CITIZEN

Specifications

Model : LT-286

Line Thermal Printer

Rev 1.00 Newly Issued on Jan, 8, 1998

Japan CBM Corporation
Information Systems Div.

<Cautions>

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<Contents>

1. Introduction

This is a small-sized printer which has been developed to be used with output such as P.O.S. terminals, measurement devices, medical devices, communication and portable terminals so on, employing the thermal dot-line printing system with a line thermal head.

<Features>

(1) Compact and light-weight design
(2) High speed printing at 400 dot/line (at Max.)
(3) High quality printing due to a high resolution of 8 dots/mm
(4) Long life thermal head
(5) Can be operated by a 5V D size(UM-1) battery and applied to two Li-Ion batteries
(6) Easy maintenance due to removable platen design
(7) High reliability due to simple design

2. General Specifications

Table 2-1 General Specifications

	Item	Specifications	Note
1	Printing Method	Thermal Line Dot Printing	
2	No. of total dots	384 dots / line	
3	Dot density	8 dots / mm	
4	Print width	48.0 mm	
5	Print Speed	150 dots line / sec	Operating Voltage 5.0 V Head Temp. over 40 °C, within 64 dots
		400 dots line / sec	Operating Voltage 7.2 V Head Temp. over 30 °C, within 64 dots
6	Paper Feed Pitch	0.125 mm	Corresponding to two motor steps
7	Detecting Function Print Head Temperature Detection Paper Detection Head Up Detection	 Thermistor Photo Interrupter Mechanical Switch	
8	Operational Voltage Range	VH DC4.2 - 8.5V	Ni-Cd or Li-Ion Ordinal voltage is to be 7.2V (Max) 8.5V can not be used for ordinal voltage. 8.5V is a voltage which is right after Charging.
		Vdd DC4.75 - 5.25V	
9	Consumption Current Head (VH) Motor (VH)	Max. Approx. 2.3A Max. Approx. 3.3A	VH=5V, 142 Ω, 64 dot, 25°C VH=7.2V, 142 Ω, 64 dot, 25°C
		Max. Approx.0.5 A, Ave. Approx. 0.3A Max. Approx.0.8 A, Ave. Approx. 0.5A	VH=5V VH=7.2V
10	Recommended Roll Paper Paper Width Paper Thickness Manufacturer and type	 58 plus 0, minus 1 mm 60 - 72 μm Shin-Oji Paper Mills : KF50-HAD	 Print side is to be outside of roll. Between the paper and the core must non adhesion. Roll diameter : ϕ83mm or less
11	Paper Feed Force	50 g or more	
12	Paper Holding Force	80 g or more	
13	Head Life Pulse Resistance Wear Resistance	 50,000,000 pulses (Print duty :12.5%) 50 km	 Normal Temp. 25°C, normal humidity Rated energy, recommended paper
14	Environment Operating Environment Storage Environment	 Temp: 0 - 45 °C Humidity : 35 - 85 % RH Temp:-20 - 60 °C Humidity :10 - 90 % RH	 Print guaranteed at 5 – 40 °C No condensation Store with head-up position
15	Vibration-resistance	6G at 10 – 55 Hz x, y and z axes, 1 hour each	
16	Shock-resistance	60G, 11 ms 6 directions, 1 time each	
17	Outer Dimension	75 (W) X 56.5 (D) X 21 (H)	Excluding Paper Feed Knob, Head-up lever and Connectors
18	Weight	Approx. 82 g	

3. Thermal head

3.1. General specifications

Table 3-1 General specifications of Thermal head

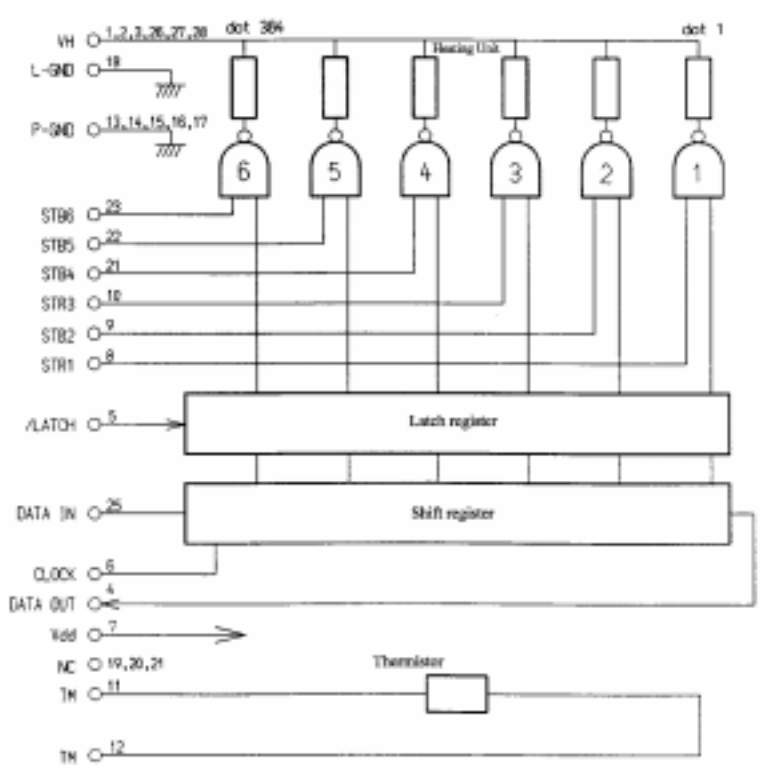
	Item		Specifications	Note
1	Print width		48 mm	
2	Number of Dots		384 dots / line	
3	Dot density		8 dots / mm	
4	Dot pitch		0.125 mm	
5	Resistance		142Ω	
6	Number of strobes		6	
7	Data transfer		1 DATA input method	
8	Configuration of driver		6 drivers	Every 64 dots
9	Driving Voltage	VH	DC 4.2 - 8.5 V	Ordinal voltage is to be 7.2V(Max)
		Vdd	DC 5 V ± 5 %	8.5V is a voltage which is right after charging.

3.2. Thermal head constitution

As shown in the fig. 3-1, the thermal head comprises heating elements and head drivers to control and drive the heating elements.

The serial print data which are input from DATAIN (DI) are transferred in synchronization with the CLOCK (CP) to the shift register, and stored in the latch register by the LATCH (LA) signal. Head activating signals (print commands STB 1 to 6) turn the gates on, and the heating elements corresponding to the stored data are activated.

Fig. 3-1 Equivalent circuit to Thermal head



STB pin are pulled down inside of IC.

3.3. Head division processing

The thermal head has 6 strobes, and print divided into up to 6 times is possible.
The relation between strobes and position of heating elements is shown in the Table 3-2.

Table 3-2 Strobe and heating elements

STR. No.	Heating elements No.	Dots / STR
1	1 - 64	64
2	65 - 128	64
3	129 - 192	64
4	193 - 256	64
5	257 - 320	64
6	321 - 384	64

3.4. Print data and print position

The data of 384 bits (No. 1 to 384) which is transferred by DATA IN (DI) are printed on the positions shown in Fig. 3-2.

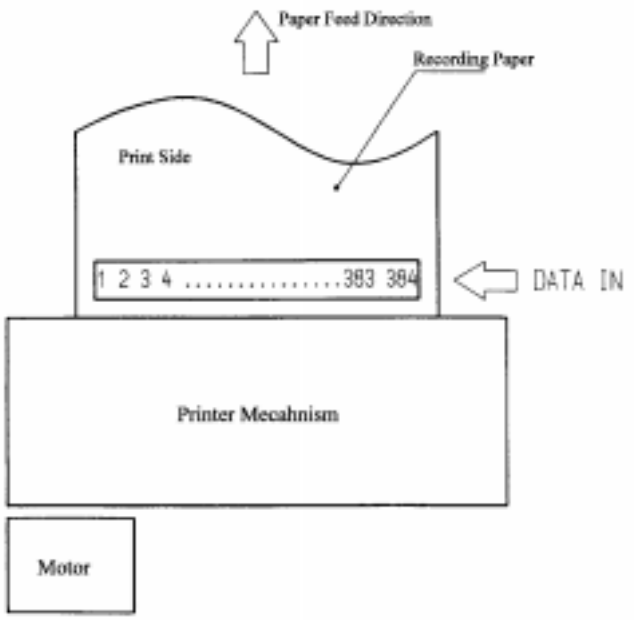


Fig. 3-2 Print data and print position

3.5. Head activating pulse width

3.5.1. Pulse width to driving voltage

To ensure a uniform contrast, control the head activating pulse width according to the head driving voltage.

Calculate the head activating pulse width by the following formula.

$$Ton(25) = Eo \times \frac{(N \times Rcom + Rav + Ric + Rlead)^2}{V^2 \times Rav}$$

Ton(25)	: Head activating pulse width (ms) at 25 °C
Eo (Note 1)	: Standard applied energy 0.31 (mJ)
V	: V should be calculated by the following formula. $V=-0.0225(VH)^2 + 1.7745(VH) - 3.41$ VH : Head driving voltage (V)
Rav	: Head average resistance 142 (Ω)
N	: Number of simultaneously activated dots
Rcom	: Common resistance 0.48 (Ω)
Ric	: Driver-On resistance 15 (Ω)
Reload	: Lead resistance 10 (Ω)

(Note 1) The standard energy in the case of using designated thermal recording paper.
(Paper : KF50-HDE)

Table 3-3 Example of head pulse width calculation

Head Driving Voltage (VH)	Head Pulse Width (ms)
4.2 V	6.4201
5.0 V	3.5545
6.0 V	2.0661
7.2 V	1.2693

(1) Temperature 25 °C
(2) When 64 dots are activated at a time
(3) 142Ω

3.5-2. Activating pulse width correction by temperature

Detect the temperature by the thermistor mounted on the head, and correct width according to the environment of the printer and rise intemperature of the thermal head to control energy to be applied.

When the thermistor temperature exceeds 65°C, stop the operation. Carry out a correction by the following formula.

$$tx = t25 \times \left[1 + \frac{(T25 - Tx) \times C}{100} \right]$$

tx : Head activating pulse width (ms) at temperature on use (Tx)
t25 : Head activating pulse width (ms) at 25 °C of temperature on use
T25 : Room temperature (25 °C)
Tx : Temperature on use (°C)
C : Temperature correction coefficient Less than 25°C ……C=1.1
More than 25°C ……C=0.8

3.5-3 Activating pulse width calculating examples

Table 3-4 Relation between temperature and Head activating pulse, and thermistor temperature characteristics.

Temp. (°C)	Termistor Res.(kΩ)	Head activating pulse width(ms)			
		VH=4.2V	VH=5.0V	VH=6.0V	VH=7.2V
0	100.99	8.1856	4.5320	2.6343	1.6183
5	77.85	7.8325	4.3365	2.5207	1.5485
10	60.57	7.4794	4.1410	2.4070	1.4787
15	47.53	7.1263	3.9456	2.2934	1.4089
20	37.61	6.7732	3.7500	2.1798	1.3391
25	30.00	6.4201	3.5545	2.0661	1.2693
30	24.11	6.1633	3.4123	1.9835	1.2185
35	19.51	5.9065	3.2702	1.9001	1.1677
40	15.89	5.6497	3.1280	1.8182	1.1169
45	13.03	5.3929	2.9858	1.7356	1.0662
50	10.75	5.1361	2.8436	1.6529	1.0154
55	8.92	4.8793	2.7014	1.5703	0.9646
60	7.45	4.6225	2.5593	1.4876	0.9139
65	6.25	4.36566	2.4171	1.4050	0.8631
70	5.27				

3.6 Specifications of Thermistor

1) Electric characteristics

(1) Resistance	30 kΩ ± 5% at 25 °C
(2) B constant	3950 K ± 2%

2) Rating

(1) Temperature(on use) range	-20 to + 80 °C
(2) Thermal time constant	Within 30 second (in the air)

3) Relation between temperature and resistance

$$Rx = R25 \times EXP\left[B \times \frac{1}{Tx + 273} - \frac{1}{298} \right]$$

Rx	: Resistance at temperature on use Tx (°C)
R25	: 30 kΩ ± 5% (at 25 °C)
B	: 3950K ± 2%
Tx	: Centigrade temperature (°C)
EXP(x)	: e to the xth power (natural logarithm)

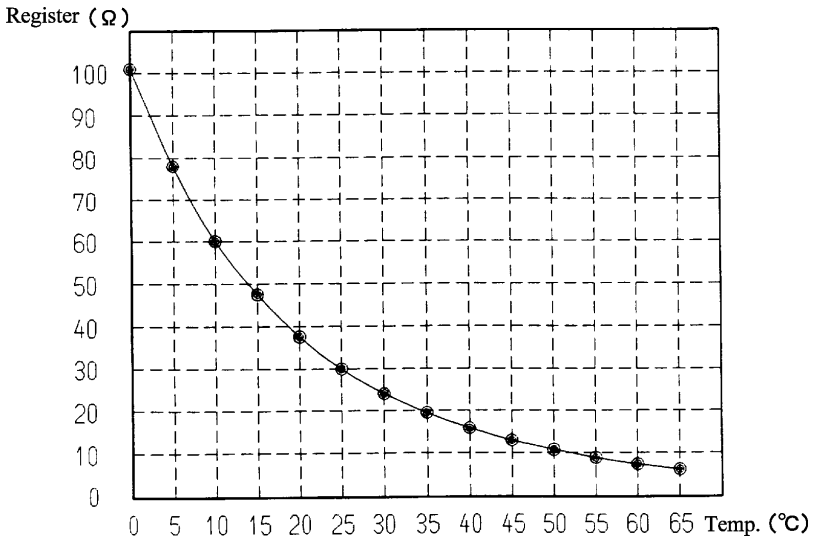


Fig. 3-3 Thermal characteristics of thermistor

3.7 Electrical characteristics of thermal head

Table 3-5 Electrical characteristics of thermal head Ta=25±10°C

Items		Signal	Minimum	Standard	Maximum	Unit	Condition
Print power source voltage		VH	4.2		8.5	V	Max.Vol. 7.5V
Circuit power source voltage		Vdd	4.75	5.00	5.25	V	
Circuit power source current		Idd	-	-	48	mA	FDI=fCLK/2
Input voltage	"H"	VIH	0.8Vdd	-	Vdd	V	STB,DI,LAT,CLK
	"L"	VIL	0.0	-	0.2Vdd	V	STB,DI,LAT,CLK
Data input current	"H"	IIH D1	-	-	0.5	μA	VIH=5V
DI	"L"	IIL D1	-	-	-0.5	μA	VIL=0V
STB input current	"H"	IIH STB	-	-	30.0	μA	
(LOW-ACTIVE)	"L"	IIL STB	-	-	-0.5	μA	
Clock input current	"H"	IIH	-	-	3.0	μA	
CLK	"L"	IIL	-	-	-3.0	μA	
Latch input current	"H"	IIH	-	-	3.0	μA	
LAT	"L"	IIL	-	-	-3.0	μA	
Data out	"H"	VD0H	4.45			V	Open Status, Vdd=4.5V
DO	"H"	VD0l	-	-	0.05	V	
Output voltage		V0L	-	(1.0)	-	V	Reference Driver output
Clock frequency		fclk	-	-	8	MHz	
Clock pulse width		tw clk	70.0	-	-	ns	See Fig.3-4
Data set up time		tsetup DI	50.0	-	-	ns	See Fig.3-4
Data holding time		thold DI	10.0	-	-	ns	See Fig.3-4
Data out delay time		td D0	-	-	120	ns	See Fig.3-4
Latch pulse width		tw LAT	100.0	-	-	ns	See Fig.3-4
Latch set up time		tsetup LAT	200.0	-	-	ns	See Fig.3-4
Latch holding time		tholdLAT	50	-	-	ns	See Fig.3-4
STB set up time		tsetup STB	300	-		ns	See Fig.3-4
Output delay time		tdo	-	-	10	μS	See Fig.3-4

3.8 Timing chart

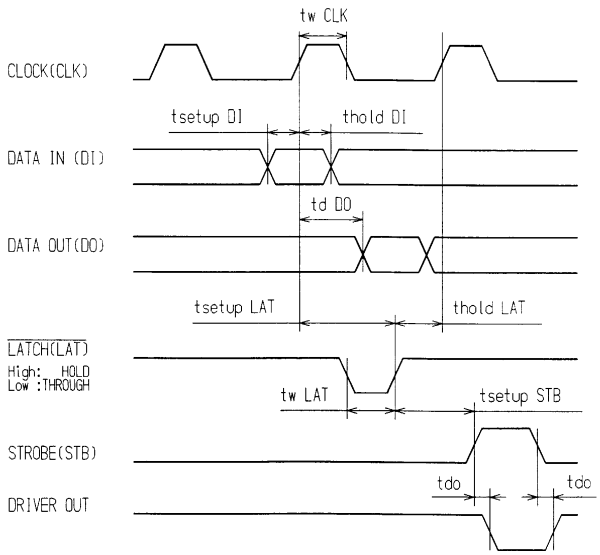


Fig. 3-4 Timing chart

3.9 Peak current

The peak current on driving the head will be shown in the following table depending on the number of the dots activated at a time. Great care should be paid to the voltage drop on the wiring route.

Table 3-6 Peak current of head

VH	No. dots activated at a-	Peak current (Theoretical value)	Note
5V	64	2.25A	Resistance 142Ω
7.2V		3.25A	25°C

3.10 Caution on using thermal head

(1) For continuous printing at a high print ratio, design system so that the power to the thermal head is cut when the thermistor temperature exceeds 65°C .
Continuous operation at a temperature exceeding 65°C may shorten the life of the thermal head.

(2) In case of disorder of the control unit (CPU), the abnormality detection by software may not function, resulting in thermal damage to the thermal head.
Be sure to use abnormality detection by hardware together, to protect the thermal head.
When there is any abnormality, turn off the power to the thermal head immediately.
The thermal head should be turned on after recovering from the abnormality.

(3) Head print energy may not exceed max 0.7mJ/dot.
Life may be shortened if it exceeds this number.

(4) Turn the power ON/OFF in the following sequence not to damage the heating element.

Turning the power ON : In the order of Vdd and VH
Turning the power OFF : In the order of VH and Vdd

(5) Turn the power ON/OFF with the STR system signal kept at "DISABLE" state.

(6) When connecting the thermal head with thermal head connector, make sure not to connect/disconnect head connector and cable forcibly.
(Maximum endurance for connecting/disconnecting is up to 20 times.)
And make sure not to hold the connector itself.

(7) To avoid surge, the length of VH, GND cable for connecting thermal head must be within 100 mm, and equip aluminum condenser(47μF) on the location between VH and GND which locates on the nearest position to thermal head as much as possible.
And equip a layer ceramic condenser(0.1μF) on the location between Vdd and GND.

(8) When the printer is not is use, keep VH power(including the voltage which is charged in a condenser) of thermal head in a OFF state.

4. Paper feed

- Rotating the motor shaft clockwise looking from the gear side (normal rotation) feeds record paper in the normal direction.
- Drive the motor with 2-2 phase excitation. One step of the motor driving signal feeds paper 0.125 mm (corresponding to 1 dot pitch)
- When the motor is started from a standstill state, make a feed operation by blank print in reverse rotation at the designated steps for removing backlash (20 steps) and make a feed operation in normal rotation at same steps to prevent the deterioration of print quality caused by the backlash of the paper feed driving system.
- During printing, it is necessary to change drive frequency depending on the conditions such the voltage, temperature, activated dot number and so on.
- To avoid heat generation of the motor, leave the motor under a non-excited condition the operation other than paper feed (including printing), and avoid continuous operation exceeding 15 minutes.
- Do not carry out the repeat operation of stopping and feeding. It may cause the deterioration of print quality due to the irregularity of paper feed pitch.
- Use a motor driver with low voltage drop (0.3V or so).

4.1 Specifications of stepping motor

Table 4-1 Specifications of stepping motor

Item	Specifications
Type	PM type stepping motor
Phase	4-phase
Drive Type	Bipolar drive
Excitation type	2-2 phase excitation
Winding resistance/phase	13Ω/phase
Rated voltage	DC 5V
Maximum consumption current	Approx. 0.5A (at 5V) Approx. 0.8A (at 7.2V)
Average consumption current	Approx. 0.3A (at 5V) Approx. 0.5A (at 7.2V)
Driving frequency	Variable depending on the driving voltage

4.2 Excitation sequence

Change-over of the excitation phase in the following order feeds paper in the normal detection.

(forward rotation)

Table 4-2 Excitation Sequence

Sequence	Signal name			
	Φ1 (A)	Φ2 ($\overline{A}$)	Φ3 (B)	Φ4 ($\overline{B}$)
Step 1	High	Low	Low	High
Step 2	High	Low	High	Low
Step 3	Low	High	High	Low
Step 4	Low	High	Low	High

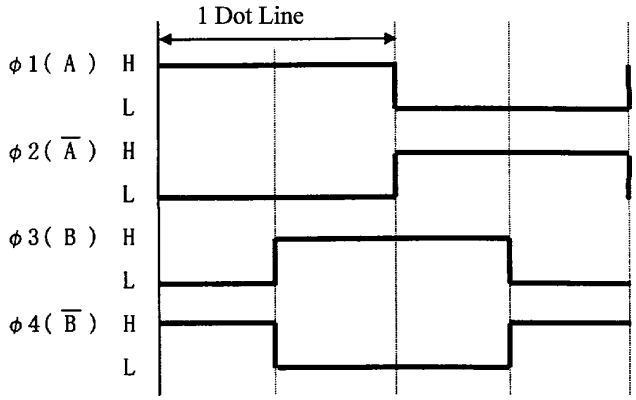


Fig. 4-1 Input power Waveforms

4.3 Example of driving circuit

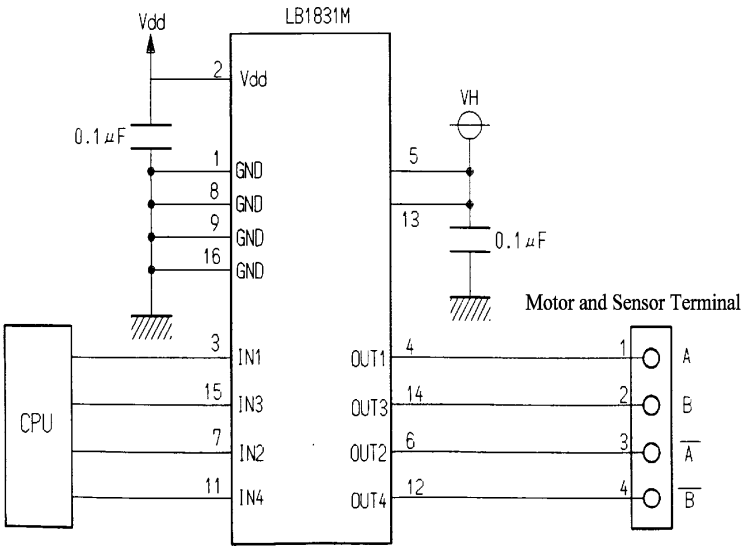


Fig.4-2 Stepping motor driving circuit example

4.4 Motor timing

(1) Stop step

Excite the motor for one step with the same phase as the last phase of the print step, when stopping.

(2) Standstill state

Leave the motor under the non-excited condition while being at a standstill to prevent heat generation. Even under the non-excited condition, record paper will not slip owing to the holding torque of the motor and the platen load by head pressure.

(3) Starting step

1) To restart the motor at a stopping step, shift to the print step immediately.

2) To restart the motor from a standstill step (under the non-excited condition), shift print sequence after excitation for one step with the same phase as that of the stopping step. Then, make a paper feed operation for 4 dot line of blank print to prevent the deterioration of print quality caused by the backlash of the paper feed driving system.

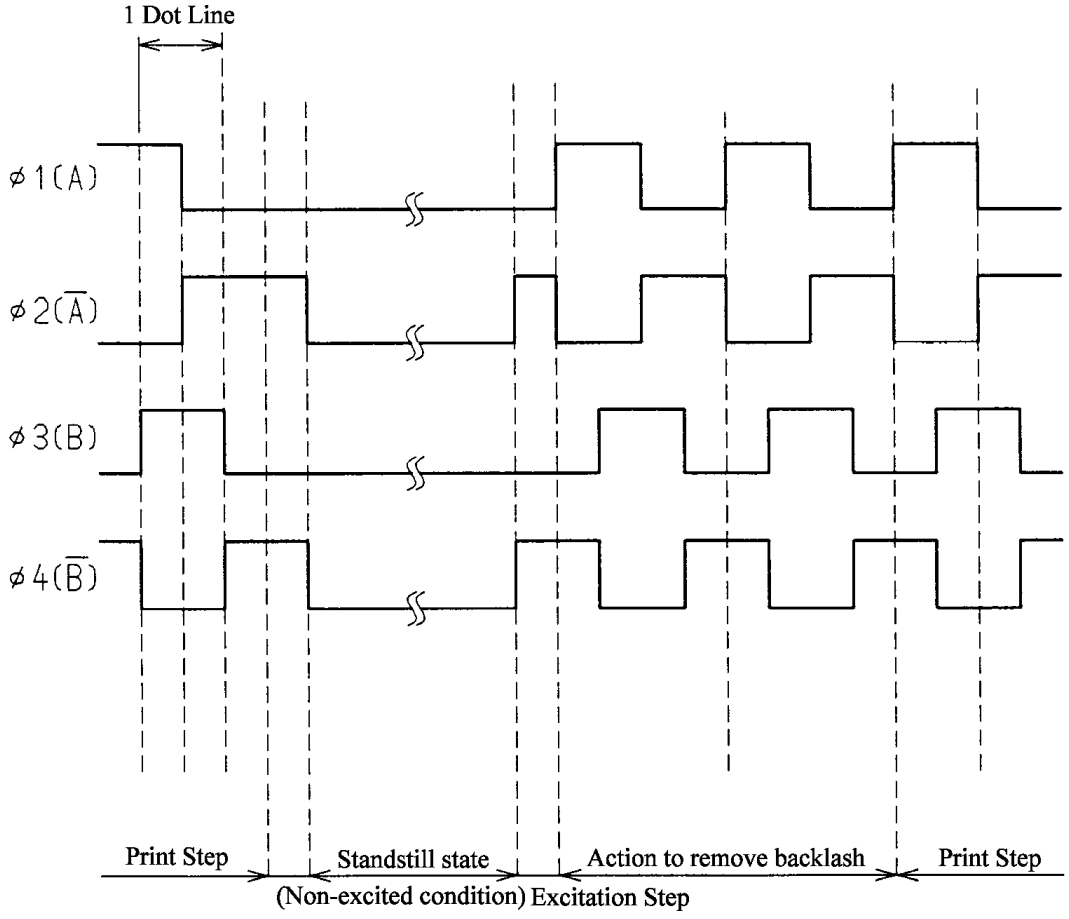


Fig. 4-3 Motor timing

4.5 Caution on operating the motor

(1)Motor driving frequency

Driving Voltage	Number of motor frequency during paper feeding	Number of motor Frequency during Auto loading
Less than 4.2 – 4.5 V	200 pps	50 pps
Less than 4.5 – 5.5 V	300 pps	75 pps
Less than 5.5 – 6.5V	560 pps	140 pps
More than 6.5V	800 pps	200 pps

Table 4-3

(2) Motor current control

At the time of printing, if the motor slows down or is held for a long time due to the environment or what is to be printed, it may cause noise by vibrations or generate heat.
To prevent this, it is necessary to control the motor current value(PWM control).
PWM control is provided when one-step time of the motor becomes longer than T1 mentioned in the following formula.

$$T1\ (ms) = 72 / (VH)^2$$

This T1 is a PWM start time. A motor drive signal is directly controlled after a lapse of T1 following a start of step output.
Make sure to set the frequency of PMW around 10 KHz – 20 KHz.

Driving voltage
Less than 4.2 – 4.5V : D = 0.45
Less than 4.5 – 5.5V : D = 0.4
Less than 5.5 – 6.5V : D = 0.35
More than 6.5 V : D = 0.3

$$\frac{T3}{T2 + T3} = D \qquad \frac{1}{T2 + T3} = 10 – 20\ KHz$$

T : Starting time of PWM
T2 : OFF time of PWM
T3 : ON time of PWM

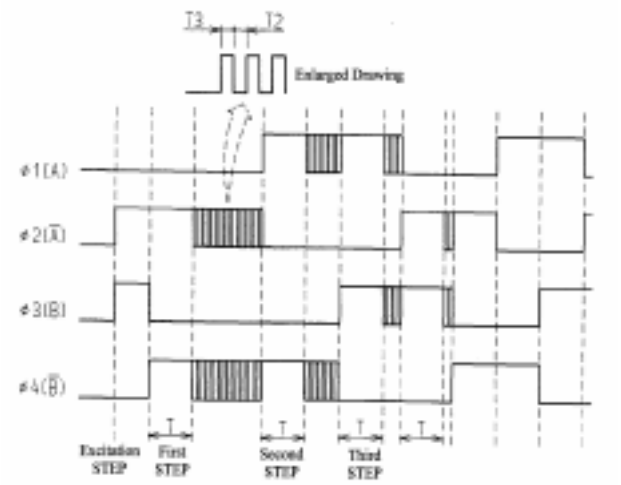


Fig.4-4

(3) Motor acceleration control

In operating motor, when load is too much on start-up, it is necessary to control motor acceleration to keep enough paper feed power. And it is necessary to control motor acceleration in LF between each lines in case that print speed is getting slow due to head driving pulse width goes more than motor driving pulse.

Make sure to drive motor by accelerating step by step up to number of driving frequency shown in Table 4-3 by following table 4-4.

Acceleration should be carried out as follows.

1. Output start step for the time which is shown in Table 4-3.
2. Output first step for the time at acceleration first step.
3. Output second step for the time at acceleration second step.
4. Repeat outputting n th step at acceleration n th step.
5. Motor drives at regular speed when it is accelerated up to the time shown in Table 4-3.

Printer can print during acceleration.

Acceleration step

Number of step	Speed (pps)	Step time (μs)
1	253	3952
2	358	2793
3	438	2283
4	506	1976
5	566	1768
6	620	1613
7	669	1495
8	716	1395
9	759	1317
10	800	1250

Table 4-4

5. Head-up sensor

This unit is provided with a head-up sensor to detect up/down condition of the head.
Activation of the head under the head-up condition can break or affect adversely the life of the head.
Design the outside circuit so that the thermal head can not be activated under the head-up condition.

5.1 General standards

Type : Mechanical leaf switch
Head-up : OPEN
Head-down : CLOSE

Rating : DC 5V, 0.1A
Touch resistance : 70 mΩ (Max) or less

5.2 Example of recommended circuits

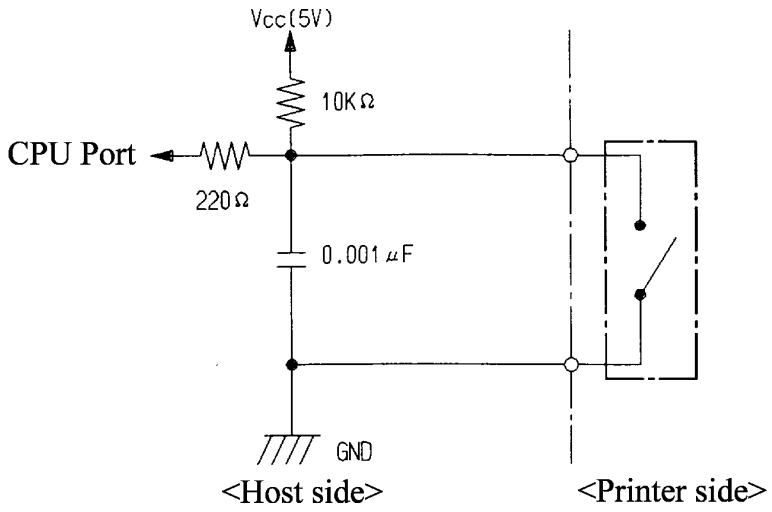


Fig. 5-1 Example of recommended circuits for head-up sensor

Use a condenser to prevent abnormal operation caused by chattering of the switch.

6. Paper sensor

The paper sensor is provided to detect the presence of paper.
Activating the head under the "absence of paper" condition can break the head or affect adversely the life of the thermal head.
Design the outside circuit so that the thermal head can not be activated under the "absence of paper" condition.

6.1 General standard

Table 6-1 Maximum rating of paper sensor (25°C)

Item		Signal	Rating	Unit
Input	Forward current	IF	50	mA
	Pulse forward current	VR	5	V
	Reverse current	PD	75	mW
Output	Collector-emitter voltage	VCEO	30	V
	Emitter-collector voltage	VECO	3	V
	Collector power dissipation	PC	50	mW
	Collector current	IC	20	mA
Operational temperature range		Topr	-25 - 85	°C
Storage temperature range		Tstg	- 30 - 100	°C
Soldering Temperature		Tsol	240	°C

Table 6-2 Electrical characteristics of paper sensor (25°C)

Item		Signal	Condition	Min.	Standard	Max.	Unit
Input	Forward Voltage	VF	IF=10 mA			1.3	V
	Reverse current	IR	VR=5 V			10	μA
	Peak wavelength	λP	IF=20 mA		940		nm
Output	Dark current	ICEO	VCE=10V, IF=0			0.2	μA
Collector current		IL	VCR=5V,IF=4mA	35			μA
Leakage current		ICEOD	VCE=5V, IF=10 mA			0.2	μA
Response time	Rise time	tr	Vdd=2 V IC=0.1 mA RL=1 KΩ		30		μsec
	Fall time	tf			25		μsec

6.2 Example of recommended circuits

Design the circuit using the following recommended circuit to ensure perfect detection of the sensor.

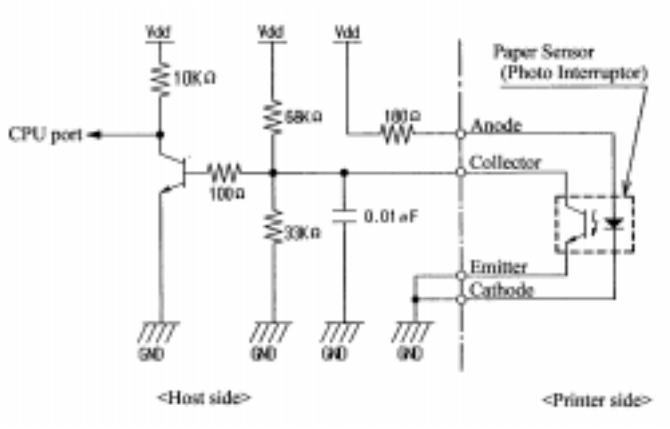


Fig. 6-1 Recommended circuits of paper sensor

7. Connecting terminal

The connecting terminal consists of two connectors, the details are as follows.

Table 7-1 Connecting terminal

No.	Function	No. of pin	Model name	Applicable connector
1	Thermal head	28	Connector for FPC/FFC Cable (pitch = 1.25 mm)	See the drawing of Applicable cable
2	Head up sensor	10	Molex 51021-1000	Molex 53047-1010 53048-1010
	Paper sensor			
	Motor			

Drawing of applicable cable (For reference)

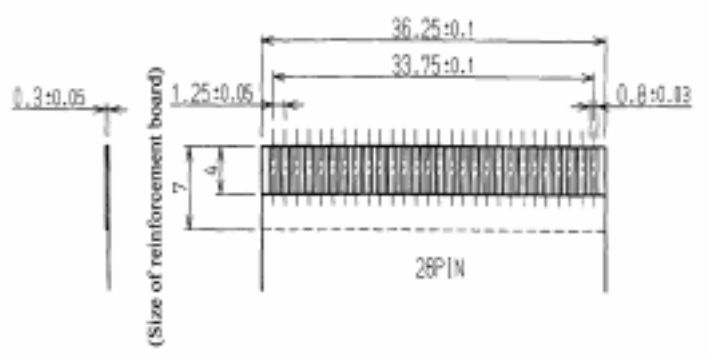


Fig. 7-1

7.1 Thermal head terminal

Fig. 7-2 shows the layout of thermal head connector terminals.

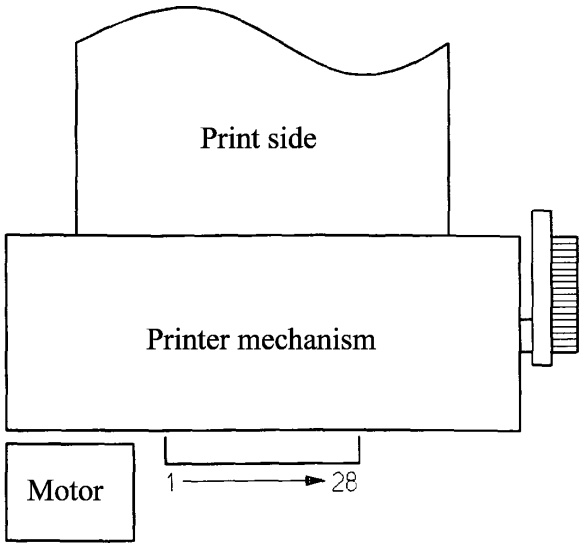


Fig.7-2 Head connector terminal layout

Table 7-1 Thermal head terminal layout

Terminal No.	Signal name	Function
1	VH	Power for thermal head
2	VH	Power for thermal head
3	VH	Power for thermal head
4	DATA OUT	Print data serial output
5	LATCH	Print data latch signal
6	CLOCK	Clock signal for data transfer
7	Vdd	Power for thermal head driver
8	STB1	Strobe 1
9	STB2	Strobe 2
10	STB3	Strobe 3
11	THERMISTOR	Thermistor
12	THREMISTOR	Thermistor
13	P-GND	POWER GND
14	P-GND	POWER GND
15	P-GND	POWER GND
16	P-GND	POWER GND
17	P-GND	POWER GND
18	L-GND	LOGIC GND
19	NC	NO CONNECTION
20	NC	NO CONNECTION
21	STB4	Strobe 4
22	STB5	Strobe 5
23	STB6	Strobe 6
24	NC	NO CONNECTION
25	DATA IN	Print data serial input
26	VH	Power for thermal head
27	VH	Power for thermal head
28	VH	Power for thermal head

7.2. Motor and sensor terminal

Table 7-3 shows the layout of sensor terminals.

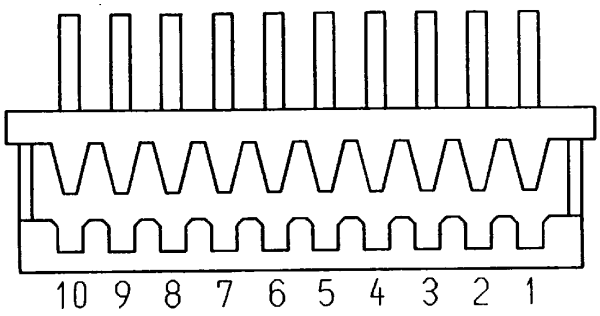


Fig. 7-3 Sensor terminal layout

Table 7-2 Motor connector pin layout

Pin No.	Terminal name	Note
1	A	Motor
2	B	
3	$\overline{A}$	
4	$\overline{B}$	
5	Photo-transistor collector	Paper sensor
6	Photo-transistor emitter	
7	LED anode	
8	LED cathode	
9	Head-up sensor output	Head-up sensor
10	Head-up output sensor	

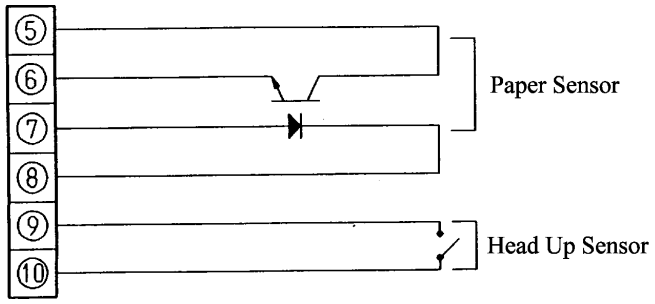


Fig. 7-4 Sensor terminal circuit diagram

8. Control system

8.1. Example of print operational method

The timing chart of Fig. 8-1 shows the timing chart on the basis that the number of division is fixed to division divided in six.

The timing chart of Fig. 8-1 is explained here by turns.

(1) Standstill condition

The system is under waiting condition, and the motor is under non-excited condition.

(2) Motor start

The phase just before the motor stop is output to the motor.

Make sure to carry out the operation to clear the backlash. The print data for 1 dot-line are sent to the head and it is latched to head resister.

(3) Activation of the first dot-line

Motor is operated for one step to print first dot line.

Activating to the thermal head is carried out by STB signal(1 - 6) with 64 dots which are considered as one unit.

When activating pulse width exceeds motor activating pulse width, Make sure to hold all of motor activating pulse until head activating pulse finishes.

(4) Activation of motor for the first dot line

After printing first dot-line, first step, change the phase of motor for one step.

(5) Activation of second dot line

Motor is operated for one step to print second dot line.

Activating to the thermal head is carried out by STB signal(1 - 6) with 64 dots which are considered as one unit.

When activating pulse width exceeds motor activating pulse width, Make sure to hold all of motor activating pulse until head activating pulse finishes.

(6) Activation of motor for the first dot line

After printing second dot-line, first step, change the phase of motor for one step.

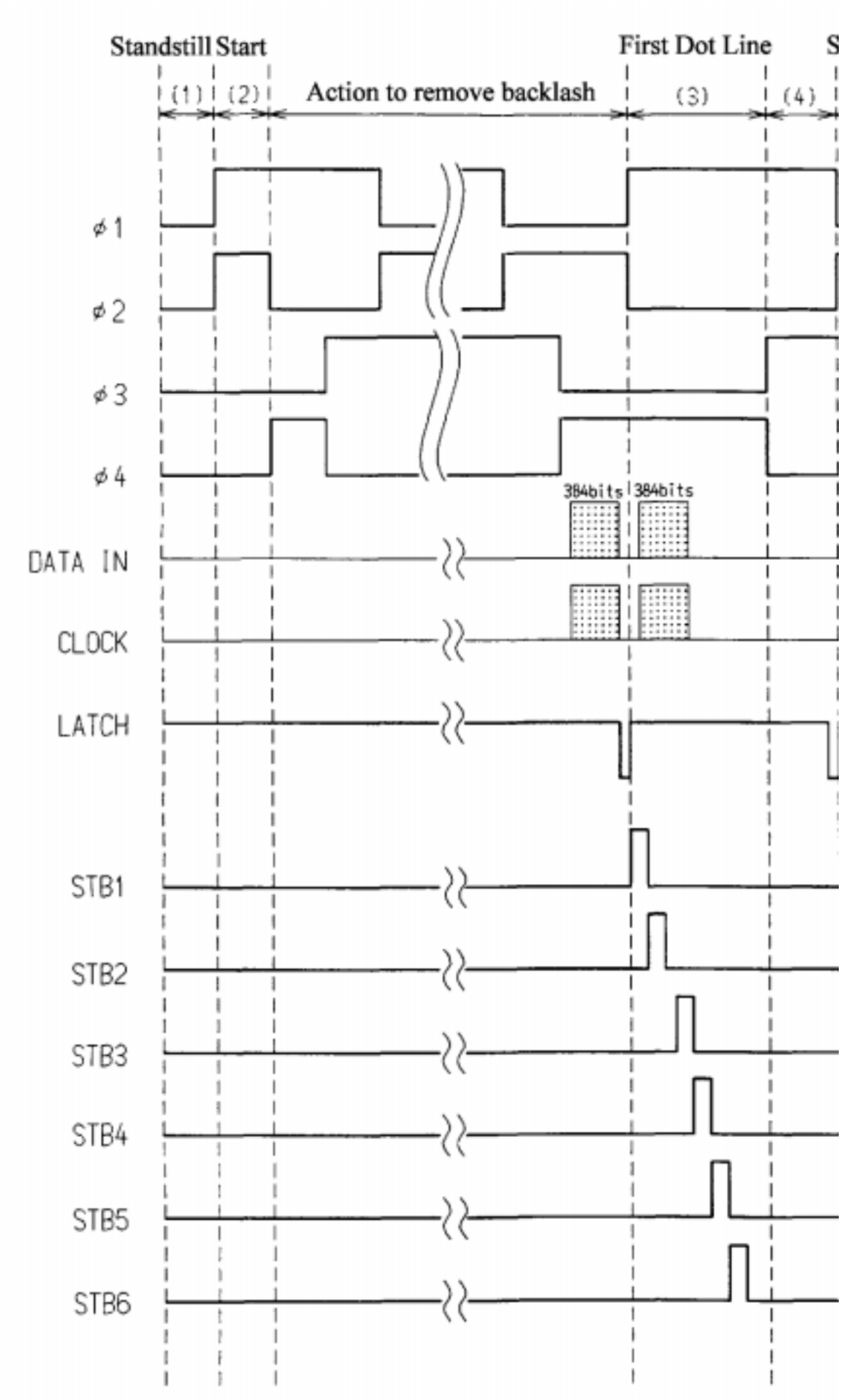

Standstill Start
First Dot Line
(1)
(2)
Action to remove backlash
(3)
(4)
ϕ1
ϕ2
ϕ3
ϕ4
384bits
384bits
DATA IN
CLOCK
LATCH
STB1
STB2
STB3
STB4
STB5
STB6

Fig 8-1

8.2. Auto paper loading

In feeding paper from rear of printer mechanism, auto paper feed is available by applying paper sensor and head up sensor.
For auto loading flow-chart, see Fig.8-3.

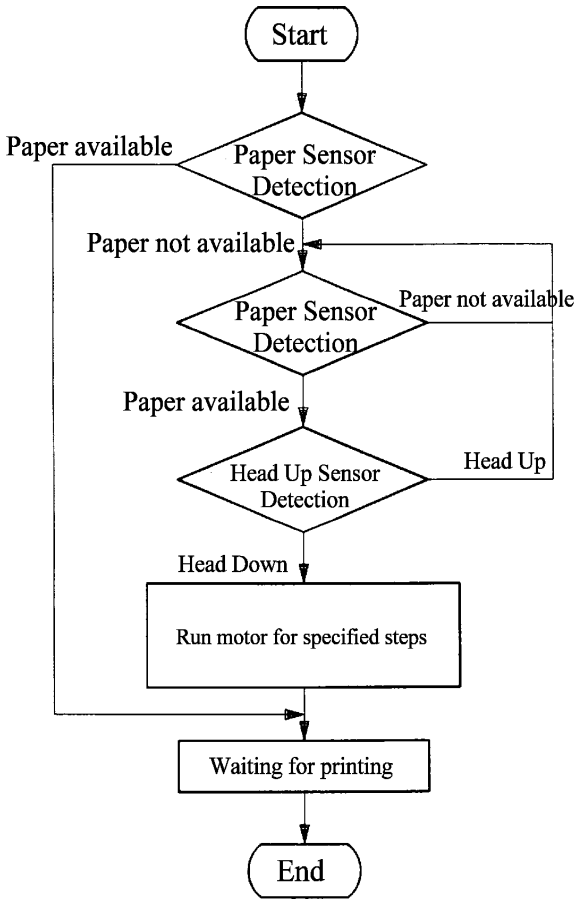


Fig.8-3 Auto paper loading flow-chart

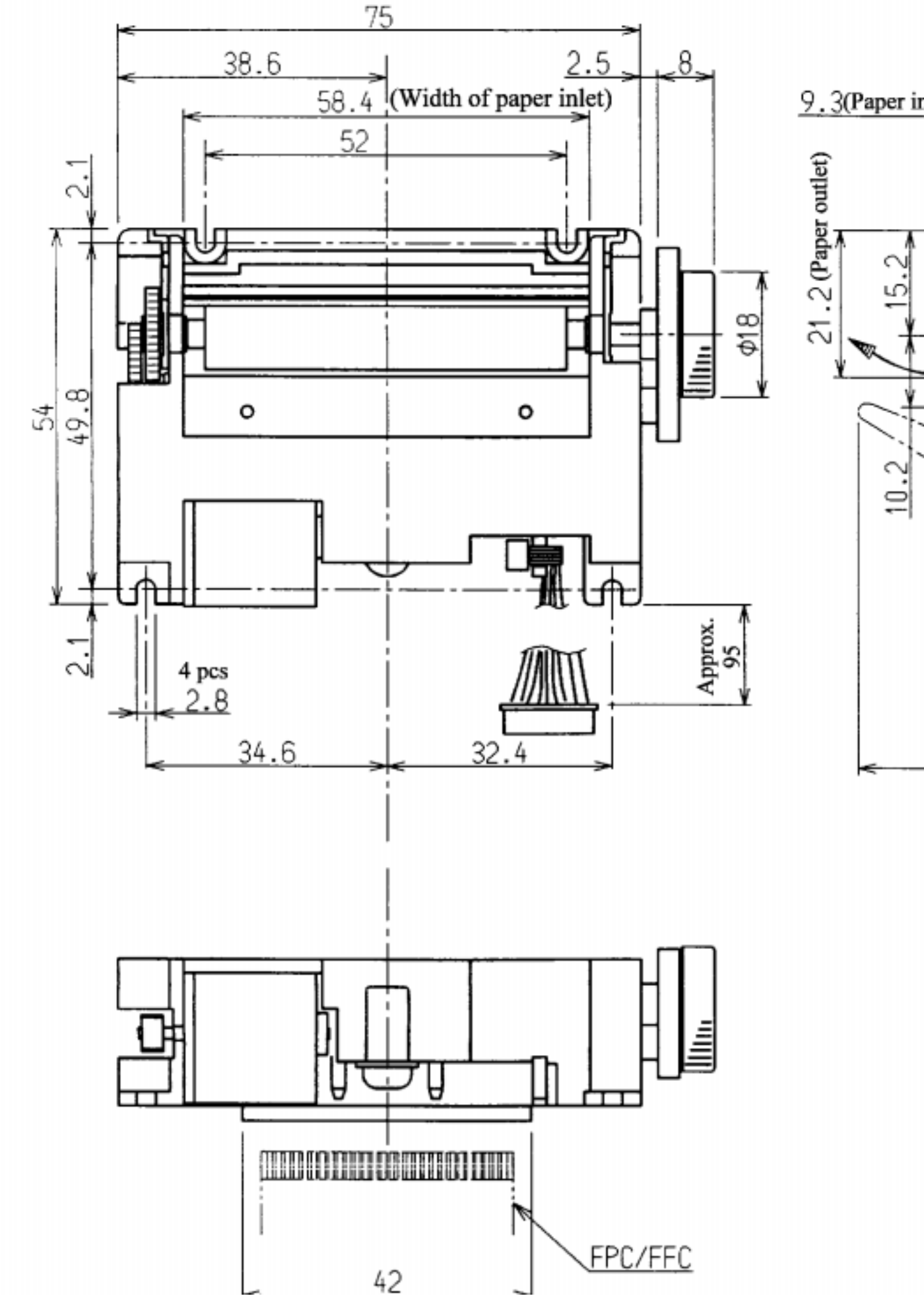
Notes:

1) Operate the motor at no more than the quarter of operational frequency (see Table 4-2) in paper feeding.
2) Decide the number of motor driving steps considering the uneven cling of paper to the platen roller and the distance to the paper outlet.

3) Distance from paper sensor to printing position is approximately 13mm.

<Cautions>
1) Cut the fore-end of paper straight at right angle to the direction of paper feed.
2) Do not insert the paper the fore-end of which is fluffy or bent.
3) In case of the skew, keep feeding until the recovery of normal feed, or reset the paper head up.
4) If paper does not come out from the paper outlet, keep feeding until the paper comes out, or paper, and re-cut its fore-end to insert it again.
5) Printer head may stick to platen roller and paper can not be loaded, if printer is left for long period at head-down position.
In this case, reload paper after making printer head at head-up position.

9. Outer drawing

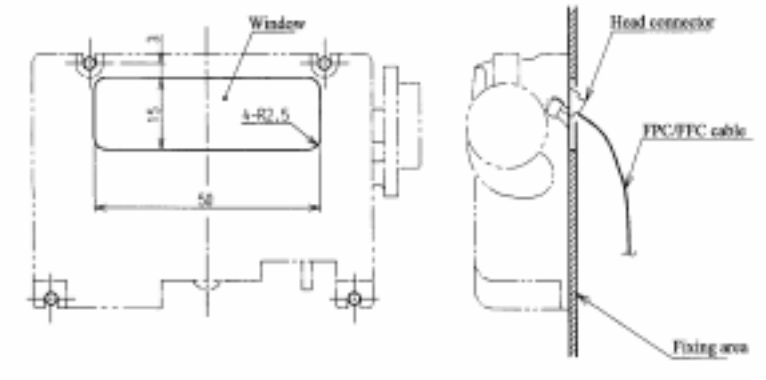

75
38.6
2.5
8
58.4
(Width of paper inlet)
52
2.1
54
49.8
2.1
4 pcs
2.8
34.6
32.4
Approx.
95
Φ18
9.3(Paper in
21.2 (Paper outlet)
15.2
10.2
FPC/FFC
42

10. Notes on design of exterior case

10.1 Fixing printer

1) When the case is fitted over the printer by four screws, design the position which the printer mechanism is installed on be horizontal not to be bent more than 0.1mm.
   Or design the tolerance of fixing portion of four screws (within Φ8 mm) not to be more than 0.1 mm and design the height of other portions except for the fixing portion of four screws to be lower than the fixing portion of four screws.
   In case that the flat degree is out of the above specifications,
   printer mechanism. (For fixing position, see 9. External drawing)
2) In the area which the printer mechanism is installed on, design to have a window for FPC or FFC cable.

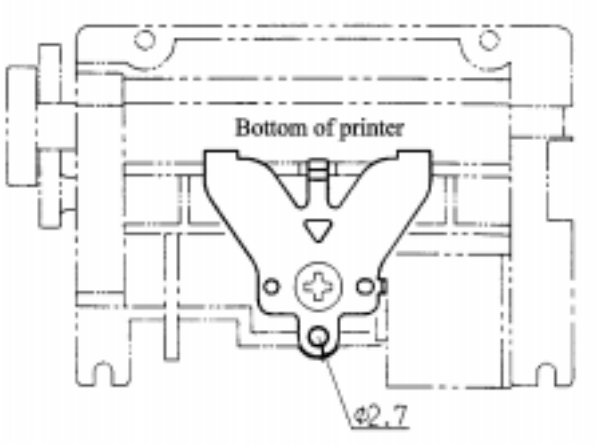
3) Anti-vibration rubber can be effectively used for fitting printer to eliminate noise.



10.2 Connecting to frame ground

To prevent the damage of thermal head caused by electrostatic, connect the printer mechanism to the

frame ground by earth plate or cable with a rug terminal using a tap hole for the earth of head spring.

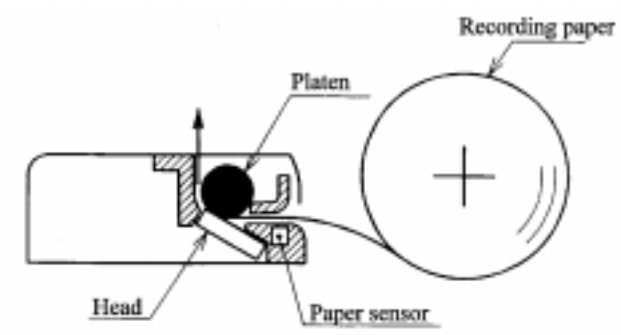


Tapping Hole for earth.
Used screw : Tapping screw M3×6

10.3 Printer and paper layout

Paper inlet is only one which is located on the rear side of printer mechanism. The paper designed to be almost straight.

One paper sensor is equipped on the paper inlet.



10.4 Recording paper holder

(1) Support the core of paper (roll paper) so that its center line may be parallel to the platen.

(2) Support the center hole of rolled paper. A drop-in paper type may cause unevenness in pitch.

(3) The paper supply load to the printer should be 50g or less.

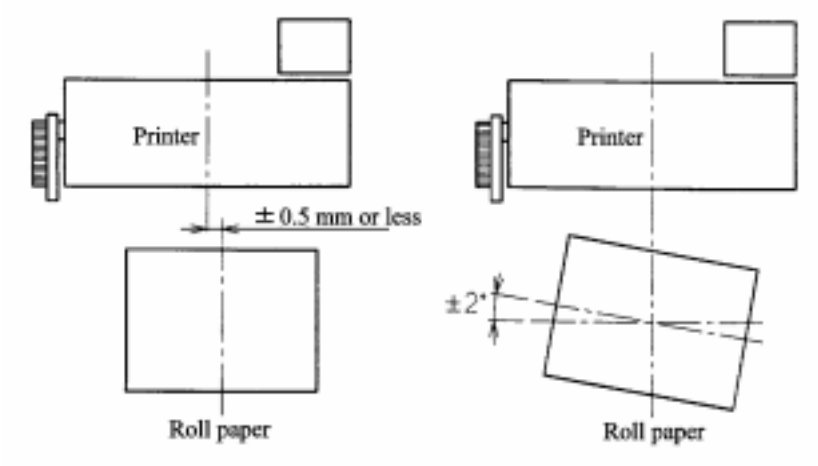
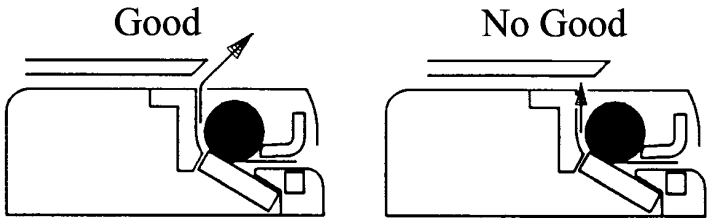


Fig 9-3 Location of paper holder

10.5 Others

(1) When an auto paper cutter is used, design it not to interfere with the fore-end of the discharged paper.



(2) The fore-end of printed paper can be caught into the paper inserting inlet, which should be given much attention when the case is designed.

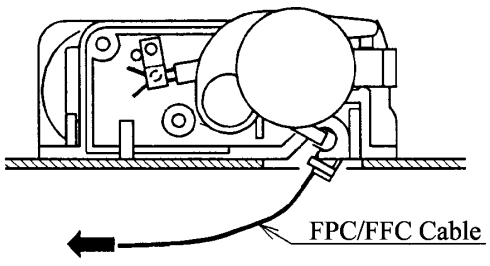
11. Caution on designing and handling

11.1 Caution on designing

(1) Design according to "3.11 Caution on using thermal head".
(2) Connect the thermal head to the frame ground using the tap for earthing of the head to protect head from damage caused by electrostatics as shown in 10.2.
(3) Wiring resistance between the power source and head connector or motor connector should as short as possible.
(4) Do not activate under the no-paper or head-up conditions. Activation under such conditions can cause poor print quality or head breakage. Control this problem using the paper sensor and head-up sensors.
(5) Make sure to design for the set with care for signal terminals shall be avoided caused by printing paper convey.

11.2 Caution on handling

(1) Use of paper other than recommended paper can affect the guarantee to the print quality. Use paper width that is within the allowable range specified in the specifications.
(2) Do not mechanically shock the surface of the substrate (heating element) of the head including that caused by a foreign matter got into the printer.
(3) To avoid breakage of the heating elements or ICs, take measures against electrification, and handle the printer after body earthing is made.
(4) Wipe softly with a cotton swab soaked into methanol, IPA, etc. to remove dust stuck on the surface of the heating element.
(5) Leave the head at up position during transportation or a long term without being used. If the platen is left under the pressure of the thermal head, the platen may be deformed.
(6) Activation of the thermal head with dew on it can cause damage of the head.
(7) Take care not to leave forcible power to the connector of the thermal head and FPC or FFC cable which is used to connect the thermal head.



(8) In case that printing is carried out (black printing or lattice printing) under the condition of high humidity and high temperature, paper can be damaged or dew condensation may be happened in the thermal printer mechanism due to the steam generated from the recording paper.
(9) Make sure to turn OFF power when platen roller is removed.
(10) Absolutely do not carry out feeding paper, printing or connecting / disconnecting print head cable during platen roller is not set or lever of platen bush is removed from the hook of frame.
(11) The LT-286 is not waterproof or drip-proof. Do not splash water or operate it with wet hands.
(12) The LT-286 is not dust-proof. Do not use it in a dusty environment.
(13) When using labeling paper, do not perform back feed. Do not use labeling paper with paste overflowing.
(14) Take care so that no external light will fall on the paper sensor when the printer has no recording paper. It will cause malfunctioning.

11.3 Paper insertion and paper removal

(1) How to insert the paper

Insert paper under head-up position. Cut the fore-end of paper straight, and do not insert paper the fore-end of which is fluffy or bent. When the fore-end of paper comes out of the portion under the head, pull the paper at its forward end, and confirm that the paper is set straight before lowering the head.

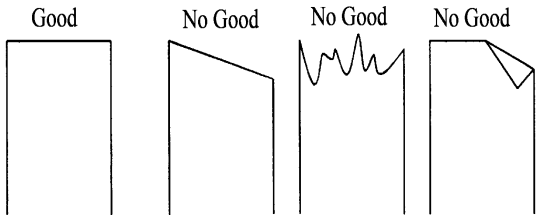


Fig. 10-1 Condition of the fore-end of paper

(2) How to remove the paper

Remove paper under head-up position. Pull paper straight in the direction of paper discharge.

11.4 How to clean the thermal head

(1) Pull up the head-up lever.
(2) Remove the platen push lever on the both side from the hook of the frame, then rotate in 90 degree to the up-side.
(3) Lift up the platen roller unit holding the both platen push lever with care to the up-side, remove the platen roller unit from the frame.
(4) Wipe softly with a cotton swab soaked into methanol, IPA, etc. to remove dust stuck on of the heating element.
(5) After clearing the thermal head, assemble the platen roller unit in the reverse procedure, and lock the platen roller unit completely pulling down the platen push lever in 90 degree.

Caution

(1) Absolutely never carry out the cleaning using a sand paper or cutter knife which may make a damage to the heating element.
(2) Absolutely do not carry out cleaning using a sand paper or paper knife which break the heating unit of print head.
(3) Carry out printing after the alcohol has been vaporized completely.
(4) Make sure to carry out head cleaning after turning OFF power.
(5) Do not bend platen bush lever excessively.
Stop bending platen bush lever immediately after platen lever is removed from the hook of frame. Excessive bending may cause breakage.