DOT MATRIX SERIAL IMPACT PRINTER

MODEL 8510A

USERS MANUAL

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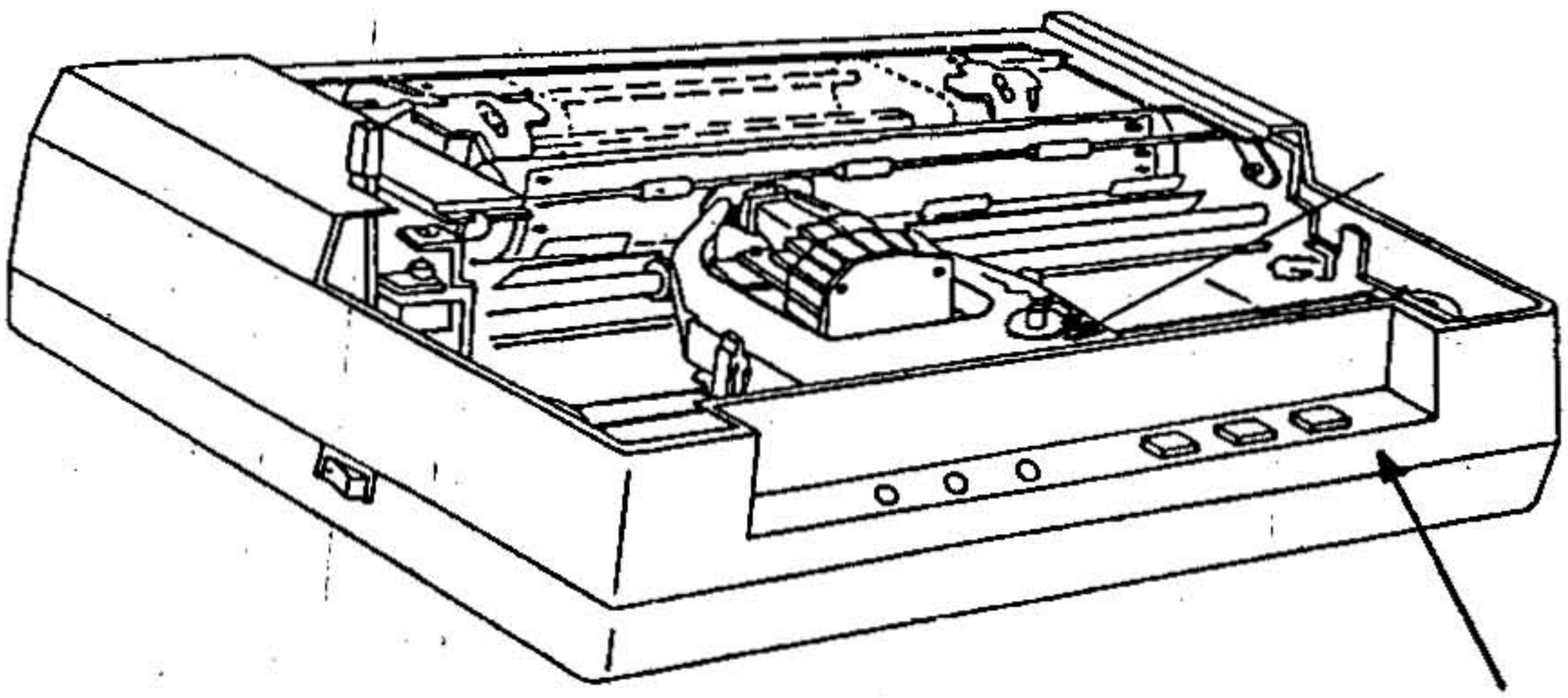
MODEL 8510



GRUNDEINSTELLUNG DER SCHALTER SW 1 + SW 2

DEFAULT FACTORY DIP-SWITCH SETTINGS SW 1 + SW 2

AN DER STELLE DIE MIT DEM PFEIL BEZEICHNET IST,BEFINDEN SICH IM GERAET 2 DIP-SCHALTER DIE FOLGENDERMASSEN EINZUSTELLEN SIND:

SW1/1=OPEN	SW2/1=CLOSED
SW1/2=OPEN	SW2/2=OPEN
SW1/3=CLOSED	SW2/3=OPEN
SW1/4=OPEN	SW2/4=OPEN
SW1/5=OPEN	SW2/5=OPEN
SW1/6=CLOSED	SW2/6=OPEN
SW1/7=CLOSED	SW2/7=CLOSED
SW1/8=CLOSED	SW2/8=OPEN

C. Itoh Electronics, Inc.
5301 BEETHOVEN ST.
LOS ANGELES, CA 90066

"This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no grarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- reorient the receiving antenna
-- relocate the computer with respect to the receiver
-- move the computer away from the receiver
-- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4."

(U.S. VERSION ONLY)

"All of the features and specifications are subject to change without prior notice"

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1. INTRODUCTION

1-1. General Description

The Model 8510A is a compact desk-top dot matrix serial impact printer used for data communication terminals, hardcopy of CRT displays, peripheral terminals for minicomputers and microcomputers, and small-sized business systems.

The character format is a dot matrix of 7(H) x 9(V). or 8(H) x 8(V).
Print speed is 120 characters/second. Up to 80 characters can be printed per line in 10CPI.

Its main features are:

1. Compact desk-top dot matrix printer
2. Eighty-column print
3. Light-weight
4. Low power-consumption
5. High-quality print
6. Bit image graphics
7. Graphic Symbols
8. Prints in six different languages
9. High reliability
10. Low cost

1-2. Specifications

(1)	Print Method	Logic Seek Printing or Incremental Printing
(2)	Print Speed	120 CPS (10CPI) 63 LPM (10CPI)
(3)	Character Format	7(H) x 9(V) Dot Matrix (Alpha-Numeric Kana & Symbols) 8(H) x 8(V) Dot Matrix (Character Generator Based Graphic) 8(H) x 8(V) Dot Matrix (Bit Image Graphic)
(4)	Characters	ASCII 96 JIS 160 Character Generator Based Graphic Fonts 64 European Characters 14 Hiragana (Option) 64 Proportional Characters 96
(5)	Character Pitch	Compressed Font 17 CPI, 136 Char/Line Compressed Font Double Width 8.5 CPI, 68 Char/Line Pica Pitch 10 CPI, 80 Char/Line Pica Pitch Double Width 5 CPI, 40 Char/Line Elite Pitch 12 CPI, 96 Char/Line Elite Pitch Double Width 6 CPI, 48 Char/Line
(6)	Paper Feed Direction	Forward, (Reverse)
(7)	Line Spacing	1/6", 1/8", N/144" (N = 0 ~99) (Minimum Pitch 1/144")
(8)	Line Feed Speed	Max. 100ms (1/6" Pitch)
(9)	Form Width	Max. 10"
(10)	Form Thickness	0.05 - 0.28mm
(11)	Number of Copies	Original + 3 (The total paper thickness may not exceed the range in item (10).)

(12) Type of Form

Fan-Folded Sprocket Paper
(see Fig. 1)

Rolled Paper

Single Sheet Paper

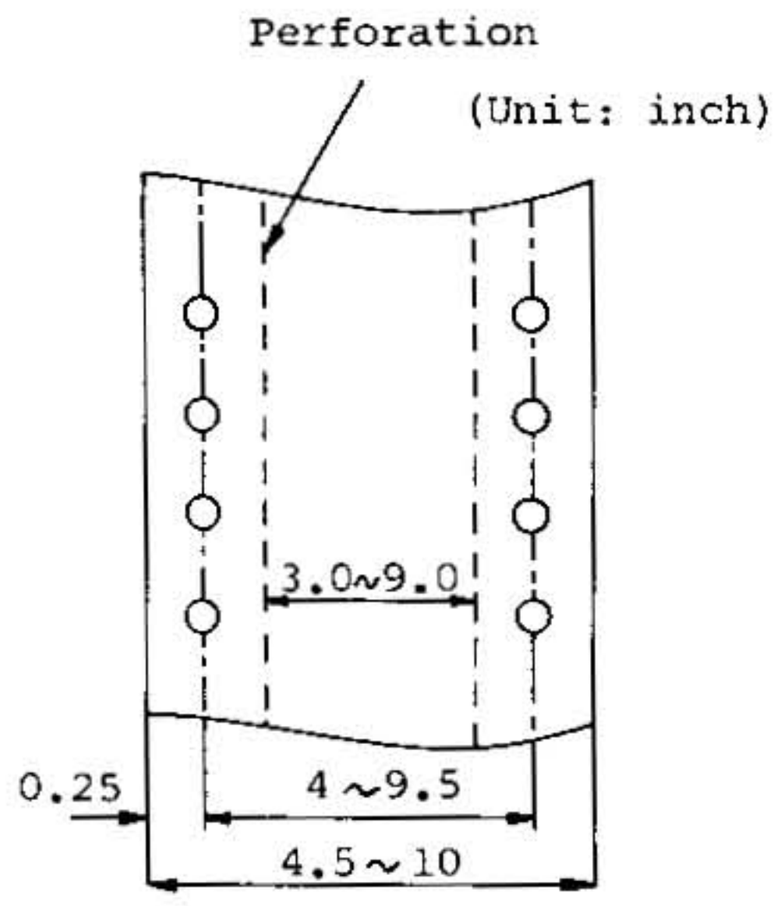


Fig. 1 Print Form

(13) Paper Feed Method — Friction Feed
Sprocket/Pin Feed (Incorporated)

(14) Form Loading — From Rear-Top

(15) Driving Method — Stepper Motor

(16) Inked Ribbon — Black (recommended)

(17) Ribbon Dimensions — 13mm (W) x 13,000mm (L)

(18) Power — 115V ± 10%, 60Hz
100V ± 10%, 50/60Hz
220V ± 10%, 50Hz
240V ± 10%, 50Hz

(19) Power Consumption — Less than 180W

(20) Weight — 8.5Kg

(21) Dimensions — 398(W) x 285(D) x 125(H)mm

(22) Parallel Interface — 8-bit Parallel

(23) Serial Interface — (RE Type) RS232C RDY/BSY System
(RD Type) RS232C RDY/BSY, XON/XOFF, ETX/ACK System
(CD Type) RS232C RDY/BSY, XON/XOFF, ETX/ACK System (Current Loop System)

1-3. Exterior View and Nomenclature

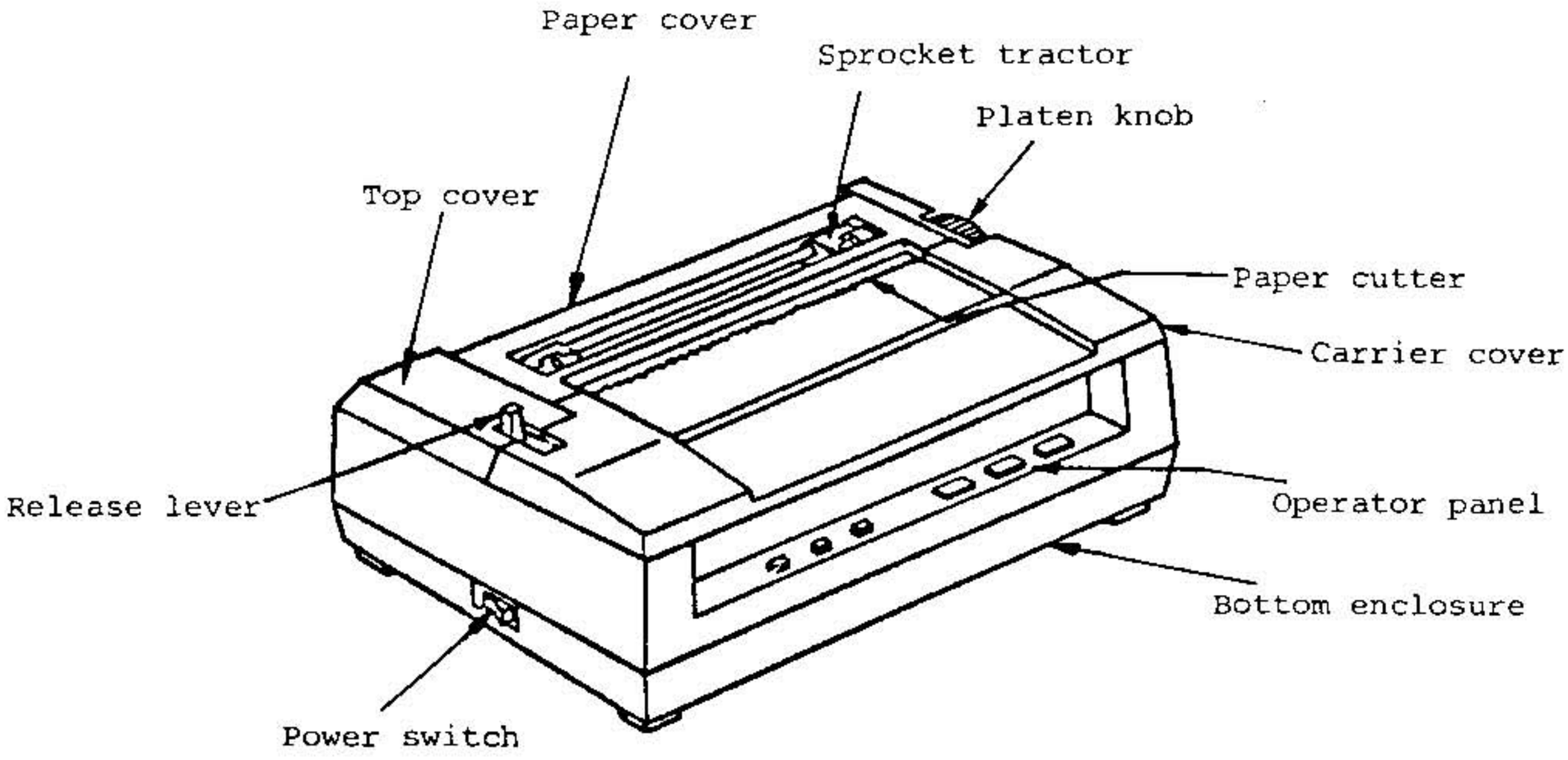


Fig. 2 Front Exterior View

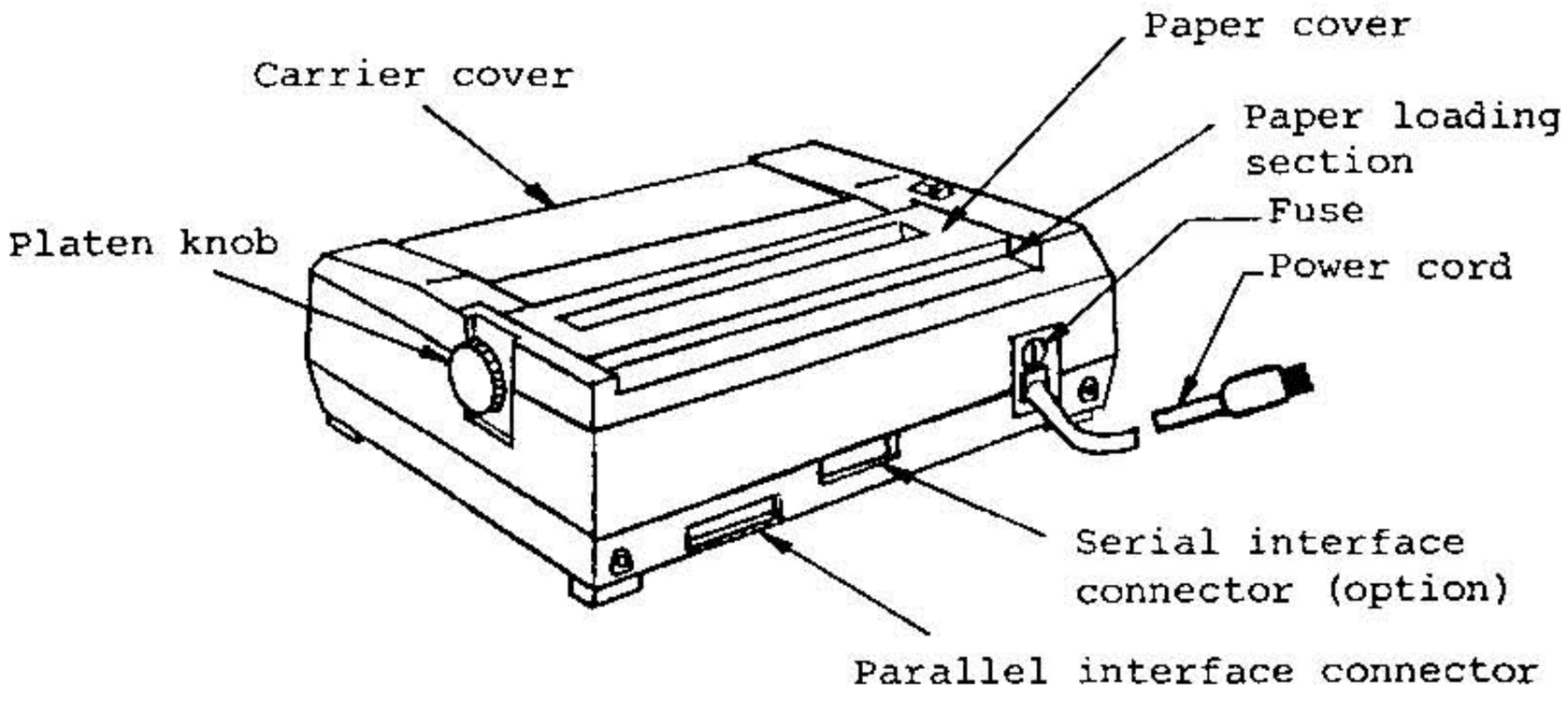
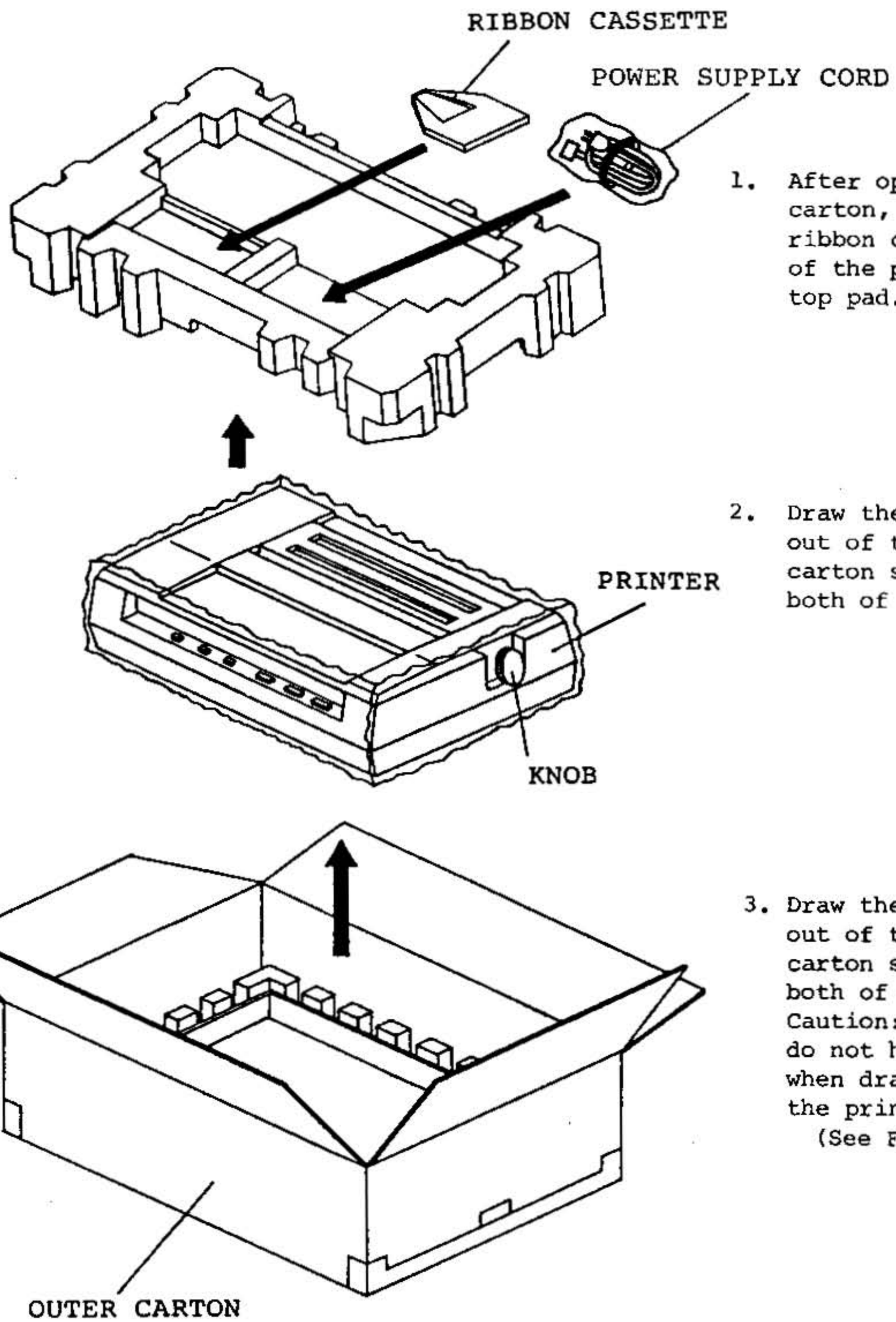


Fig. 3 Rear Exterior View

2. PREPARATION FOR USE

2-1. Unpacking Instructions



1. After opening outer carton, take the ribbon cassette out of the pocket in the top pad.

2. Draw the top pad out of the outer carton slowly with both of your hands.

3. Draw the printer out of the outer carton slowly with both of your hands. Caution: Please, do not hold the knob when drawing out the printer. (See Fig. 4)

Fig. 4 Unpacking Instruction (1)

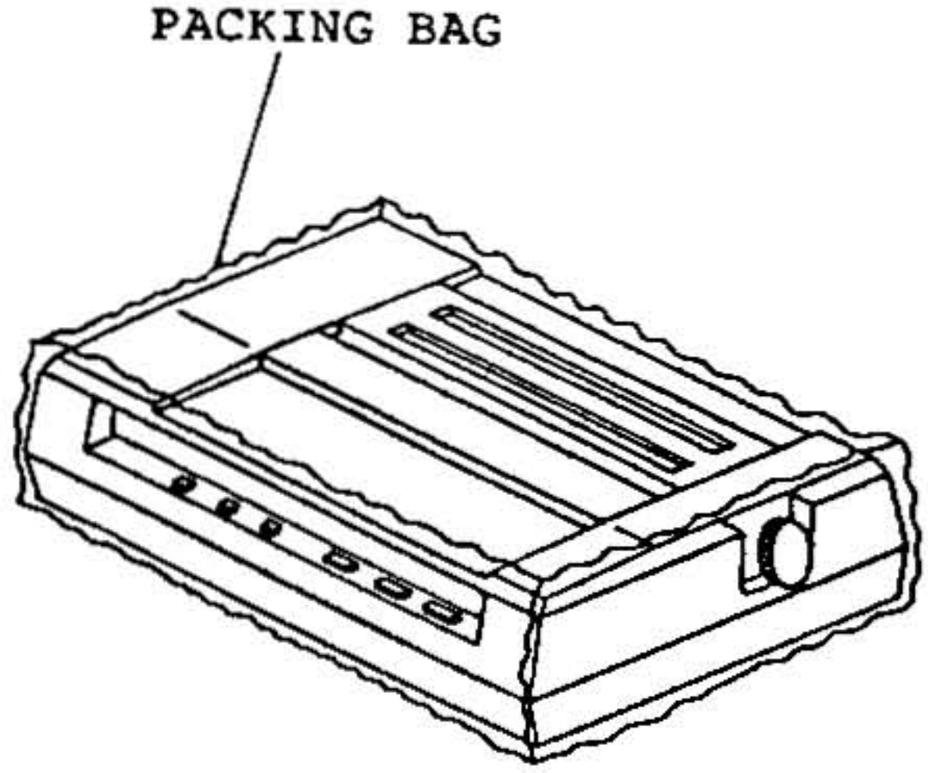


Fig. 5 Unpacking Instruction (2)

4. Remove the packing bag.
   (See Fig. 5)

5. Remove the carrier cover from the top cover. Then remove the stopper that is provided to retain the head.

6. Install the ribbon cassette to the printer.

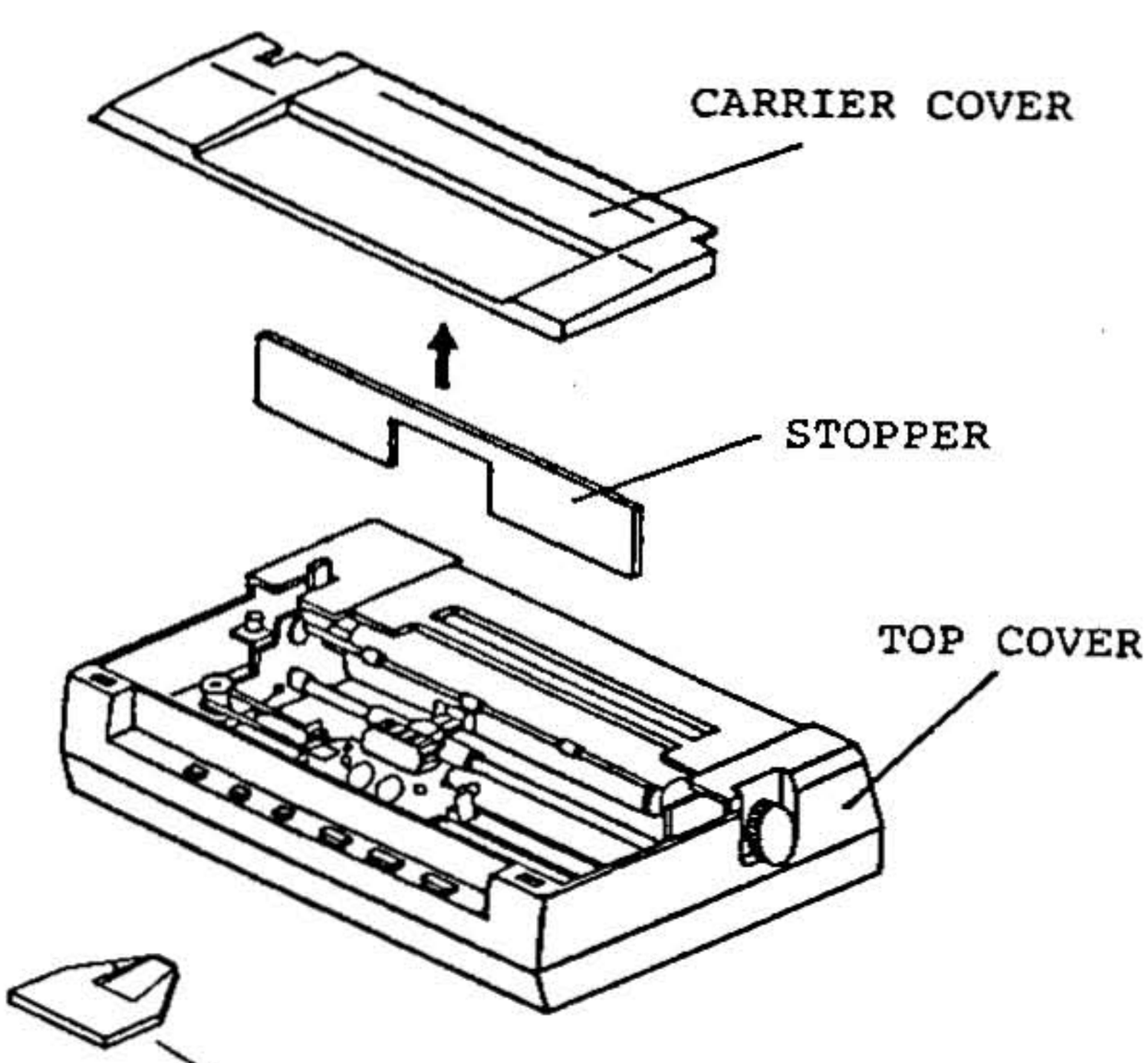


Fig. 6 Unpacking Instruction (3)

7. Install the carrier cover.
   (See Fig. 6)

2-2. Power Switch and Control Panel

(1) Power Switch

The power ON-OFF switch is located on the left side of the printer. its ▭ mark side should be pushed to turn it ON.

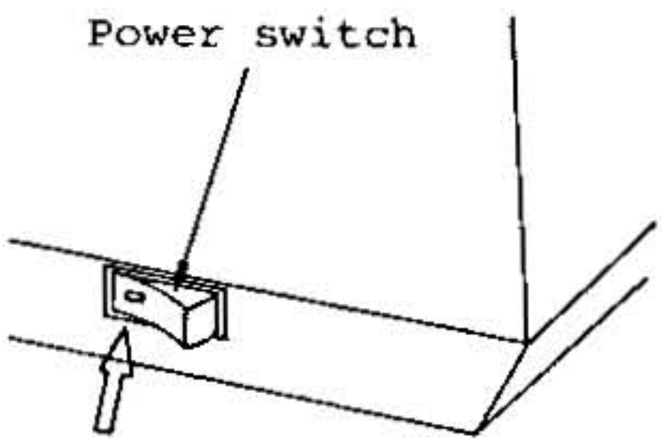


Fig. 7 Power Switch

(2) Control Panel

The control panel is located on the right front side of the top cover. As shown in Fig. 8 , the panel has 3 push switches, 2 green LEDs, and one red LED.

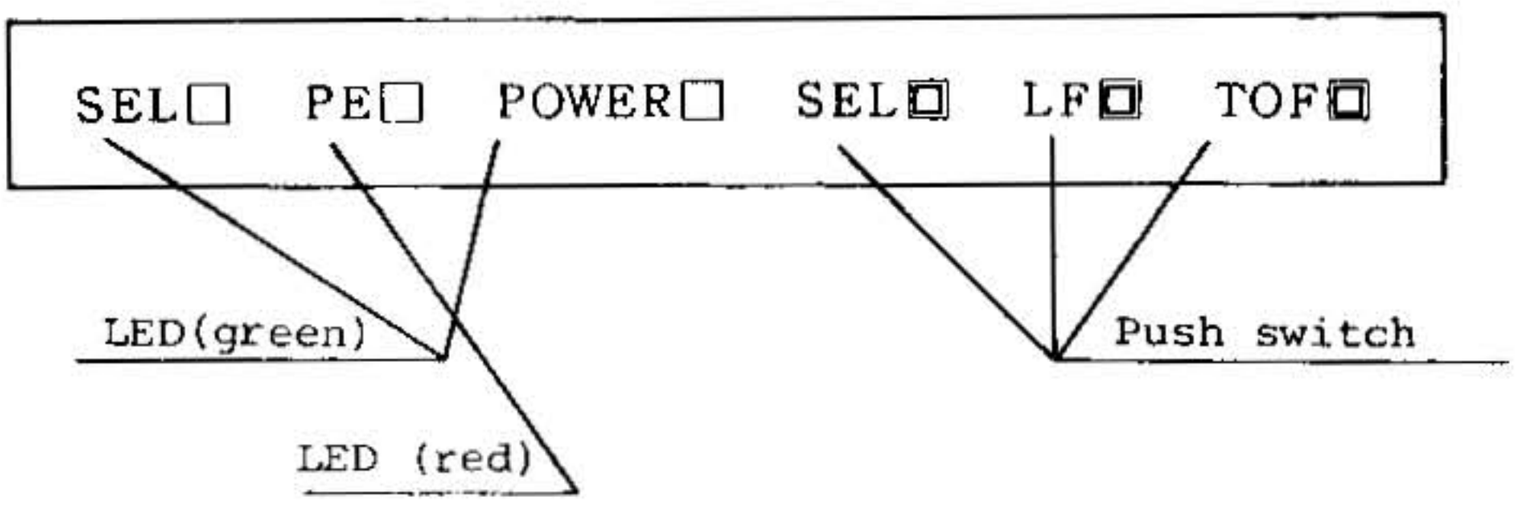


Fig. 8 Control Panel

2.3 Paper Insertion and Removal

A In Case of Pin Feed (Fan-Folded Sprocket Paper)

(1) Paper Removal

When the paper end is near, the printer will enter the PAPER EMPTY state, activating the red PE indicator light. To remove paper, first open the paper cutter as indicated below, and pull the center roller shaft forward, toward the control panel. Then pull the release lever forward and turn the platen knob clockwise, taking the paper out upward (refer to Fig. 9).

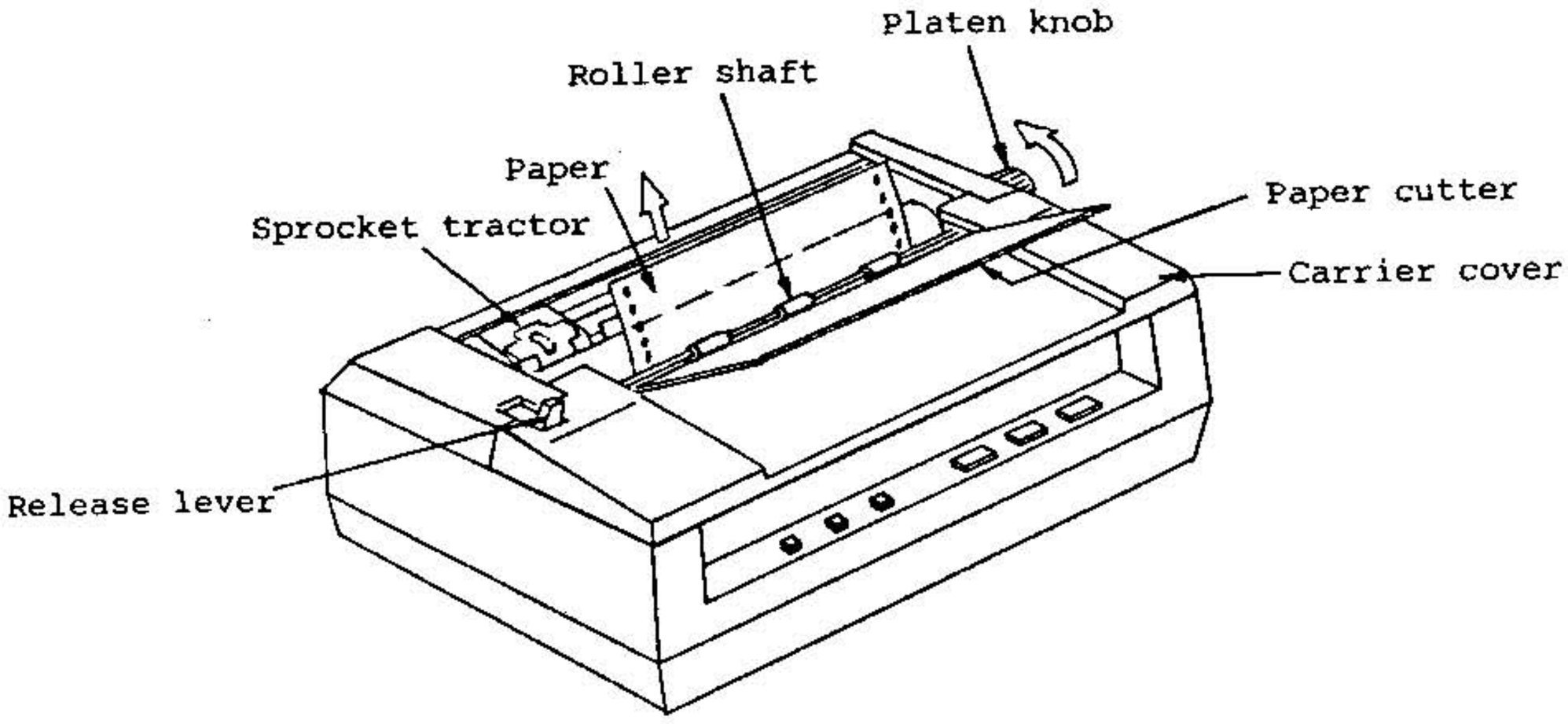


Fig. 9 Paper Removal

(2) Paper Insertion

First remove the paper cover, open the paper cutter, and pull the center roller shaft forward.

(a) Next, lift up the paper clamps attached to the right and left sprocket tractors (refer to Fig. 10).

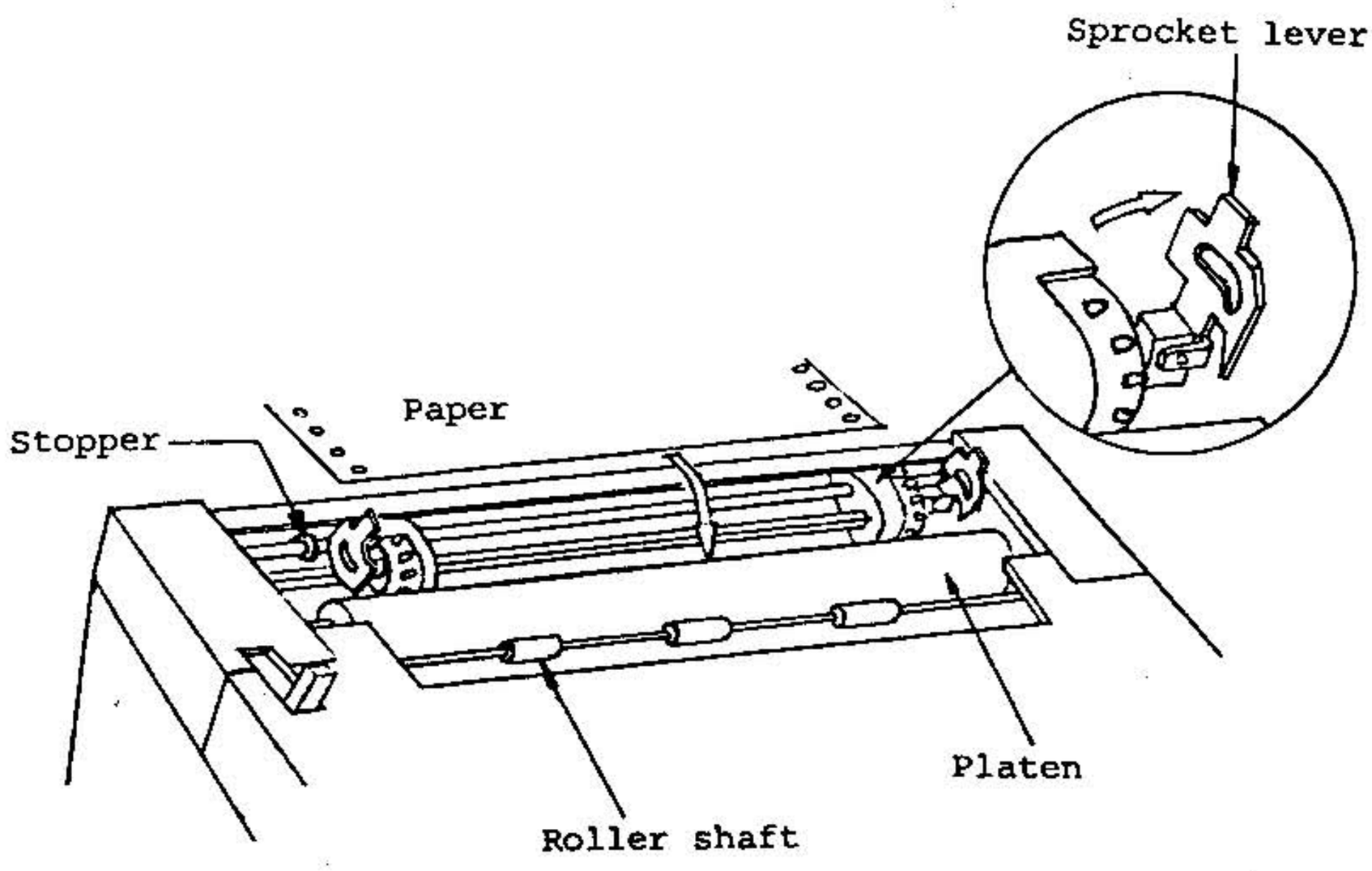


Fig. 10 Paper Insertion (1)

(b) Take the end of the paper and fit the paper sprocket holes onto the right and left sprocket pins. If the paper width necessitates adjusting the distance between the sprocket tractor, push back the right or left sprocket lever (allowing the sprocket tractor(s) to move freely) and move the sprocket tractor(s) right or left as needed to match paper width. Then pull the sprocket lever(s) forward to lock the position of the sprocket tractor(s) (refer to Fig. 11).

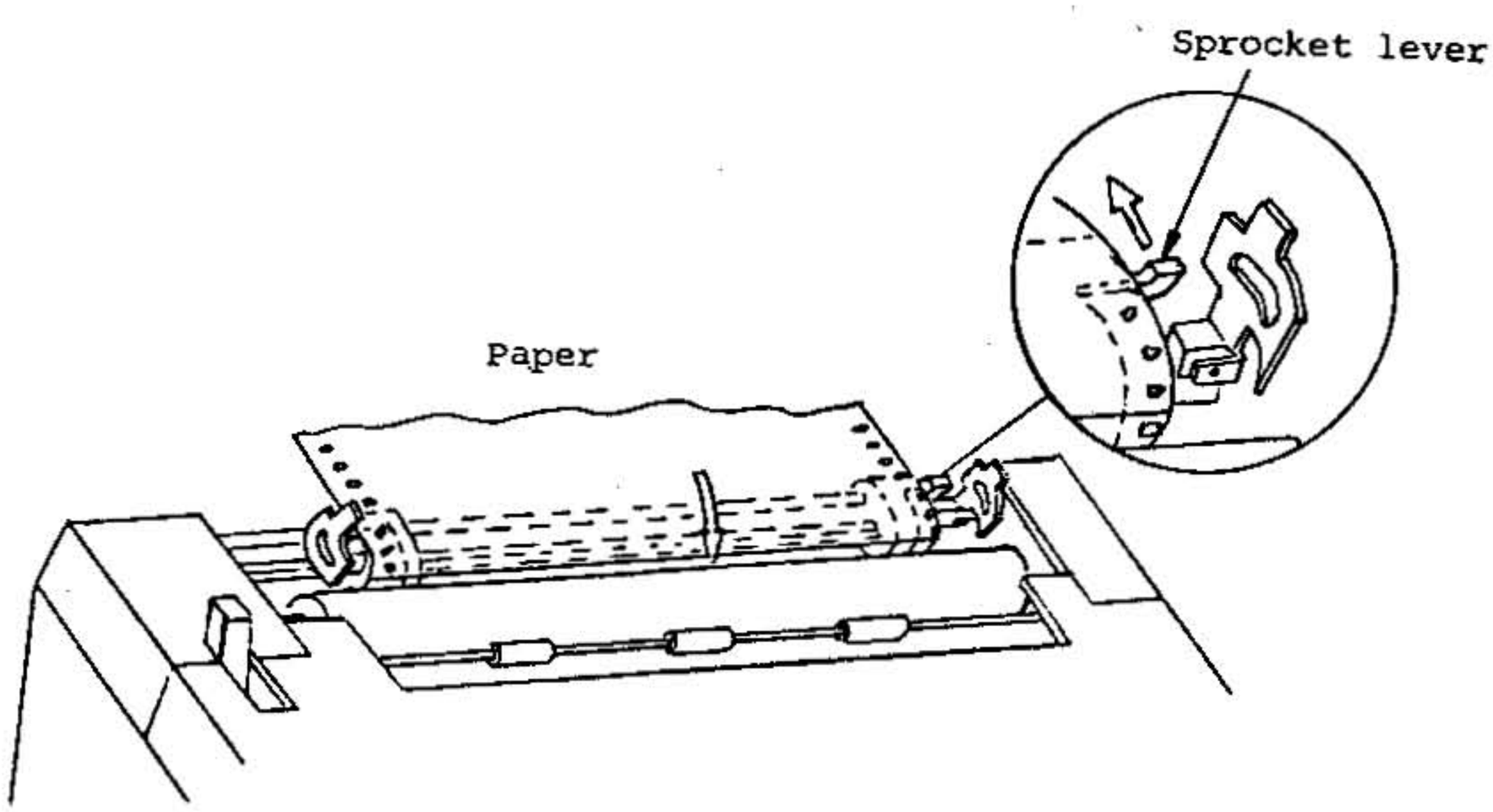


Fig. 11 Paper Insertion (2)

(c) Now push down the paper clamps of the sprocket tractors. Turn the platen knob clockwise, bringing the paper out on the front side of the platen. Return the roller shaft and release lever to their previous positions (refer to Fig.12).

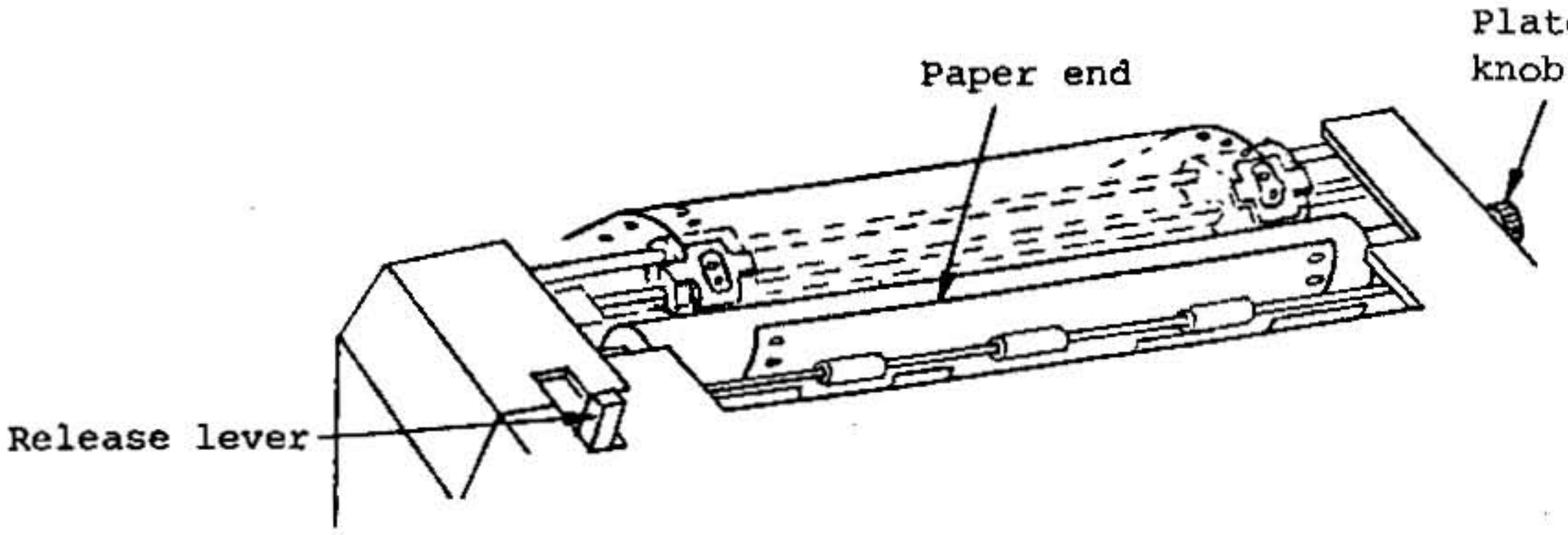


Fig. 12 Paper Insertion (3)

B. In Case of Friction Feed (Rolled paper Single Sheet paper)

(a) Slide the head to the left end.

(b) Open the paper cutter toward you and pull the roller shaft toward you. Then push the release lever away from you, and take out the paper upward.

(c) Insert new form. Insert the form through the form inlet in the paper cover in the rear of the paper cover in case of paper roll. When the form end comes out before the platen, properly set the form, push the release lever away from you, and return the roller shaft and paper cutter to their places.

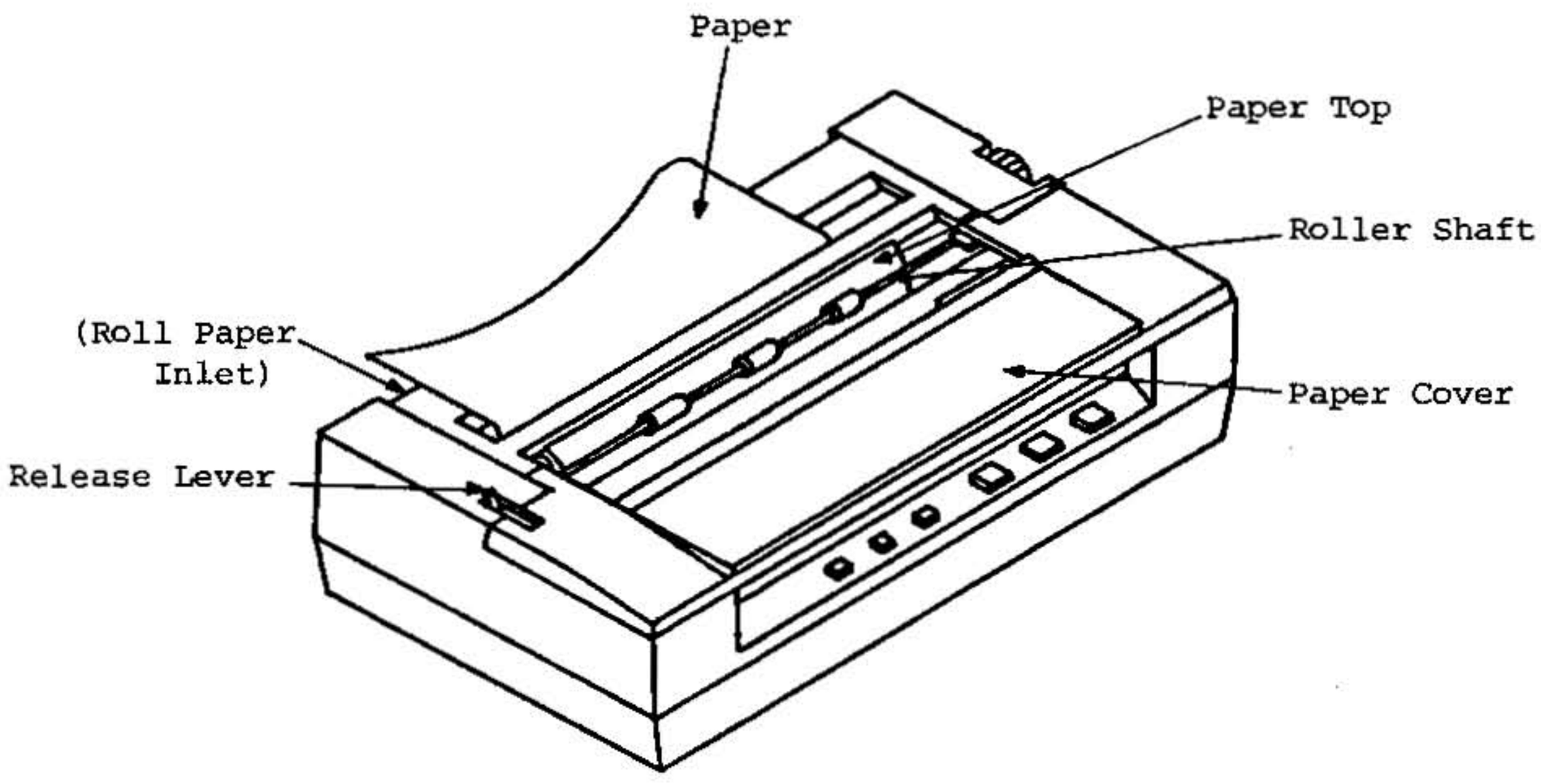


Fig 13 Paper Insertion (4)

2-4 Print Line Adjustment (TOF)

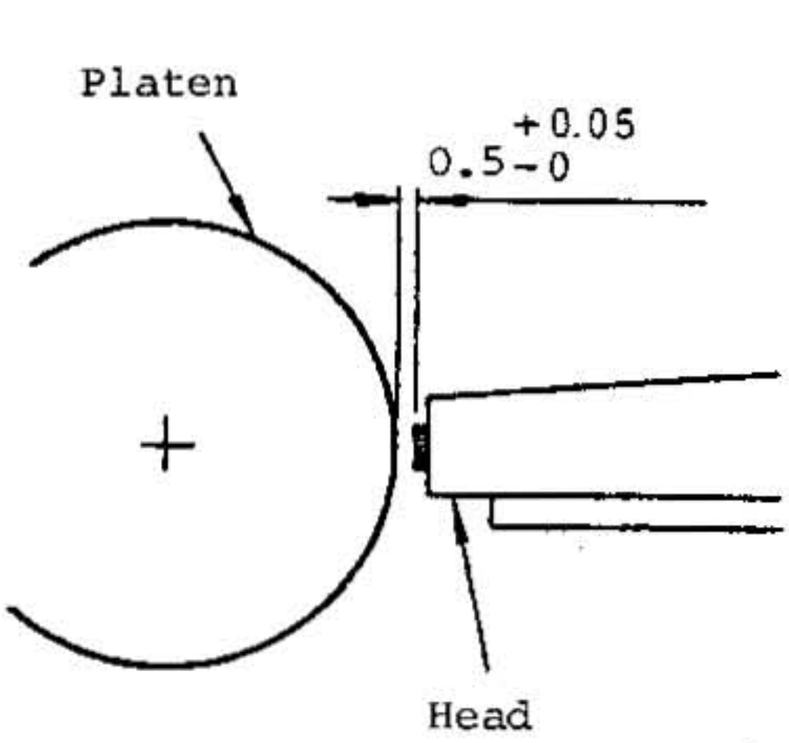
After the paper is inserted, turn the printer OFF-LINE using the "SEL" pushbutton on the front panel. Now depress the TOF pushbutton, bringing the paper to TOF of Form. Turn the right platen knob, adjusting the first print line to the desired position. This procedure sets TOF. Pushing the LF button will merely advance the paper; it will not affect TOF.

2-5 Gap between Dot Head and Platen

The gap between the head needle end and the platen is adjustable in 4 steps.

(a) When the gap adjusting lever is pushed fully away from you, the gap between the head needle end and the platen will be 0.5 to 0.55. The lever is usually set at this position when a single sheet of paper is used.

(b) Depending on the number of sheets of paper, pull the gap adjusting lever toward you to adjust the gap.



Platen-to-head-gap with adjusting lever fully pushed away from you.

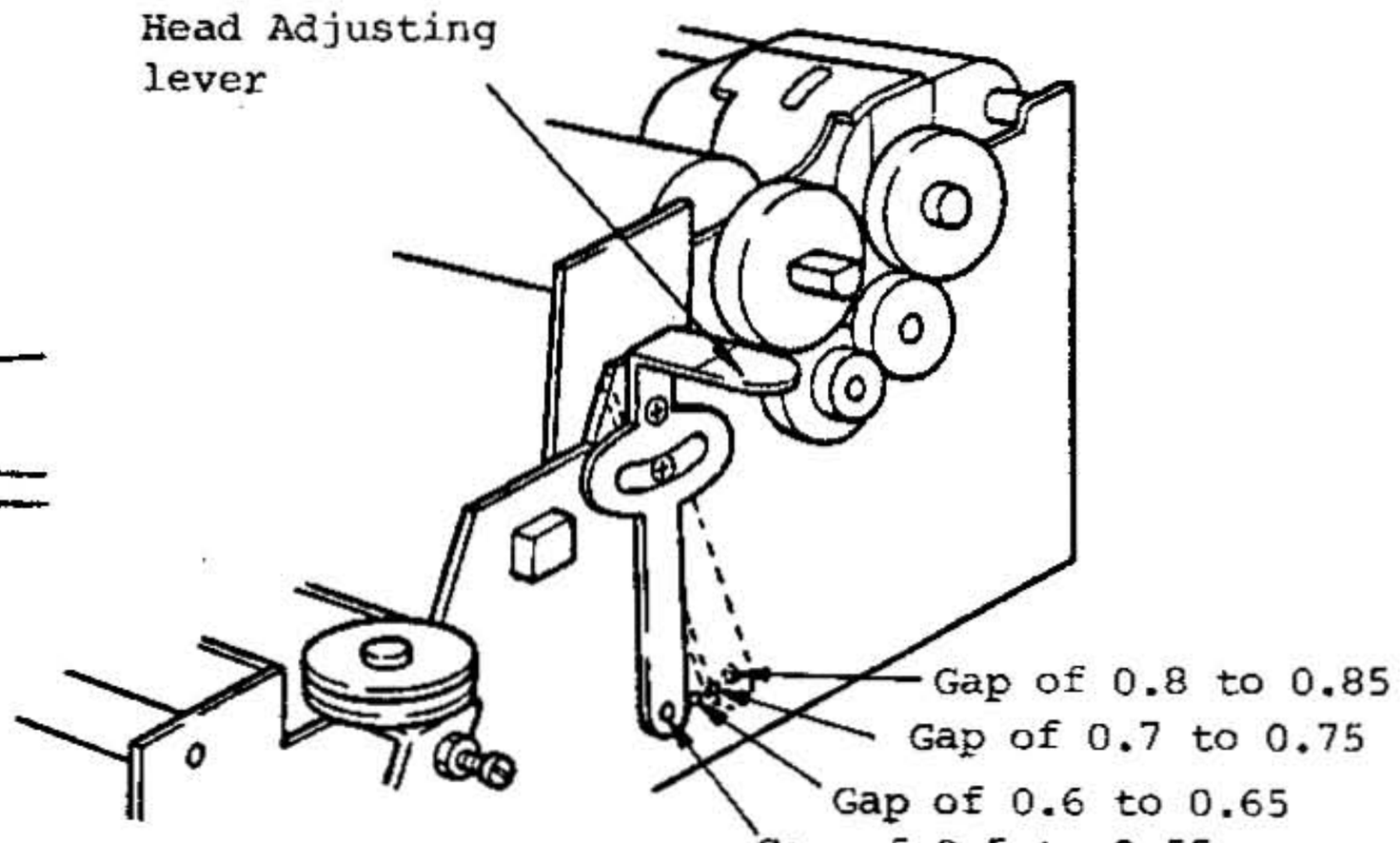


Fig. 14 Gap Adjustment between Dot Head and Platen

2-6. Ribbon Replacement

If characters are printed too lightly, replace the ribbon ahead of time. To replace the ribbon, the ribbon cassette shown in the figure below should be replaced.

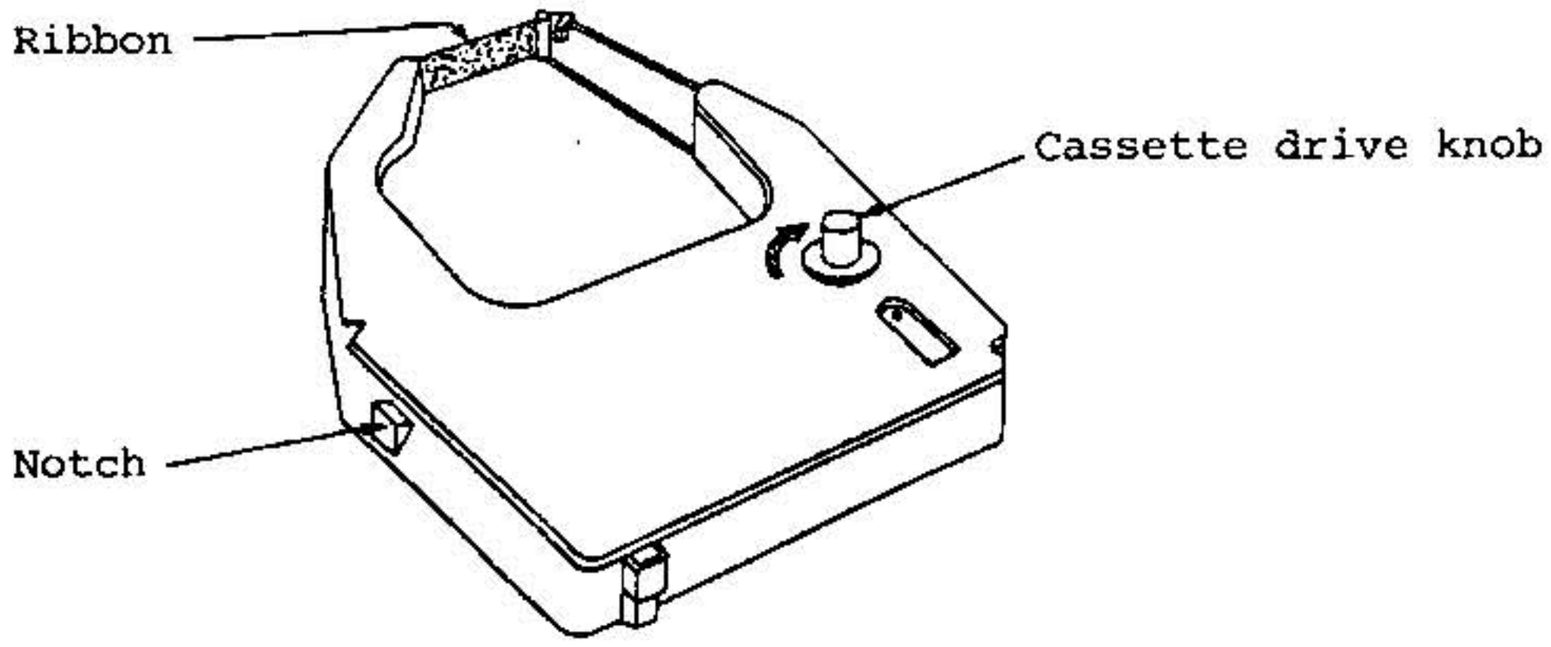


Fig. 15 Ribbon Cassette

1. Before removing the paper cover and carrier cover, turn off the printer power.

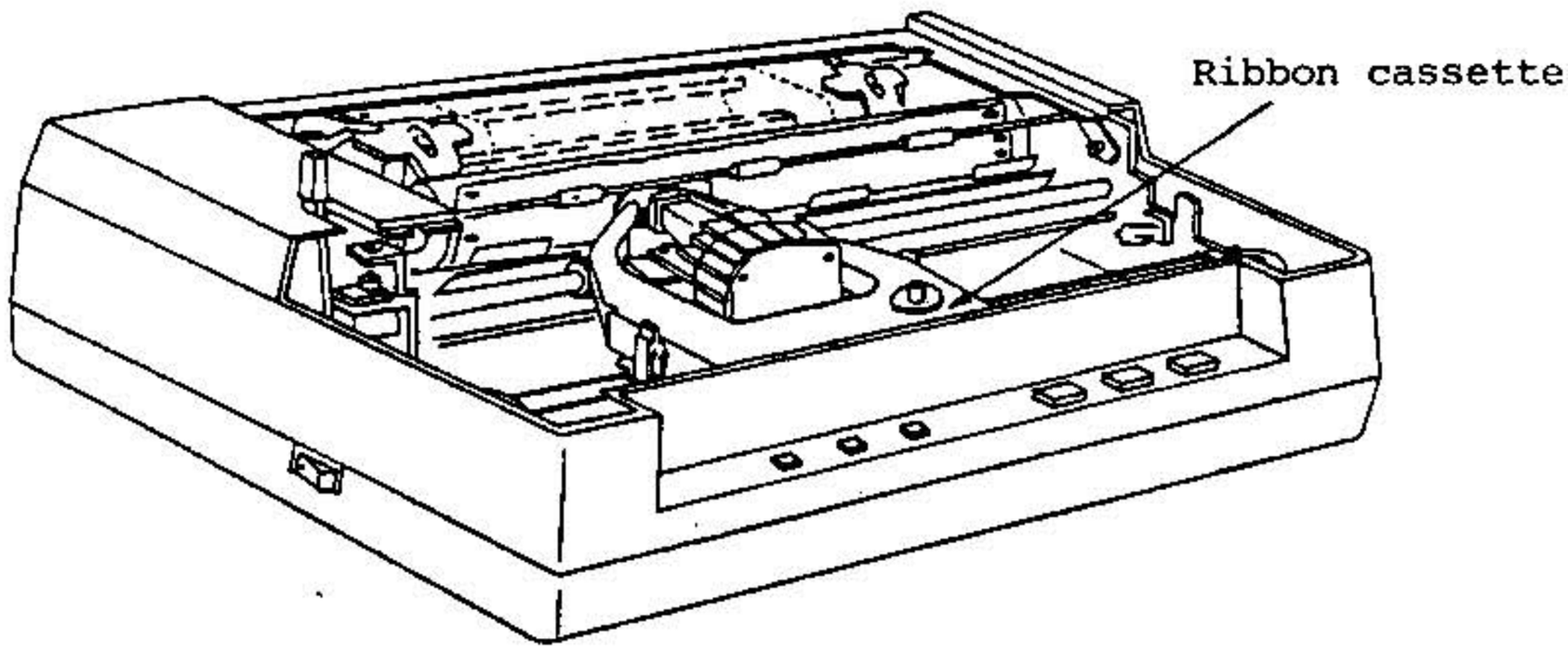


Fig. 16 Printer without Paper Cover and Carrier Cover

2. To detach the ribbon cassette, lift up the cassette while pushing the cassette supporters outward.
(Do not try to lift at the location of roller, which interferes the removal.)

3. Install a new ribbon cassette. To install, turn the cassette drive knob of the cassette in the direction of the arrow (clockwise) to tension the ribbon. Holding the cassette, carefully insert the ribbon end between the ribbon guide plate and ribbon guide, and push down the cassette on the ribbon deck. At this time, align the two guide projections at the cassette bottom with the cassette guide holes. Make sure that the notches on the both sides of the cassette are supported completely by the two cassette supporters. If not supported by the cassette supporters (the cassette is raised), push down the cassette while turning the cassette drive knob clockwise.

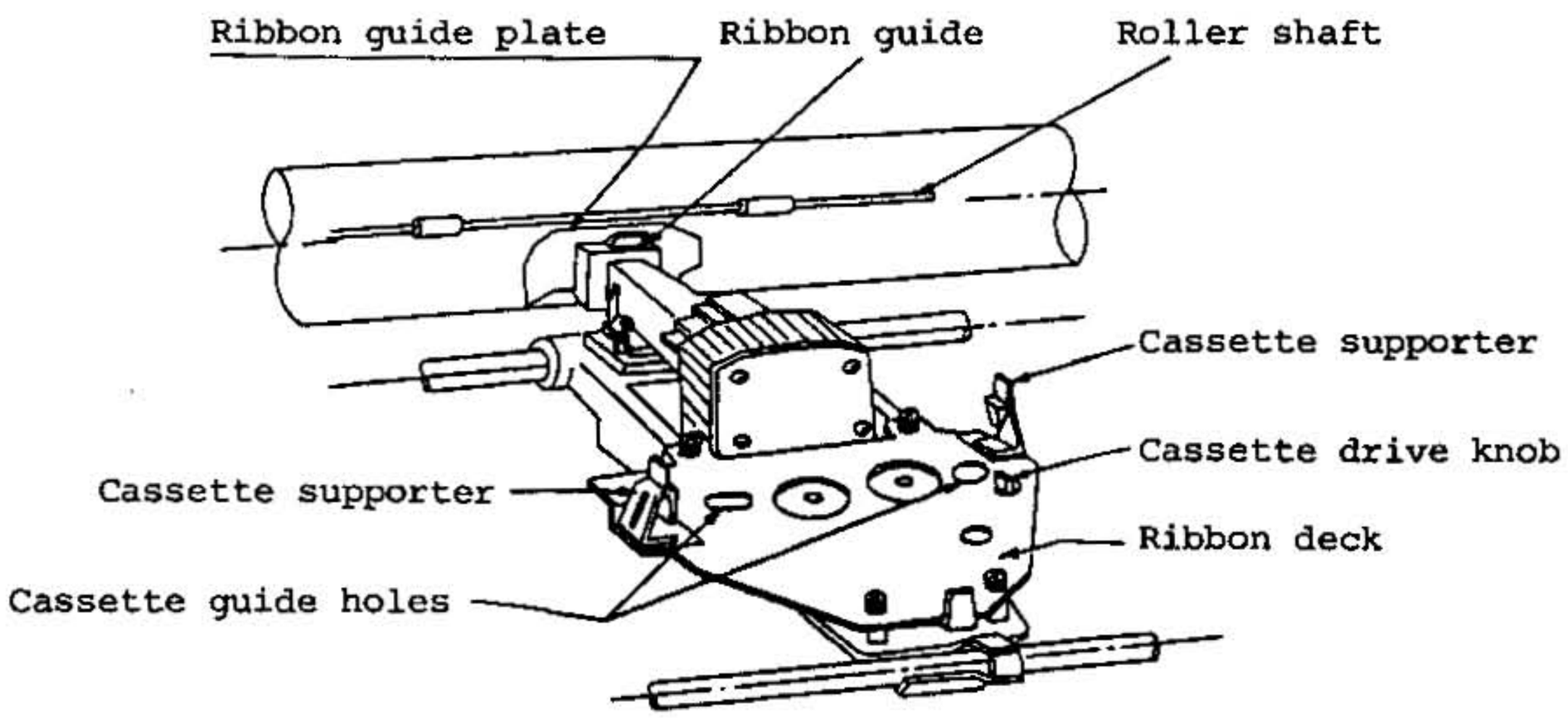


Fig. 17 Ribbon Deck without Ribbon Cassette

4. Install the paper cover and the carrier cover.

2-7. Connecting the Interface Cable

The connector cable from the interface should be connected as shown in Fig. 18 .

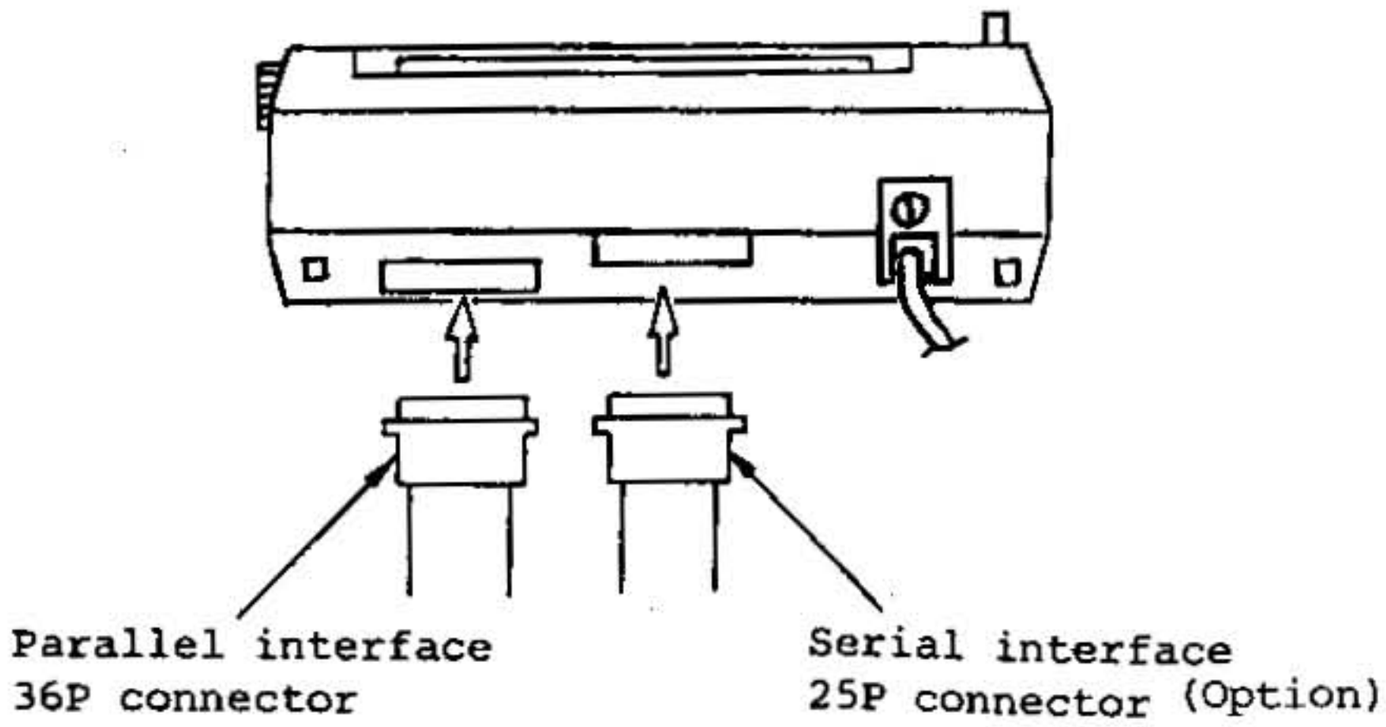


Fig. 18 Interface Connection

2-8. Self-Test Function

M8510 has a Self-Test function to check printing operation. To activate Self-Test, perform the following steps:

(1) Turn power ON. Check to see that the carriage is returned to the left home position. Turn power OFF.

(2) Set the paper.

(3) With the TOF button depressed, turn power ON, then release the button. The printer will automatically print the preprogrammed test pattern, perform line feed, and print again. The Self-Test function will continue, providing a sample of the print capabilities.

(4) To stop Self-Test, turn power OFF.

2-9. Periodic Maintenance

It is important to perform the following periodic maintenance to enable proper printer function and prolong printer performance.

(1) Lubrication

(a) Lubrication Points and Method

First take some dry gauze or absorbent cotton and wipe off any dirt on the carrier shaft and the carrier guide shaft. Then lightly apply a small amount of Launa oil to the lubrication ring.

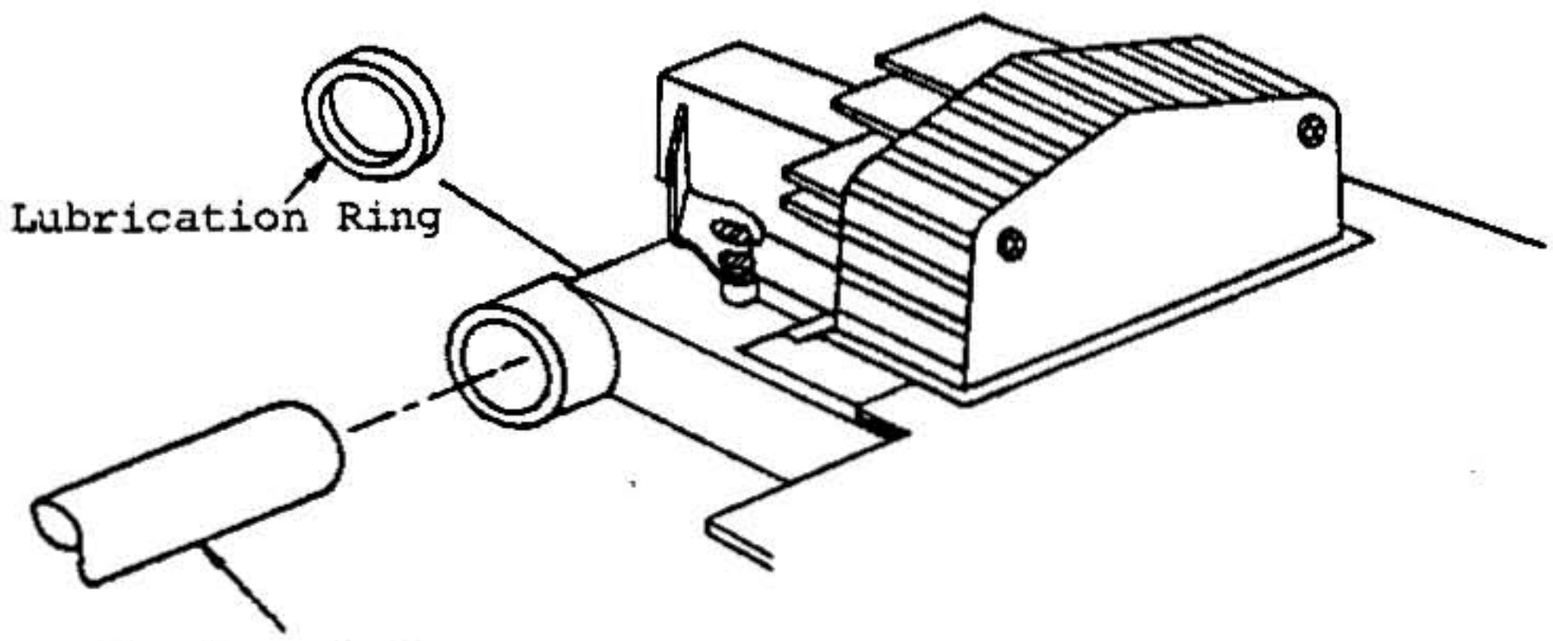


Fig. 19 Lubrication Points

(b) Lubrication Period

Oil should be applied yearly or with every 500,000 lines of printing.

(c) Notes on Lubrication

Do not use oils other than Launa oil. Lubricate only those points specified above.

(2) Cleaning

(a) Cleaning Points and Method.

1) The Detector

Brush off any paper dust on and around the detector (refer to Fig. 20).

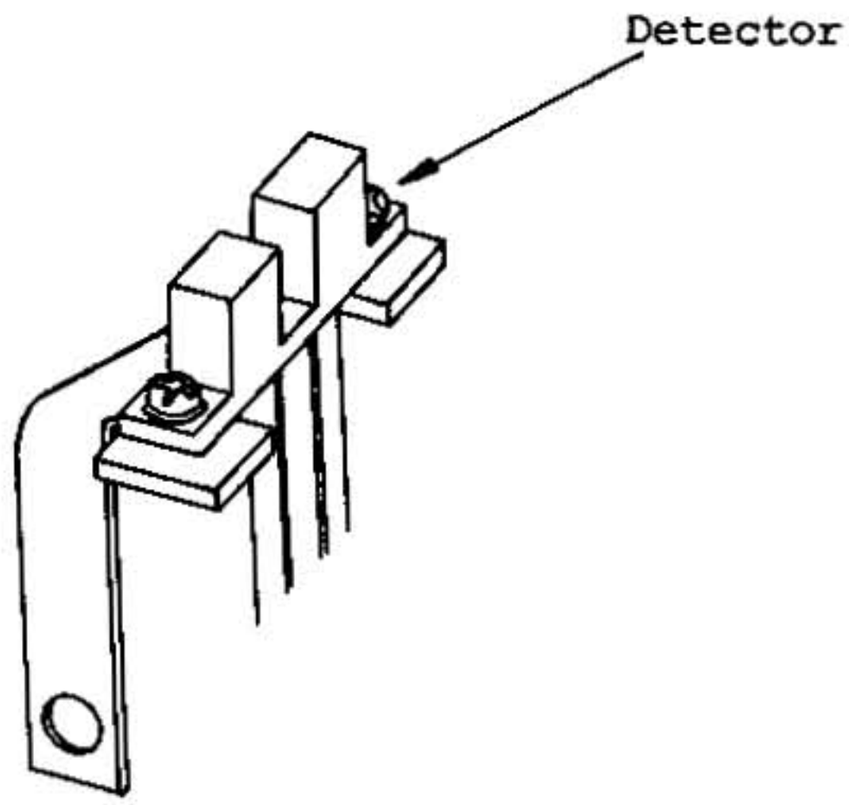


Fig. 20 The Detector

2) The Head Top

Remove the ribbon and brush off any ribbon chips or paper dust on the head end (refer to Fig. 21).

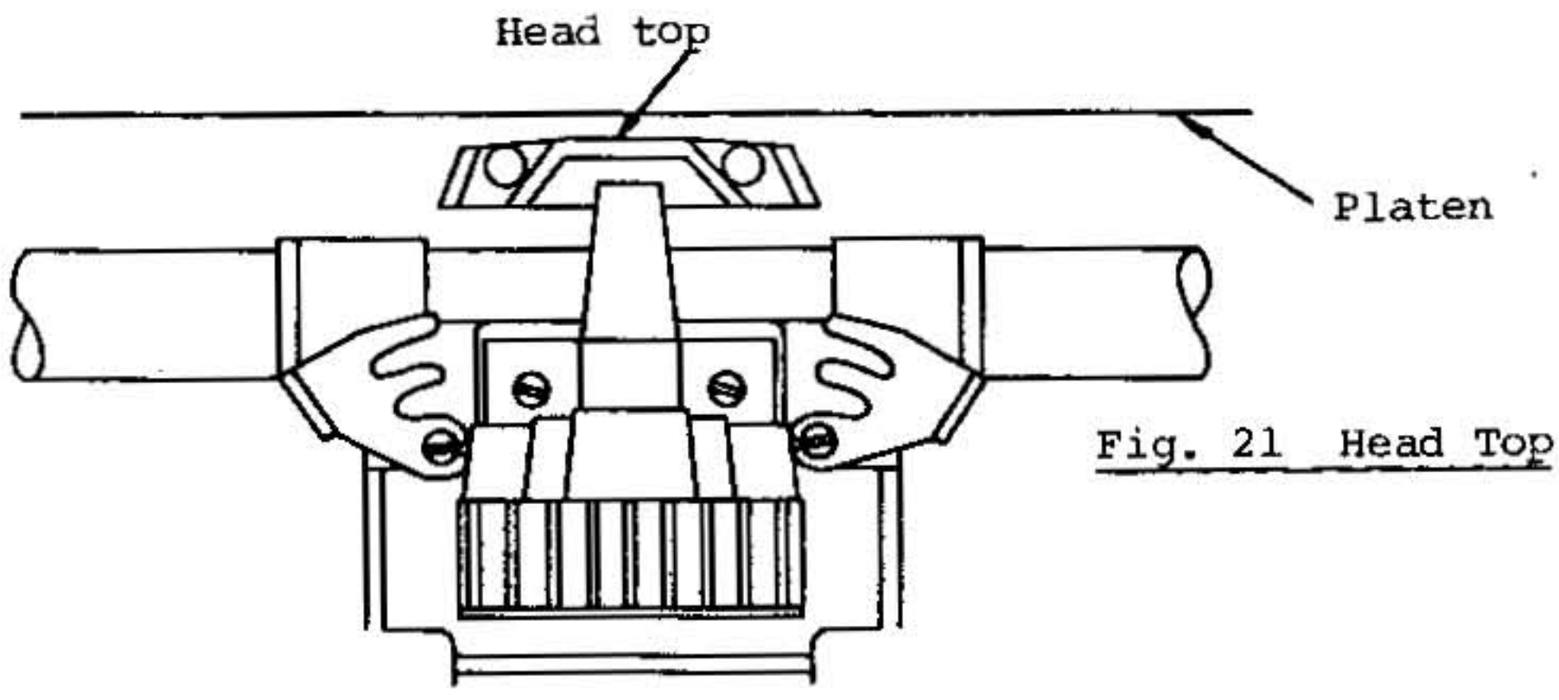


Fig. 21 Head Top

(b) Cleaning Period

1) Whenever ribbon chips or dust accumulate on the detector or the head end.

2) Every 500,000 lines of printing or every year.

(c) Notes on Cleaning

1) To avoid disturbing delicate mechanical adjustment made during assembly, do not remove parts other than the ribbon when cleaning.

2) Do not use detergents or solvents such as benzine when cleaning.

3) To clean the cover, use cloth with water or weak liquid soap.

2-10. General Operating Notes

(1) DO NOT print without a ribbon. This can damage the head pins.

(2) Use only recommended ribbon. The use of low-quality ribbons can damage the head.

(3) The ribbon should be replaced whenever torn or worn-down due to excessive use.

(4) Use the recommended paper.

(5) Avoid dropping foreign material into the printer.

3. PARALLEL INTERFACE: M8510AP

3-1.	Data Input Method:	8-bit Parallel (DATA1-8) (Bit 8 reserved for Japanese characters and graphics mode)
3-2.	Control Signals:	$\overline{\text{ACK}}$, $\overline{\text{BUSY}}$, SELECT, $\overline{\text{DATA.STB}}$, PE, INPUT-PRIME, FAULT, INPUT. BUSY
3-3.	Data Input Codes:	ASCII, JIS 8 or 7-bit, US, UK, GE, SW Codes, Character Generator Based Graphic Symbol Codes, Bit Image Graphic 8-Bit Codes
3-4.	Data Buffer:	1K (Option 3K bytes)

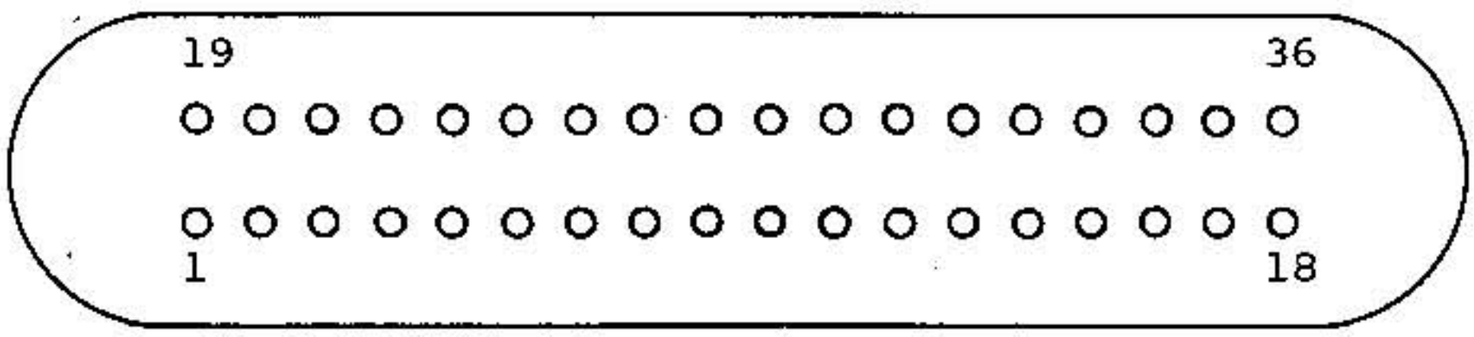
3-5. Connectors:

Printer: Japan AMP 552742-1 Connector or the equivalent
DDK 57L-40360-27CB Connector or the equivalent

Cable: Japan AMP 552470-1 Connector or the equivalent
DDK 57-30360-1 Connector or the equivalent

3-6. Connector Pin Assignment Table

PIN NO.	SIGNAL NAME	PIN NO.	SIGNAL NAME
1	$\overline{\text{DATA STB}}$	19	TWISTED PAIR GND PIN 1
2	DATA 1	20	2
3	2	21	3
4	3	22	4
5	4	23	5
6	5	24	6
7	6	25	7
8	7	26	8
9	DATA 8	27	9
10	$\overline{\text{ACK}}$	28	10
11	INPUT-BUSY	29	11
12	PE	30	TWISTED PAIR GND 31
13	SELECT	31	$\overline{\text{INPUT-PRIME}}$
14	OV	32	$\overline{\text{FAULT}}$
15	NC	33	OV
16	OV	34	NC
17	CHASSIS GND	35	NC
18	+5V DC	36	INPUT-BUSY



NOTE: Pin 11 can be used for BUSY signal on the CPU PC board (jumper selectable)

Jumper No. J12: INPUT BUSY
J13: BUSY

Fig. 22 Connector Pin Assignments

3-7. Explanation of Control Signals

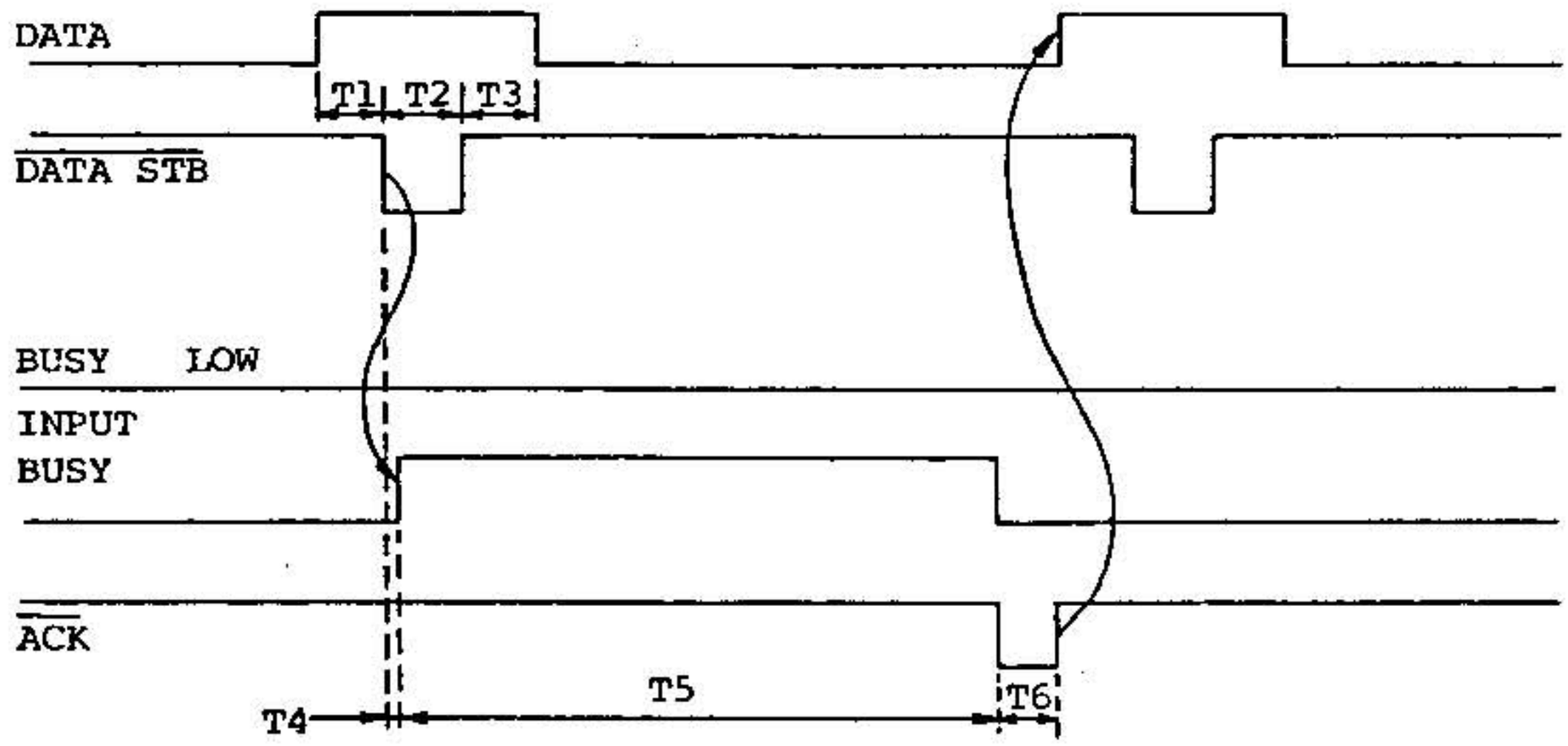
SIGNAL	FUNCTION
DATA 1-8	* 8-bit parallel input data signal (bit 8 reserved for Japanese characters); also used in graphics mode * Logic 1 represents HIGH level * Minimum data pulse width is 3 microseconds
$\overline{\text{DATA.STROBE}}$ or $\overline{\text{DATA.STB}}$	* This is a synchronizing signal for reading-in the above data signal. * This signal is normally HIGH. The above data signal is clocked-in when $\overline{\text{DATA.STB}}$ is made LOW by the host computer. * Minimum pulse width is 1 microsecond
$\overline{\text{INPUT.PRIME}}$	* This input signal brings the electronic controls of the printer to the initial state; however, this signal will not affect SELECT/DESELECT or the pre-set VFU conditions. * Upon receipt of this signal, all data stored in the DATA BUFFER will be printed; the printer will then return to the initial state. * This signal is normally HIGH. $\overline{\text{INPUT.PRIME}}$ is activated when the signal is LOW. * Minimum pulse width is 1 microsecond. * After receiving an $\overline{\text{INPUT.PRIME}}$, allow a delay time (5 ms.) until next data is received.
$\overline{\text{ACKNOWLEDGE}}$ $\overline{\text{ACK}}$	* The printer transmits this signal to the host computer after it has received and processed input data and performed any function commands. This signal indicates that the printer is ready to receive additional data or function codes. * When the DESELECT state changes to the SELECT state, an $\overline{\text{ACK}}$ signal is also output. * The printer will not transmit this signal when a DC1 code is entered during PE status, nor in the case where a DC3 code is received under a SELECT state. * Nominal pulse width is 5.5 microseconds * This signal is normally HIGH. $\overline{\text{ACK}}$ is activated when the signal is LOW.

SIGNAL	FUNCTION
BUSY	* This is an output signal from the printer. When the signal is HIGH, no input codes or data except DC1 may enter the printer. * This signal will be HIGH (BUSY) under any of the following conditions: 1. The DATA BUFFER is full. 2. The printer is in the DESELECT state. 3. The printer is in the FAULT state. 4. An $\overline{\text{INPUT PRIME}}$ code is received. (The BUSY status in this case will be cancelled after a specified period of time if the $\overline{\text{INPUT PRIME}}$ signal is high). 5. Reception is not ready during the operation.
SELECT	* This is an output signal from the printer, indicating whether the printer is in a SELECT or DESELECT state. * The signal is HIGH under SELECT and LOW under DESELECT. * SELECT state occurs under any of the following conditions: 1. The SEL switch is depressed under a DESELECT state. (However, if the SEL switch is depressed during a PE state, the printer will temporarily assume the SELECT state and print one line of data before returning to the DESELECT state. This override function enables the printing of the last few lines of a report, even under a PE state. 2. The DC1 code is received under a DESELECT state 3. The power switch is turned-on while the selector switch is closed. * DESELECT state will occur under any of the following conditions: 1. The SEL switch is depressed under a SELECT state. 2. A DC3 code is received. 3. The printer is in the PE state. 4. The power switch is turned-on while the selector switch is open. 5. The printer is in a FAULT state.

SIGNAL	FUNCTION
PAPER EMPTY (PE)	* This is an output signal from the printer indicating that the paper end is near (approx. 25mm from the paper's edge). PE status is also created when no paper is present. * This signal is activated by a micro switch located below the platen. * This signal is HIGH when activated.
$\overline{\text{FAULT}}$	* This is an output signal from the printer indicating printer FAULT state. * The signal is LOW during a FAULT state. * FAULT state occurs under any of the following conditions: 1. Under a PE state. (However, if the SEL switch is depressed during a FAULT state, the FAULT signal will temporarily become HIGH, enabling the printing of one line before returning to LOW.) 2. Under a DESELECT state. 3. An error or malfunction has occurred in the printer. (e.g., no timing pulses are generated) 4. Cover Open is detected.
INPUT BUSY	* This output signal is similar to the BUSY signal. When HIGH, INPUT.BUSY indicates that the printer is not ready to receive data. * INPUT. BUSY becomes HIGH whenever $\overline{\text{DATA.STB}}$ or BUSY is activated. * INPUT.BUSY becomes LOW when $\overline{\text{ACK}}$ is activated, either simultaneously with $\overline{\text{ACK}}$ or immediately after.
+5V DC	* This is not a signal. This is a +5V DC power source to an outside device. * The maximum output amperage is 50mA.

3-8. Timing Charts

(1) When data are being received



T1～T3 = MIN 1 μs

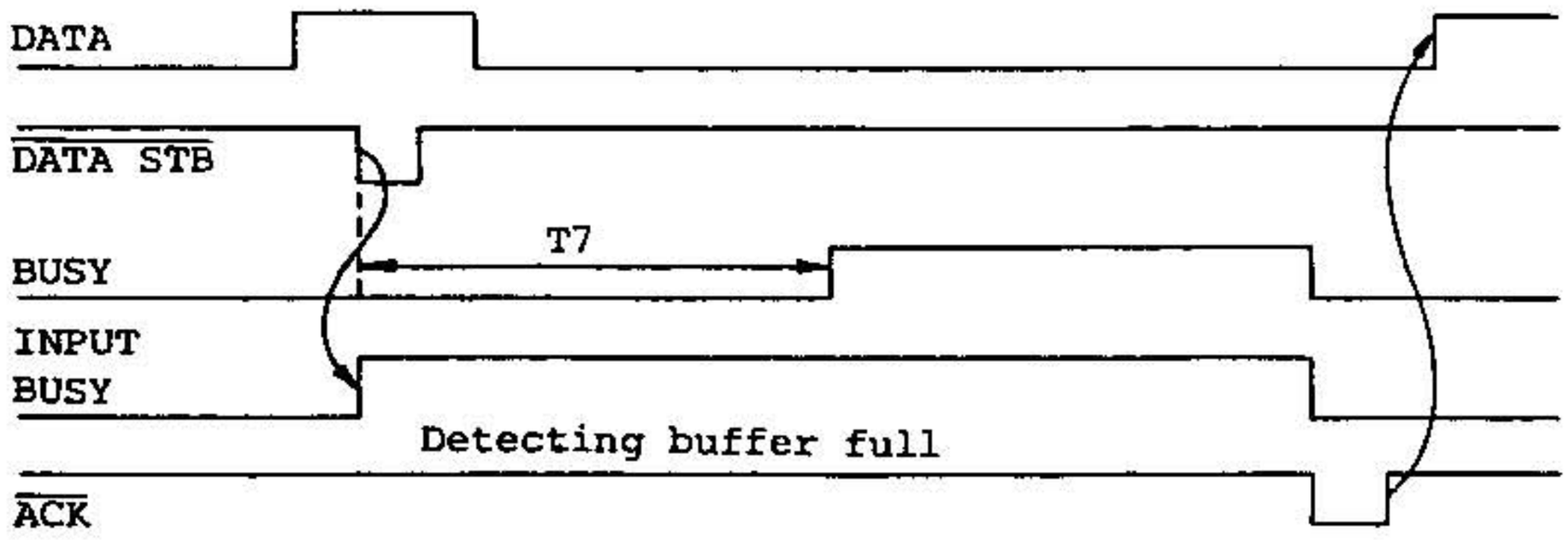
T4 = MAX 400 ns

T5 = MAX 2 ms

T6 = 5.5μs

Fig. 23 Timig Chart A

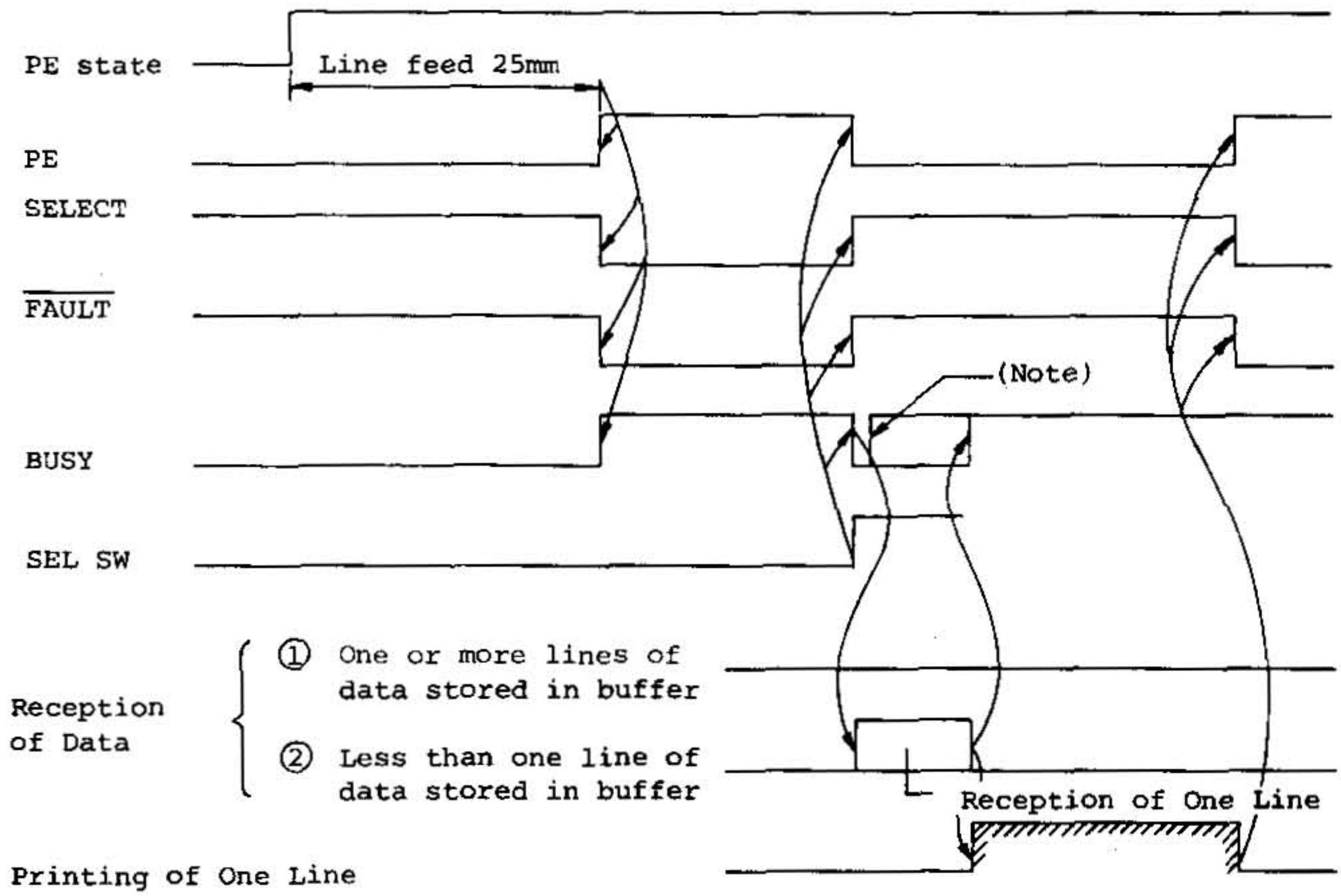
(2) When the DATA BUFFER is full



T7 = MAX 2 ms

Fig. 24 Timig Chart B

(3) When PE is detected in SELECT status



Note: In case that one or more lines of data are stored in the buffer.

Fig. 25 Timig Chart C

3-9. Selection of Optional Functions

The following optional functions for M8510AP may be selected by use of DIP switches. The symbol "(ST)" appearing alongside each switch box below indicates which switch setting comes standard (pre-set) with the unit.

(1) National Character Set

The character set desired will vary from country to country. Selection of character sets may be made using DIP switches according to the following table. Switch settings not listed in this table will print the Swedish character set. To select Hiragana or Greek character sets, refer to chapter 7.

Country	SW1-1	SW1-2	SW1-3
JA	Open	Open	Open
US	Open	Closed	Open
UK	Closed	Closed	Open
GE	Open	Open	Closed
SW	Closed	Open	Closed

(2) TOF-to-TOF

The number of lines from TOF to the next TOF can be selected. The maximum TOF-to-TOF length is either 66 or 72.

Number of TOF-TOF line	SW1-4
66 line	Open
72 line	Closed

(ST)

(3) Processing of DC1 and DC3

Input signals DC1 and DC3 can be rendered ineffective.

Processing	SW1-5
Ineffective	Closed
Effective	Open

(ST)

(4) LF or NON-LF when DATA BUFFER is Full

When the DATA BUFFER is full, the data will be printed out with or without a print command code. At this point, one line feed may or may not take place, depending on the position of the DIP switch.

Condition	SW1-6
LF	Closed
Non-LF	Open

(ST)

(5) Print Command Code (Valid only in Logic Seek Print Mode)

In logic seek mode, several command codes in addition to CR may serve as print command codes. (In incremental print mode this selection is unnecessary because each character is printed as it is received.)

Command Code	SW1-7
CR Only	Open
CR, LF, VT, FF	Closed

(ST)

(6) Function of CR

One line feed may or may not take place following a Carriage Return.

Function	SW1-8
CR	Open
CR+LF	Closed

(ST)

(7) Numeric Display of 0

The numeral 0 may be printed with or without a slash.

Display	SW2-1
O	Open
Ø	Closed

(ST)

(8) Selection of Character Pitch at Power-On

Characters may be printed ten characters per inch or proportionally (spacing allowance made depending on the size of the character). These are the options available at Power-On. Other print modes are software selectable. See section 7.2 for details.

Print Mode	SW2-5
10CPI character	Open
Proportional character	Closed

(ST)

(9) Selection of 7-Bit or 8-Bit Data

8-Bit data enable the selection of Hiragana or Greek character sets and graphics mode. See section 9 for details.

Data	SW2-6
8-bit	Open
7-bit	Closed

(ST)

(10) SELECT or DESELECT at Power-On

Either SELECT or DESELECT will occur when the printer power is turned-on.

Data	SW2-7
SELECT	Closed
DESELECT	Open

(ST)

(11) Bidirectional Print or Unidirectional Print

Data	SW2-8
Bi-directional	Open
Uni-directional	Closed

(ST)

(12) Selection of N Buffer or Single Line Buffer

Condition	SW2-2
N Buffer	Open
Single Line Buffer	Closed

(ST)

(N=3K or 1K, 3K Buffer is option)

4. SERIAL INTERFACE: M8510AR

4-1. SERIAL INTERFACE: M8510AR (RE Type)

4-1-1. Type

Conforming to RS232C interface

4-1-2. Data transmission Speed

110, 200, 300, 600, 1.200, 2.400, 4.800 and 9.600 BPS

At a transmission Speed of 9600BPS, the total number of bits must not be less than 10 (Example 1).

Example 1:

Start	1
Data	7
NO parity	
Stop	1 bit
Total	9 bits

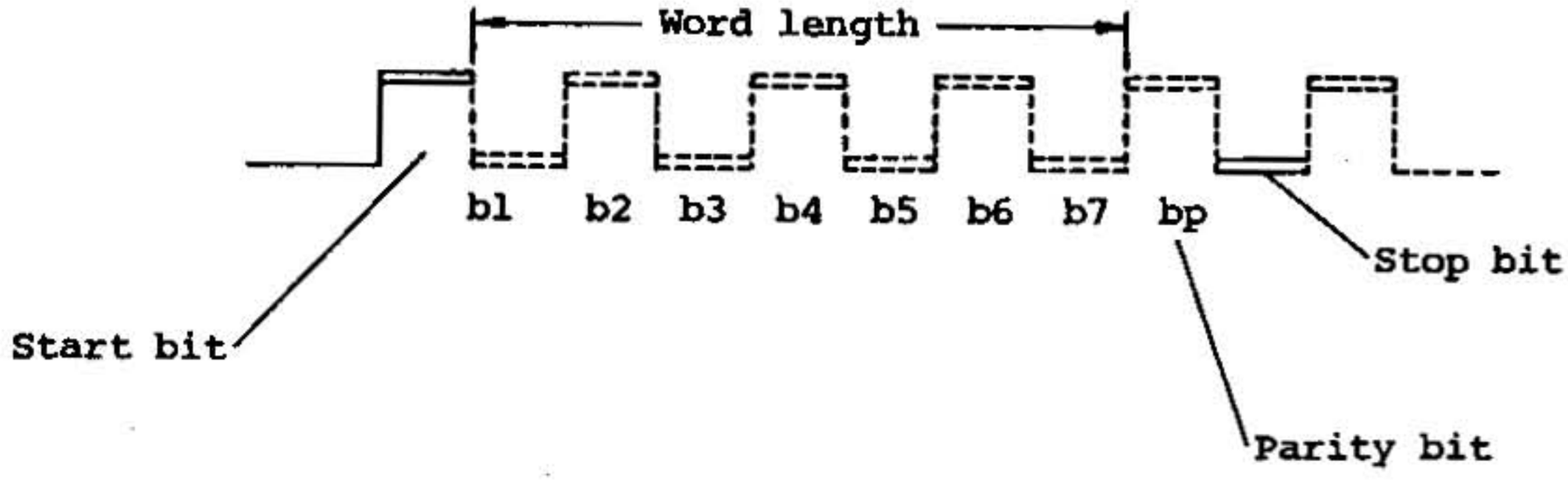
4-1-3. Data Protocol

DATA READY/BUSY (DTR) system

4-1-4. Synchronous system ASYNCHRONOUS

① START-BIT : 1 bit

② STOP-BIT : 1 bit or 2 bits



③ Word length: 7 or 8 bits

4-1-5. Error Detection

① Parity Check : VRC (vertical redundancy check), EVEN, ODD NO-PARITY, and IGNORE

② Framing Error : Identifies when there is no STOP BIT within a frame specified by the START BIT.

③ Overrun Error : Identifies when the next data are input befor the data input by the host CPU to UART are read by the printer.

NOTE: If any of the above errors occurs, the erroneous data is printed intact.
An error in Bit Image is also printed intact.

4-1-6. Interface connector signal arrangement

NOTE: "C" = Connected;
"NC"= Not Connected

RS232C

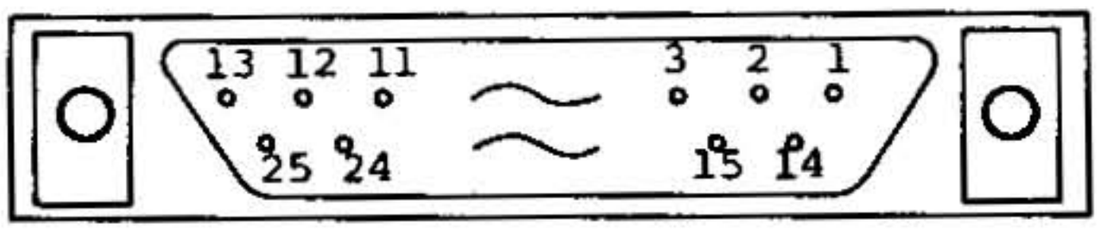
PIN-NO.	Symbol	Descriptions	Direction	RDY / BSY
1	FG	Frame Ground		C
*(2)	SD	Send Data	Output	NC
3	RD	Received Data	Input	C
4	RTS	Request to Send	Output	NC
5	CTS	Clear to Send	Input	NC
6	DSR	Data Set Ready	Input	NC
7	SG	Signal Ground		C
8	CD	Carrier Detect	Input	NC
20	DTR	Data Terminal Ready	Output	C
*(2)	CER	Carrier Error	Output	C
14	$\overline{\text{FAULT}}$	Fault	Output	C

* SD can be output in place of CER by switching jumper wire.

4-1-7. Applicable connector

Plug (cable side) : DB-25 (made by JAE) or the equivalent

Receptacle (printer side) : DB-25S (made by JAE) or the equivalent



4-1-8. DATA RDY/BSY system (RS232C)

When the printer is operated with DATA READY/BSY system, the following signal lines are necessary;

1. FG (Frame Ground)

   Grounding line for circuit protection.

2. CER (Carrier Error)
   (This signal is output by switching the Dip switch.)

   When any of the errors (Parity Error, Framing Error or Overrun Error) is detected, this signal is turned to low level within 1ms from the stop bit end of received data. When the host computer continuously transmits codes to the printer without sending the CAN code, the printer continuously receives codes.

   In case the CER line is low level when the printer receives the CAN code or the DC3 code, or when the printer is deselected by the select switch, this line becomes high level.

   NOTE: In the Bit Image Graphic mode the CAN code and the DC3 code become Bit Image Graphic data.
   When a transmission error occurs in the Bit Image Graphic mode and the CER line becomes low (high) level, the host CPU does not turn the CER line to high (low) level until the Bit Image Graphic mode is finished.

3. RD (Received Data)

   This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state (low level).

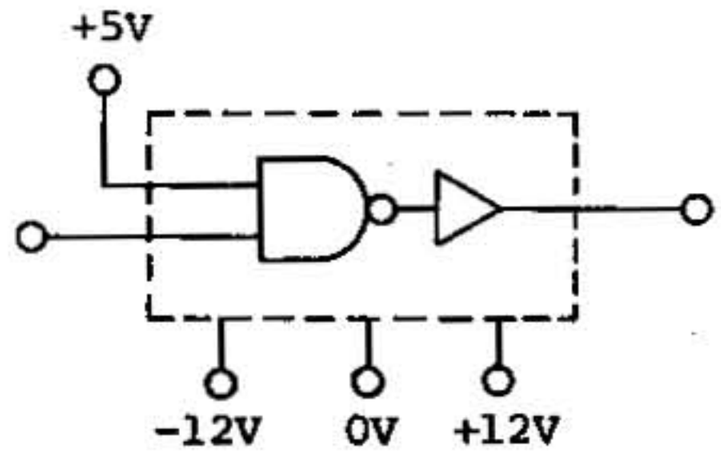
7. SG (Signal Ground)

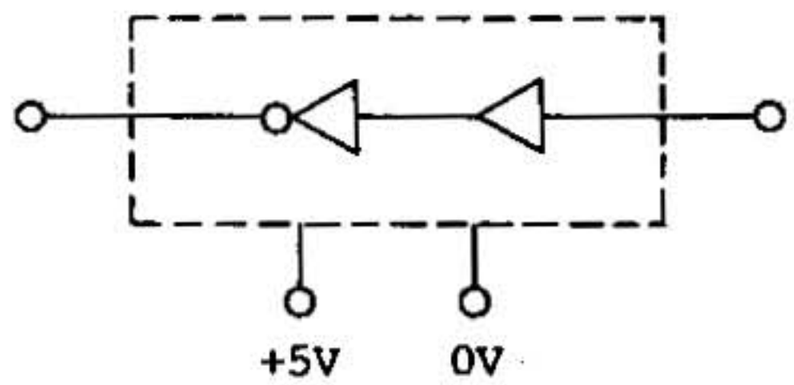
   This is a grounding line for the signals.

20. DTR (Data Terminal Ready)

   This line becomes a high level while the printer is receiving data. This line becomes a low level while the printer is not receiving data.

4-1-9. Input/Output circuit configuration

	Signals	Circuit
Output	SD(CER) DTR	 SN75150 or the equivalent

	Signals	Circuit
Input	RD CTS DSR CD	 SN74154 or the equivalent

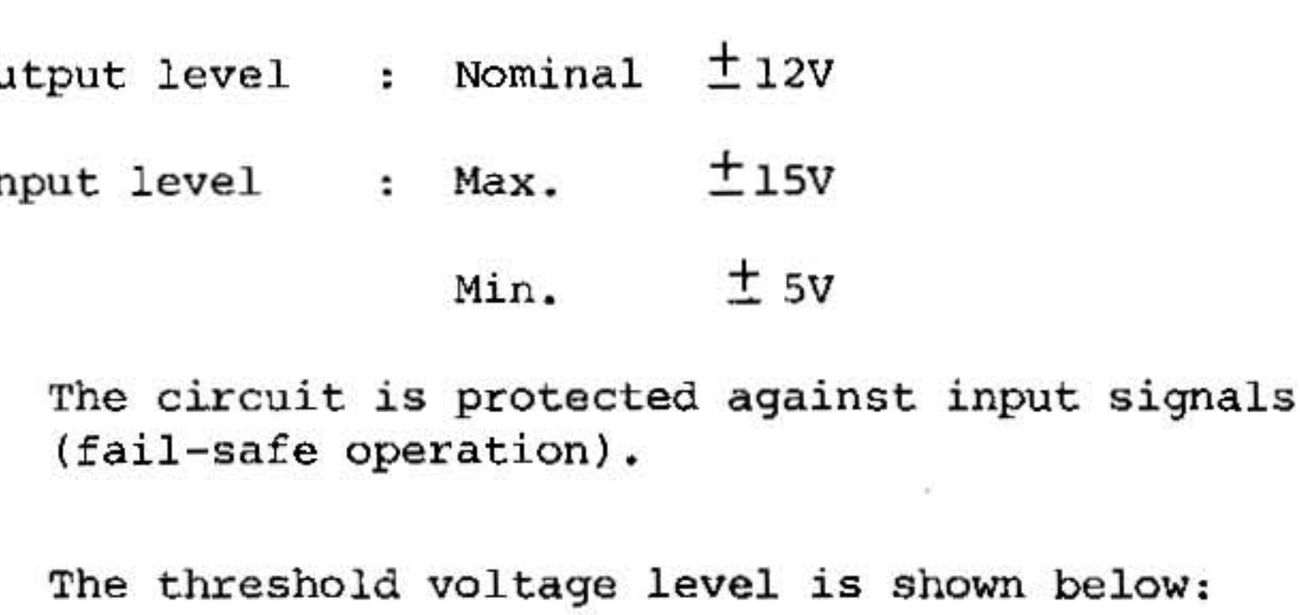
1. Output level : Nominal ±12V

2. Input level : Max. ±15V

   Min. ± 5V

NOTE: The circuit is protected against input signals (fail-safe operation).

The threshold voltage level is shown below:



4-1-10. Selection by Dip Switch

(1) Selection of 7-bit or 8-bit data

Data	21-6
8-bit	Open
7-bit	Closed

(ST)

(2) Selection of parity check

Parity Check	21-3	21-4
EVEN	Open	Open
ODD	Closed	Open
NO PARITY	Open	Closed

(ST)

Note: For the Ignore Parity, refer to page 50.

(3) Selection of stop bit 1 or 2

Number of Lines	21-1
1 bit	Open
2 bits	Closed

(ST)

(4) Selection of data transmission speed (Unit: baud)

Speed	22-1	22-2	22-3
9600	Open	Open	Open
4800	Open	Open	Closed
2400	Open	Closed	Open
1200	Open	Closed	Closed
600	Closed	Open	Open
300	Closed	Open	Closed
200	Closed	Closed	Open
110	Closed	Closed	Closed

(ST)

When the transmission rate is 9600 baud, do not specify 7-bit, no parity and one stop bit.

4-2. SERIAL INTERFACE: M8510AR (RD TYPE)

4-2-1. Type

① Conforming to RS232C interface

4-2-2. Data transmission Speed

110, 200, 300, 600, 1.200, 2.400, 4.800 and 9.600 BPS

At a transmission Speed of 9600BPS, the total number of bits must not be less than 10 (Example 1).

Example 1:

Start	1
Data	7
No parity	
Stop	1 bit
Total	9 bits

4-2-3. Data Protocol

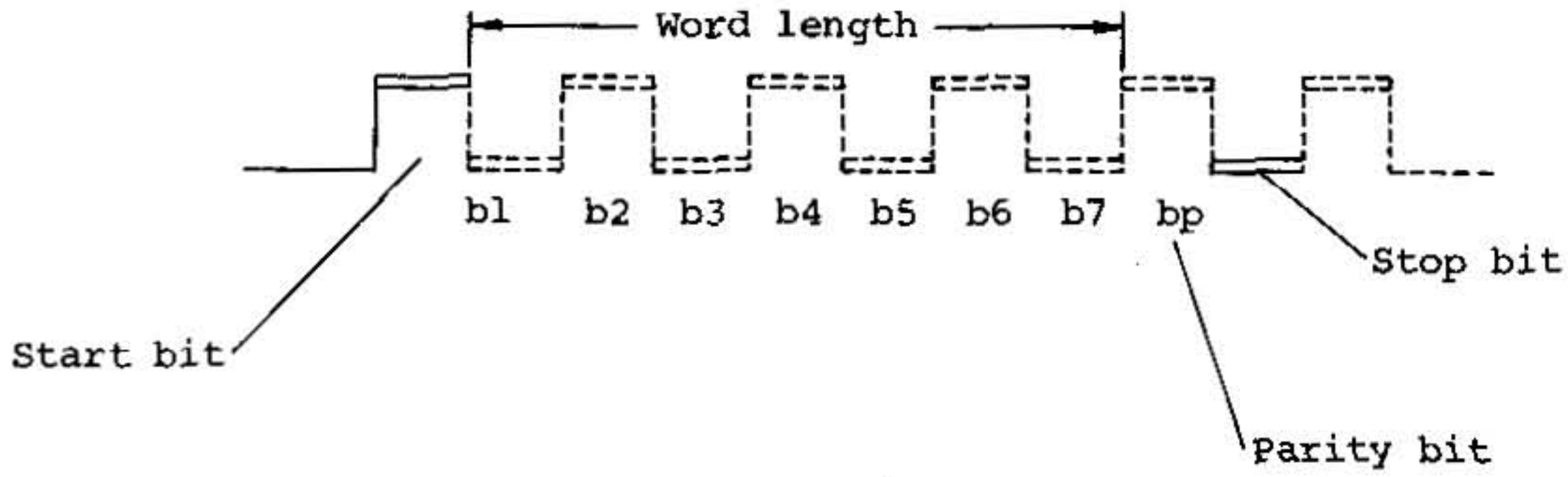
① DATA READY/BUSY (DTR) system

② Xon/Xoff, ETX/ACK system

4-2-4. Synchronous system ASYNCHRONOUS

① START-BIT : 1 bit

② STOP-BIT : 1 bit or 2 bits



③ Word length: 7 or 8 bits

4-2-5. Error Detection

① Parity Check : VRC (vertical redundancy check), EVEN, ODD, NO-PARITY, and IGNORE

② Framing Error : Identifies when there is no STOP BIT within a frame specified by the START BIT.

③ Overrun Error : Identifies when the next data are input before the data input by the host CPU to UART are read by the printer.

NOTE: If any of the above errors occurs, the erroneous data is printed intact.
An error in Bit Image is also printed intact.

4-2-6. Interface connector signal arrangement NOTE: "C" = Connected;
"NC"= Not Connected

① RS 232C

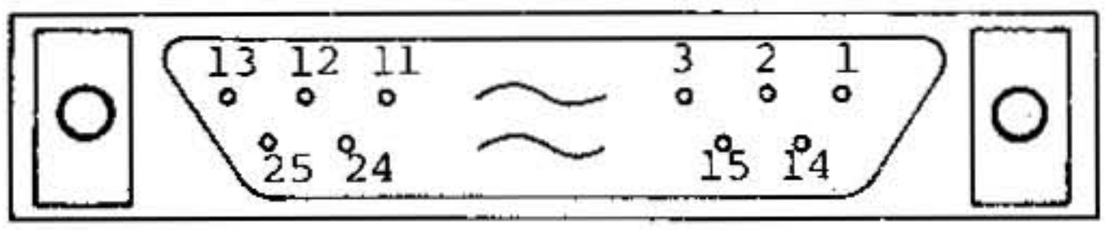
PIN-NO.	Symbol	Descriptions	Direction	RDY / BSY	XON/XOFF ETX/ACK
1	FG	Frame Ground		C	C
*(2)	SD	Send Data	Output	NC	C
3	RD	Received Data	Input	C	C
4	RTS	Request to Send	Output	NC	C
5	CTS	Clear to Send	Input	NC	C
6	DSR	Data Set Ready	Input	NC	C
7	SG	Signal Ground		C	C
8	CD	Carrier Detect	Input	NC	C
20	DTR	Data Terminal Ready	Output	C	C
*(2)	CER	Carrier Error	Output	C	NC
14	$\overline{\text{FAULT}}$	Fault	Output	C	C

* SD can be output in place of CER by switching jumper wire.

4-2-7. Applicable connector

Plug (cable side) : DB-25 (made by JAE) or the equivalent

Receptacle (printer side) : DB-25S (made by JAE) or the equivalent



4-2-8. Signal Descriptions

(1) Xon/Xoff, ETX/ACK system (In case of RS232C)

When the printer is operated with Xon/Xoff, ETX/ACK system, the following signal lines are necessary;

1. FG (Frame Ground)

   Grounding line for circuit protection.

2. SD (Send Data)

   This is a serial data transmission line to the host CPU from the printer.
   When no data is transmitted, this line must be in "MARK" state.
   It goes low when the logic is "0" and high level when the logic is "1".

3. RD (Received Data)

This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state. It goes low level when the logic is "0" and high level when the logic is "1".

4. RTS (Request to Send)

This is an output signal from the printer, and goes high level when the printer is selected.

5. CTS (Clear to Send)

This is a line for printer input signals.
This line must go high level to allow the printer to send out the data.

6. DSR (Data Set Ready)

This is a signal line to the printer. It must go high level in order to permit the printer to receive data signals.

7. SG (Signal Ground)

This is a grounding line for signals.

8. CD (Carrier Detect)

This line is used to detect the input signal carrier entering the printer. It is normally ignored. It is not used in this printer.

14. FAULT (Fault)

This signal is low when the printer is abnormal or when deselected.
It is high when the printer is normal and selected.

20. DTR (Data Terminal Ready)

This is a line for the printer output signals.
When power is supplied to the printer and the printer is ready to receive the data, this line becomes a high level.

NOTE: The DSR and CTS lines can be isolated for ignorance by switching the jumper line.

(2) DATA RDY/BSY system (In case of RS232C)

When the printer is operated with DATA READY/BSY system, the following signal lines are necessary;

1. FG (Frame Ground)

Grounding line for circuit protection.

2. CER (Carrier Error)
(This signal is output by switching the Dip switch.)

When any of the errors (Parity Error, Framing Error or Overrun Error) is detected, this signal is turned to low level within 1ms from the stop bit end of received data. When the host computer continuously transmits codes to the printer without sending the CAN code, the printer continuously receives codes.

In case the CER line is low level when the printer receives the CAN code or the DC3 code, or when the printer is deselected by the select switch, this line becomes high level.

NOTE: In the Bit Image Graphic mode the CAN code and the DC3 code become Bit Image Graphic data.
When a transmission error occurs in the Bit Image Graphic mode and the CER line becomes low (high) level, the host CPU does not turn the CER line to high (low) level until the Bit Image Graphic mode is finished.

3. RD (Received Data)

This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state (low level).

7. SG (Signal Ground)

This is a grounding line for the signals.

14. FAULT (Fault)

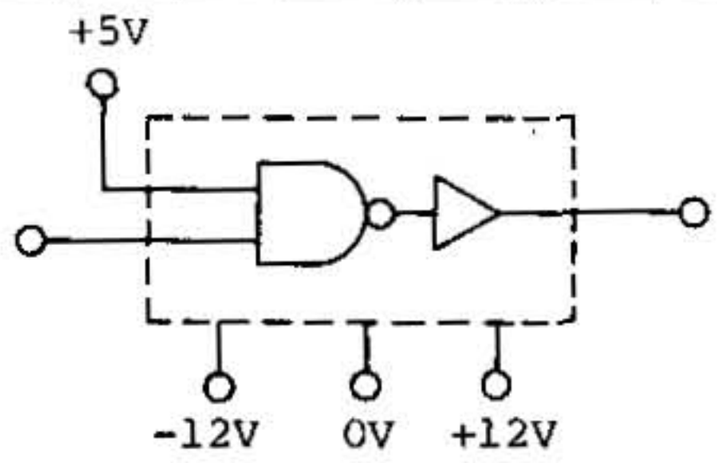
This signal is low when the printer is abnormal or when deselected. It is high when the printer is normal and selected.

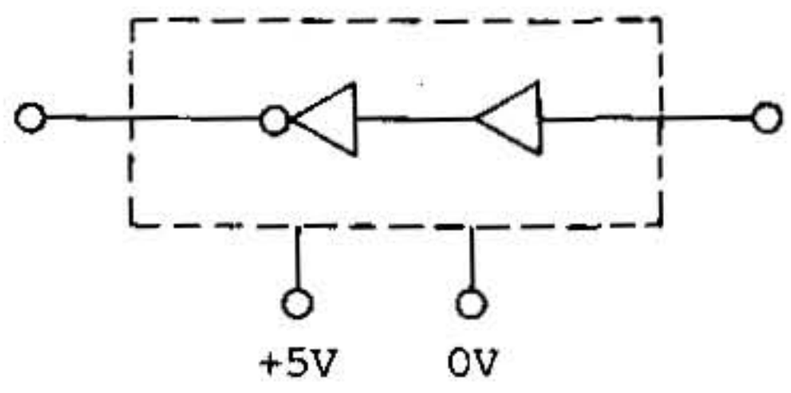
20. DTR (Data Terminal Ready)

This line becomes a high level while the printer is receiving data. This line becomes a low level while the printer is not receiving data.

4-2-9. Input/Output circuit configuration

(1)

	Signals	Circuit
Output	$\overline{\text{FAULT}}$ SD(CER) RTS DTR	 SN75150 or the equivalent

	Signals	Circuit
Input	RD CTS DSR CD	 SN74154 or the equivalent

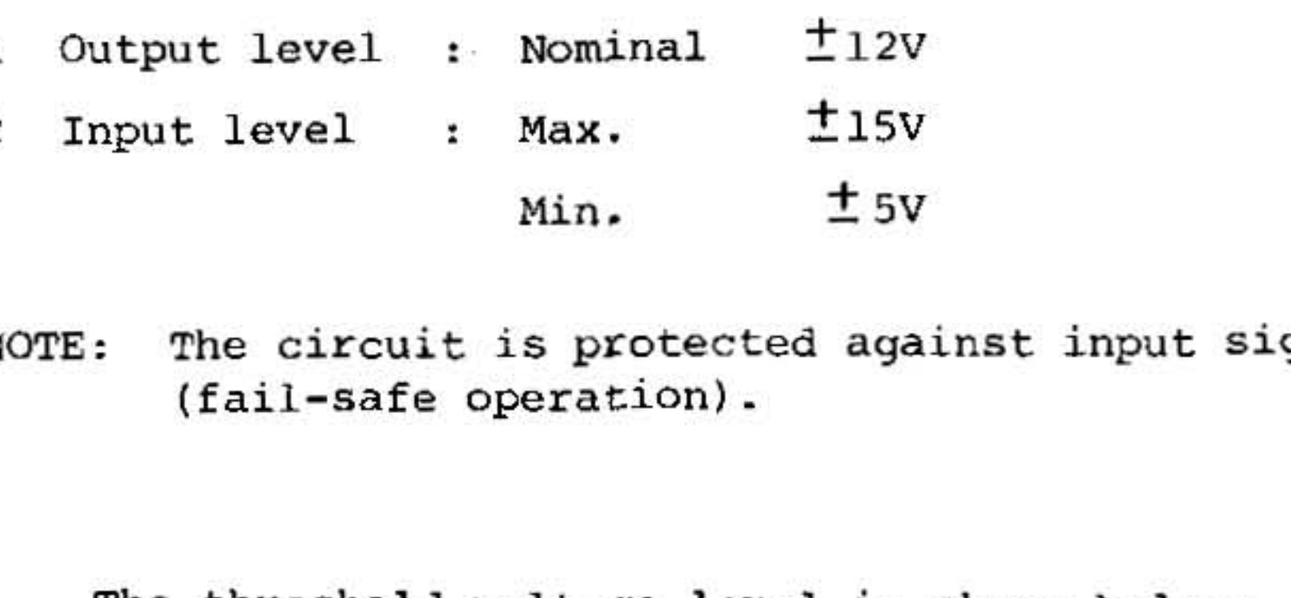
1 Output level : Nominal ±12V

2 Input level : Max. ±15V

Min. ±5V

NOTE: The circuit is protected against input signals (fail-safe operation).

The threshold voltage level is shown below:



4-2-10. Switching of the functions

(1) Selection of RS232C or 20mA current loop

(ST)

SW NO.	RS232C	20mA Current loop
23-1	Closed	Open
23-2	Open	Closed

(ST) stands for standard machine.

(2) Selection of SD or CER

	Except JA	JA
SW NO.	SD	CER
21-2	Open	Closed

(3) Selection of use or unuse of CTS

(ST)

SW NO.	Use	Unuse
24-5	Open	Closed
24-6	Closed	Open

(4) Validity of CD It is not used in this printer.

(ST)

SW NO.	CD Valid	CD Invalid
24-7	Closed	Open
24-8	Open	Closed

(5) Selection of RTS or DTR

(ST)

SW NO.	RTS	DTR
24-3	Open	Closed
24-4	Closed	Open

(6) Selection of DSR

(ST)

SW NO.	Ignored	RS232C	20mA Current Loop
23-3	Open	Open	Closed
23-4	Open	Closed	Open
23-5	Closed	Open	Open

(7) Selection of DTR

SW No.	RDY/BSY	XON/XOFF ETX/ACK
24-1	Closed	Open
24-2	Open	Closed

(8) Selection of data protocol

DATA	21-7	21-8
RDY/BSY	Open	Open
	Closed	Open
XON/XOFF	Open	Closed
ETX/ACK	Closed	Closed

(ST)

(9) Selection of 7-bit or 8-bit data

Data	21-6
8 bit	Open
7 bit	Closed

(ST)

(10) Selection of parity check

Parity Check	21-3	21-4
EVEN	Open	Open
ODD	Closed	Open
NO PARITY	Open	Closed

(ST)

Note: For the Ignore Parity, refer to page 50.

(11) Selection of stop bit 1 or 2

Number of Lines	21-1
1 bit	Open
2 bits	Closed

(ST)

(12) Selection of data transmission speed (Unit: baud)

Speed	22-1	22-2	22-3
9600	Open	Open	Open
4800	Open	Open	Closed
2400	Open	Closed	Open
1200	Open	Closed	Closed
600	Closed	Open	Open
300	Closed	Open	Closed
200	Closed	Closed	Open
110	Closed	Closed	Closed

(ST)

When the transmission rate is 9600 baud, do not specify 7-bit, no parity and one stop bit.

4-3. SERIAL INTERFACE: M8510AR (CD TYPE)

4-3-1. Type

① Conforming to RS232C interface

② 20mA current loop

4-3-2. Data transmission Speed

110, 200, 300, 600, 1.200, 2.400, 4.800 and 9.600 BPS

At a transmission Speed of 9600BPS, the total number of bits must not be less than 10 (Example 1).

Example 1:

Start	1
Data	7
No parity	
Stop	1 bit
Total	9 bits

4-3-3. Data Protocol

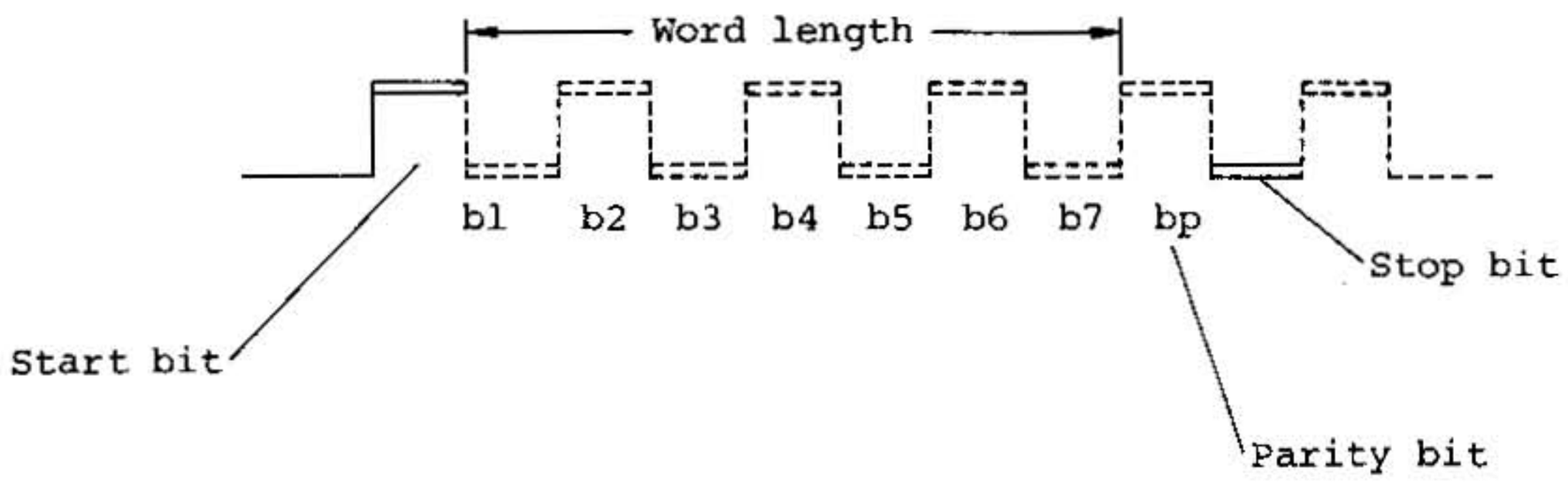
① DATA READY/BUSY (DTR) system

② Xon/Xoff, ETX/ACK system

4-3-4. Synchronous system ASYNCHRONOUS

① START-BIT : 1 bit

② STOP-BIT : 1 bit or 2 bits



③ Word length: 7 or 8 bits

4-3-5. Error Detection

① Parity Check : VRC (vertical redundancy check), EVEN, ODD, NO-PARITY, and IGNORE

② Framing Error : Identifies when there is no STOP BIT within a frame specified by the START BIT.

③ Overrun Error : Identifies when the next data are input before the data input by the host CPU to UART are read by the printer.

NOTE: If any of the above errors occurs, the erroneous data is printed intact.
An error in Bit Image is also printed intact.

4-3-6. Interface connector signal arrangement

NOTE: "C" = Connected;
"NC"= Not Connected

① RS 232C

PIN-NO.	Symbol	Descriptions	Direction	RDY / BSY	XON/XOFF ETX/ACK
1	FG	Frame Ground		C	C
*(2)	SD	Send Data	Output	NC	C
3	RD	Received Data	Input	C	C
4	RTS	Request to Send	Output	NC	C
5	CTS	Clear to Send	Input	NC	C
6	DSR	Data Set Ready	Input	NC	C
7	SG	Signal Ground		C	C
8	CD	Carrier Detect	Input	NC	C
20	DTR	Data Terminal Ready	Output	C	C
*(2)	CER	Carrier Error	Output	C	NC
14	$\overline{\text{FAULT}}$	Fault	Output	C	C

② Current Loop

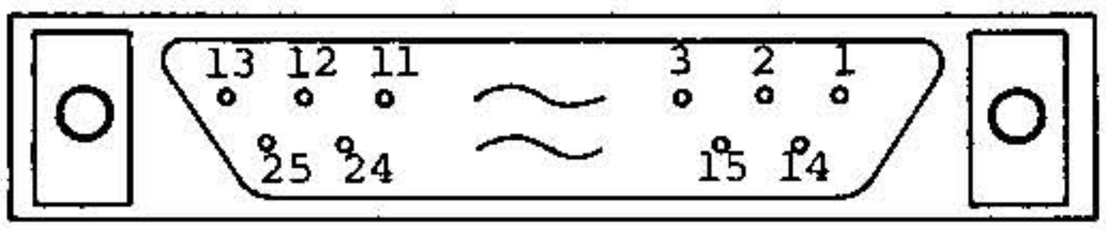
PIN-NO.	Symbol	Descriptions	Direction	RDY / BSY	XON/XOFF ETX/ACK
1	FG	Frame Ground		C	C
*(18)	SD(+)	Send Data (+)	Output	NC	C
9	RD(+)	Received Data (+)	Input	C	C
13	DSR (+)	Data Set Ready (+)	Input	NC	C
*(19)	SD(-)	Send Data (-)	Output	NC	C
10	RD(-)	Received Data (-)	Input	C	C
25	DSR(-)	Data Set Ready (-)	Input	NC	C
11	DTR(+)	Data Terminal Ready(+)	Output	C	C
12	DTR(-)	Data Terminal Ready(-)	Output	C	C
*(18)	CER(+)	Carrier Error (+)	Output	C	NC
*(19)	CER(-)	Carrier Error (-)	Output	C	NC

* SD can be output in place of CER by switching jumper wire.

4-3-7. Applicable connector

Plug (cable side) : DB-25 (made by JAE) or the equivalent

Receptacle (printer side) : DB-25S (made by JAE) or the equivalent



4-3-8. Signal Descriptions

(1) Xon/Xoff, ETX/ACK system (In case of RS232C)

When the printer is operated with Xon/Xoff, ETX/ACK system, the following signal lines are necessary;

1. FG (Frame Ground)

   Grounding line for circuit protection.

2. SD (Send Data)

   This is a serial data transmission line to the host CPU from the printer.
   When no data is transmitted, this line must be in "MARK" state.
   It goes low when the logic is "0" and high level when the logic is "1".

3. RD (Received Data)

   This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state. It goes low level when the logic is "0" and high level when the logic is "1".

4. RTS (Request to Send)

   This is an output signal from the printer, and goes high level when the printer is selected.

5. CTS (Clear to Send)

   This is a line for printer input signals.
   This line must go high level to allow the printer to send out the data.

6. DSR (Data Set Ready)

   This is a signal line to the printer. It must go high level in order to permit the printer to receive data signals.

7. SG (Signal Ground)

   This is a grounding line for signals.

8. CD (Carrier Detect)

   This line is used to detect the input signal carrier entering the printer. It is normally ignored. It is not used in this printer.

14. FAULT (Fault)

   This signal is low when the printer is abnormal or when deselected.
   It is high when the printer is normal and selected.

20. DTR (Data Terminal Ready)

   This is a line for the printer output signals.
   When power is supplied to the printer and the printer is ready to receive the data, this line becomes a high level.

   NOTE: The DSR and CTS lines can be isolated for ignorance by switching the jumper line.

(2) DATA RDY/BSY system (In case of RS232C)

When the printer is operated with DATA READY/BSY system, the following signal lines are necessary;

1. FG (Frame Ground)

   Grounding line for circuit protection.

2. CER (Carrier Error)
   (This signal is output by switching the Dip switch.)

   When any of the errors (Parity Error, Framing Error or Overrun Error) is detected, this signal is turned to low level within 1ms from the stop bit end of received data. When the host computer continuously transmits codes to the printer without sending the CAN code, the printer continuously receives codes.

   In case the CER line is low level when the printer receives the CAN code or the DC3 code, or when the printer is deselected by the select switch, this line becomes high level.

   NOTE: In the Bit Image Graphic mode the CAN code and the DC3 code become Bit Image Graphic data.
   When a transmission error occurs in the Bit Image Graphic mode and the CER line becomes low (high) level, the host CPU does not turn the CER line to high (low) level until the Bit Image Graphic mode is finished.

3. RD (Received Data)

   This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state (low level).

7. SG (Signal Ground)

   This is a grounding line for the signals.

14. FAULT (Fault)

   This signal is low when the printer is abnormal or when deselected. It is high when the printer is normal and selected.

20. DTR (Data Terminal Ready)

   This line becomes a high level while the printer is receiving data. This line becomes a low level while the printer is not receiving data.

(3) X ON/X OFF, ETX/ACK system (In case of 20mA current loop)

When the printer is operated with X ON/X OFF or ETX/ACK system, the following signal lines are necessary.

1. FG (Frame Ground)

   Grounding line for circuit protection.

18. SD(+)

19. SD(-) (Send Data)

This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state (20mA current flows).

9. RD(+)

10. RD(-) (Received Data)

This is a serial data transmission line to the printer from a host CPU. When no data is transmitted, this line must be in "MARK" state.

13. DSR(+)

25. DSR(-) (Data Set Ready)

This is an input signal to the printer. When the printer receives data, this line must be in "MARK" state.

11. DTR(+)

12. DTR(-) (Data Terminal Ready)

This is an output signal from the printer.
When power is supplied to the printer and the printer finishes the restore operation, the printer becomes "MARK" (READY) state.

NOTE: DSR(+) and (-) can be ignored by switching the jumper wire.

(4) Data RDY/BSY system (In case of 20mA current loop)
When the printer is operated with this system, the following signal lines are necessary.

1. FG (Frame Ground)

Grounding line for circuit protection.

18. CER(+)

19. CER(-) (Carrier Error) (Valid for D type Dip switch only)
This signal is output by switching the Dip switch.

When any of the errors (Parity Error, Framing Error or Overrun Error) is detected, this signal line must be in "MARK" state within 1ms from the stop bit end of the received data. When the host computer continuously receives codes.
In case the CER line is "MARK" state when the printer receives the CAN code or the DC3 code, or when the printer is deselected by the select switch, the CER line must be in "SPACE" state (no 20mA current flows.).

NOTE: In the Bit Image Graphic mode the CAN code and the DC3 code become Bit Image Graphic data.
When the transmission error occurs in the Bit Image Graphic and the CER line becomes "MARK(SPACE)" state, the host CPU does not turn the CER line to "SPACE(MARK)" state until the Bit Image Graphic mode is finished.

9. RD(+)

10. RD(-) (Recived Data)

    This is a serial data transmission line to the printer from the host CPU. When no data is transmitted, this line must be in "MARK" state.

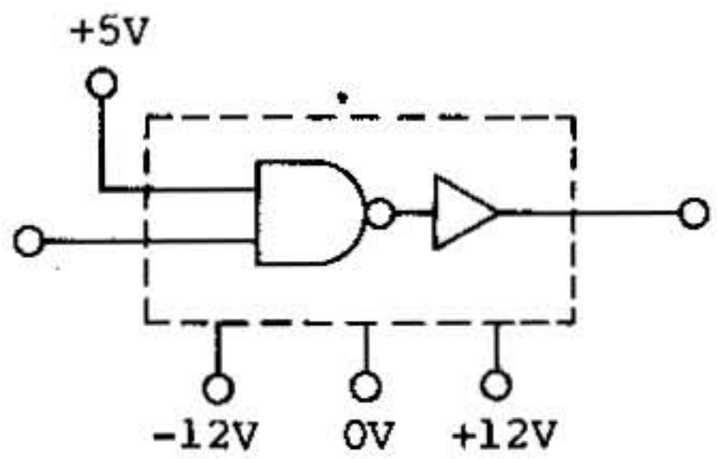
11. DTR(+)

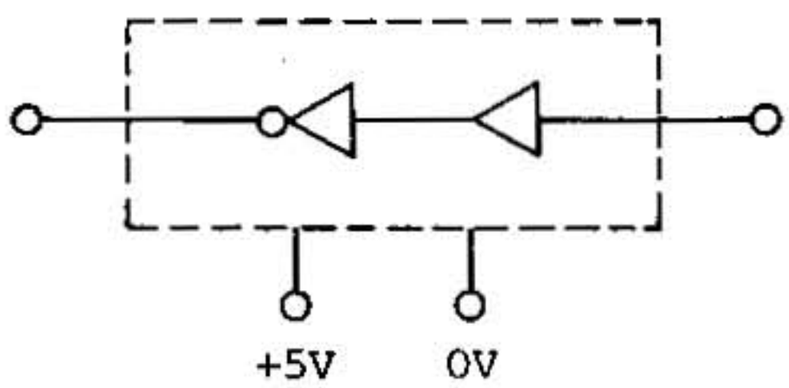
12. DTR(-) (Data Terminal Ready)

    When the printer is ready for receiving data, the DTR line is "SPACE" state and when the printer is not ready for receiving, the DTR line is "MARK" state.

4-3-9. Input/Output circuit configuration

(1)

	Signals	Circuit
Output	$\overline{\text{FAULT}}$ SD(CER) RTS DTR	 SN75150 or the equivalent

	Signals	Circuit
Input	RD CTS DSR CD	 SN74154 or the equivalent

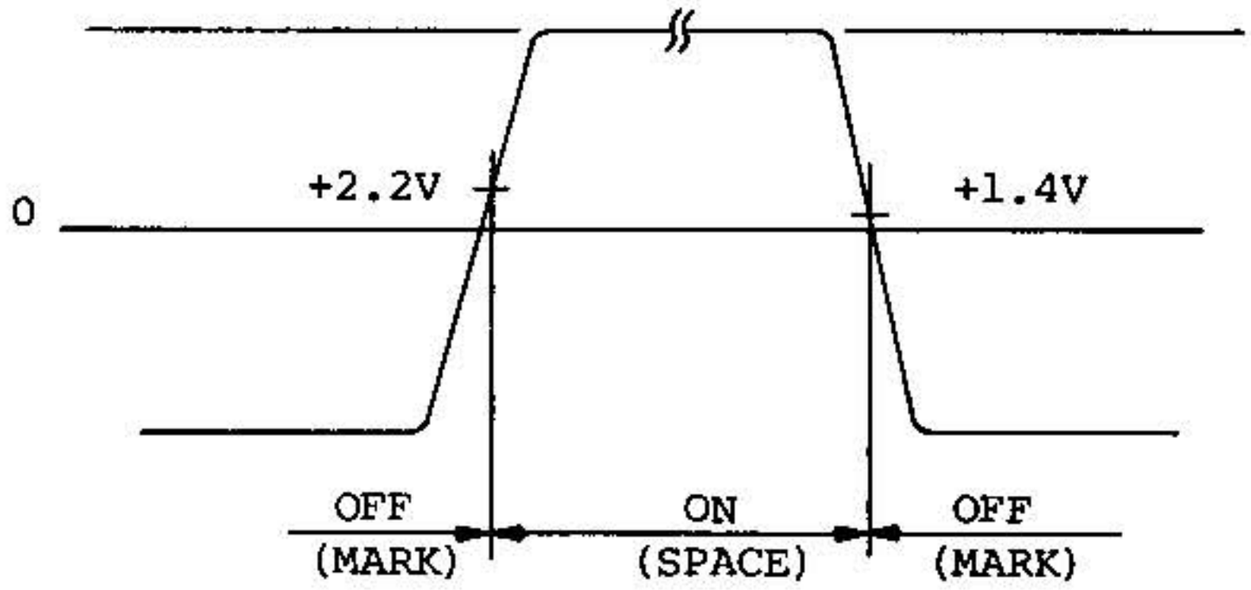
1 Output level : Nominal ±12V

2 Input level : Max. ±15V

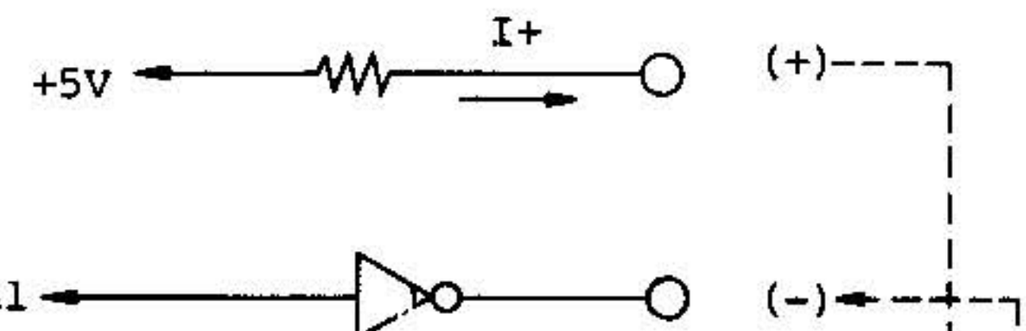
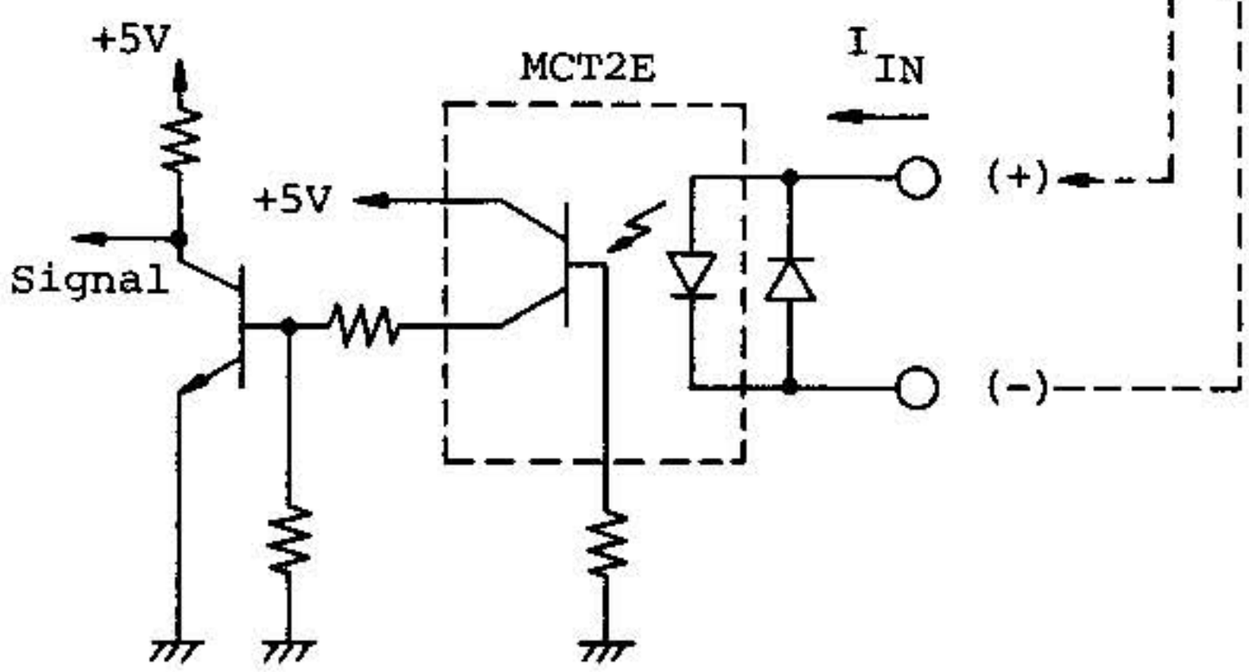
Min. ±5V

NOTE: The circuit is protected against input signals (fail-safe operation).

The threshold voltage level is shown below:



(2) 20mA Current Loop

	Signals	Circuit
Output	SD(+) (CER(+)) DTR(+) SD(-) (CER(-)) DTR(-)	
Input	RD(+) DSR(+) RD(-) DSR(-)	

Output level	I+	20mA
Input level	I_{IN}	20mA

4-3-10. Switching of the functions

(1) Selection of RS232C or 20mA current loop

(ST)

SW NO.	RS232C	20mA Current loop
23-1	Closed	Open
23-2	Open	Closed

(ST) stands for standard machine.

(2) Selection of SD or CER

	Except JA	JA
SW NO.	SD	CER
21-2	Open	Closed

(3) Selection of use or unuse of CTS

(ST)

SW NO.	Use	Unuse
24-5	Open	Closed
24-6	Closed	Open

(4) Validity of CD It is not used in this printer.

(ST)

SW NO.	CD Valid	CD Invalid
24-7	Closed	Open
24-8	Open	Closed

(5) Selection of RTS or DTR

(ST)

SW NO.	RTS	DTR
24-3	Open	Closed
24-4	Closed	Open

(6) Selection of DSR

(ST)

SW NO.	Ignored	RS232C	20mA Current Loop
23-3	Open	Open	Closed
23-4	Open	Closed	Open
23-5	Closed	Open	Open

(7) Selection of DTR

SW No.	RDY/BSY	XON/XOFF ETX/ACK
24-1	Closed	Open
24-2	Open	Closed

(8) Selection of data protocol

DATA	21-7	21-8
RDY/BSY	Open	Open
	Closed	Open
XON/XOFF	Open	Closed
ETX/ACK	Closed	Closed

(ST)

(9) Selection of 7-bit or 8-bit data

Data	21-6
8 bit	Open
7 bit	Closed

(ST)

(10) Selection of parity check

Parity Check	21-3	21-4
EVEN	Open	Open
ODD	Closed	Open
NO PARITY	Open	Closed

(ST)

Note: For the Ignore Parity, refer to page 50.

(11) Selection of stop bit 1 or 2

Number of Lines	21-1
1 bit	Open
2 bits	Closed

(ST)

(12) Selection of data transmission speed (Unit: baud)

Speed	22-1	22-2	22-3
9600	Open	Open	Open
4800	Open	Open	Closed
2400	Open	Closed	Open
1200	Open	Closed	Closed
600	Closed	Open	Open
300	Closed	Open	Closed
200	Closed	Closed	Open
110	Closed	Closed	Closed

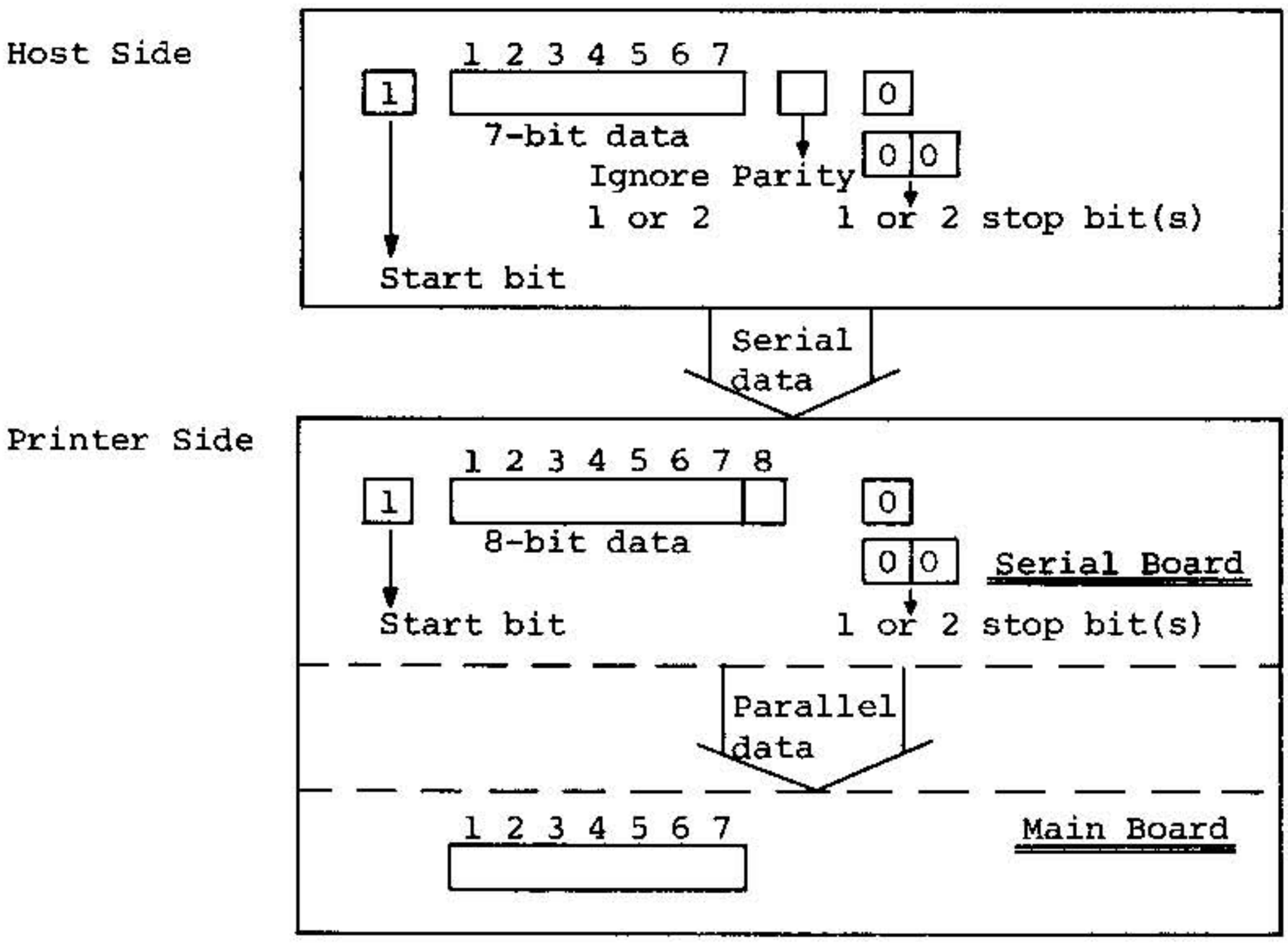
(ST)

Do not use current loop at more than 2400 BPS.
When the transmission rate is 9600 baud, do not specify 7-bit, no parity and one stop bit.

Note: In this machine, the parity can be ignored under the following setting.

Host Side	Printer Side	
	Serial Board	Main Board
∘ 7-bit ∘ Ignore Parity (ex. Even, Odd, Mark, Space)	∘ 8-bit (SW21-6 open) ∘ No Parity (SW21-3 open SW21-4 closed)	∘ 7-bit (SW2-6 closed)

Principle of Ignore Parity



5. Data Protocol

5-1. Data Protocol (RE TYPE)

Data RDY/BSY system

This system uses the level signal (DTR) which indicates the printer state.

This printer provides a data buffer which stores on the principle of "first-in, first-out". If the host CPU continues to transfer data ignoring the signals from this printer, some data may be lost.

When the remaining capacity of the data buffer becomes less than 30 bytes, the DTR signal becomes low level. Therefore the printer outputs the BSY signal. When the remaining capacity of the data buffer becomes more than 99 bytes, the DTR signal becomes high level and printer becomes ready for receiving data.
The host CPU must stop the data transmission within 27 bytes after the DTR signal becomes low level.
The host CPU transmits the data exceeding the capacity of the data buffer ignoring the BSY signal, this printer receives the overflow data but it must be discarded.
At power on time, when the printer is ready to receive the data and is selected, the DTR signal becomes ready state.

NOTE 1. Relationship between SEL Switch and DC1/DC3 Code

The DTR and RTS signals go low when the printer is deselected by the SEL switch or it receives a DC1 code. The DTR signal also goes low when the receive buffer is under the conditions described on page 51.

The DTR and RTS signals go high when the printer is selected by the SEL switch or it receives a DC1 code. The DTR signal also goes high when the printer is under the conditions described on page 51.

NOTE 2. Abnormality of Printer

When an abnormality occurs in the printer, the printer will be deselected under any of the following conditions.

1. When the paper has run out.
2. The cover is open.
3. When the carrier has overrun.
4. There is remnant printer data even after the carrier has passed the left detection position.
5. When the printer is in DESELECT status.

The signals to the host CPU at this time are as follows:

	At abnormal printer time	At printer restored time
RDY/BSY system	DTR = L	DTR = H

NOTE 3. The $\overline{\text{INPUT PRIME}}$ signal causes the printer to be reset when a space state (break state) of more than one character is detected in the received data regardless of the protocol.

5-2. Data Protocol (RD CD TYPE)

This printer provides three types of transmission system.

1. Data RDY/BSY system

   This system uses the level signal (DTR) which indicates the printer state.

2. ETX/ACK system

   This system uses the serial codes ASCII CODE-ETX, ACK.

3. XON/XOFF system

   This system uses the serial coded ASCII CODE-XON, XOFF.
   They are selected by using the dip switches.

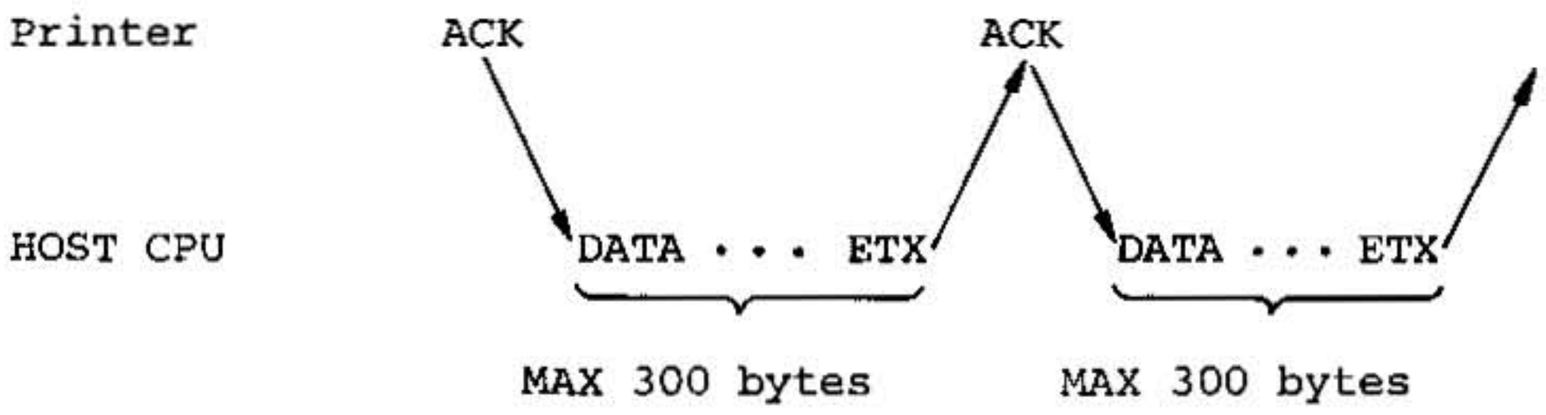
This printer provides a data buffer which stores on the principle of "first-in, first-out". If the host CPU continues to transfer data ignoring the signals from this printer, some data may be lost.

5-2-1. Data RDY/BSY system

When the remaining capacity of the data buffer becomes less than 30 bytes, the DTR signal becomes low level. Therefore the printer outputs the BSY signal. When the remaining capacity of the data buffer becomes more than 99 bytes, the DTR signal becomes high level and printer becomes ready for receiving data.
The host CPU must stop the data transmission within 27 bytes after the DTR signal becomes low level.
The host CPU transmits the data exceeding the capacity of the data buffer ignoring the BSY signal, this printer receives the overflow data but it must be discarded.
At power on time, when the printer is ready to receive the data and is selected, the DTR signal becomes ready state.

5-2-2. ETX/ACK system

When the buffer is ready to restore the data, it makes the DTR level high (ready state) and sends out ACK code.
The printer stores the received data in the buffer, prints the data in series when it finds the ETX code in the buffer.
When this performance is finished, the printer sends out the ACK code.
Therefore, the host CPU must transmit the next text when it receives the ACK code. And it is necessary to include the ETX does properly in the data stream of the CPU considering the capacity of the printer's buffer.



Rule of Text

The number of characters including the ETX code must be up to 300 bytes in a text. A text must ends with the ETX code.

5-2-3. XON/XOFF System

When the remaining capacity of the data buffer becomes less than 30 bytes, the printer sends an XOFF code (13H). When the remaining capacity exceeds 100 characters, the printer sends an XON code (11H).
The host CPU must send the next data after an XON code is received.
When the printer is ready to receive data after power on, it causes the DTR signal to go high (READY) and an XON code is sent if the printer is selected, and an XOFF code if deselected.
The printer sends an XOFF code when it is deselected.
The printer sends an XON code when it changes from SELECT to DESELECT state. A text must be within the maximum capacity of the data buffer minus 29 characters.

NOTE 1. Relationship between SEL Switch and DC1/DC3 Code

1) RDY/BSY system

The DTR and RTS signals go low when the printer is deselected by the SEL switch or it receives a DC1 code. The DTR signal also goes low when the receive buffer is under the conditions described on page 53.

The DTR and RTS signals go high when the printer is selected by the SEL switch or it receives a DC1 code. The DTR signal also goes high when the printer is under the conditions described on page 53.

2) XON/XOFF system

The printer sends an XOFF code to the host CPU when it is deselected by the SEL switch or it receives a DC3 code. However, if an XOFF code has already been sent because the data buffer became full, the printer will send an XOFF code.

When the printer is selected by the SEL switch or it receives a DC1 code, it sends an XON code only if an XOFF code has already been sent due to operation of the SEL switch or reception of a DC3 code.

3) ETX/ACK system

The ETX and ACK codes are transferred independently regardless of operation of the SEL switch or reception of a DC1/DC3 code.

NOTE 2. Abnormality of Printer

When an abnormality occurs in the printer, the printer will be deselected under any of the following conditions.

1. When the paper has run out.
2. The cover is open.
3. When the carrier has overrun.
4. There is remnant printer data even after the carrier has passed the left detection position.
5. When the printer is in DESELECT status.

The signals to the host CPU at this time are as follows:

In Case of RS232C

	At abnormal printer time	At printer restored time
RDY/BSY system	FAULT = L DTR = L	FAULT = H DTR = H
ETX/ACK system	FAULT = L	FAULT = H
XON/XOFF system	FAULT = L XOFF output	FAULT = H XON output

In Case of 20mA Current Loop (CD only)

	At abnormal printer time	At printer restored time
RDY/BSY system	DTR line is in SPACE state. (No 20mA current flows.)	DTR line is in MARK state. (A 20mA current flows).
ETX/ACK system	———	———
XON/XOFF system	XOFF output	XON output

NOTE 3. The $\overline{\text{INPUT PRIME}}$ signal causes the printer to be reset when a space state (break state) of more than one character is detected in the received data regardless of the protocol.

6. FUNCTION CODES

6-1 Function Codes

CODES	FUNCTION
CR (0D)H Carriage Return 13 Decimal	* Print command code * Auto line feed upon completion of printing is selectable by a function control switch (SW1-8). * Carriage return command in incremental print mode. * This code is ignored in logic seek print mode when no print data is found in buffer.
LF (0A)H Line Feed 10 Decimal	* Line feed command * May be selected as a print command by setting DIP switch (SW1-7) closed in logic seek print mode. * Forward feed in FORWARD mode (reverse feed in REVERSE mode) * When bottom of form (BOF) code is used in VFU control in FORWARD mode, a line feed from the last line causes a skip to the next top of form (TOF). (In REVERSE mode, a line feed from TOF causes reverse feed to the bottom position of previous form.)
VT (0B)H Vertical Tab 09 Decimal	* Multiple line feed code. Automatic line feed to vertical tab set in channel 2 of VFU. * May be selected as a print command in logic seek print mode by setting DIP-SW (SW1-7) at closed position. When SW-7 is open, VT often print data is ignored. * When no vertical tab has been set at channel 2 of VFU, line feed to the next top of form (TOF) position. * The above also applies to REVERSE mode.
FF (0C)H Form Feed 12 Decimal	* Multiple line feed code, automatic feed to top of form (TOF) position, as set in VFU channel 1. (The form does not stop at the BOF position set in VFU.) * Can be selected as a print command in logic seek print mode by setting DIP SW (SW1-7) closed when SW-7 is open, FF after print data is ignored. * The above also applies to REVERSE mode.

CODES	FUNCTION
CAN (18)H Cancel 24 Decimal	* Cancels print data received prior to this code and within the same line as this code. * This code is ignored in incremental print mode. * Any control code or print mode in effect prior to the CAN code remains valid. The last mode before the reception of CAN code is maintained.
SO (0E)H Shift Out 14 Deciaml	* Elongated character command code. (Double Width Character) * Data following reception of this code shall be elongated until SI code is received. * This code functions as a selection code for selecting KANA character area in case Japanese 7-bit code is used (SW1-1 1-3/OPEN, SW2-6/CLOSED)
SI (0F)H Shift In 15	* A clear command for elongated character command. * In case the Japanese 7-bit code is used, this code functions as a clearing code for KANA character area and selects Alpha-Numeric area.
DC1 (11)H Device Control 1 17	* This code is used to place printer in SELECT state. * Can be ineffective by setting switch (SW1-5) closed.
DC3 (13)H Device Control 3 19	* Code is used to place printer in DESELECT state. * Can be ineffective by setting DIP switch (SW1-5) CLOSED.
BS (08)H Back Space 8	* Effective only in incremental print mode. * Back space command. Back spacing is carried out after the data received just prior to this code is printed. * Ignored when no print data is found. * The printer head will not stop at the next position to be printed.

CODES	FUNCTION
HT (09)H Horizontal Tab 9	* Moves the head to the nearest horizontal tab set position. Ignored when no horizontal tab set is found. * Not ignored in incremental print mode. The carrier slides to the right end.
DC2 (12)H Device Cont. 2 18	* Elongated character command code in case Japanese 7-bit code is used. * Japanese 7-bit code data following this code shall be elongated until DC4 code is received. * Ignored when codes other than Japanese 7-bit code are used.
DC4 (14)H Device Cont. 4 20	* A clear command for elongated character command for Japanese 7-bit code. * Ignored when codes other than Japanese 7-bit code are used.
GS (1D)H Group Separator 29	* Initial start load command to load electronic Vertical Format Unit (VFU). Data preceded by GS code will be stored in VFU memory. * TOF code must immediately follow GS or the entire format load will be cancelled and the printer will revert to the programmed format. When the power is turned on, the printer is set to the preprogrammed format.
RS (1E)H Record Separator 30	* The end of load command for VFU loading. * TOF must immediately precede RS or RS is ignored and the printer will revert to the preprogrammed format.

<table>
<tr><th>CODES</th><th>FUNCTION</th></tr>
<tr><td>US (1F)H
Unit Separator
31</td><td>* Vertical tab start command combined with the following 1 byte which defines either (A) the number of channel of VFU where the format to be followed is contained or (B) number of lines to be fed expressed in weighted binary.
* Feeds the form up to the next TOF position, in case that no tab is found in the specified channel at a line below (in case of reverse mode, above) than the current position. The binary value of N3N2N1N0 must be between 0 and 15.

<table>
<tr><td></td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>1</td><td>Bit</td></tr>
<tr><td></td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>US Code</td></tr>
<tr><td>(A)</td><td>X</td><td>X</td><td>X</td><td>0</td><td>0</td><td>C2</td><td>C1</td><td>C0</td><td>Channel of VFU
or</td></tr>
<tr><td>(B)</td><td>X</td><td>X</td><td>X</td><td>1</td><td>N3</td><td>N2</td><td>N1</td><td>N0</td><td>Number of lines</td></tr>
</table>

* X may be either 0 or 1

NOTE - When C=1, the form is fed to the next bottom or TOF position.
When C=0, the code is ineffective.
The code is ineffective other than when $1 \leq C \leq 6$.
When the code is ineffective, the reception of US code is cancelled.

* In logic seek print mode, this code doubles as a print command with DIP SW (SW1-7) closed. When SW1-7 is open, VT after print data is ignored.</td></tr>
<tr><td>DEL (7F)H 127</td><td>* This is an ignore code.</td></tr>
</table>

6-2 Vertical Printing Format

The user has the option of programming his own vertical format, or using the pre-programmed format in the line printer. The pre-programmed format consists of Top of Form at line 1, Bottom of Form at line 66 (or 72), and a vertical tab in channel 2 every sixth line down the form. If the EVFU is not programmed by the user, or if the EVFU programming is incorrect, the printer will default to the pre-programmed format.

6-3 Electronic Vertical Format Unit-(EVFU)

The EVFU is a user-programmable vertical format unit similar in principle to the mechanical VFU tape readers found on older printer. The EVFU can accomodate maximum form lengths of 66 or 72 lines.
These lengths are determined by the setting of SW1-4 (see Section 3-9).

Any forms length may be specified by programming the EVFU, as long as the specified length does not exceed the maximum selected by the DIP switch.

There are three basic steps for loading vertical format data into the printer. For these steps assume that the printer is to be set up for 66 lines. Use the same technique for any other forms length.

a. Send the Start Load command to alert the printer that the following data are EVFU commands. Start Load is the ASCII control character GS (29 Decimal).

b. Send 66 pairs of bytes, one pair for each line on the form, which indicate which of the six available channels is to be set for that line. The format of each byte is:

	7	6	5	4	3	2	1	0
BYTE 1	X	1	CH6	CH5	CH4	CH3	CH2	CH1
BYTE 2	X	1	X	X	X	X	X	X

X=Not Used

Channel 1 is used for Top of Form (TOF) and Bottom of Form (BOF).
A TOF command must contain a 1 in channel 1 and a 0 in every other channel. The first pair of bytes entered must contain the TOF code or the entire format load will be cancelled, and the printer will revert to the preprogrammed format. Channels 2 through 6 are vertical tab channels and may be configured in any combination desired, as long as channel 1 contains a 0.Al in both channels 1 and 2 indicates BOF.

After the 66 byte pairs have been entered, a 67th byte pair containing a TOF code must be entered. If this is not done, the printer reverts to the preprogrammed format. This TOF code effectively represents the top of the next form. It must always follow the entry for the last line of the form used (e.g. if forms are 15 lines long, TOF must be entered in line position 16).

c. Immediately following the 67th entry, load the End of Load command, ASCII control character RS (Record Separator), 30 Decimal.

EVFU Program Example:

A typical EVFU program is shown in the example. As shown, a Form Feed command (ASCII Character FF, 12 Decimal) or a tab to channel 1 will advance the form to the next top of form.

A vertical Tab command (ASCII character VT, 11 Decimal) or a tab to channel 2 will first advance the form to line 17, then if issued a second time, to line 25. Note that the VT command always uses channel 2.

Two consecutive tabs to channel 5 will advance forms to line 15, then to line 17.

Two consecutive tabs to channel 4 will advance forms to line 17, then to the top of the next form (the printer will always stop at top of form if it is reached before the designated tab channel is detected).

In the course of printing, when line 63 is reached, the BOF setting will automatically cause the forms to advance to the top of the next form.

EVFU PROGRAM EXAMPLE

```
    00011101                    GS CODE-START VFU LOAD

 1. 01000001                    Line 1:  Top of Form
    01000000

 2. 01000000                    Line 2:  No Tabs Set in this line
    01000000

 3. 01010000                    Line 15:  Tab set in Channel 5
    01000000
      :  :
17. 01011010                    Line 17:  Tab set in Channels 2,4 and 5
    01000000
      :  :
25. 01000010                    Line 25:  Tab set in Channel 2
    01000000
      :  :
63. 01000011                    Line 63:  Bottom of Form
    01000000
      :  :
67. 01000001                    Effective   Line 1 of next page:  Top of Form
    01000000
```

Summarizing the commands utilizing the EVFU:

Form Feed: ASCII character FF (12 Decimal) advances forms to the next top of form.

Vertical Tab: ASCII character VT (21 Decimal) advances forms to the next line for which channel 2 of the EVFU is set.

Unit Separator: ASCII character US (31 Decimal) informs the printer that the next byte contains forms motion information. This succeeding byte is formatted in one of two ways, as follows:

	7	6	5	4	3	2	1	0
A	X	X	X	0	0	C2	C1	C0
B	X	X	X	1	N3	N2	N1	N0

In example A, C0-C2 is a weighted binary number indicating the tab channel to be used (e.g., 101= channel 5). In example B, N0-N3 is a weighted binary number indicating the absolute number of lines that forms are to be advanced, regardless of their present position (e.g., 1111 advances forms 15 lines.) The 1 in position 4 indicates that this absolute format is to be used.

Referring to the EVFU programming example, the following are examples of US code usage:

```
00011111    US Code
00000001    Advance to Channel 1 (TOF)

00011111    US Code
00000100    Advance to Channel 4 (Line 17)

00011111    US Code
00011101    Absolute advance of 13 lines
```

7. SPECIAL FUNCTIONS OF THE M8510A

Introduction

The M8510A has a number of special functions which can be selected by the use of "Escape Sequences". These are multiple-byte commands beginning with the ASCII ESC code, (27 decimal or 1B hexadecimal), followed by one or more ASCII codes, which cause the printer to enter various operating modes (proportional spacing, graphics, etc.) These escape sequences are explained below.

7-1 Incremental and Logic Seek Print Mode

In incremental print mode, the M8510A prints each character as it is received from the host computer. A carriage return causes the dot head to move to the left margin. In logic seek mode characters are stored in a buffer until a print command (e.g. carriage return) is received, or an entire line of data is received with no print command. Printing is bidirectional, and the dot head always moves at high speed to the starting point of each line. The logic seek mode is assumed when the printer is powered on.

Command	Decimal Data	Hex. Decimal Data	Function
ESC [	27 91	1B 5B	Incremental Print Mode
ESC]	27 93	1B 5D	Logic Seek Print Mode

NOTE-In incremental mode, once the dot head reaches the rightmost printing position, and no print command has been received, all characters will be printed in the same column.

7-2 Character Pitch

The character pitch is the number of characters per inch in a line of print. The M8510A has four basic pitches: Pica (10 CPI); Elite (12 CPI); Compressed (17 CPI) and Proportional, which varies according to the actual characters printed. When the printer is powered on, it will assume either pica or proportional, depending on the setting of DIP switch 2-5 (see Section 3-9).

Command	Decimal Data	Hex. Decimal Data	Character Pitch
ESC P	27 80	1B 50	Proportional
ESC N	27 78	1B 4E	Pica Pitch (10 CPI)
ESC E	27 69	1B 45	Elite Pitch (12 CPI)
ESC Q	27 81	1B 51	Compressed Pitch (17 CPI)

Example: Printing in proportional, compressed, elite and pica pitches.

DATA: [ESC] P A B C D [ESC] Q A B C D [ESC] E A B C D

[ESC] N A B C D [CR]

PRINT:

ABCDABCDABCDABCD

7-3 Line Feed Pitch

The number of lines printed per inch can be set by escape sequences. The line feed amount can be set to 1/6 inch, 1/8 inch or N/144 inch (where N is a number between 0 and 99). The printer assumes a 1/6 inch line feed when it is powered on.

Command	Decimal Data	Hex. Decimal Data	Line Feed Pitch
ESC A	27 65	1B 41	1/6 Inch Line Feed
ESC B	27 66	1B 42	1/8 Inch Line Feed
ESC T n1n0	27 84 n1 n0	1B 54 (n1) (n0)	N/144 Inch Line Feed*

*NOTE - To use N/144 inch line feed pitch, send ESC T immediately, followed by n1n0, a two digit decimal number between 00 and 99. Line feed pitch remains effective until changed by another command.

Example: Line feeds of 1/6, 1/8, 16/144 and 48/144 inch.

Data: [ESC] A 12345 [CR] [ESC] B 12345 [CR] [ESC] T16 12345 [CR] [ESC] T48 12345 [CR] 12345 [CR]

PRINT:

12345
12345
12345
12345

12345

7-4 Forward and Reverse Line Feed

The printer is capable of both forward and reverse line feeding. When powered on, it assumes forward line feed.

Command	Decimal Data	Hex. Decimal Data	Direction of Line Feed
ESC f	27 102	1B 66	Forward
ESC r	27 114	1B 72	Reverse

Once the line feed direction has been selected, it remains in force until changed by another escape sequence.

7-5 Bold Print Characters

Bold print characters are printed significantly darker than normal characters. When the printer is powered on, the bold print function is de-activated.

Command	Decimal Data	Hex. Decimal Data	Function
ESC !	27 33	1B 21	Bold Print Select
ESC "	27 34	1B 22	Bold Print Clear

Once selected, bold printing continues until cleared.

Example: Printing in normal and bold print

Data: 1 2 3 4 5 [ESC] ! 1 2 3 4 5 [ESC] " 1 2 3 4 5

PRINT:

12345**1234512345**

7-6 Underline

Printed characters can be underlined. An underline command causes subsequent characters to be underlined; this continues until the clear underline command is received.

Command	Decimal Data	Hex. Decimal Data	Function
ESC X	27 88	1B 58	Start Underline
ESC Y	27 89	1B 59	Stop Underline

Example: Printing underlined characters.

Data: 1 2 3 [ESC] X 4 5 6 [ESC] Y 7 8 9

PRINT:

123<u>456</u>789

7-7 Left Margin Set

The left margin, once set, remains effective until it is either changed by another left margin set command, or is reset to the leftmost print position by the INPUT.PRIME signal from the host computer. When the printer is powered on, the left margin is set to the leftmost print position.

Command	Decimal Data	Hex. Decimal Data
ESC L n2n1n0	27 76 n2n1n0	1B 4C (n2)(n1)(n0)

"0"

n2n1n0 is a three digit decimal number expressed in ASCII. That is, add 48 to each digit to obtain its ASCII equivalent. The left margin is set in accordance with the current character pitch selection. Pica (10 CPI) is used in proportional printing mode.

Example: Setting the left margin to column 10

Data: 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 [CR] [ESC]

L 010 A B C D [CR]

PRINT:

```
0123456789012345678 9
ABCD
```

NOTE - The first print column is column 0.

7-8 Horizontal Tab Set/Clear

Up to thirty two horizontal tabs can be set at one time. The horizontal tab command, HT (09 decimal), causes the dot head to move to the next tab set. The printer will ignore a horizontal tab command if no tabs have been set, or if the dot head is at or beyond the last tab set (logic seek print mode). Tabs can be cleared selectively or entirely. The tabs are set in accordance with the current character pitch (pica pitch is used in proportional printing mode). If character pitch is changed after setting tabs, they will no longer conform column-wise--they will remain in the same physical positions as when they were set. Therefore, tabs should be set only after pitch is selected. No tabs are set printer is powered on.

Command	Decimal Data	Hex. Decimal Data	Function
ESC (a,b,c,~n .	27 40 o o o	1B 28 o o o	Set Tabs
ESC)a,b,c,~n .	27 41 o o o	1B 29 o o o	Clear Tabs
ESC 0	27 48	1B 30	Clear All Tabs

a,b,c are 3 digit decimal numbers expressed in ASCII (add 48 to each digit for ASCII code). They are the print column numbers.

NOTE - When using the selecting tab set/clear commands, the column numbers must be 3 digits long. They must be separated by commas (44 decimal), and terminated by a period (46 decimal). If any error is made in the tab setting method, all tabs are automatically cleared, and must be re-set. This also happens if an attempt is made to set more than 33 tabs at one time.

Example: (1) Tab Set - Tab positions are columns 2, 4, 8, 16 and 32 in pica pitch.

Data: [ESC] N [ESC] (002, 004, 008, 016, 032.

(2) Horizontal tabs are executed between characters to be printed.

Data: 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 [CR]

[HT] A [HT] B [HT] C [HT] D [HT] E [CR]

PRINT:

```
1234567890 1234567890 1234567890 1234567890
 A B    C         D                    E
```

7-9 Character Set Selection

In addition to the switch selectable foreign language character sets (see Section 3-9), the M8510A can print Japanese Hiragana code, Greek letters and special graphics characters by using escape sequence. See Chapter 9 for tables of the various character sets.

Command	Decimal Data	Hex. Decimal Data	Character Set
ESC $	27 36	1B 24	Alphanumeric (ASCII) Characters
ESC &	27 38	1B 26	Greek Characters or Hiragana
ESC #	27 35	1B 23	Graphic Symbols (7-bit)

When the printer is powered on, the alphanumeric character set is assumed. See section 9-3 for explanation of character set selection.

7-10 Bit Image Graphics

The M8510A has a graphics capability which enables the user to specify which wires of the dot head are to be fired in any dot position. Thus, special characters not in the printer's character set can be printed. In addition, by setting the line feed pitch to 16/144 inch (see Section 7-3.), full page high resolution graphics can be accomplished.

Command	Decimal Data	Hex. Decimal Data
ESC S n3n2n1n0	27 83 n3n2n1n0	1B 53 (n3)(n2)(n1)(n0)

This is a six byte command which sets up the bit image graphics mode. The four bytes, n3n2n1n0, are the ASCII presentation of the number of dot positions (horizontally) to be printed in graphics mode.
For example, if 200 dot positions are to be printed, the command would be ESC S 0200 (decimal data would be 27 83 48 50 48 48).
This six byte command would then be followed by 200 bytes, with each of the 8 bits controlling one wire of the dot head. The density of the bit image graphics is affected by the character pitch currently in force. (see Section 7-2) The density of dots and the maximum number of dot positions per line are defined in the following table.

Pitch	Dots Per Inch	Dots Per Line
Pica 10 CPI	80	640
Elite 12 CPI	96	768
Compressed 17 CPI	136	1088
Proportional	160	1280

Bit Image Graphic Command

(a) The number of bit image transmission data bytes is specified by the data of the data of the 6th bytes.

Ex. In case of 200 bytes.

ESC S $30_H32_H30_H30_H$

(b) The specified maximum number of bytes is 9,999 bytes.

(EX. 1)

1-1.

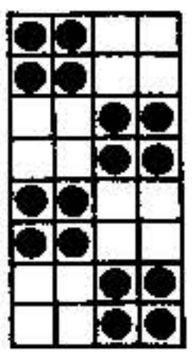


FIG.A

Six times of the format shown in FIG. A, ABC is ASCCII code, and six times of the format shown in FIG. A are printed in this order

1-2. Data Entry Method

1 To Enter ABC in ASCII Code:

ESC S 0 0 2 4 $\overbrace{(33)_H(33)_H(CC)_H(CC)_H}^{*}$ ..... $(33)_H(33)_H(CC)_H(CC)_H$

ESC S 0 0 2 4: Reservation of 24 bytes

$(33)_H(33)_H(CC)_H(CC)_H$ ..... $(33)_H(33)_H(CC)_H(CC)_H$: Repeat the part marked * 6 times. (Note 1)

A B C [ESC] S 0 0 2 4 $(33)_H(33)_H(CC)_H(CC)_H$ ..... $(33)_H(33)_H(CC)_H(CC)_H$

Reservation of 24 bytes

Repeat the part marked * 6 times.

Print sample ABC

2 To Enter All Data in Dot Image Graphic Mode

[ESC] S 0 7 2 [Data same as note 1] [Data of note 2] [Data same as note 1] [CR]

Print sample ABC

(Data of note 2) ..... "A" $(78)_H(14)_H(12)_H(11)_H(12)_H(14)_H(78)_H(00)_H$

"B" $(7F)_H(49)_H(49)_H(49)_H(49)_H(36)_H(00)_H(00)_H$

"C" $(3E)_H(41)_H(41)_H(41)_H(41)_H(22)_H(00)_H(00)_H$

(EX. 2) Vertical Line Print

Close the DIP switch(SW2-8) to select the single directional printing, eliminating the divergence in the line.

[ESC] T 1 6 [ESC] S 0 0 0 1 FF_H CR

Line spacing: 16/144 inches

Repeat 10 times

Eight dots are printed simultaneously.

Bit Image of FF_H Data

Dot Pin No.	Bit No.	Image	[Print]
1	0	.	
2	1	.	
3	2	.	
4	3	.	
5	4	.	
6	5	.	
7	6	.	
8	7	.	

In the actual print, this is not a broken line but a straight line. (The line is spaced for explanatory reasons.)

7-11 Dot By Dot Spacing

When the printer is in proportional spacing mode (see Section 7-2.), the space between characters can be controlled by escape sequence. Spacing of 1 to 6 dot positions can be commanded, and by repeating the codes, up to 128 dot positions can be accumulated.

Command	Decimal Data	Hex. Decimal Data	Function
ESC 1	27 49	1B 31	1 Dot Space
ESC 2	27 50	1B 32	2 Dots Space
ESC 3	27 51	1B 33	3 Dots Space
ESC 4	27 52	1B 34	4 Dots Space
ESC 5	27 53	1B 35	5 Dots Space
ESC 6	27 54	1B 36	6 Dots Space

NOTE - Dot By Dot spacing is functional only in proportional spacing mode. In other character pitches, the commands are ignored.

7-12 Print Direction

The following commands allow the choice of the unidirectional and bidirectional print.

Command	Decimal Data	Hex. Data	Print Direction
ESC >	27 62	1B 3E	Unidirectional print command
ESC <	27 60	1B 3C	Bidirectional print command

ESC >(1B, 3E)H

(a) Upon the reception of this code, the unidirectional print mode is assumed.
(b) The unidirectional print mode cotinues until the reception of a bidirectional print command code (ESC,<).
(c) If SW2-8 is closed when the printer power is turned on, the unidirectional print is assumed.

ESC < (1B, 3C)H

(a) Upon the reception of this code, the bidirectional print mode is assumed.
(b) The bidirectional print mode continues until the reception of a unidirectional print command code (ESC, >).
(c) If SW2-8 is open when the printer power is turned on, the bidirectional print is assumed.

7-13 Repeat and Addressing

The repear command and addressing command offer the following functions:

Command	Decimal Data	Hex. Data	Function
ESC Rn2n1n0	27 82	1B 52	Character repeat
ESC Vn3n2n1n0	27 86	1B 56	Dot column repeat
ESC Fn3n2n1n0	27 70	1B 46	Dot addressing

ESC, R n2n1n0 [1B,52,(n2),(n1), (n0)] (n2)～(n0)=30H～39H

(a) This code consists of 5 bytes.
(b) Upon the reception of this code, the following one character is repeatedly printed the number of times indicated by n2n1n0.

Ex. ESC, R 010 * Character * is repeatedly printed 10 times.

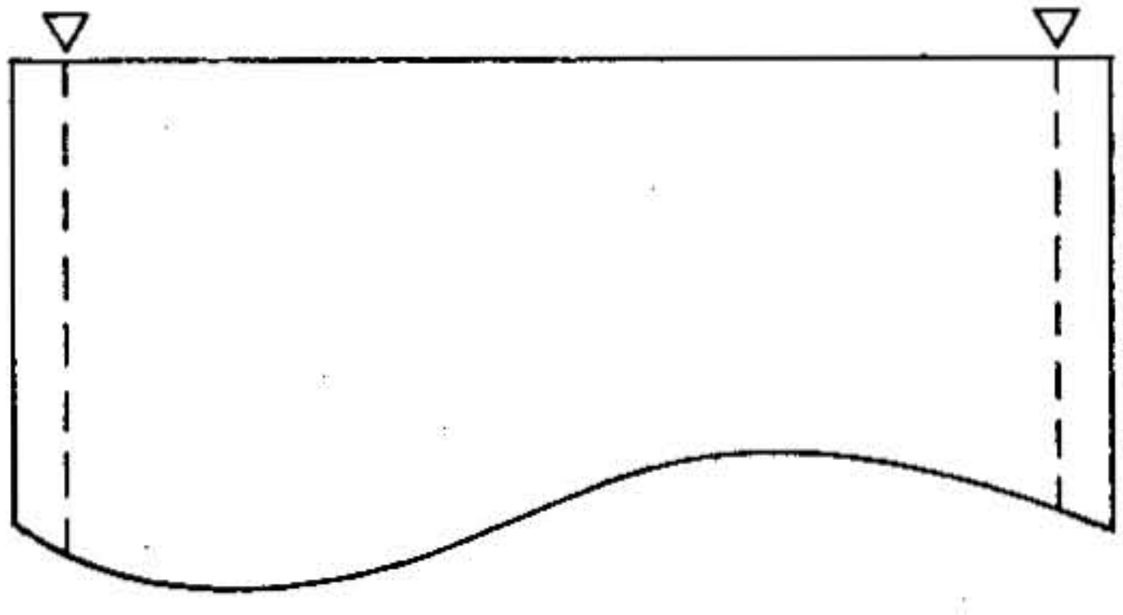
ESC, V n3n2n1n0 [1B,56,(n3),(n2),(n1), (n0)] (n2)～(n0)=30H～39H

(a) This code consists of 6 bytes.
(b) Upon the reception of this code, the following one byte is repeatedly printed in 8 dots/dot column.

ESC, F n3n2n1n0

(a) This code consists of 6 bytes.

(b) Upon the reception of this code, the head is moved to the dot position indicated by n3-n0.
In the case of 10 CPI (Pica pitch): $0 \leqq n3n2n1n0 \leqq 639$



(c) Dot base addressing is done using relative addresses with the left margin set position as 0.

(d) Max. Number of Dots

	Type	Max. Number of Dots
1	10 CPI (pica pitch)	640
2	Proportional	1280
3	17 CPI (Condensed)	1088
4	12 CPI (Elite pitch)	768

8. OPERATING/ALERT SWITCHES AND INDICATOR LAMPS

8-1 Operating Switches

(1) Power Switch

(a) This is a rocker-type switch used to turn the printer power ON/OFF.
(b) Power is turned-on when the marked side is depressed.

(2) SEL (Select) Switch

(a) This is a push switch located on the control panel.
(b) SELECT and DESELECT states alternate with every push.
(c) When power is applied, the printer will become either SELECT or DESELECT, depending on DIP switch selection (refer to section 3-9).
(d) Data transmission and printing of data in the DATA BUFFER can be stopped temporarily. To perform this operation, press the SEL switch with the LF switch already depressed. To resume printing and data transmission, press the SEL switch.

(3) LF (Line Feed) Switch

(a) This is a push switch located on the operating panel.
(b) One line feed occurs with every push.
(c) Line feed can be performed only when the printer is in a DESELECT state.
(d) Data transmission and printing of data in the DATA BUFFER can be stopped temporarily. To perform this operation, press the SEL switch with the LF switch already depressed. To resume printing and data transmission, press the SEL switch.

(4) TOF (Top of Form) Switch

(a) This is a push switch located on the operating panel.
(b) When this switch is pressed, the paper feeds to the next TOF position as set in the VFU.
(c) TOF can be performed only when the printer is in a DESELECT state.

8-2 Alert Switches

(1) PE (Paper Empty) Switch

(a) This is a microswitch installed beneath the platen.

(b) When this sensor detects that the paper end is near (25mm from the end), the PE lamp is lit. The printer enters the DESELECT state, data reception ceases and print operation stops. The printer enters a FAULT state.

(2) Cover Interlock Switch

(a) When the top cover is open, printing will stop and the printer will enter the DESELECT and FAULT states.
(b) To resume printer operation, close the cover and press the SEL switch.

8-3 Indicator Lamps

The following lamps are located on the control panel.

(1) SEL Lamp (Green)

This lamp is lit when the printer is in the SELECT state.

(2) PE Lamp (Red)

This lamp is lit when the PE microswitch is activated.

(3) Power Lamp (Green)

The lamp is lit when the printer power is on.

9. CHARACTER SETS/ASCII TABLES

9-1 Switch Selectable Character Sets

By the appropriate setting of DIP switches, the printer can replace eleven of the ASCII special characters (@, [, etc.) with special characters used in other countries. Refer to Section 3-9 for switch settings. Table 9-1 shows the alternate characters with their hexadecimal codes. If a box is left empty, the character is the same as the United States' character.

9-2 Software Selectable Character Sets In 8-Bit Mode

When switch 2-6 is in the OPEN position, the 8-bit data format is assumed. This allows 256 characters to be printed instead of the usual 128. Characters with codes between 0 and 127 are the standard ASCII character set, while characters between 128 and 255 cause graphics, Greek letters and/or Katakana characters.

Table 9-2 shows the 256 character set that is standard in the M8510A for all national designations except Japan (see switches 1-1 ∿1-3 in Section 3-9). For the Japanese configuration, substitute Table 9-2 for columns A∿D of Table 9-3. This is the Katakana character set.

The eight data bits in a character are numbered 7∿0 from left to right; Bit 7 is the most significant bit (value=128) and Bit 0 is the least significant Bit (Value=1). Referring to Table 7-2 symbols in columns 0∿7 are printed when character Bit 7 is 0 (decimal value of character code is less than 128); symbol in columns 8∿F are printed when Bit 7 is set to 1 (decimal value is 128 or greater).

NOTE - Some printer interfaces automatically set Bit 7 of all characters. This is done because standard ASCII codes use only Bits 6∿0. If no provision has been made for program control of Bit 7, the 8-Bit character format cannot be used. See Section 9-3 for an alternate 7-Bit method.

9-3 Software Selectable Character Sets In 7-Bit Mode

When switch 2-6 is closed, the 7-Bit data format is assumed. Seven-Bit data allows only the standard 128 character ASCII code, so commands have been provided to replace a section of the ASCII code table with either Greek, Japanese Katakana or Graphic Symbols. Columns 0 to 7 of Table 9-2 show the 7-Bit ASCII character set, and Tables 9-4, 9-5 and 9-6 show the characters that can be substituted by use of the commands listed below.

*No.	1	2	3	4	5	6	7	8	9	10	11
HEX.	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
US	$	@	[	\	]	^	`	{	¦	}	~
UK	£										
GE		§	Ä	Ö	Ü			ä	ö	ü	ß
SW	¤	E	Ä	Ö	Å	Ü	é	ä	ö	å	ü
JA				¥							

TABLE 9-1 SPECIAL CHARACTERS FOR FOREIGN CHARACTER SETS

	0	1	2	3	4	5	6	7	8	9	A	B	O	D	E	F
0			SP	0	(*2)	P	(*7)	p	▁	┴	α	ρ	↑	1	═	╳
1	SOH	DC1	!	1	A	Q	a	q	▂	┬	β	σ	↓	2	╞	····
2	STX	DC2	"	2	B	R	b	r	▃	┤	γ	τ	←	3	╪	⋮
3	ETX	DC3	#	3	C	S	c	s	▄	├	δ	υ	→	4	╡	⋮
4	EOT	DC4	(*1)	4	D	T	d	t	▅	─	ε	φ	±	5	◢	⋮
5	ENQ		%	5	E	U	e	u	▆	┼	ζ	χ	÷	6	◣	···|
6	ACK		&	6	F	V	f	v	▇	|	η	ψ	≥	7	◥	|···
7			'	7	G	W	g	w	▇	|	θ	ω	≤	8	◤	⋮
8	BS	CAN	(	8	H	X	h	x	▌	┌	ι	Δ	≈	9	♠	
9	HT	EM	)	9	I	Y	i	y	▌	┐	κ	Γ	·	(	♥	
A	LF		*	:	J	Z	j	z	▌	└	λ	Σ	⊕	)	♦	
B	VT	ESC	+	;	K	(*3)	k	(*8)	▌	┘	μ	Λ	∞	+	♣	
C	FF	FS	,	<	L	(*4)	l	(*9)	▌	┌	ν	Ω	∴	-	●	
D	CR	GS	-	=	M	(*5)	m	(*10)	▌	┐	§	¢	½	.	○	
E	SO	RS	.	>	N	(*6)	n	(*11)	▌	└	0	√	¼	*	/	
F	SI	US	/	?	O	-	o		+	┘	π	¤	°	'	\	

TABLE 9-2 M8510A CHARACTER SET, 7 & 8 BIT CODE

(7 Bit code uses only columns 0 ~ 7)

* Circled numbers: Refer to Table 9-1
See Section 9-1 for explanation.

	A	B	C	D
0	SP	ー	タ	ミ
1	。	ア	チ	ム
2	「	イ	ツ	メ
3	」	ウ	テ	モ
4	、	エ	ト	ヤ
5	・	オ	ナ	ユ
6	ヲ	カ	ニ	ヨ
7	ァ	キ	ヌ	ラ
8	ィ	ク	ネ	リ
9	ゥ	ケ	ノ	ル
A	ェ	コ	ハ	レ
B	ォ	サ	ヒ	ロ
C	ャ	シ	フ	ワ
D	ュ	ス	ヘ	ン
E	ョ	セ	ホ	゛
F	ッ	ソ	マ	゜

TABLE 9-3

KATAKANA (8 BIT)

	2	3	4	5
0	SP	ー	タ	ミ
1	。	ア	チ	ム
2	「	イ	ツ	メ
3	」	ウ	テ	モ
4	、	エ	ト	ヤ
5	・	オ	ナ	ユ
6	ヲ	カ	ニ	ヨ
7	ァ	キ	ヌ	ラ
8	ィ	ク	ネ	リ
9	ゥ	ケ	ノ	ル
A	ェ	コ	ハ	レ
B	ォ	サ	ヒ	ロ
C	ャ	シ	フ	ワ
D	ュ	ス	ヘ	ン
E	ョ	セ	ホ	゛
F	ッ	ソ	マ	゜

TABLE 9-4

KATAKANA (7 BIT)

	2	3	4	5
0	▬	┴	═	╳
1	▬	┬	╞	┄
2	▬	┤	╪	┆
3	▮	├	╡	┴
4	▮	─	◢	┬
5	▮	─	◣	─┤
6	▮	│	◥	├─
7	▮	│	◤	┼
8	▌	⌐	♠	
9	▌	¬	♥	
A	▌	└	♦	
B	▌	┘	♣	
C	▌	⌐	●	
D	▌	⌒	○	
E	▌	⌒	／	
F	+	⌒	＼	

TABLE 9-5

GRAPHIC SYMBOLS (7 BIT)

	2	3	4	5
0	α	ρ	↑	1
1	β	σ	↓	2
2	γ	τ	←	3
3	δ	υ	→	4
4	ε	φ	±	5
5	ζ	χ	≒	6
6	η	ψ	≥	7
7	θ	ω	≤	8
8	ι	Δ	≈	9
9	κ	Γ	.	(
A	λ	Σ	⊕	)
B	μ	Λ	∞	+
C	ν	Ω	∴	−
D	ξ	¢	½	.
E	ο	√	¼	*
F	π	□	°	′

TABLE 9-6

GREEK (7 BIT)

NOTE - Tables 9-2 9-3 use the hexadecimal numbering system (base 16). Each character is represented by a two-digit hexadecimal number. The first digit can be found at the top of the table and the second digit is on the left side. To convert to decimal, multiply the first digit by 16, then add the second digit (the letters A∿F represent the decimal numbers 10∿15).

9-3 Software Selectable Character Sets In 7-Bit Mode - Cont.

Command	Decimal Data	Character Set
ESC $	27 36	United States ASCII (Table 9-2)
ESC #	27 35	Graphic Symbols (Table 9-5)
ESC &	27 38	Greek Letters (Table 9-6)
SO	14	Katakana (Table 9-4) *
SI	15	United States ASCII (Table 9-2)

NOTE - SO and SI codes select and clear Katakana only when DIP switches 1-1, 1-2 and 1-3 are open (Japanese setting - See Section 3-9.) For all other countries, SO and SI are elongated character set and clear commands.

10. OTHERS

10-1 Operating Temperature & Humidity : 5 ~ 40°C, 10%~85%RH

10-2 Storing Temperature & Humidity : -25~+60°C, 10~90%RH

10-3 Power : 115V ±10%, 60HZ
100V ±10%, 60HZ/50HZ
220V ±10%, 50HZ
240V ±10%, 50HZ

10-4 Power Consumption : Operating 180W max.
Idling 16W

11. STRUCTURE

11-1 Weight : 8.5Kg

11-2 Dimension : 398(W); exluding knob x 285(D) x 125(H)mm; excluding lever

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Addendum

Mit Freude habe ich — als stolzer Besitzer eines Itoh 8510A — Ihren sehr positiven Testbe-richt über das Modell 8510B erfolgt. Leider ist dem Autor des Beitrags bei der Beschreibung des »Dot-by-Dot-Spacing« ein kleiner Fehler unterlaufen, der zwar recht leicht wegen einer etwas mißverständlichen Formulierung im — sonst sehr guten — »User's Manual« geschehen kann, aber spätestens beim Beispiel-Ausdruck (Bild 11, Seite 143) hätte auffallen müssen, daß dort nämlich trotz vermeintlich fünf verschieden eingestellten Punktabständen fünfmal der gleiche Text erschienen ist.

Warum? Nun, der »Dot-by-Dot-Spacing«-Code ESC 1 ... ESC 6 ist kein Umschalt-Code wie zum Beispiel ESC X für Unterstreichen oder ESC! für Fettdruck, sondern steht stellvertretend für den entsprechenden Zwischenraum, muß also jeweils zwischen den Druckzeilen ausgegeben werden, zwischen denen der gewünschte Punktabstand gegeben sein soll.

Hier nun deshalb ein dahingehend modifiziertes Basic-Listing:

```
1000 LPRINT CHR$(27)"P"
1010 DEMO$ = "Once upon a time there was a lineprinter ..."
1020 FOR DOT = 1 to 6
1030   DOT = CHR$(27) + RIGHT$(STR$(DOT),1)
1040 FOR CHA = 1 TO LEN (DEMO$)
1050 LPRINT DOT$;MID$(DEMO$,CHA,1);
1060 NEXT CHA
1070 LPRINT
1080 NEXT DOT
1090 END
```

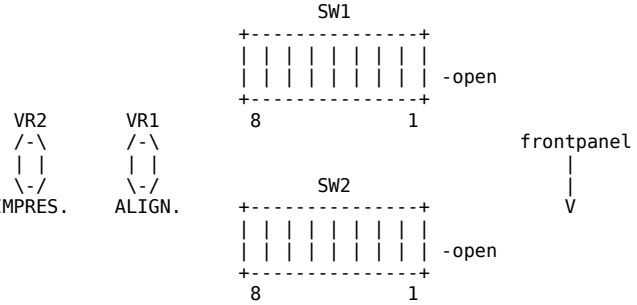
```
Once upon a time there was a lineprinter...
Once upon a time there was a lineprinter...
Once upon a time there was a lineprinter
Once upon a time there was a lineprin
Once upon a time there was a linepr
Once upon a time there was a line
```

Verschiedene Punkt-Abstände richtig dargestellt

```
Umschaltung auf ASCII:
LPRINT CHR$(27);"'"

Zurückschalten auf nationalen Zeichensatz:
LPRINT CHR$(27);"$"

Drucker in Einschaltzustand zurücksetzen:
LPRINT CHR$(27);CHR$(92);CHR$(0);CHR$(0)

Alle gesendeten Daten (Bytes) in hexadezimaler Form ausgeben:
LF-Taste beim Einschalten des Druckers gedrückt halten.
Diese Funktion kann nur durch Ausschalten des Druckers
wieder aufgehoben werden.

Komprimiertes Listing:
LPRINTCHR$(27);CHR$(81);:REM 17 CPI
LPRINTCHR$(27);CHR$(84);"17";:REM Line Feed 17/144 Inch
```

C-Itoh, Model 8510 Printer, Centronics interface (parallel)

Switches and vars inside the case:




```
SW1:   Pin
         1 \   National character set. 000=Japan, 010=USA,
         2  }    110=UK, 001=Germany, 101=Swedish
         3 /
         4 0=66 lines/page, 1=72 lines/page
         5 0=DC1, DC3 effective; 1=ignored
         6 1=line feed for too-long line
         7 1=CR emulated when LF, VT, FF recieved
         8 0=CR does only cr; 1=CR forces LF too

 SW2:   Pin
         1 1=zero has a line through it
         2 0=multiple-line buffer
         3 unused
         4 unused
         5 0=10 cpi, 1=proportional -- font at power-up
         6 0=8-bit data, 1=7-bit data
         7 1=selected at power-on
         8 0=bidirectional printing

VR1/ALIGN. : adjust to make bidirectional printing line up
             horizontally. Print a pattern with the | character,
             and adjust so they fall exactly in line.

VR2/IMPRES.: adjust if printing is too faint. The book does not
             describe how this is done, as a worn ribbon will
             also give faint printing.

              Selection of Optional Functions * As shipped

    Switch    Status          Result/Function
      2-1       X             Slashed Zero
                O           * Un-Slashed Zero

      2-2       X             Device Address Effective
                O           * Inneffective

      2-3       O           * Device Address 1
      2-4       O             /

      2-3       X             Device Address 2
      2-4       O             /

      2-3       O             Device Address 3
      2-4       X             /

      2-3       X             Device Address 4
      2-4       X             /

      2-5       O           * 10 CPI character
      2-5       X             Proportional character

      2-6       X             7 bit data
      2-6       O           * 8 bit data

      2-7       X             Power-On Selected
      2-7       O           * Power-On Deselected

      2-8       X             Unidirectional Print
      2-8       O           * Bidirectional Print

 Note:  Up to four printers may be connected through the same cable to
        the host.  The device address allows selection of each printer.
        Switches 2-2/3/4 relate to this capability.  The printers are
        selected by escape sequence sent by the host as follows:

                ESC a         Select printer 1
                ESC b         Select printer 2
                ESC c         Select printer 3
                ESC d         Select printer 4
                ESC '         Deselect all printers
```

NO ACD 8111773

Factory Test Printout

pica characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~

elite characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

condensed characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

proportinal characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

enhanced pica characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~

enhanced elite characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

enhanced & proportional characters
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

Computer-Shop Printout

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
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0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ ｡
1234689

 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~_▂▃▄▅▆▇ｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀ
ﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ═╪▲▼♠♥♦♣●○╱╲╳╎╌┤├
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~_▂▃▄▅▆▇ｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀ
ﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ═╪▲▼♠♥♦♣●○╱╲╳╎╌┤├
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~_▂▃▄▅▆▇ｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀ
ﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ═╪

▂▃▄▅▆▇ｲｳｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ｡｢｣､･ｦｧｨｩｪｫｬｭｮｯｰｱｲ
ｳｴｵｶｷｸｹｺｻｼｽｾｿﾀﾁﾂﾃﾄﾅﾆﾇﾈﾉﾊﾋﾌﾍﾎﾏﾐﾑﾒﾓﾔﾕﾖﾗﾘﾙﾚﾛﾜﾝﾞﾟ═╪▲▼♠♥♦♣●○╱╲╳╎╌┤├

▂▃▄▅▆▇

10 LPRINTCHR$(27)"S0255";:FORA=1TO255:OUT253,A:NEXT:LPRINT
```