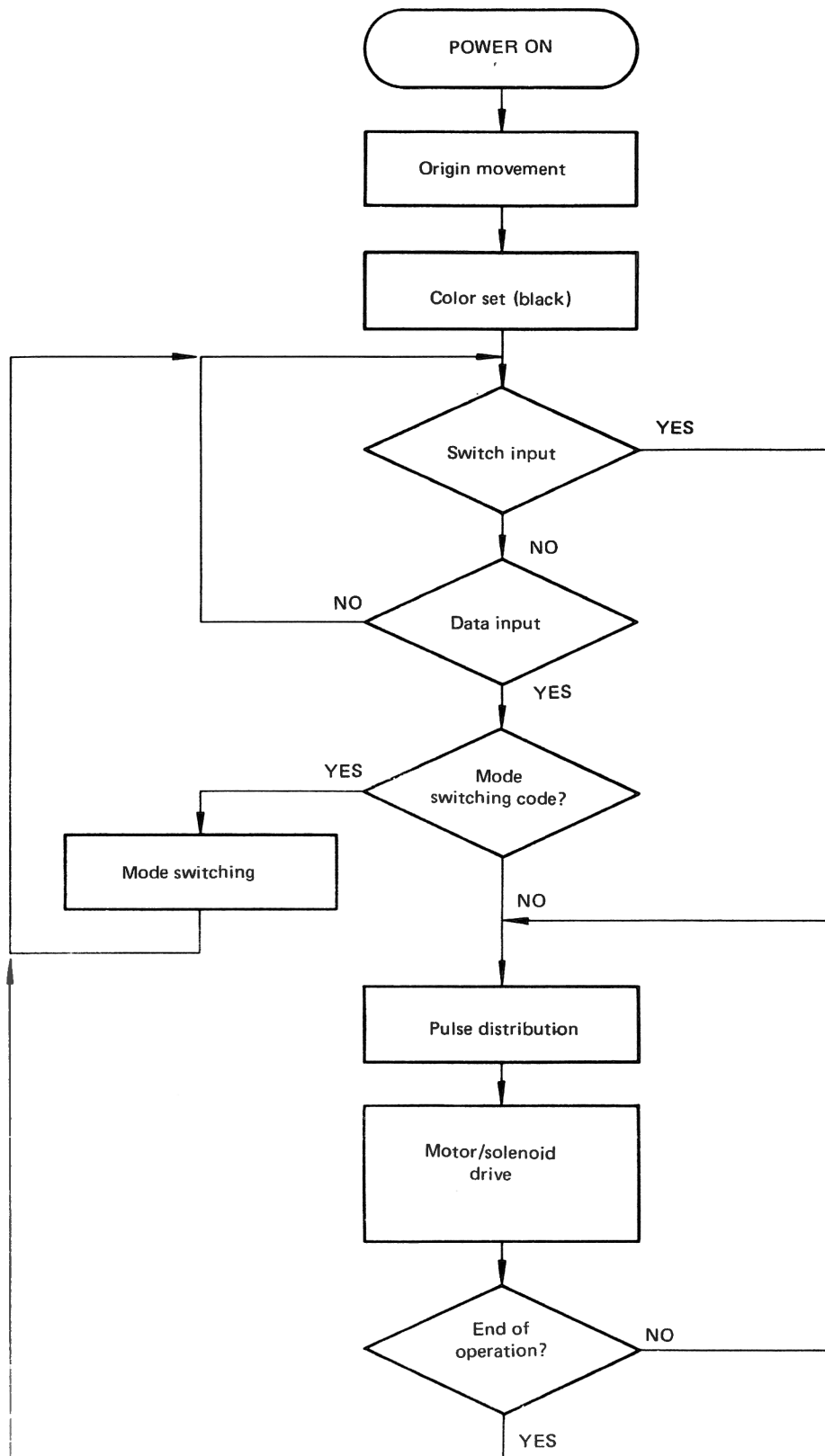
**Note:** When taking off the upper case, the jack of the serial interface connector and the upper part of the P.C.B. hit each other. So, try to take it off in a straight upward direction.



3. BASIC BLOCK DIAGRAM



#### 4. GENERAL OPERATION FLOW CHART



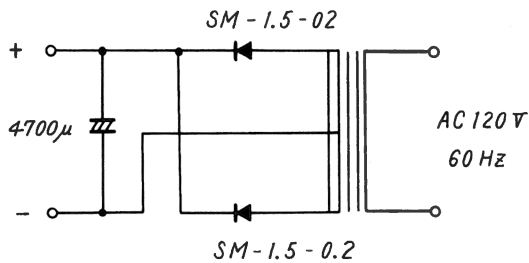
## 5. OPERATIONAL DESCRIPTION

### (1) Control Unit

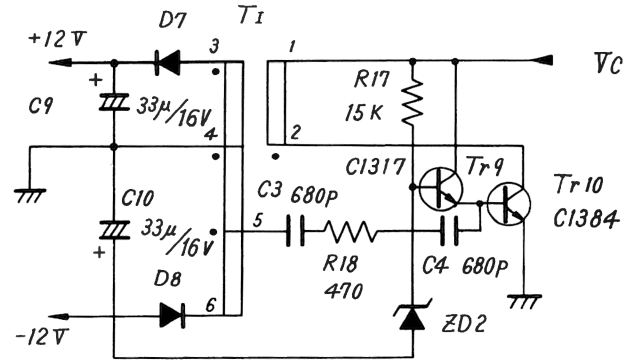
#### 1) Power supply circuit

The main power supply is an AC adapter which is encased separately from the main unit. Regulated outputs are obtained through a 3-terminal regulator in the main unit. The power supply system consists of

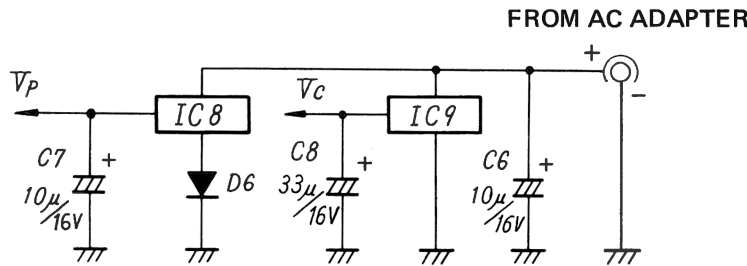
- $V_c$   $5V \pm 5\%$  for logic circuit and for driving the X, Y-motor
- $V_p$   $5.6 + 0.3V$  for driving the Pen UP/DOWN solenoid  
 $-0.85V$
- $\pm 12V \pm 20\%$  for serial interface ( $\pm 12V$  is obtained from  $V_c$  through a DC-DC converter circuit)



1) AC adapter



3)  $\pm 12V$



2)  $V_c, V_p$

Fig. 1 Power supply circuit

#### 2) MPU (Microprocessing unit) (HD6805V1A08P)

The MPU is an N-MOS one-chip microcomputer with a built-in 4K ROM, a 96-byte RAM and a clock circuit. Most of the IC pins are used as I/O ports.

#### 3) Interface

The interface circuits of the unit consist of an 8-bit parallel interface and RS-232C (serial) interface which can be changed over by a switch. (The parallel interface works with S1,1 OFF and the serial interface can be used with the switch ON. Provided, however, that the parallel interface and the serial interface can be changed over only after the power switch is turned off once, then turned on again.)

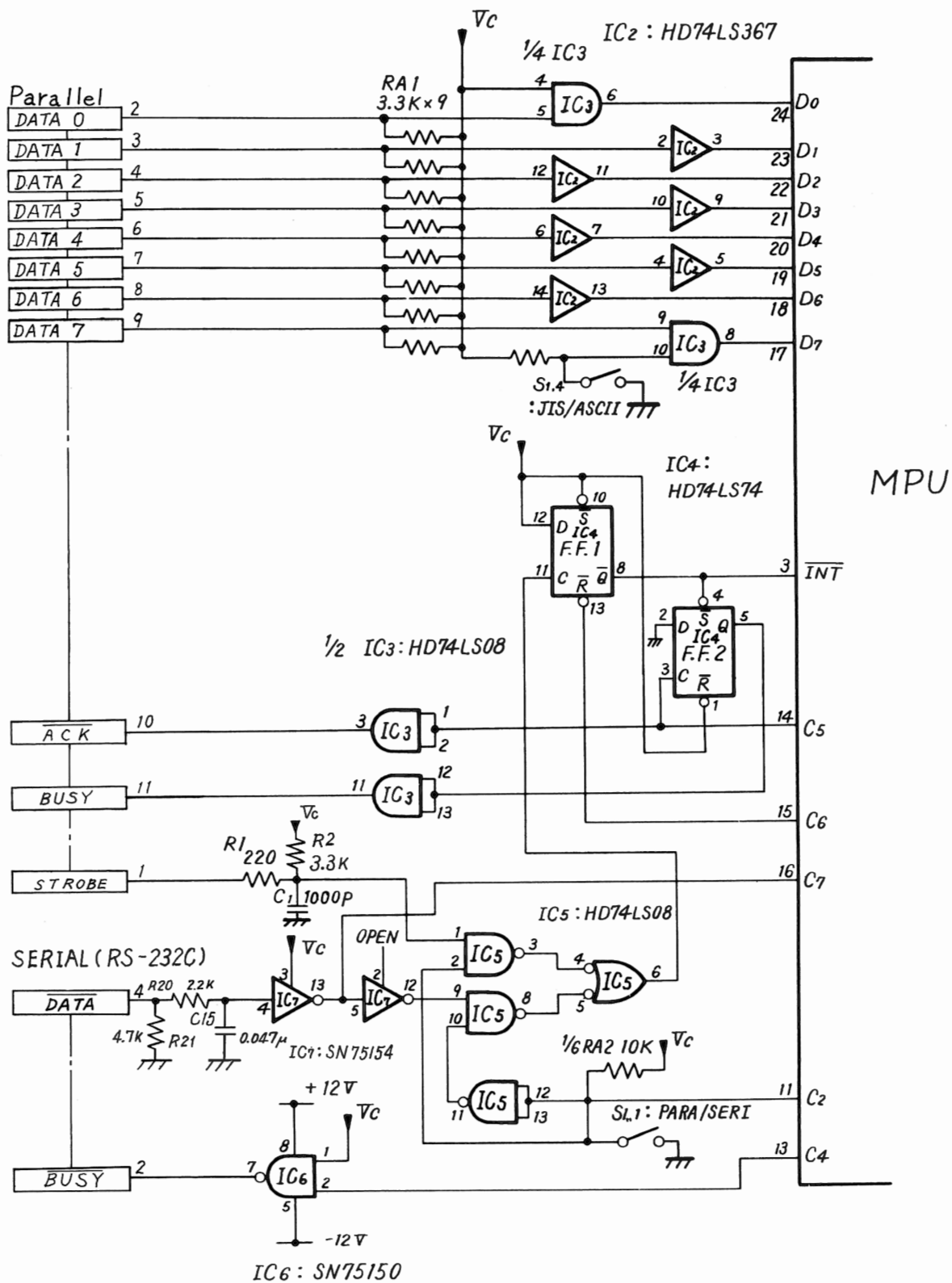


Fig. 2 Parallel/serial interface circuits

- Parallel interface

The parallel interface is composed of the following signals:

**STB (Strobe):** High going strobe of  $1.5\ \mu\text{Sec}$  duration from the host computer used to clock data into the printer logic.

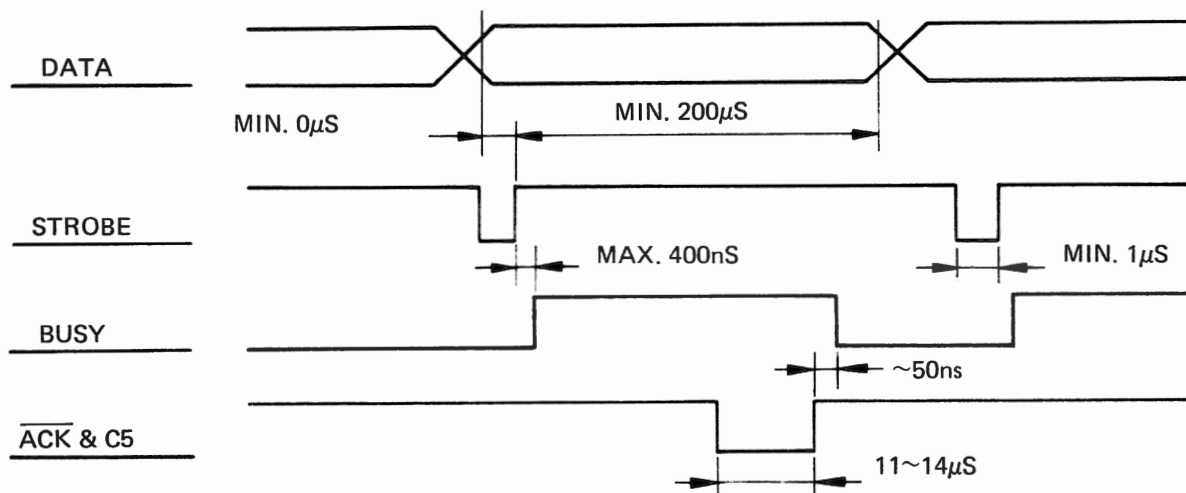
**D0–D7 (Data lines):** 8-bit data input lines from the host computer to the printer logic. All eight data lines have pull up resistors. (NOTE: If the computer uses 7-bit data (D0–D6), DATA line 7 <the last data bit D7> must be at a logic low. This can be achieved by closing switch 4 of the DIP switch located on the back of the unit.)

**BUSY (Logic high):** Signal from printer to computer indicating that the printer cannot receive data.

**ACK (Acknowledge Not):** Low going signal to the host computer indicating that data has been received.

The above signals are required for the parallel interface connector.

From the computer, the STB (Strobe) signal passes through two NAND gates (IC5) and is connected to the clock input of FF1 (IC4). The output Q of IC4 is connected to INT of the MPU. The INT terminal is an interrupt input which accepts an interrupt at the leading edge of the input signal. Pin 15 of the MPU is C6 which resets FF1 (IC4) before the next incoming strobe signal. The Q output of FF1 (IC4) is also connected to  $\bar{S}$  input of flip-flop 2 so that Q output of flip-flop 2 changes from "Low" to "High" at STB signal input. This signal is connected to the BUSY terminal through IC3 gate. C5 output of the MPU is connected to the ACK terminal via the IC3 gate and also to clock input of IC4 flip-flop 2 (IC4) so that this signal switches the BUSY terminal from "High" to "Low" to enable the next data input. The timing of the above-mentioned process is shown in Fig. 3.



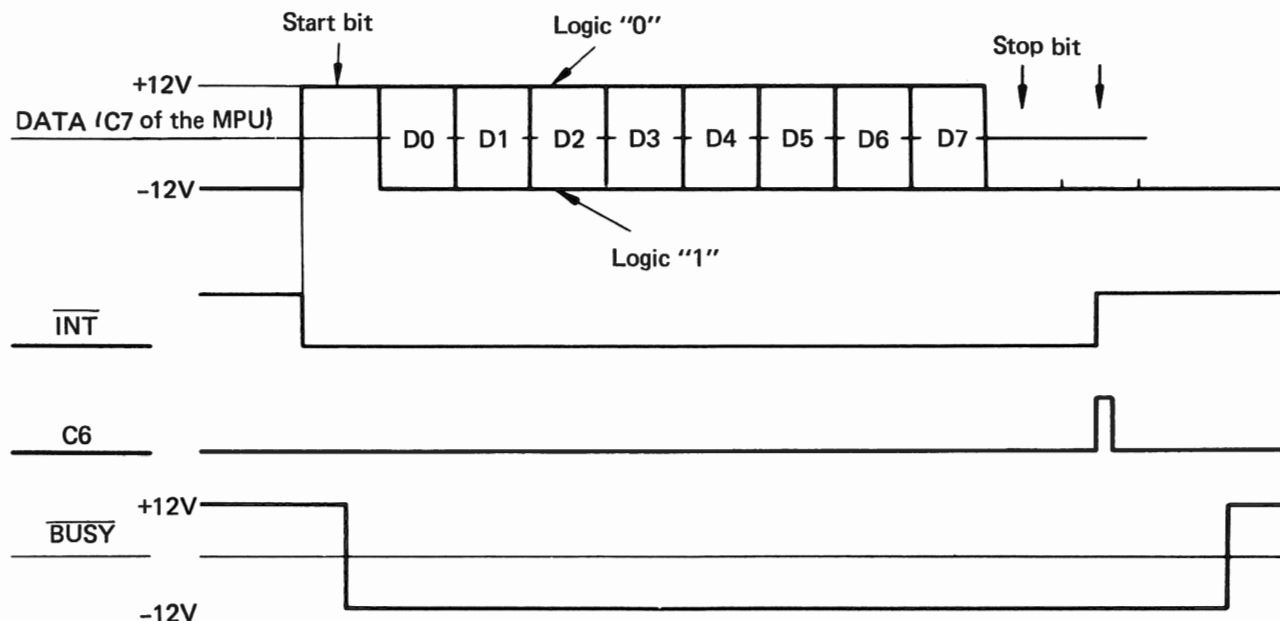
**Fig. 3 Parallel interface timing chart**

- Serial interface

This is an RS-232C level interface which consists of the following signal lines:

- **DATA** Serial data input. The baud rate is fixed at 600 bps.
- **BUSY** "High" (+12V) on the output of IC6 enables data input from the computer.





**Fig. 4 Serial interface timing chart**

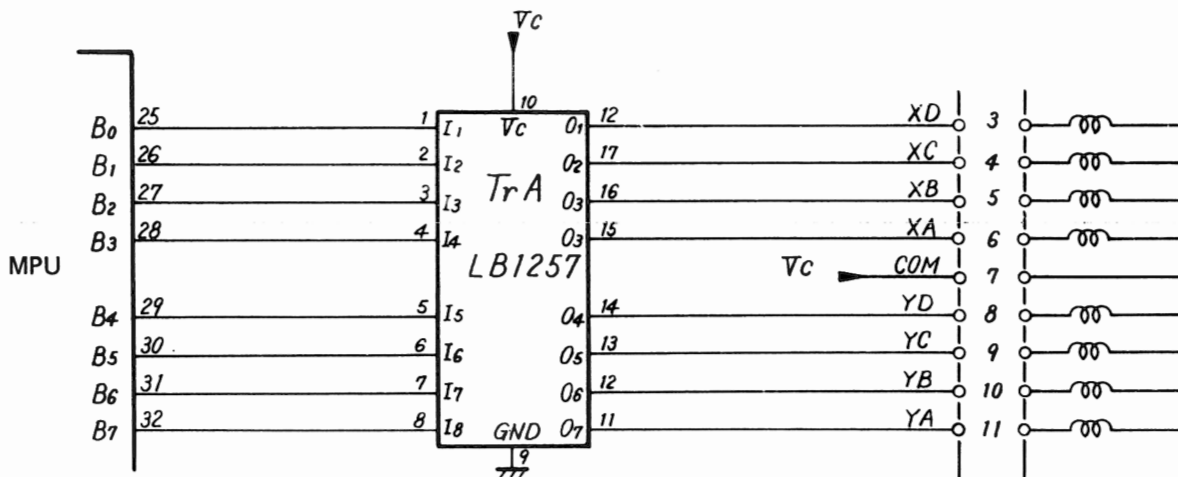
Fig. 4 shows the interface timing chart when using the serial interface.

The leading edge of the incoming serial data byte is gated through IC5 and clocks FF1 (IC4). This generates an interrupt to the MPU. The MPU reads the incoming serial data at C7 (pin 16) of the MPU. During the last stop bit of serial data byte a single pulse is output from the MPU at C6 (pin 15), this signal resets FF1 (IC4) before the next data byte.

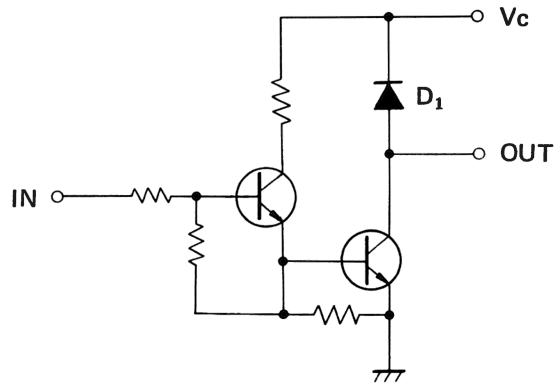
#### 4) X, Y motor drive circuit

The LB1257 has active high inputs in the equivalent circuit in Fig. 6. D1 is a surge absorbing diode. The X, Y motor is a stepping motor driven by 2-phase excitation. Clock pulses to the motor are approximately 4 msec which may be increased to 5 msec.

When data is input from the interface circuit during the motor operation. The motor power is supplied from Vc same as the circuit drive.



**Fig. 5 X, Y motor drive circuit**



**Fig. 6 LB1257 equivalent circuit (1 Phase)**

**5) Pen UP/DOWN solenoid drive circuit**

UP/DOWN of the ballpoint pen is controlled from C0 (Pin 9) and C1 (Pin 10) of the MPU so that Pen UP or DOWN status is held thereafter by giving a single pulse input of approx. 5.4 msec.

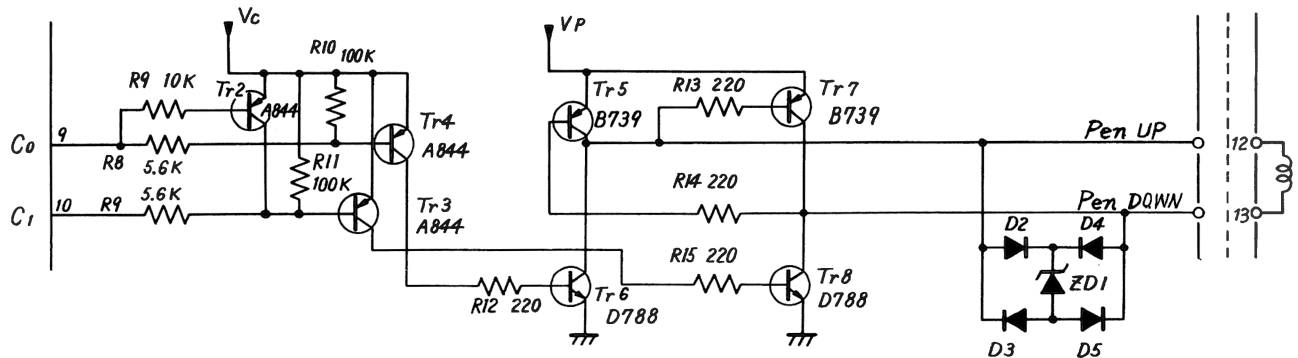
UP/DOWN action of the solenoid is determined by the current direction in the solenoid. The Pen UP current flows as

$V_p \rightarrow \text{Tr7} \rightarrow \text{Solenoid Pen Down terminal (No. 13)} \rightarrow \text{Solenoid Pen UP terminal (No. 12)} \rightarrow \text{Tr6} \rightarrow \text{GND.}$

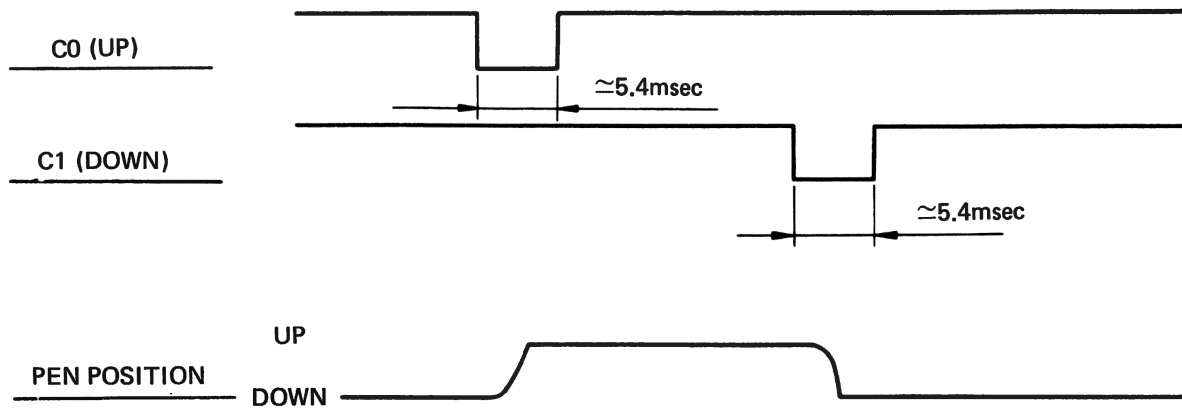
The Pen DOWN current flows as

$V_p \rightarrow \text{Tr5} \rightarrow \text{Solenoid Pen UP terminal (No. 12)} \rightarrow \text{Solenoid Pen DOWN terminal (No. 13)} \rightarrow \text{Tr8} \rightarrow \text{GND.}$

Tr2 transistor is to force Tr5 to be OFF when both C0 and C1 terminals output signals simultaneously for any cause. A surge voltage generated at the solenoid ON/OFF is suppressed to 16V by the bridge circuit which consists of diodes D2 through D5 and a zener diode ZD1. The solenoid drive power is supplied from Vp (5.6V).



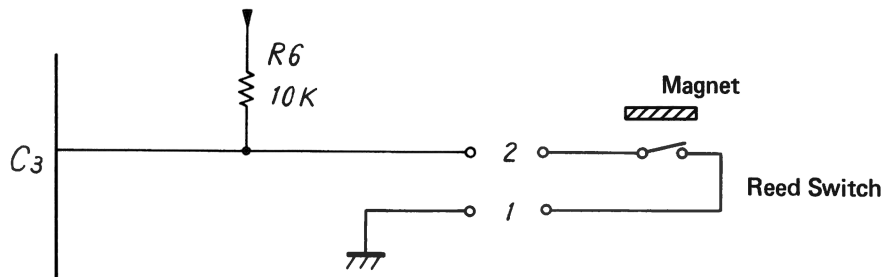
**Fig. 7 Pen UP/DOWN solenoid**



**Fig. 8 Pen UP/DOWN signal and pen position**

6) Color detect switch

The home position of the pen holder (as opposed to the home position of the carriage) is determined by a bar magnet mounted between two of the pen cartridges and reed switch mounted on the left side of the case next to the home position of the carriage. When the carriage is at home, and the pen holder is at home position at this time, the magnet will close the reed switch pulling the signal at C3 (pin 12) of the MPU to ground. (Ref. Fig. 9) This logic low will tell the MPU that the pen holder is at home position. If the magnet is not present the reed switch will remain open and pull up resistor R6 will force C3 (pin 12) to a logic high. When the printer is first turned on, the home position of the pen holder is selected so the MPU can keep track of which pen is in current use.



**Fig. 9 Color detect switch circuit**

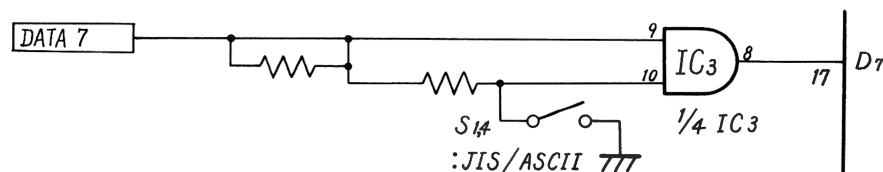
7) Operation switches

• Preset switches

Four switches are located on the rear of the printer.

a) JIS/ASCII code select switch (S14)

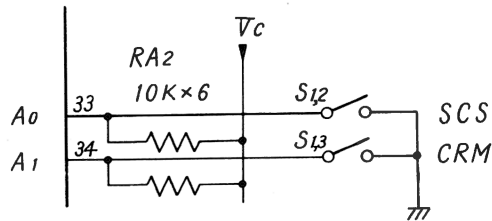
This is the fourth switch of the 4-pole DIP switch. This switch forces low Pin 10 of IC3, regardless of the status of incoming data bit 7. Pin 17. of the MPU is held low. This switch must be turned on when external data is in 7 bit ASCII code and the bit 7 is always High.



**Fig. 10 JIS/ASCII code select switch circuit**

b) Scale set switch (S1,2)

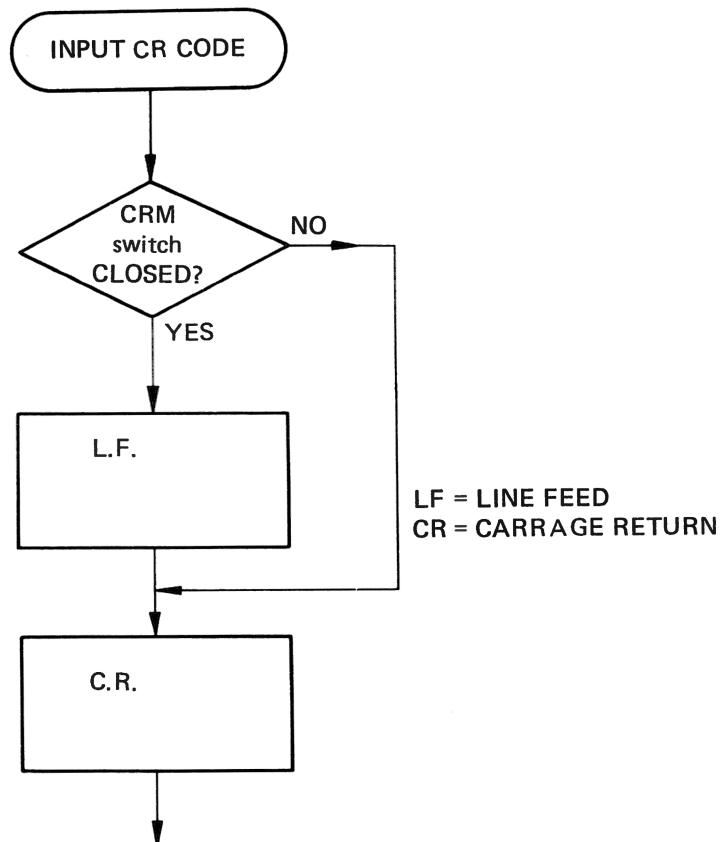
Character scale just after power ON is selected by this switch. The character scale to be printed can then be changed by sending a control code to the printer. This switch is located at the second position of the 4-pole DIP switch. The character size is set to the minimum with this switch OPEN, i.e. input to the MPU is High, and set to the double size with the switch ON.



**Fig. 11 SCS switch and CRM switch circuit diagram**

c) Carriage return/Carriage return-Line feed switch (S1,3)

This is the number three switch of the four position dip switch. The printer responds to control codes sent from the host computer. The carriage return code <CR> causes the printer to move the carriage to the home position. Some computers send a <CR> code and a <LF> (line feed) code together. Other computers send only a <CR> code and assume that the printer will automatically insert a line feed. With this switch close, the printer will add a line feed for every carriage return received. In the open position the printer must receive a carriage return and a line feed both from the computer. (Ref. Fig. 11 & Fig. 12)



**Fig. 12 Switch process (CR-CR/LF switch)**

d) Parallel/serial select switch (S1,1)

This switch selects either parallel or serial interface. It is located at the first switch of the 4-position DIP switch.

When this switch is closed it forces low the signal at C2 (pin 11) of the MPU. This low signal is also inverted at pin 11 of IC5 which forces high pin 10 of IC5. This gate is now enabled so that any signal present at pin 9 will also be present at pin 8 which is incoming serial data. The low signal at the switch also goes to pin 2 of IC5 which disables any output on pin 3. This stops STB from triggering FF1 (IC4) and allows the serial data input to control FF1. When the switch is open the pull up resistor in RA2 forces this line high, which tells the MPU that parallel interface is in use and allows STB to trigger FF1 and prevents and incoming signals on the serial data input from entering into the circuit.

The circuit diagram is shown in Fig. 13. It is necessary to turn the printer off and turn on it again after an interface is selected.

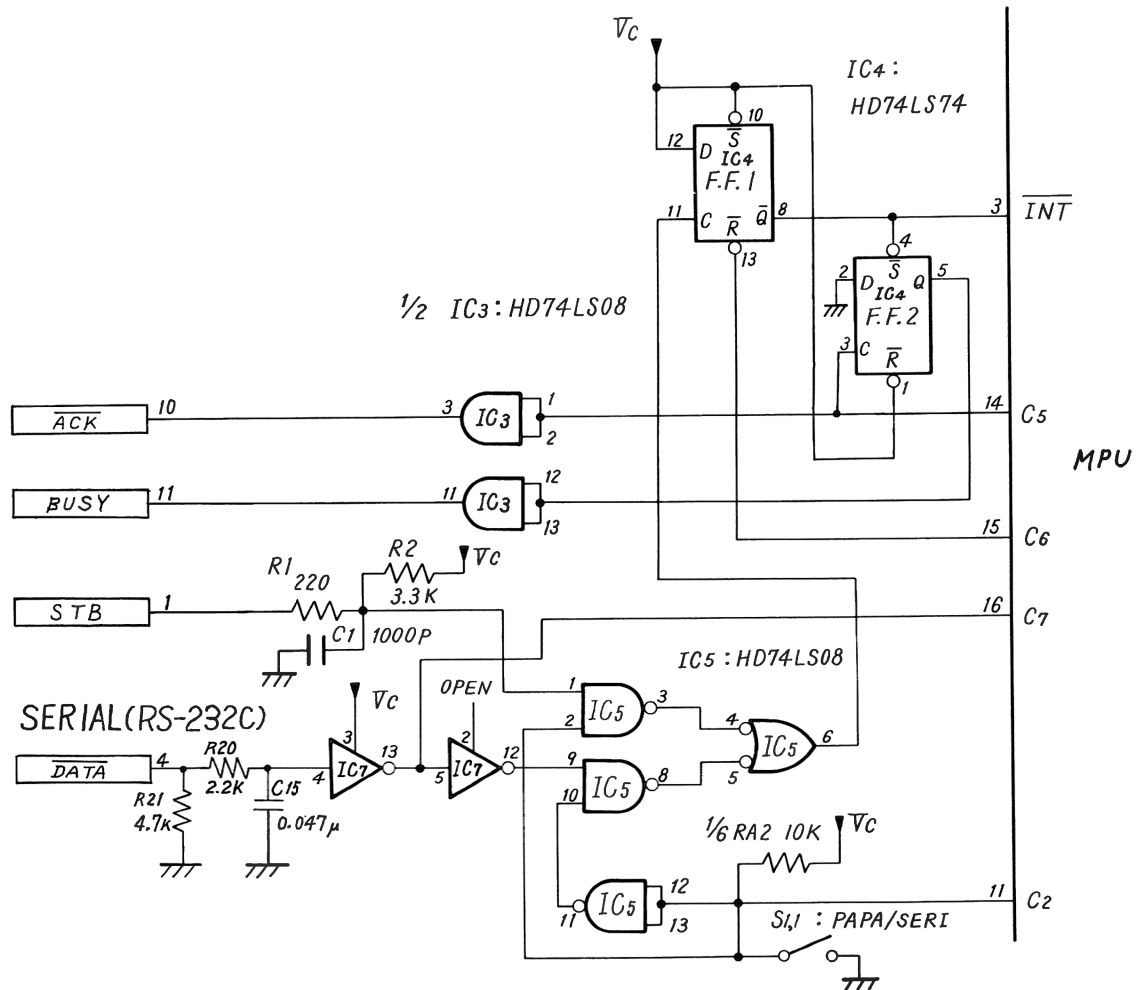


Fig. 13 Parallel/ Serial select switch circuit

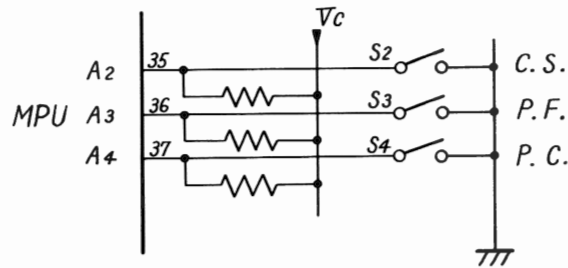
- Manual switches

Paper feed switch and Color select switch are located on the top face of the printer and Pen change switch can be seen by opening the top cover. These switches have the following functions:

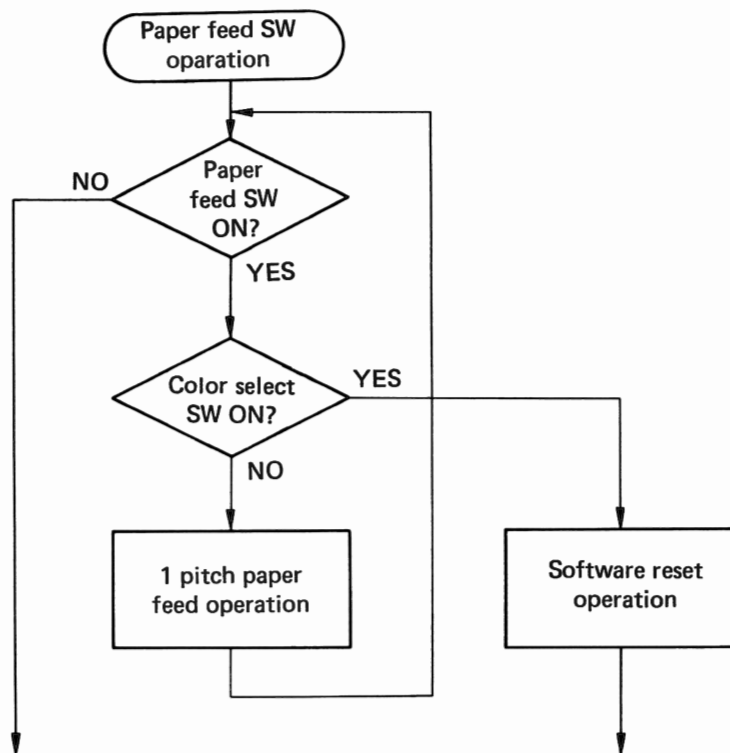
(Note) All of these switches are inoperable unless input data array ends with CR or LF code. When the printer stops under such a status, the switches are made operable by inputting CR code.

#### a) Paper feed switch

This switch is for feeding paper, and paper is fed during the making of this switch. When this switch is pressed simultaneously with the Color Select switch described later, software reset works to set the printer to the text mode and the carriage is moved to the home position. The switch makes by pressing its key top to send Low signal to the MPU which causes the MPU to make paper feed action. The circuit diagram is shown in Fig. 14 and the flow chart in Fig. 15.



**Fig. 14 Manual switch circuit**



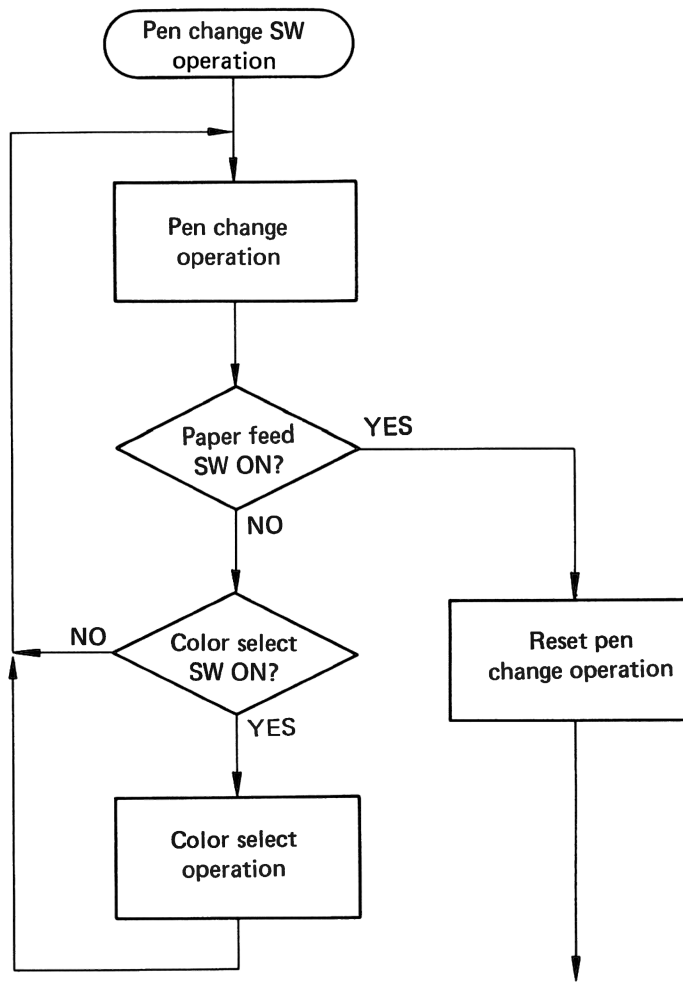
**Fig. 15 Paper feed operation**

#### b) Color select switch

This switch is for changing colors. When this switch makes, pen color is changed to the next color position. Pressing the key makes this switch to force a Low signal to the MPU causing color change action. The circuit diagram is shown in Fig. 14.

#### c) Pen change switch

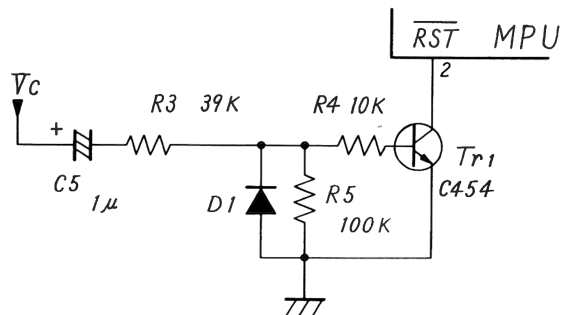
Pressing this switch gives Low signal to the MPU to perform pen change action. Thus, the carriage moves to the right end and stops. Then, the pen can be taken out by operating the Pen eject lever. After that, the printer returns to the normal operation mode by turning on the Paper Feed switch. If the Color Change switch is turned on, pen change action is made again after color change action. The circuit diagram is shown in Fig. 14 and the flow chart in Fig. 16.



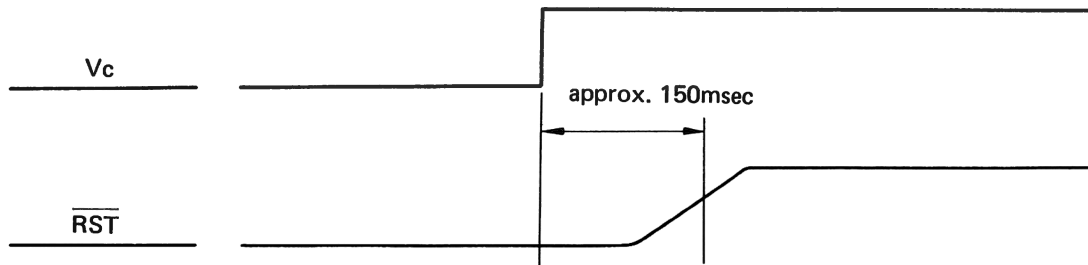
**Fig. 16 Pen change operation**

#### 8) Power ON reset (POR)

When the printer Power switch is turned on, the MPU is reset by the POR circuit shown in Fig. 17. Waveform during the reset operation is shown in Fig. 18. At power ON, the transistor (Tr1) is ON to give Low signal to the MPU  $\overline{RST}$  (pin 2) terminal. Capacitor C5 charges to  $V_C$  and Turns Tr1 OFF to make the  $\overline{RST}$  terminal at High level which allows the MPU to begin operation.



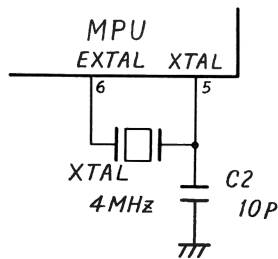
**Fig. 17 Power ON reset circuit**



**Fig. 18 Waveform at Power ON reset**

#### 9) Oscillator circuit

The MPU uses an external quartz oscillator which determines the operation frequency. The oscillation frequency is  $4\text{MHz} \pm 700\text{ppm}$ . The circuit diagram is shown in Fig. 19.



**Fig. 19 Oscillator circuit**

## (2) Printer Head

The printer roughly consists of six blocks — a frame, X-direction drive, Y-direction drive, pen drive mechanism, color change mechanism, and pen take-out mechanism sections. An explanation is made per each block.

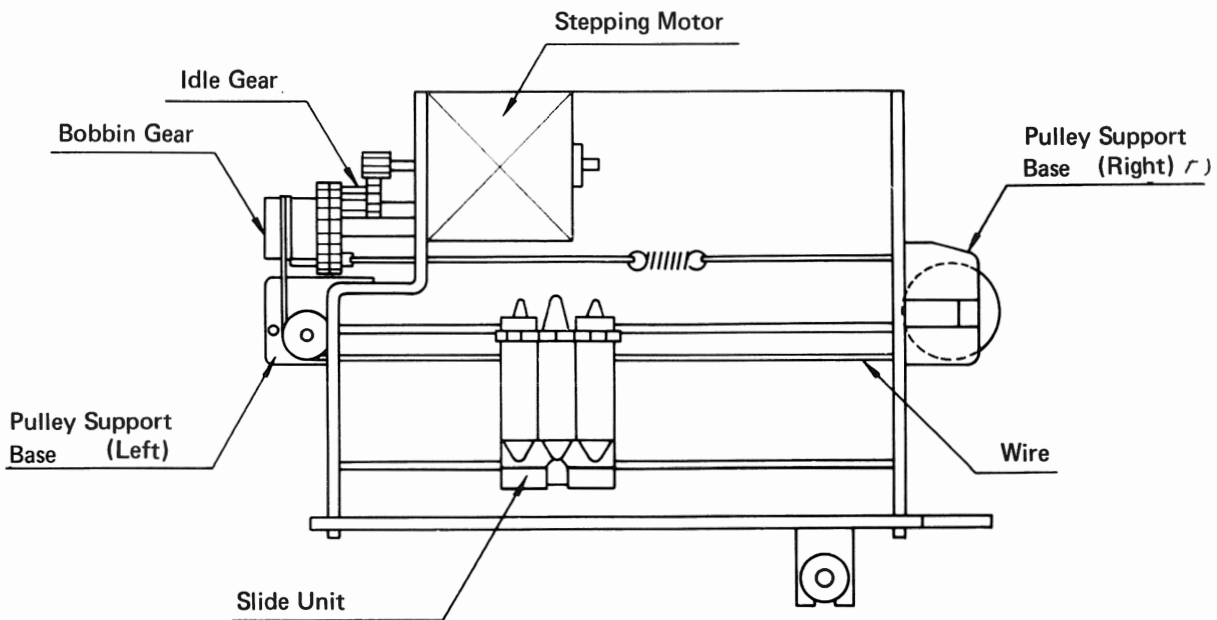
### 1) Frame Section

The frame section has a side plate (right), side plate (left), holding plate, and paper guide. The lower edge of the frame, bent in the shape of the letter L, acts as a mounting leg.

### 2) X Drive Mechanism Section

The principal elements of the X-direction drive mechanism are the X stepping motor, idle gear, bobbin gear, pulley support base (left), pulley support base (right), slider unit and wire.





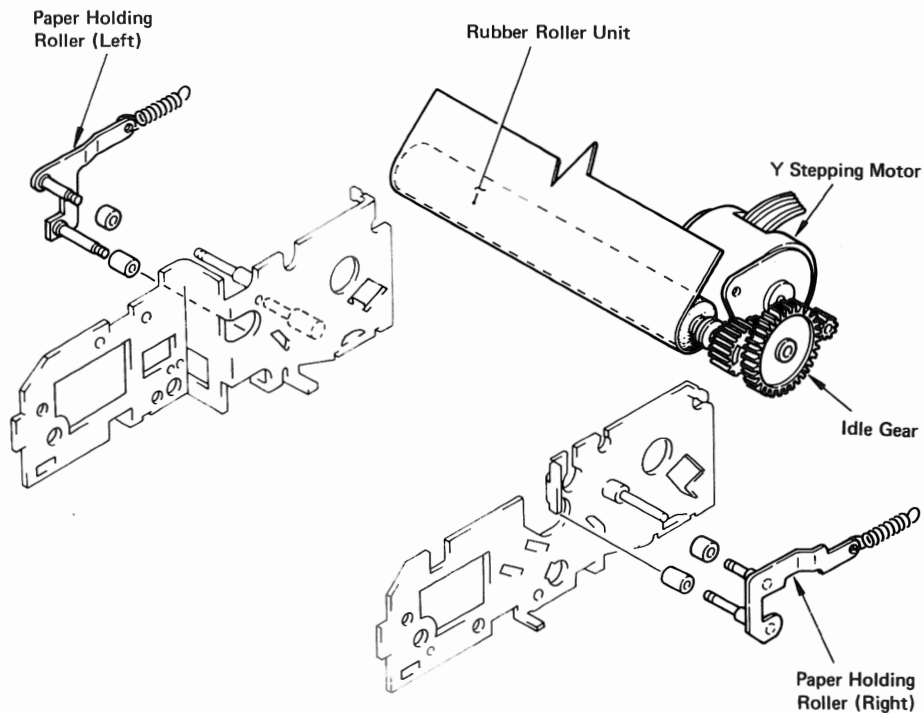
**Fig. 20**

- Step Angle and Minimum Movement Pitch

The reduction ratio between the stepping motor and bobbin gear is 1 : 9.01, and for each stepping motor pulse ( $18^\circ/360$ ), the slider unit, that is, direction movement of pen X is 0.2 mm. The motive power is transmitted to the bobbin gear via idle gear and to the slider unit by a wire. The wire tension is maintained by a coil spring.

3) Y Drive Mechanism (Paper Feed Mechanism) Section

The Y-direction drive mechanism consists of the Y stepping motor, idle gear, rubber roller unit, paper holding roller (right) and paper holding roller (left). The reduction ratio between the Y stepping motor (called as the Y motor hereafter) and rubber roller gear is 1 : 7.86. As is the case with the X direction, the rubber roller movement per each pulse of the Y motor, that is, the Y direction movement of the paper, is 0.2 mm.



**Fig. 21**

#### 4) Pen Drive Mechanism Section

The pen drive mechanism, that is, the pen up-down mechanism comprises a self-holding type electromagnet, ejection lever, roller lever, and ball-point pens. Pen up and down directions are as shown below.

##### ● Pen-up State

The pen retracts when the suction iron core is pulled by a current for 5 ms against the actuator spring of the electromagnet, and suction is maintained by a permanent magnet even after the current is cut off after the initial 5 ms.

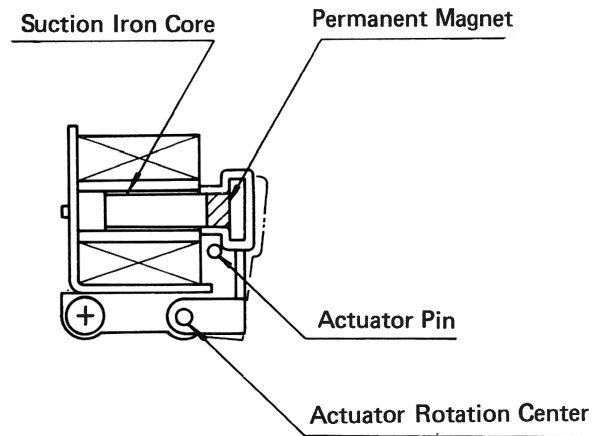


Fig. 22

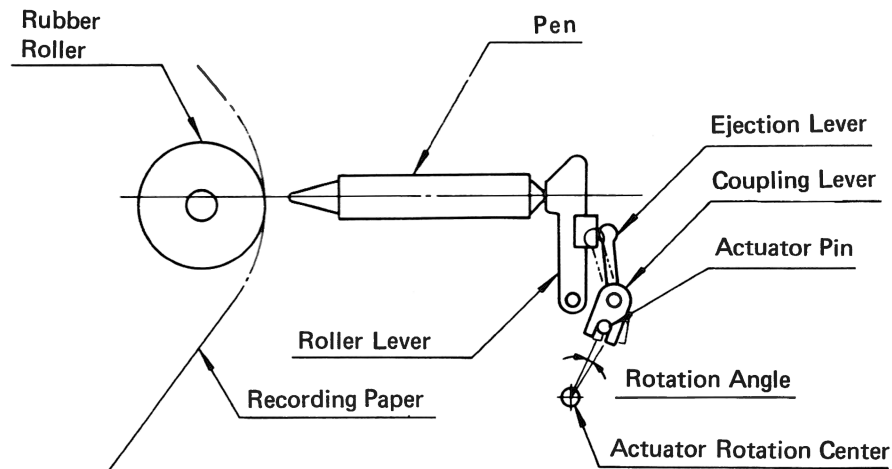


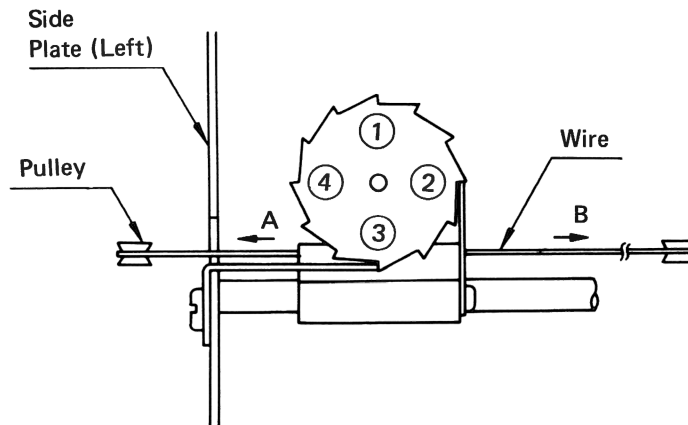
Fig. 23

##### ● Pen-down State

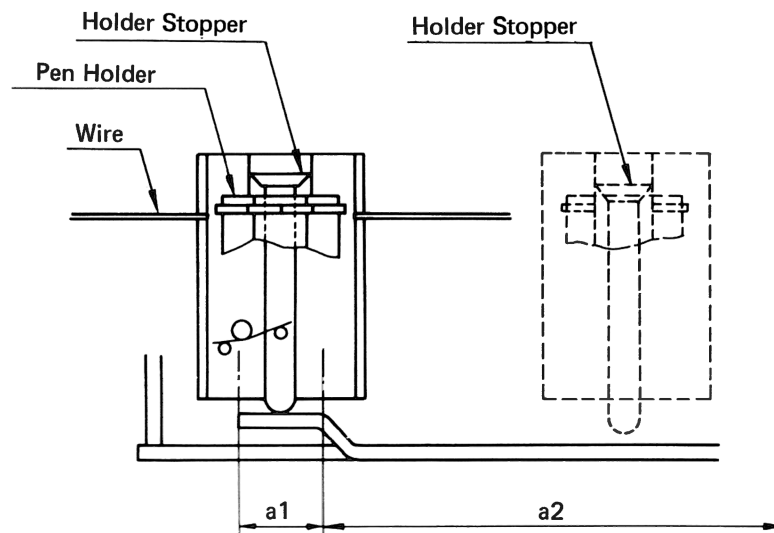
The pen descends when a current flows through the electromagnet for 5 ms in a direction opposite in which is impressed during suction against the suction force of the permanent magnet. After 5 ms, the pen-down state will be maintained by the actuator spring force.

## 5) Color Change Mechanism Section

The color change mechanism section consists of the X-direction drive mechanism, a pen holder and holder stopper, both in the slider unit, and projections inside the holding plates. The operating principles are explained below.



**Fig. 24**

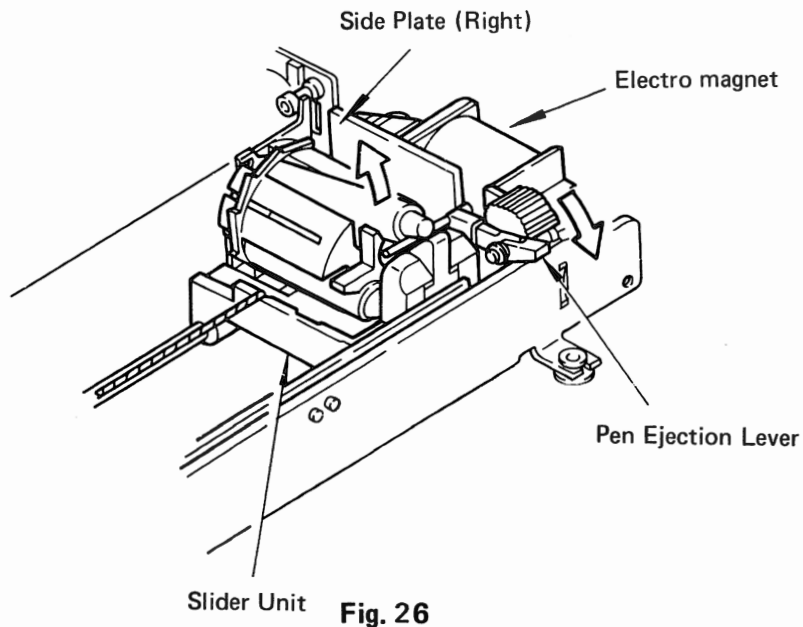


**Fig. 25**

First, the slider moves to the area a-1 in Figure 22 (45 pulses to the left from the origin). Then, the holder stopper in the slider contacts the projection on the holding plate, and the wedge section of the holder stopper slips out of the pen holder, and releases holder to rotate. Next, by repeating the movement of the X motor for 30 pulses each in direction A and to the left, the pen 1 in Figure 21 changes to pen 2. The spring moves the pen holder to the right until it returns to the origin. The pen holder then enters its groove, and printer is ready to print.

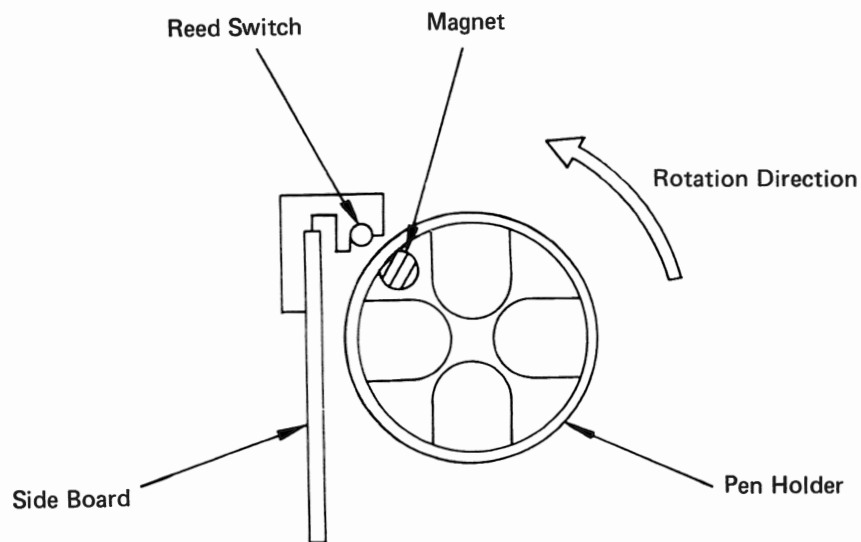
## 6) Pen Ejection Mechanism

The pen ejection mechanism consists only of the pen ejection lever that is mounted on the side plate (right). The slider unit is moved fully to the side plate (right) and stops. Push the pen ejection lever towards you, and the pen will eject.



7) Detection Mechanism for Color Position and Home Position

A magnet is built into one part of the pen holder. A reed switch is placed on the left side of the side board, and is turned on when the pen holder repeats a color change operation and the magnet comes close to detect the home position of the color location. The location of the ball-point pen that is placed opposite to the rubber roller will be in the "black" position. (4-color separation film is attached to the tip part of the pen holder or on the pen holder it

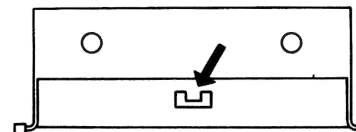


## 6. PRINTER HEAD DISASSEMBLY AND REASSEMBLY

### (1) Disassembly

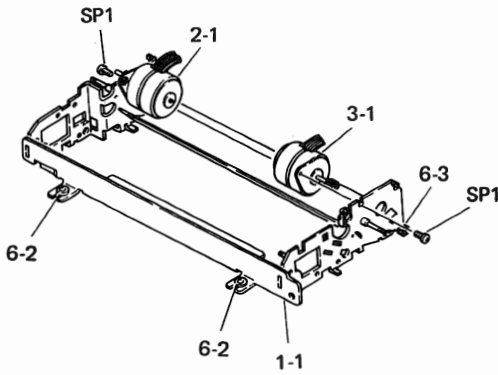
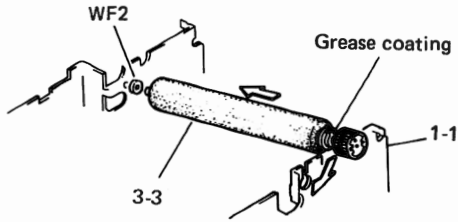
Remove the following parts from the frame in the sequence shown below.

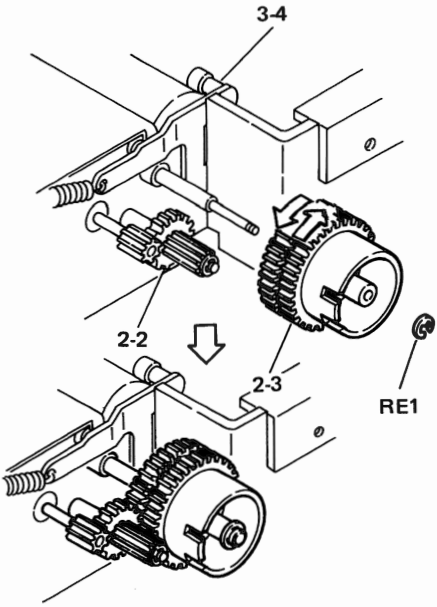
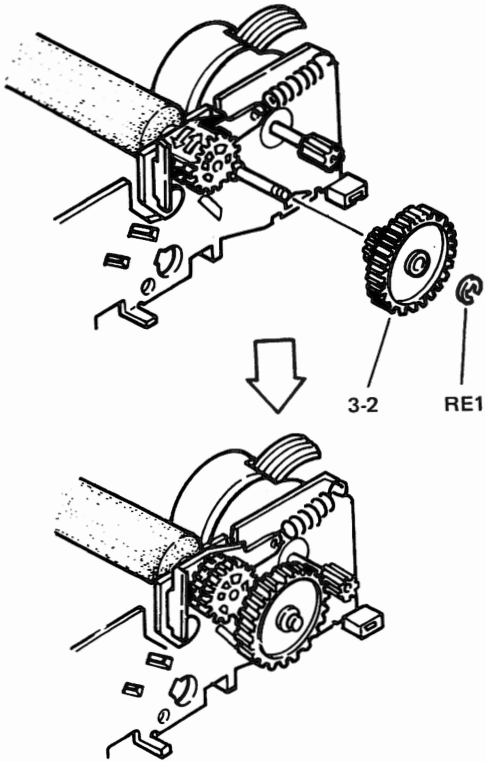
Disassembly Sequence	Part No.	Part to be Removed	Point for Disassembly
1	4-1	# Electromagnet Unit	<ul style="list-style-type: none"> <li>Disassemble after removing cross-recessed pan head machine screws (SP2) and (SP1), and sleeves (2-6).</li> </ul>
	2-5	# Wire Unit	
	5-1	# Pen Take-out Lever Unit	
	5-3	Pen Queller	
	2-8	# Pulley Support Base (Right) Unit	
	3-2	Y Idle gear	
	3-5	# Paper Holding Roller Support Plate (Right) Unit	
2	6-1	Motor Cover	<ul style="list-style-type: none"> <li>Lift up the motor cover (6-1) covering the cross-recessed pan head machine screws (SP1) holding the motor.</li> <li>Remove the entire motor cover (6-1) by inserting a flat-blade screwdriver in the paper guide as shown.</li> </ul>
3	3-3	# Rubber Roller Unit	<ul style="list-style-type: none"> <li>Push the rubber roller unit bearing to the left and remove from the right side of the rubber roller unit (3-3) as it comes off the frame unit (1-1).</li> </ul>
4	3-1	# Y Motor Unit	<ul style="list-style-type: none"> <li>Suction solder in the junction section of the two printed circuit boards.</li> </ul>
	2-3	# Bobbin Gear Unit	
	2-2	X Idle Gear	
	3-4	# Paper Holding Roller Support Plate (Left) Unit	
5	2-1	# X Motor Unit	
	2-7	# Pulley Support Base (Left) Unit	
	2-9	Slider Shaft (A)	
	2-10	Slider Shaft (B)	
	4-5	# Slider Unit	
	4-2	# Ejection Lever Shaft Unit	
	4-3	Ejection Lever	
	4-7	Color Change Click	
	4-6	# Reed Switch Unit	
	6-2	Rubber Bushing	
	6-3	Rubber Pad	

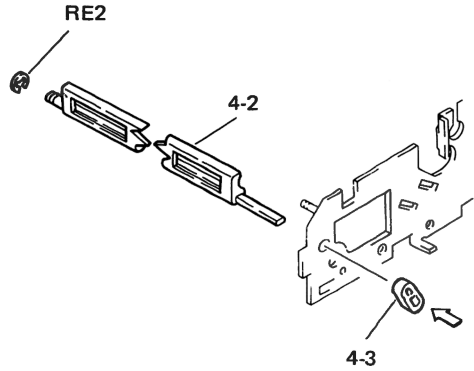
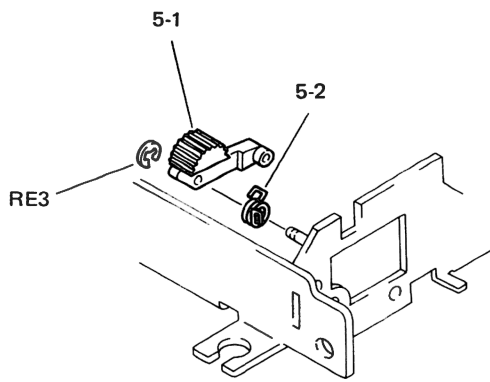


## (2) Reassembly

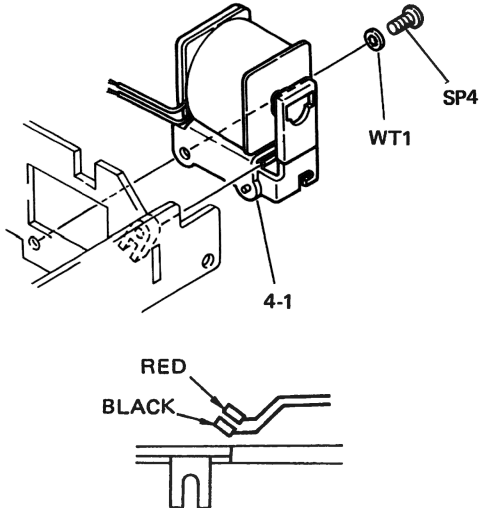
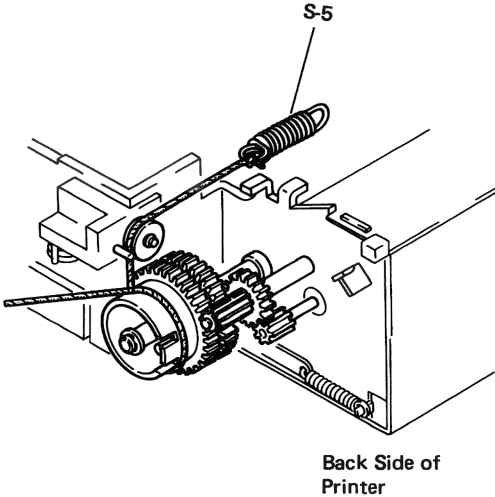
Reassembly can be completed most efficiently by referring to the reassembly sequence and precautions shown below.

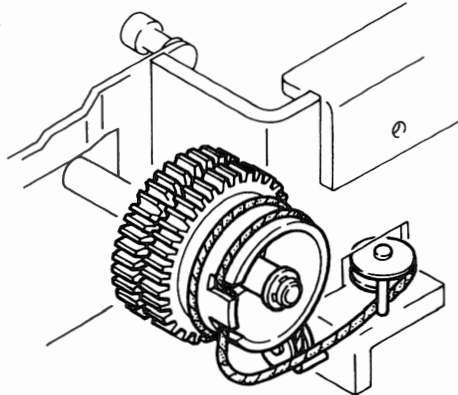
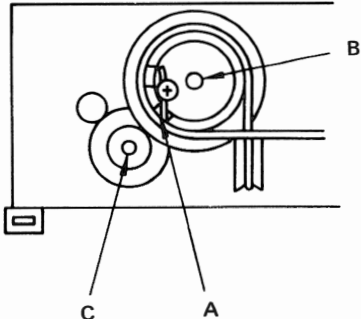
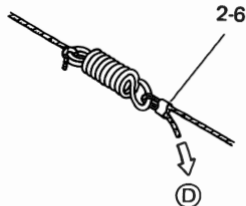
Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
1	2-1 SP1 3-1 SP1 6-3 6-2	# X Motor Unit Cross-recessed Pan Head Machine Screws Y Motor Unit Cross-recessed Pan Head Machine Screws Rubber Pad Rubber Bushing	<p>Screw lock paint coating</p> 
2	3-4 3-3 WF2 3-5	# Paper Holding Roller Support Plate (Left) Unit # Rubber Roller Unit Plain Washer # Paper Holding Roller Support Plate (Right) Unit	<p>Fit the end of the rubber roller unit into the left side and push the bearing to the left side to fit the other end into the right side.</p> 

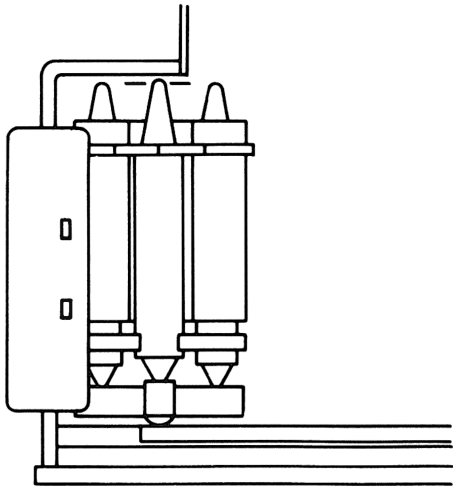
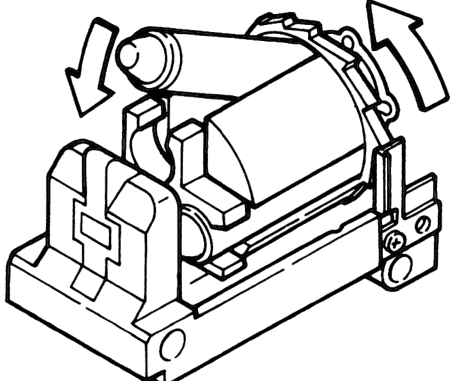
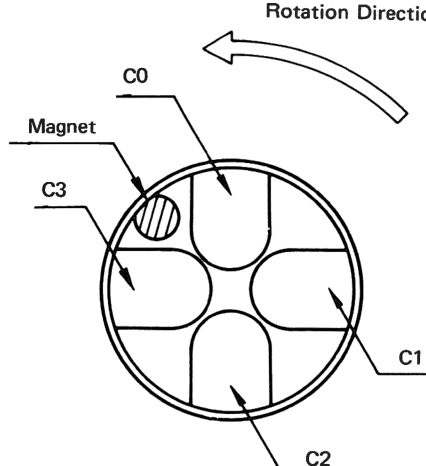
Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
3	2-2 RE1 2-3	X Idle Gear Type E Stopper Ring # Bobbin Gear Unit	<p>Move the bobbin gear by one tooth and insert the X idle gear.</p>  <p>Recommended to engage after marking the tooth tip and moving the gear by one tooth.</p>
4	3-2 RE1	Y Idle Gear Type E Stopper Ring	<p>Insert the Y idle gear after moving the paper feed gear by one tooth.</p> 

Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
5	6-1	Motor Cover	Recommended to engage after marking the tooth tip and moving the gear by one tooth.
6	4-2 4-3 RE2	# Ejection Lever Shaft Unit Ejection Lever Type E Stopper Ring	Hang the motor cover by its square hole on the hook on the paper guide B on the rear of the frame unit.  Insert the ejection lever shaft unit into the frame through a bearing hole and press in the coupling lever from outside the frame.
7	5-1 5-2 RE3	# Pen Take-out Lever Unit Pen Take-out Lever Spring Type E Stopper Ring	 
8	4-7 SP5	Color Change Click Cross-recessed Pan Head Machine Screws	Screw lock paint coating
9	4-5 2-9 2-10 RE-2	# Slider Unit Slider Shaft (A) Slider Shaft (B) Type E Stopper Ring	Never bring another magnet close to the slider unit magnet. (The magnet inside the slider unit demagnetizes causing the color detection switch to operate incorrectly)
10	2-7	# Pulley Support Base (Left) Unit	



Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
11	4-1 SP4 WT1	# Electromagnet Unit Cross-recessed Pan Head Machine Screws Shake-proof Washer	<p>Hang the electromagnet unit actuator on the coupling lever on the ejection lever unit.</p>  <p>Mount the pen so that open strokes are 0.6 mm. Clamping torque, 3.5 kg-cm. Screw lock paint coating.</p>
	4-6 SP2	# Reed Switch Unit Cross-recessed Pan Head Machine Screws	<p>Screw lock paint coating Rotate the bobbin gear. The reed switch must actuate when the magnet at the left edge of the slider approaches the closest reed switch.</p>
13	2-8	# Pulley Support Base (Right) Unit	
14	2-5 2-6	# Wire Unit Sleeve	<p>Stretch wire on the pulley support plate (left) unit and bobbin gear.</p>  <p>Wind wire once on the bobbin gear.</p>

Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
			  <p>Pass wire through the bobbin gear notch.</p> <p>Reassemble when the notch (B) of the bobbin gear (A) is aligned with the straight line extending between the bobbin gear shaft (B) and idle gear shaft (C).</p> <p>Insert the wire through the pulley and slider of the pulley support plate (left) unit, and then through the sleeve and spring of the pulley support plate (right) unit.</p>  <p>Pull wire end (D) to produce tension (Wire Tension 160 gr). (Expansion limit of the spring: about 2mm)</p> <p>Fix the bobbin gear and wire.</p> <p>Adjust the relative positions of the wire and slider so that the drawing line in the X-direction will be at the center of the paper guide.</p> <p>Screw lock paint coating.</p>
	SP2 SP2	Cross-recessed Pan Head Machine Screw Cross-recessed Pan Head Machine Screw	

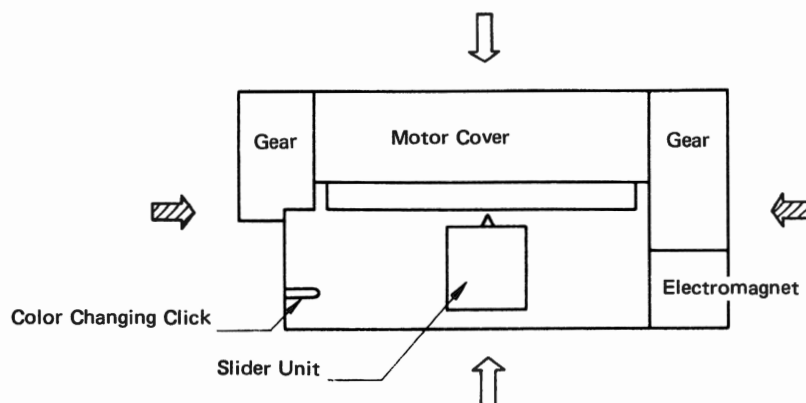
Reassembly Sequence	Part Symbol	Parts to be Reassembled	Precautions for Reassembly
		Ball-point Pen (Black) Ball-point Pen (Blue) Ball-point Pen (Green) Ball-point Pen (Red)	<p>Move the slider to the left edge.</p>  <p>Insert the pen tip at the tip of the pen return spring and push the rear section.</p>  <p>Rotate the rotary holder in the direction of arrow A and insert the pen. Mount the pen color position making the magnet for the reed switch as the reference.</p> 



## 7. MAINTENANCE AND TROUBLESHOOTING

### (1) Maintenance

#### 1) Handling Precautions

- Carrying Printer



- 1 Carry the printer by holding it in the directions shown by  Carrying the printer in the  direction will cause various troubles.
  - 2 The printer may be carried by holding on to the upper face of the motor cover and paper guide. However, do not apply strong pressure to it.
- Sections where Pressure should not be applied
    - 1 Do not touch the slider unit except when taking a pen out. Particularly, never apply pressure in the direction of rotation.
    - 2 Do not touch the wire. The pulley may come off.
    - 3 Do not touch the color changing click. When bent, color changing cannot be accomplished.
  - Sections not to be touched
    - 1 No shaft should be touched with bare hands.
    - 2 Do not touch the pen return spring.
    - 3 Do not touch the rotary holder except when the slider is positioned at the left edge of the frame and a pen is mounted.
    - 4 Do not touch the slider.
  - Sections where Magnetic Substances should be kept away
    - 1 Do not place a magnetic substance or powder, a permanent magnet, or an electromagnet close to the permanent magnet of the color position detector.
    - 2 A strong rare earth magnet is used in the electromagnet unit.
  - Other

Be very careful not to drop the pen or in any way joint it. When the ink is exhausted, hold by the tail plug section and shake it.

#### 2) Cleaning

Clean the printer and remove paper dust, dirt, etc. periodically (after using about every three months)

Points for Cleaning.

- 1 Paper dust, dirt, dust, etc. should be vacuumed up. (Use an electric vacuum cleaner).
- 2 Use alcohol or benzene when removing stains. Thinner, trichloroethylene and ketone solvent may damage the plastic parts, so do not use.

- 3 Grease any places where there is no grease or where it is not sufficient. (Do not use a lubricant except the one specified. Refer to "(5) Oiling Standard.")

### 3) Repair Procedure

When a fault occurs, carefully observe and check the type of the trouble. Find out the cause and make repairs after checking the location of the fault, referring to the "Repair Guide."

- 1 "Phenomenon" : Determine the trouble phenomenon from this column.
- 2 "Condition" : Compare the trouble with this column and verify whether it coincides.
- 3 "Cause" : Causes based on the condition of the trouble are listed. Verify the cause.
- 4 "Locations and Methods of Checking" : The column lists where to check for trouble and by what method. Check according to the instructions in this column and locate the trouble.
- 5 "Repair Method" : Repair the trouble according to the instructions described in this column. If the same phenomenon or conditions exist after making repairs, check the other items in the cause of this column and make necessary repairs.

### 4) Special Repair Tools

- Screwdrivers (Precision Screwdrivers)
  - Phillips Type 4,
  - Phillips Type 5,
  - Flat-blade Type 5
- Pliers
- Tweezers
- Soldering Iron
- ET Holders
  - ET 2
  - ET 1.5
  - ET 1.2

### 5) Oiling Standard

Two types of oil are used in this printer - G488 and CRC 5-56. When oiling during disassembly and reassembly, thoroughly clean the parts and oil in accordance with the table below.

No.	Oiling Location	Oil Type	Remarks
1	Area of contact between paper holding roller support plate (left) and side plate.	G-488	
2	Contact section between paper holding roller support plate (right) and side plate.	G-488	
3	Sliding sections (4 locations) between paper holding roller and roller shaft.	G-488	
4	Sliding section between rubber roller unit shaft and plain washer.	G-488	
5	Contact section between plain washer and side plate.	G-488	
6	Sliding section between ejection lever shaft unit and slide plate.	G-488	
7	Sliding section between ejection roller and slider set.	G-488	
8	Tooth section of X idle gear.	G-488	
9	Tooth section of Y idle gear.	G-488	
10	Sliding section between holder stopper and holding plate.	G-488	
11	Electromagnet unit actuator shaft.	G-488	
12	Slider shaft (A)	CRC5-56	
13	Slider shaft (B)	CRC5-56	

## 6) Adhesion Standard

The table below shows points on the clamps where adhesion is to be applied to lock the screws as well as adhesion points on the printer bearings. Make sure that more than 1/4 of the screw heads are glued, but that no adhesive is present in the screw head recessors.

No.	Adhesion Point	Adhesive	Remarks
1.	X motor unit set-screws Cross-recessed pan head machine screws (SP1)	Screw lock	
2.	Bobbin gear unit wire set-screws Cross-recessed pan head machine screws (SP2)	Screw lock	
3.	Slider unit wire set-screws Cross-recessed pan head machine screws (SP2)	Screw lock	
4.	Y motor unit set-screws Cross-recessed pan head machine screws (SP1) Phillips type pan head machine screws (SP2 × 3)	Screw lock	
5.	Electromagnet unit set-screws Cross-recessed pan head machine screws (SP4)	Screw lock	
6.	Reed switch unit set-screw Cross-recessed pan head machine screws (SP2)	Screw lock	
7.	Color change click set-screws Cross-recessed pan head machine screws (SP5)	Screw lock	
8.	Rubber roller unit bearing and side plate	Cyanoacrylate adhesive	VISCA NS-10 (Matsumoto Trading)
9.	Printer unit set-screw in 2 places Cross-recessed dish head machine screw and Hex nut (SD3 and NH3)	Screw lock	
10.	Pen up spring set-screw Cross-recessed pan head wave screw (SPW4)	Screw lock	
11.	Main P.C.B. unit set-screw in 2 places Cross-recessed pan head machine screw and Hex nut (SP6 and NH3)	Screw lock	
12.	Heat sink set-screw in 2 places Cross-recessed pan head wave screw (SPW2)	Screw lock	
13.	Panel R.C.B. set-screw in 4 places Cross-recessed pan head wave screw (SPW1)	Screw lock	
14.	Pan change P.C.B. set-screw in 2 places Cross-recessed pan head wave screw (SPW1)	Screw lock	
15.	Voltage Reg. set-screw in 2 places Cross-recessed pan head machine screw (SP7)	Screw lock	

## (2) Troubleshooting Guide

Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
Does not draw lines	X-motor (2-1), Y-motor (3-1) and pen drive electro-magnet (4-1) operate normally, but no printing is done.	Pens have come off, or the ink is exhausted.	Are the pens mounted properly? Do the pens have enough ink?	Mount properly. Replace the pens.
2. Lateral lines cannot be drawn	(1) X-motor (2-1) does not rotate.	(1) X-motor lead wire is cut.	Check that normal current is impressed to each phase of the motor.	Replace X-motor.
		(2) X idle gear (2-2) is deformed.	Check if the X idle gear is normal.	Replace the X idle gear.
		(3) Deformation of bobbin gear unit (2-3), misalignment of two-piece teeth.	Dismount wire unit (2-5), rotate bobbin gear by hand and check rotation state.	Replace bobbin gear unit.
		(4) Foreign matter has accumulated between gears.	Rotate bobbin and unit by hand and check for foreign matter.	Remove foreign matter.
		(6) Slider unit (4-5) does not slide properly on the shaft.	Dismount wire and move slider unit to the right and left by hand.	<ul style="list-style-type: none"> <li>● Replace slider unit.</li> <li>● Remove foreign matter if it is obstructing movement.</li> </ul>
		(1) Wire has come off.	Check if wire has come off the bobbin gear.	Restretch wire properly.
3. Insufficient Lateral Movement	(2) X-motor rotates, but slider unit does not move to the right or left.	(2) Wire is cut.	Check that wire has not been cut.	Replace wire unit.
		(3) Bobbin gear and wire slip.	Confirm that wire is properly screwed on to bobbin gear.	<ul style="list-style-type: none"> <li>● Tighten the screws.</li> <li>● Replace the bobbin gear unit.</li> </ul>
		(4) Gear is damaged.	Check that X idle gear and bobbin gear are operating properly.	<ul style="list-style-type: none"> <li>● Replace the damaged gear.</li> </ul>
		(1) Rubber roller unit (3-3) is scratched.	Slowly rotate the rubber roller by hand and check for scratches and foreign matter.	<ul style="list-style-type: none"> <li>● Replace rubber roller unit if scratches are found.</li> <li>● Remove foreign matter.</li> </ul>
		(2) Print paper has steps.	Check the surface of the print paper.	Use normal print paper.
		(3) Deformation of ejection lever shaft unit (4-2).	Check the contact between the ejection lever and ejection roller (4-4).	<ul style="list-style-type: none"> <li>● Replace ejection lever shaft unit.</li> </ul>


Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
4. Drawing is done segment by segment.	(2) Abnormality is noticed regardless of whether the pen is moving up or down.	(1) Foreign matter has accumulated in the moving section of the slider unit.	Check that slider unit moves smoothly on the effective printing area and check for an abnormal load by slowly rotating the bobbin gear by hand.	Remove any foreign matter.
		(2) Contact between pen take-out lever unit (5-1) and pen.	Check contact between pen take-out lever and slider unit.	Replace pen take-out lever.
		(3) Wire fastening position on bobbin has moved.	Rotate bobbin gear unit (2-3) by hand and check that slider unit moves smoothly from left edge to right edge.	Restretch wire if its fastening position is wrong.
		(4) Improper pulley rotation of pulley support base unit (right).	Dismount wire from pulley and check for smooth rotation.	Replace pulley support base unit.
		(5) Sleeve (2-6) and frame make contact.	Check for deformation between frame unit and sleeve, as well as for other phenomena.	Replace sleeve.
		(6) X motor unit (2-1) is operating improperly.	Dismount X idle gear (2-2), slowly rotate motor gear, and check for abnormal load.	Replace motor.
		(7) Contact between set-screw of return spring and small roller.	Move slider and confirm contact.	<ul style="list-style-type: none"> <li>● Replace rotary holder.</li> <li>● Replace paper holding roller support plate unit.</li> </ul>
	(1) Actuator of the electromagnet unit (4-1) is detached from the electromagnet coil.	(1) Current is not being supplied to the electromagnet properly.	Check if current is going to the electromagnet.	Replace electromagnet and repair drive circuit.
		(2) Abnormally large electromagnet suction stroke.	Check if gap between rubber roller and pen tip is 0.6 mm in the pen-up mode.	<ul style="list-style-type: none"> <li>● Replace with a pen having the standard length (<math>23.3^{+0}_{-0.1}</math> mm).</li> <li>● Adjust the gap by turning the mounting screw on the electromagnet unit (4-1).</li> </ul>
		(3) Electromagnet unit is faulty.	Check operation of the actuator for the electromagnet unit, spring fatigue, deformation, etc.	Replace electromagnet unit.

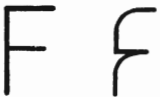



Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
5. Color does not Change	(2) Electromagnet operates normally.	(4) Rotary holder on slider unit has moved.	Check that rotary holder pen is directly above the specified position (print position).	Manually maintain electromagnet actuator in the absorption state, rotate rotary holder in a counterclockwise direction, and fix it in its proper position.
		(5) Ejection lever does not operate smoothly.	Check for a bend in the ejection lever and inspect the bearing section.	<ul style="list-style-type: none"> <li>● Exchange ejection lever and ejection lever shaft unit.</li> </ul>
		(1) Pen movement is slow.	Check the shape of the pen. Also check for rotary holder deformation and the presence of foreign matter.	<ul style="list-style-type: none"> <li>● Pen exchange</li> <li>● Rotary holder exchange</li> <li>● Removal of foreign matter</li> </ul>
		(2) Deformation and fatigue of pen return spring.	Inspect the pen return spring.	Replace rotary holder set.
		(3) Paper is not winding on rubber roller properly.	Remove paper and check for paper guide deformation, etc.	<ul style="list-style-type: none"> <li>● Return it to its normal shape using tweezers, etc. if it is only slightly deformed.</li> <li>● Remount properly if small roller which holds the paper has come off.</li> </ul>
	(1) Pen moves to color change area without moving up. (2) Carriage does not move until it reaches the left edge.	(4) Pen is too long.	Measure the pen length.	<ul style="list-style-type: none"> <li>● Mount a proper pen. (length <math>23.3^{+0}_{-0.1}</math> mm)</li> </ul>
		(1) Electromagnet induced pen up function is abnormal.	Check transmission system from electromagnet to pen drive.	See Phenomenon 4.
		(1) Foreign matter has accumulated in slider section.	Check for foreign matter. Check if slider move smoothly by rotating the bobbin gear by hand.	Remove foreign matter and exchange slider unit.
		(2) Contact between slide shaft support plate and frame.	Check for contact.	Replace slider unit.
		(1) Fatigue and deformation of color change click (4-7)	Check color change click.	<ul style="list-style-type: none"> <li>● Gently lift color change click using tweezers.</li> <li>● Replace color change click.</li> </ul>
	(3) Rotary holder does not rotate at all.			

Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
6. Does not select proper color		(2) Pen tip has come off the return spring.	Check all four pens to see if they have come off.	<ul style="list-style-type: none"> <li>● Repair using tweezers.</li> <li>● Replace rotary holder if return spring is deformed.</li> <li>● Replace rotary holder.</li> </ul>
		(3) Pen return spring is deformed.	Check the shape of the pen return spring.	
		(4) Holder stopper inside slider unit does not operate well.	Check holder stop operation.	Replace slider unit.
		(1) Deformation of hooking click.	Check if hooking click and rotary holder ratchet are making proper contact.	Replace slider unit.
	(4) Rotary holder rotates not only counterclockwise, but also clockwise.			
	(5) Rotary holder makes excessive rotations.	(1) Deformation of paper guide	Check for contact between paper guide and pen tip.	<ul style="list-style-type: none"> <li>● Adjust pen stroke.</li> <li>● Replace printer.</li> </ul>
		(2) Presence of foreign matter	Check for foreign matter.	Remove foreign matter.
	(6) Rotary holder rotation is bad only for the first movement after resetting.	(1) Slider unit is misaligned	Check stop sections of slider and wire.	Adjust relative positions of slider and wire.
	(1) It is reproduced no matter how many times power supply is turned on.	(1) Pen mounting position is different.	Check that the proper colored pen is mounted using as reference the position when the color position detection magnet is located at the left side.	Refit pen in its proper position.
	(2) A different color is selected when the power supply is turned on again and reset.	(1) Insufficient magnetic force	Check the magnetic flux on the magnet surface with a Gauss meter.	Replace rotary holder.
7. Paper is not fed.	(1) Y motor (3-1) does not rotate.	(2) Reed switch is faulty.	Check if reed switch actuates when magnetic flux is normal.	Replace reed switch unit (4-6).
		(1) Discrepancy in mounting of the reed switch unit.	Check position of reed switch unit.	Replace reed switch unit.
		(2) Excessive rotation of rotary holder	Check if rotary holder rotates excessively due to foreign matter, etc.	Remove foreign matter, etc.
		(1) Y motor lead wire is cut.	Check if normal current is impressed to each phase of the motor.	Replace Y motor.

Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
8. Y-direction movement is insufficient.	(2) Paper and rubber roller slip.	(2) Deformation of Y idle gear (3-2)	Check if Y idle gear is normal or not.	Replace Y idle gear.
		(3) Rubber roller unit (3-3) does not rotate well.	Dismount Y idle gear and check rubber roller rotations.  Caution : rotations are heavy due to friction between rubber roller and paper guide when paper is not inserted.	Replace rubber roller unit.
		(4) Foreign matter between gears	Slowly rotate Y idle gear by hand and check for foreign matter.	Remove foreign matter.
		(6) Paper holding roller support plate unit (left) (3-4) does not operate smoothly.	Hook tweezer tips in hole of spring hook on paper holding roller support plate unit and move it up and down.	Replace paper holding roller support plate unit (left).
		(7) Paper holding roller support plate unit (right) (3-5) does not function well.	Hook tweezer tips in hole of spring hook on paper holding roller support plate unit and move it up and down.	Replace paper holding roller support plate unit (right).
		(1) Damage to paper holding roller (large) (3-6) and paper holding roller (small) (3-7)	Check if paper holding roller is there.	Replace damaged roller.
		(2) Deformation of paper guide	Check for paper guide deformation.	Replace printer.
		(3) Foreign matter in paper guide	Check for foreign matter in paper guide and for insertion of paper.	Remove foreign matter.
		(1) Roll paper load is too heavy.	Check that roll paper is guided smoothly in to the printer.	Repair roll paper guide.
		(2) Stopping error in Y-direction	(1) Y drive mechanism gear is damaged.	Replace gears.

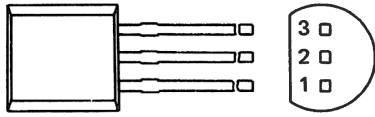
Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
9. Character misalignment is substantial.	(3) Origin position differs after making many reciprocal movements in Y direction. Origin position changes after printing a large number of characters.	(2) Sliding paper feed gear, by one tooth, gearing of rubber roller unit is not enough.	Check that the two-piece tooth gear on rubber roller unit is engaging after being slid by one tooth.	Mount after setting it properly.
		(3) Rubber roller unit bearing is worn.	Move rubber roller unit gear up and down by hand and check for play.	<ul style="list-style-type: none"> <li>● Replace rubber roller unit if wear is noticed.</li> <li>● Fix by using a cyanoacrylate adhesive when there is play between the bearing and frame.</li> <li>● Replace printer.</li> </ul>
		(1) Rubber roller and paper slip	Check for stained rubber roller.	Wipe off rubber rollers stain.
		(2) Deformation of paper guide	Check paper guide.	<ul style="list-style-type: none"> <li>● Repair paper guide if there is any deformation.</li> <li>● Replace printer.</li> </ul>
	(1) "F" is drawn as shown below. 	(3) Roll paper is guided improperly.	Check roll paper rotation and ensure that the center of the paper and the center of the printer are aligned.	Repair roll paper guide.
		(4) Paper type does not match printer.	Check that the specified paper is used.	Use the specified paper.
		(1) Improper engagement of bobbin gear unit (2-3) after sliding by one tooth	Check gear engagement.	Mount properly.
		(2) Rotary holder and slider do not lock sufficiently.	Check rotary holder play by rotating it slowly by hand.	Exchange slider unit.
		(3) Play between pen return spring and pen tips.	Check by rotating X bobbin gear back and forth for several seconds by hand in the pen-down mode.	Replace rotary holder.
		(4) Wire spring fatigue in wire unit (2-5), elongation of wire	Check for slack in wire spring.	Replace wire unit.

Phenomenon	Condition	Cause	Location and Method of Checking	Repair Method
	<p>(2) "F" is printed as shown below.</p>  <p>OK NG</p> <p>(3) "P" is short as shown below.</p>  <p>OK NG</p>	<p>(1) Pen and return spring</p> <p>(2) Play in entire slider.</p> <p>(1) Faulty engagement of paper feed gear inside rubber roller unit after sliding by one tooth</p> <p>(2) Substantial play in rubber roller bearing</p>	<p>Check by rotating Y idle gear back and forth for several seconds by hand in the pen-down mode.</p> <p>Check slider and X drive system.</p> <p>Check gear engagement.</p> <p>Check for play by moving the gear vertically.</p>	<p>Replace rotary holder.</p> <p>Exchange slider.</p> <p>Mount properly.</p> <p>Replace rubber roller unit.</p>

## 8. ELECTRONIC CIRCUIT INTERNAL CONNECTION

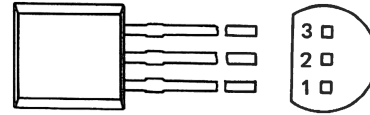
### (1) Semiconductor Lead Identification and IC Internal Connection

#### • 2SA844



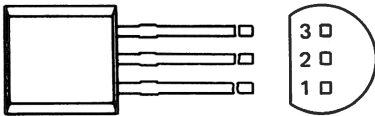
1: Emitter  
2: Collector  
3: Base

#### • 2SC454



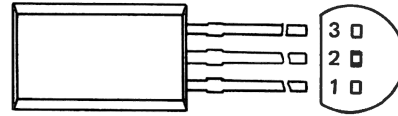
1: Emitter  
2: Collector  
3: Base

#### • 2SC1317R



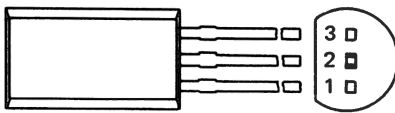
1: Emitter  
2: Collector  
3: Base

#### • 2SB739



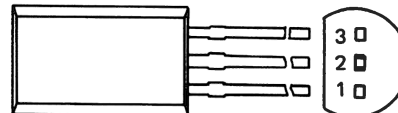
1: Emitter  
2: Collector  
3: Base

#### • 2SD788



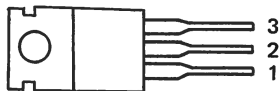
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2: Collector  
3: Base

#### • 2SC1384R



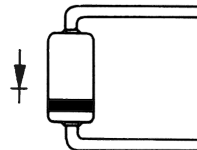
1: Emitter  
2: Collector  
3: Base

#### • HA17805

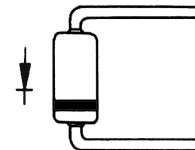


1. Input . . . . .  $V_{in}$   
2. Common . . . . . COMMON  
3. Output . . . . .  $V_{out}$

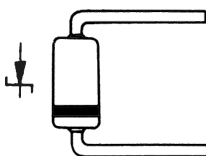
#### • 1S2076FA



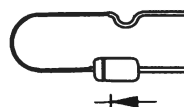
#### • 1S2075KFA



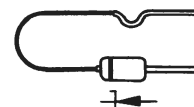
#### • HZ12C1FA



#### • 1S2076S1



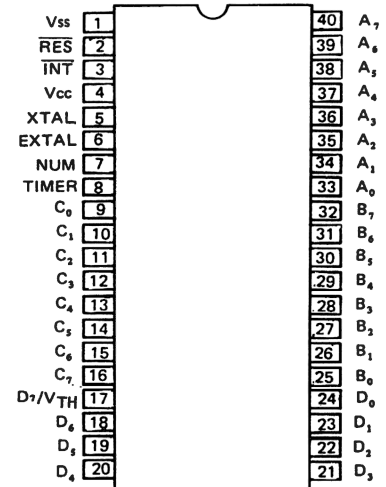
#### • HZ11AS1



● HD6805V1A08P

Pinboard arrangement and functions

1) Pinboard arrangement  
(top views)



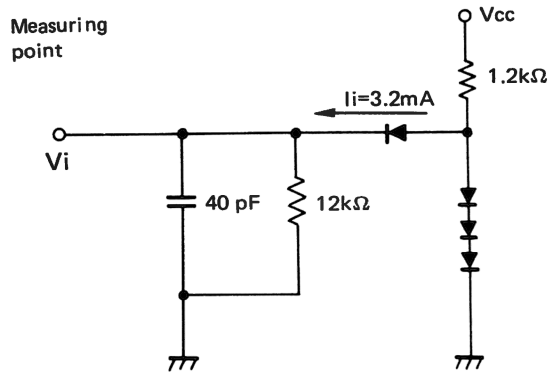
2) Pin functions

Pin No.	Name	Function				
33	A <sub>0</sub>	Character Scale Set	H: S = 0	L: S = 1		
34	A <sub>1</sub>	Carriage Return Mode	H: CRonly	L: CR/LF		
35	A <sub>2</sub>	Color Select Switch	Active low			
36	A <sub>3</sub>	Paper Feed Switch				
37	A <sub>4</sub>	Pen Change Switch				
38	A <sub>5</sub>	} PRINTER Select	Paper Width	H: 58 mm	L: 114 mm	
39	A <sub>6</sub>		Color	H: 1 color	L: 4 color	
40	A <sub>7</sub>	Connect to Vcc				
25	B <sub>0</sub>	XD	Stepping Motor drive pulse (X)	Active High		
26	B <sub>1</sub>	XC				
27	B <sub>2</sub>	XB				
28	B <sub>3</sub>	XA				
29	B <sub>4</sub>	YD	Stepping Motor drive pulse (Y)	Active High		
30	B <sub>5</sub>	YC				
31	B <sub>6</sub>	YB				
32	B <sub>7</sub>	YA				
9	C <sub>0</sub>	<u>pen-up</u>				
10	C <sub>1</sub>	<u>pen-down</u>				
11	C <sub>2</sub>	<u>parallel/serial</u>	H: para.	L: sili.		
12	C <sub>3</sub>	<u>color detect switch</u>				
13	C <sub>4</sub>	<u>Busy</u>				
14	C <sub>5</sub>	<u>ACK</u>				
15	C <sub>6</sub>	<u>strobe latch F/F Reset</u>				
16	C <sub>7</sub>	serial data input				
24	D <sub>0</sub>	Data — 0	para. data input			
23	D <sub>1</sub>	1				
22	D <sub>2</sub>	2				
21	D <sub>3</sub>	3				
20	D <sub>4</sub>	4				
19	D <sub>5</sub>	5				
18	D <sub>6</sub>	6				
17	D <sub>7</sub>	7				
1	V <sub>ss</sub>	GND (Minus)				
2	<u>RES</u>	reset				
3	<u>INT</u>	data strobe input (Active low)				
4	V <sub>cc</sub>	+5V				
5	XTAL	} crystal OSC.				
6	EXTAL					
7	NUM	connect to GND				
8	TIMER	connect to Vcc				

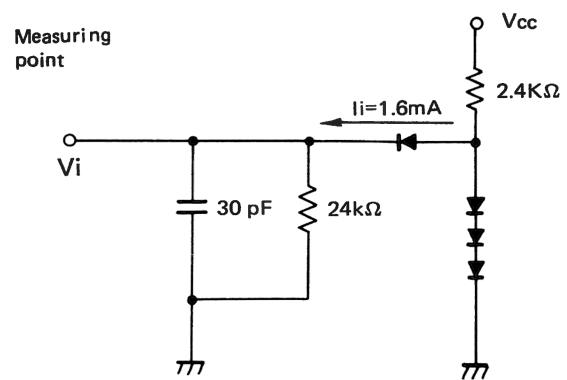
Port characteristics (unless otherwise specified,  $V_{cc} = 5.25V \pm 0.5V$ ,  $V_{ss} = GND$ ,  $t_a = 0$  to  $+70^\circ C$ )

Item		Symbol	Measuring condition	min	typ	max	unit
Output “high” level voltage	port A	Voh	Ioh = -10μA	3.5	—	—	V
	port B		Ioh = -100μA	2.4	—	—	V
			Ioh = -200μA	2.4	—	—	V
	port C		Ioh = -1mA	1.5	—	—	V
Output “low” level voltage	port A, C	Vol	Iol = 1.6mA	—	—	0.4	V
			Iol = 3.2mA	—	—	0.4	V
	port B		Iol = 10mA	—	—	1.0	V
Input “high” level voltage	port A, B, C, D	Vih		2.0	—	Vcc	V
Input “low” level voltage		Vil		-0.3	—	0.8	V
Input leak current	port A	II	Vin = 0.8V	-500	—	—	μA
	port B, C, D		Vin = 2V	-300	—	—	μA
			Vin = 0.4~ Vcc	-20	—	—	μA

TTL load (port B)



TTL load (port A, C)

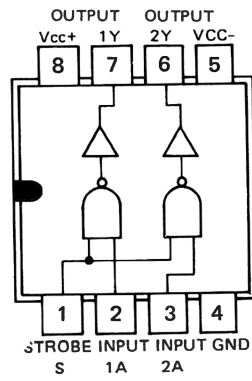


- (Note)
1. Load capacity includes a stray capacity of the probe, jig, etc.
  2. All the diodes are IS2074(H).

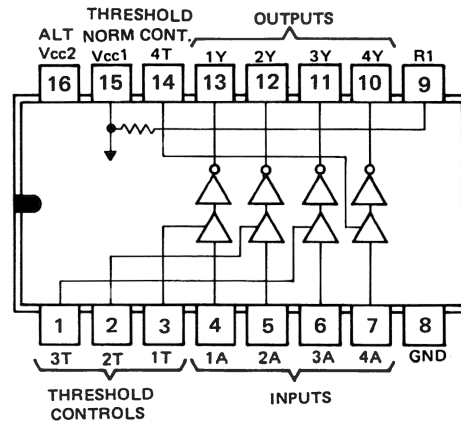
Fig. 28 Bus timing load circuit



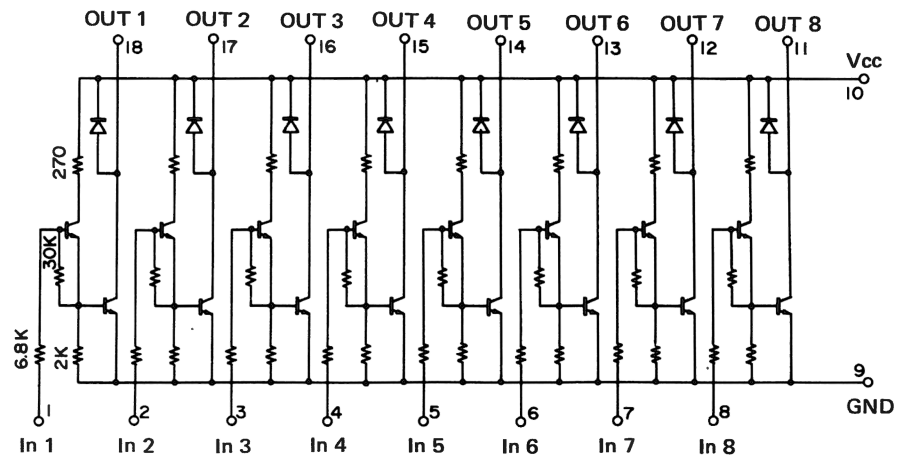
● SN75150



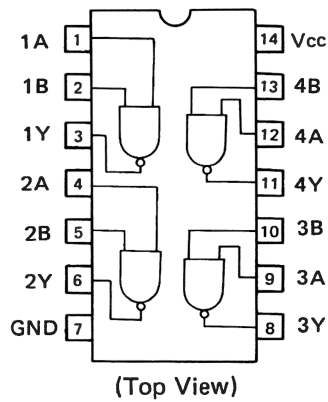
● SN75154



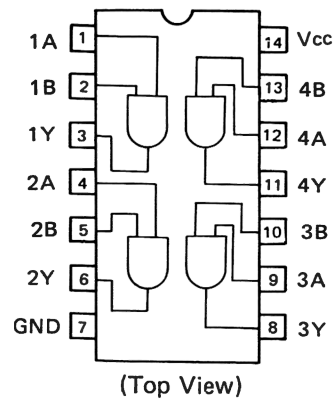
● LB1257



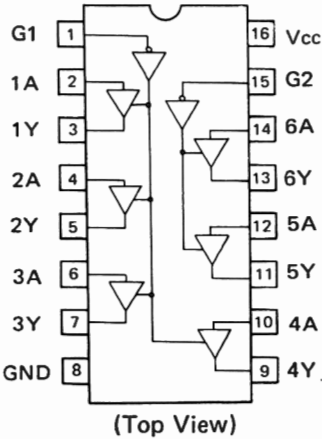
● HD74LS00



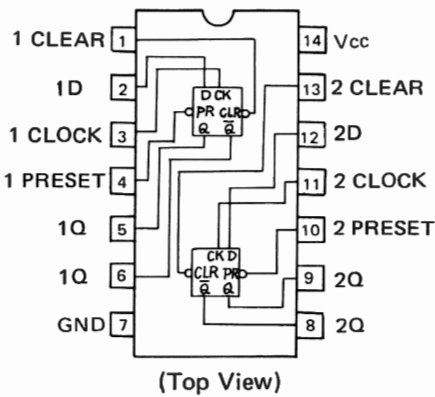
● HD74LS08



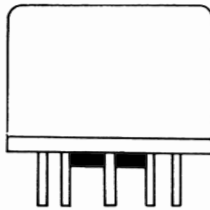
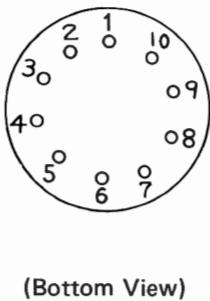
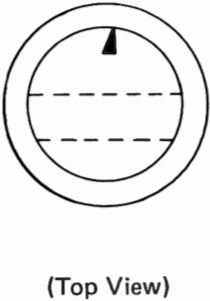
● HD74LS367



● HD74LS74



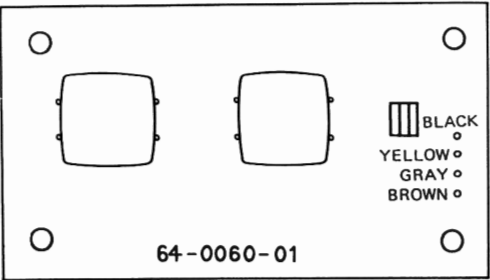
● DC-DC Converter Transformer



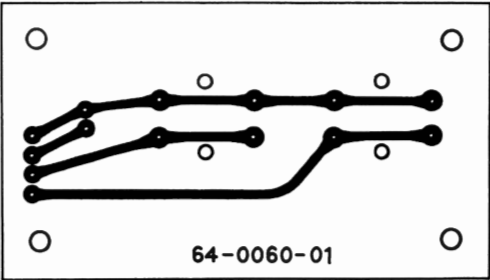
(2) Panel P.C.B. and Pen Change P.C.B. Diagram

1) Panel P.C. Board

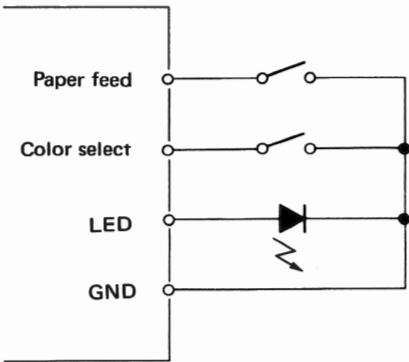
(Top View)



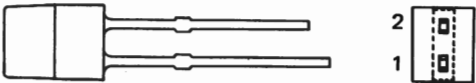
(Bottom View)



Schematic Diagram



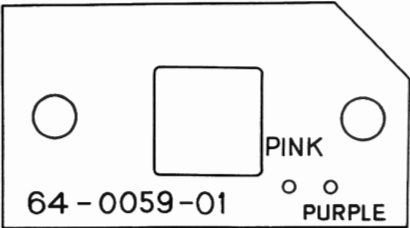
• LED LN229RP



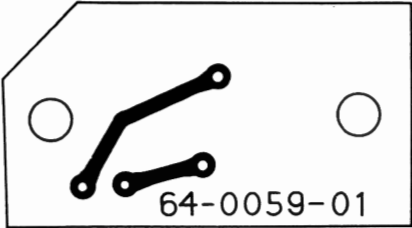
1: Anode  
2: Kathode

2) Pen Change P.C. Board

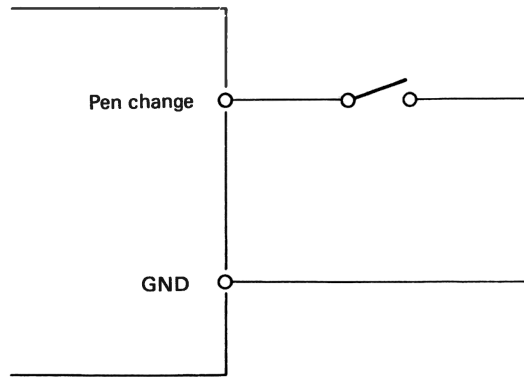
(Top View)



(Bottom View)

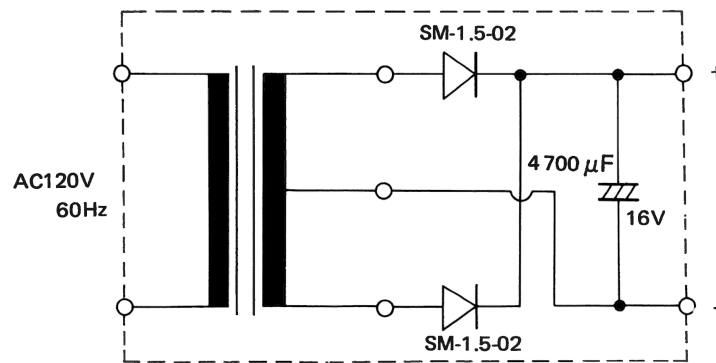


### Schematic Diagram

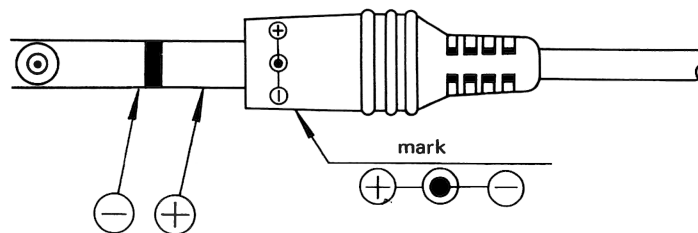


### (3) AC Adapter Diagram

#### 1) Schematic Diagram



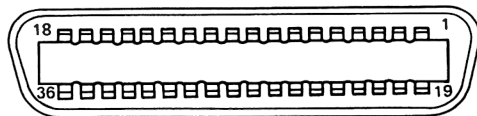
#### 2) Terminal



#### (4) Connector Pin Layout

##### 1) Parallel Interface

\*Connector pin layout



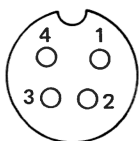
1	STROBE	19	GND
2	D <sub>0</sub>	20	GND
3	D <sub>1</sub>	21	GND
4	D <sub>2</sub>	22	GND
5	D <sub>3</sub>	23	GND
6	D <sub>4</sub>	24	GND
7	D <sub>5</sub>	25	GND
8	D <sub>6</sub>	26	GND
9	D <sub>7</sub>	27	GND
10	$\overline{\text{ACK}}$	28	GND
11	BUSY	29	GND
12	GND	30	GND
13	NC	31	NC
14	GND	32	NC
15	NC	33	GND
16	NC	34	NC
17	GND	35	NC
18	5V, 80mA	36	NC

\*Input/output terminal connections

##### 2) Serial Interface

\*Connector: 4 pin DIN Jack  
TCS 4640-01A (HOSHIDEN CO., LTD.)

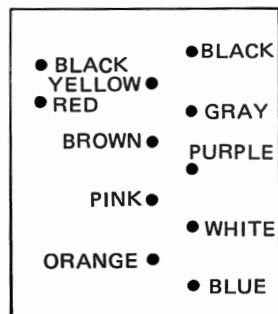
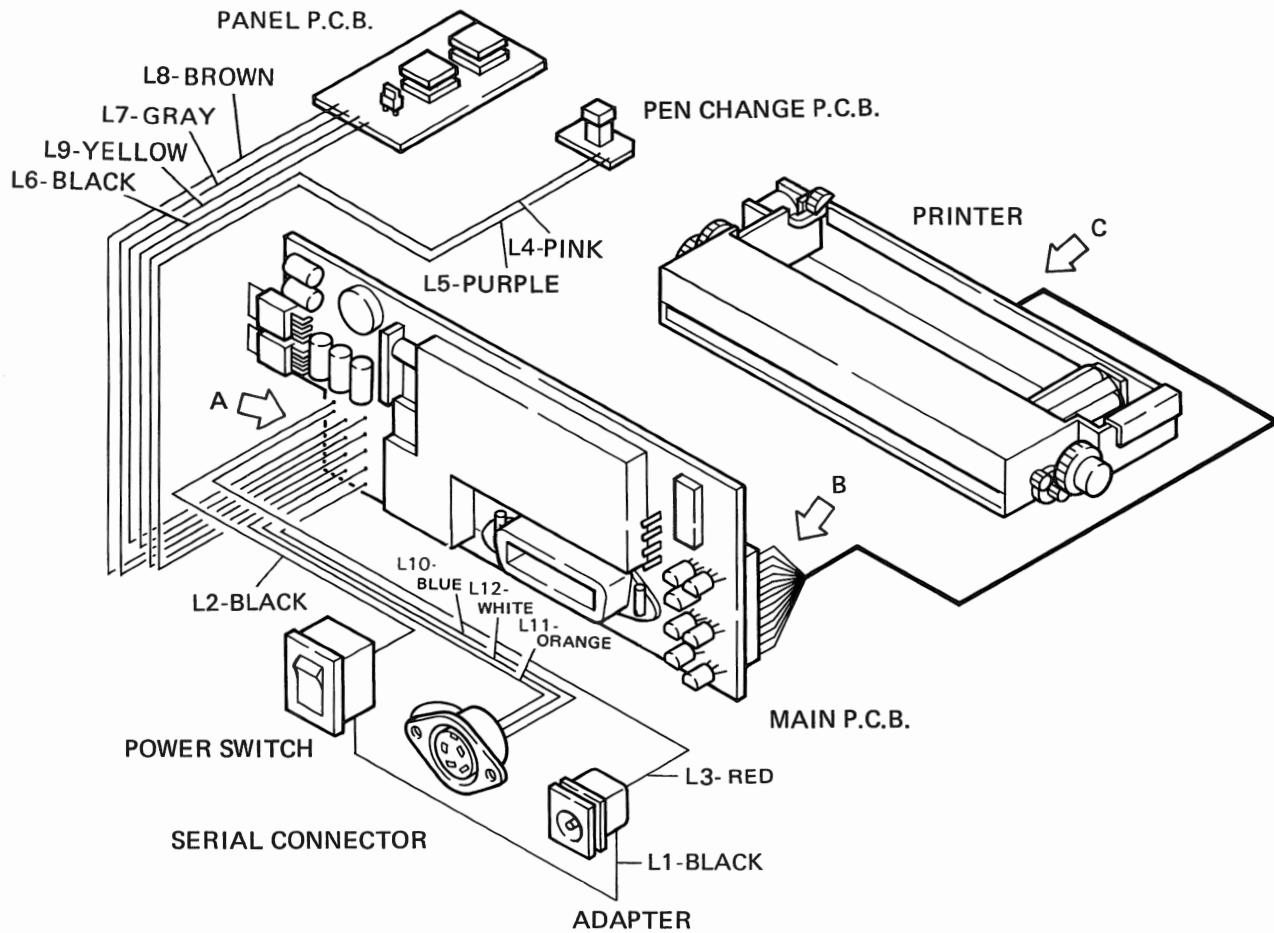
\*Pin layout



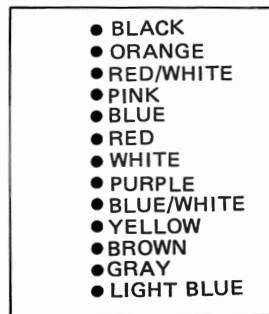
PIN NO.	SIGNAL
1	NOT USED
2	$\overline{\text{BUSY}}$
3	GND
4	DATA

### Top and Bottom View

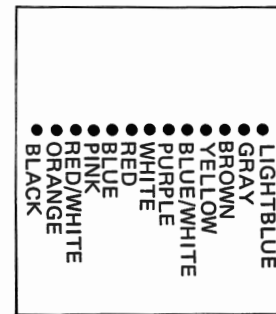
## 10. WIRING DIAGRAM



View A



View B



View C

## 11. PARTS LIST

### (1) Electrical Parts List

Ref. No.	Description	Radio Shack Part Number	Manufacturer Part Number
ADP	AC Adapter		DAG2300-01
C1	Ceramic Capacitor 50V 1000pF ±10%		52-1002-01
C2	Ceramic Capacitor 50V 10pF ±10%		52-1007-01
C3	Ceramic Capacitor 50V 680pF ±10%		52-1008-01
C4	Ceramic Capacitor 50V 680pF ±10%		52-1008-01
C5	Electrolytic Capacitor 50V 1μF ±20%		52-2010-01
C6	Electrolytic Capacitor 16V 10μF ±20%		52-2008-01
C7	Electrolytic Capacitor 16V 10μF ±20%		52-2008-01
C8	Electrolytic Capacitor 16V 33μF ±20%		52-2011-01
C9	Electrolytic Capacitor 16V 33μF ±20%		52-2011-01
C10	Electrolytic Capacitor 16V 33μF ±20%		52-2011-01
C11	Tantalum Electrolytic Capacitor 16V 1μF ±20%		52-2012-01
C12	Tantalum Electrolytic Capacitor 16V 1μF ±20%		52-2012-01
C13	Tantalum Electrolytic Capacitor 16V 1μF ±20%		52-2012-01
C14	Tantalum Electrolytic Capacitor 16V 1μF ±20%		52-2012-01
C15	Ceramic Capacitor 50V 0.047μF ±20%		52-1009-01
CON1	Parallel Connector		63-0006-01
CON2	Flat Wafer		63-4003-01
CON3	Serial Connector		63-0005-01
CON4	DC Jack		63-0007-01
CPCB	#Pen Change P.C. Board Unit		DG902
CU	Connector Unit		DG150
D1	Diode 1S2076FA 250MW		40-1003-01
D2	Diode 1S2076S1 250MW		40-1004-01
D3	Diode 1S2076S1 250MW		40-1004-01
D4	Diode 1S2076S1 250MW		40-1004-01
D5	Diode 1S2076S1 250MW		40-1004-01
D6	Diode 1S2076FA 250MW		40-1003-01
D7	Diode 1S2075KFA 250MW		40-1005-01
D8	Diode 1S2075KFA 250MW		40-1005-01
HS	Heat Sink		69-2002-01
IC1	Micro Processor HD6805V1A08P (Mask Rom)		DLG-12
IC2	Hex Buffer HD74LS367		42-1004-01
IC3	Quad And HD74LS08		42-1001-01
IC4	Flip Flop HD74LS74		42-1002-01
IC5	Quad Nand HD74LS00		42-1003-01
IC6	RS-232 Driver SN75150		42-1005-01
IC7	RS-232 Receiver SN75154		42-1006-01
IC8	Voltage Reg. HA17805		43-2001-01
IC9	Voltage Reg. HA17805		43-2001-01
IF	Insulation Film		69-0035-01
L1	Electric Wire AWG24		68-0047-01
L2	Electric Wire AWG24		68-0048-01
L3	Electric Wire AWG28		68-0049-01



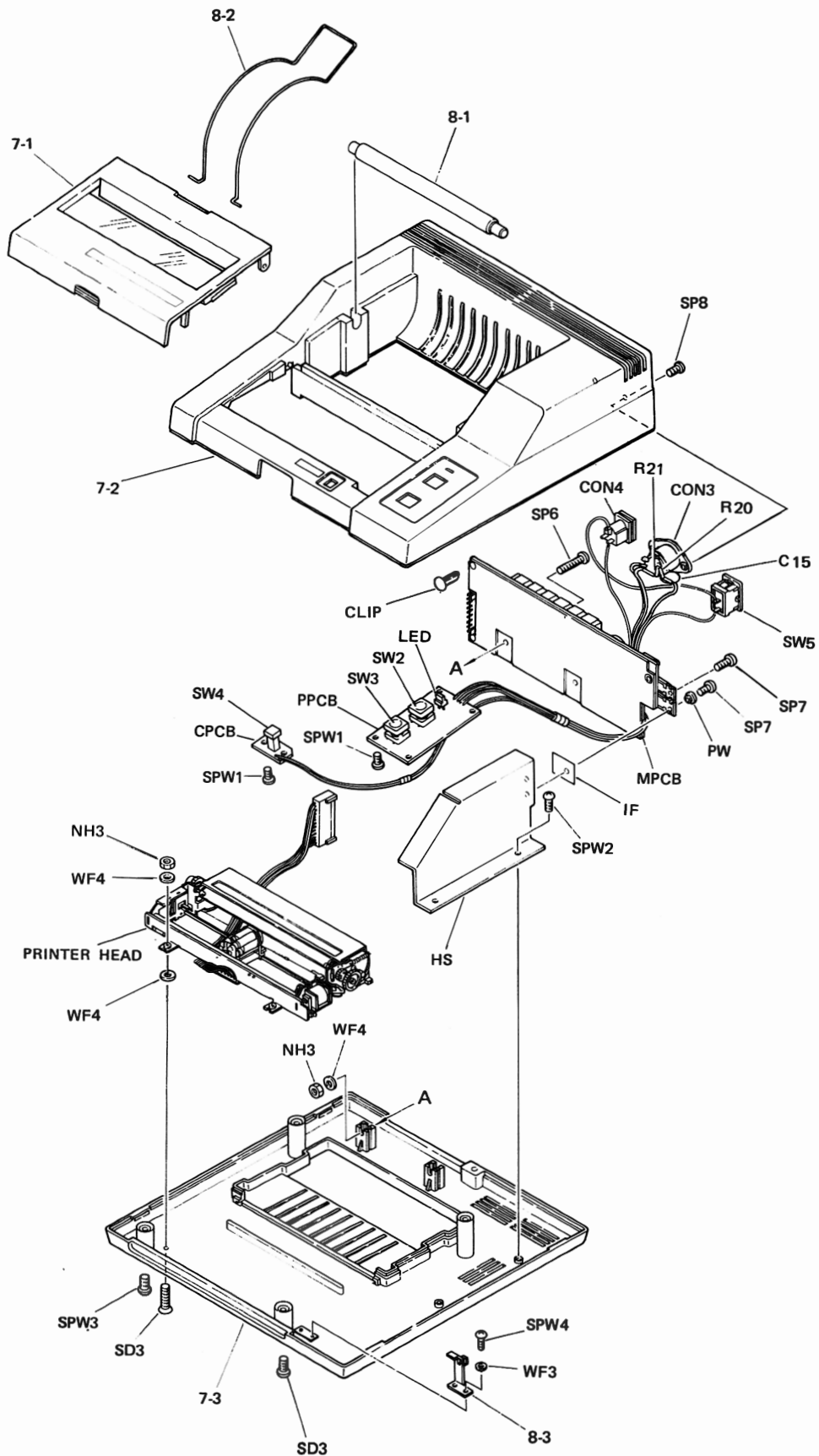
Ref. No.	Description					Radio Shack Part Number	Manufacturer Part Number
L4	Electric Wire	AWG28					68-0050-01
L5	Electric Wire	AWG28					68-0051-01
L6	Electric Wire	AWG28					68-0052-01
L7	Electric Wire	AWG28					68-0053-01
L8	Electric Wire	AWG28					68-0054-01
L9	Electric Wire	AWG28					68-0055-01
L10	Electric Wire	AWG28					68-0056-01
L11	Electric Wire	AWG28					68-0057-01
L12	Electric Wire	AWG28					68-0058-01
LED	Power Indicate Led	LN229R P					40-3003-01
MPCB	#Main P.C.B. Unit						DG 900
P1	Main Print Circuit Board						64-0052-03
P2	Panel P.C. Board						64-0060-01
P3	Pen Change P.C. Board						64-0059-01
PPCB	#Panel P.C. Board Unit						DG901
PW	Plastic Insulation Washer						23-0034-01
R1	Carbon Resistor	1/4 W	220	(H)	J		50-1012-01
R2	Carbon Resistor	1/4 W	3.3K	(H)	J		50-1014-01
R3	Carbon Resistor	1/4 W	39K	(H)	J		50-1026-01
R4	Carbon Resistor	1/4 W	10K	(H)	J		50-1016-01
R5	Carbon Resistor	1/4 W	100K	(H)	J		50-1018-01
R6	Carbon Resistor	1/4 W	10K	(H)	J		50-1016-01
R7	Carbon Resistor	1/4 W	10K	(H)	J		50-1023-01
R8	Carbon Resistor	1/4 W	5.6K	(V)	J		50-1022-01
R9	Carbon Resistor	1/4 W	5.6K	(V)	J		50-1022-01
R10	Carbon Resistor	1/4 W	100K	(V)	J		50-1024-01
R11	Carbon Resistor	1/4 W	100K	(V)	J		50-1024-01
R12	Carbon Resistor	1/4 W	220	(V)	J		50-1021-01
R13	Carbon Resistor	1/4 W	220	(V)	J		50-1021-01
R14	Carbon Resistor	1/4 W	220	(V)	J		50-1021-01
R15	Carbon Resistor	1/4 W	220	(V)	J		50-1021-01
R16	Carbon Resistor	1/4 W	470	(H)	J		50-1013-01
R17	Carbon Resistor	1/4 W	15K	(H)	J		50-1025-01
R18	Carbon Resistor	1/4 W	470	(V)	J		50-1013-01
R20	Carbon Resistor	1/4 W	2.2K $\Omega$	(H)	J		50-1027-01
R21	Carbon Resistor	1/4 W	4.7K $\Omega$	(H)	J		50-1028-01
RA1	Resistor Array	1/8 W	3.3K x 9	K			50-9006-01
RA2	Resistor Array	1/8 W	10K x 6	K			50-9007-01
S1	Shield Plate (A)	(Back)					69-2005-01
S2	Shield Plate (B)	(Cover)					69-2006-01
S3	Shield Plate (C)	(Frame)					69-2007-01
S1	Dip Switch 4-circuit						62-7001-01
S2	Color Change Switch						62-0001-01
S3	Paper Feed Switch						62-0001-01
S4	Pen Change SW						62-0002-01
S5	Power Switch						62-3002-01
T1	DC-DC Convertor Transformer	For $\pm 12V$					54-2002-01

Ref. No.	Description			Radio Shack Part Number	Manufacturer Part Number
TR1	Transistor	2SC454C or D			41-3002-01
TR2	Transistor	2SA844C or D			41-1002-01
TR3	Transistor	2SA844C or D			41-1002-01
TR4	Transistor	2SA844C or D			41-1002-01
TR5	Transistor	2SB739C or D			41-2001-01
TR6	Transistor	2SD788C or D			41-4002-01
TR7	Transistor	2SB739C or D			41-2001-01
TR8	Transistor	2SD788C or D			41-4002-01
TR9	Transistor	2SC1317R			41-3003-01
TR10	Transistor	2SC1384R			41-3004-01
TRA	Transistor Array	LB1257	8 CIRCUIT		41-9001-01
XTAL	Quartz Oscillator	4MHz			55-0001-01
ZD1	Zenor Diode	HZ11AS1	VZ = 9.9V		40-2003-01
ZD2	Zenor Diode	HZ12C1FA	VZ = 13.5V		40-2004-01

## (2) Mechanical Parts List

Ref. No.	Description			Radio Shack Part Number	Manufacturer Part Number
1-1	#Frame Unit				DG151
2-1	#X Motor Unit				DG104
2-2	X Idle Gear				07-0132-01
2-3	#Bobbin Gear Unit				DG013
2-4	Bobbin Cap				11-8073-01
2-5	#Wire Unit				DG115
2-6	Sleeve				26-0001-01
2-7	#Pulley Support Base (Left) Unit				DG015
2-8	#Pulley Support Base (Right) Unit				DG109
2-9	Slider Shaft (A)				10-0349-01
2-10	Slider Shaft (B)				10-0350-01
3-1	#Y Motor Unit				DG105
3-2	Y Idle Gear				07-0131-01
3-3	#Rubber Roller Unit				DG107
3-4	#Paper Holding Roller Support Plate (Left) Unit				DG108
3-5	#Paper Holding Roller Support Plate (Right) Unit				DG109
3-6	Paper Holding Roller (Large)				10-0297-01
3-7	Paper Holding Roller (Small)				10-0296-01
4-1	#Electromagnet Unit				DG025
4-2	#Ejection Lever Shaft Unit				DG113
4-3	Ejection Lever				12-0147-01
4-4	Ejection Roller				10-0287-01
4-5	#Slider Unit				DG059
4-6	#Reed Switch Unit				DG063
4-7	Color Change Click				19-0219-02
5-1	#Pen Take-out Lever Unit				DG060
5-2	Pen Take-out Lever Spring				19-0214-02
5-3	Pen Queller				11-0062-02

### 13. EXPLODED VIEW OF COLOR GRAPHIC PRINTER ASSEMBLIES



RADIO SHACK, A DIVISION OF TANDY CORPORATION

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