CITIZEN

Specifications

LINE THERMAL PRINTER MECHANISM

MODEL LT1221H

Rev. 0.10 First created on May 30, 2001

Japan CBM Corporation

REVISION-UP LIST

Rev.No.	Date	Comment
Rev.0.10	30 May 2001	First Edition

The specifications of this product are subject to change without prior notice.
Make sure that they are the latest version when the product is planned to develop.

Contents

1 IMPORTANT INSTRUCTIONS

1.1 Before planning to develop this product

The shape and specifications of this product described in this manual are subject to change without prior notice because of improvements to the product. Therefore, you may be requested to contact our business personnel of Japan CBM Corporation for more information on this product.

1.2 For safety

(1) Precautions against heating when using thermal head

The thermal head heats up during printing or immediately after printing. The exterior case should be designed so that it does not allow the user to touch the thermal head directly. And take measures to meet the situation; for example, indicate the warnings etc so the user can be careful not to touch it. Also, design the exterior case considering the radiating of heat of thermal head so that the increase of head temperatures is minimized.

(2) Precautions when cleaning the head

When the head is cleaned with the head cleaning mechanism of this printer, indicate the warnings etc that the user should wait to clean the head until the thermal head temperatures falls fully.

(3) Thermal head abnormally heating

The thermal head may run out of order (due to CPU malfunction etc) because of the mechanism of printing by giving heat to the thermal recording paper. Heating the thermal head may cause burning or fire and you may get burnt if you touch the heated thermal head. To avoid this situation be sure to adopt an abnormality detection circuit integral as hardware that breaks the current to the thermal head in abnormal situations.

(4) Precautions against heating when using paper feed motor

A part of the paper feed motor is exposed to the frame of the printer. The paper feed motor heats up during printing or immediately after printing. The exterior case should be designed so that it does not allow the user to touch the paper feed motor directly. And take measures to meet the situation; for example, indicate the warnings etc so the user can be careful not to touch it. The paper feed motor of this printer is not equipped with the temperature detection mechanism of a thermistor etc. Thus design the exterior case considering the radiating of heat of paper feed motor so that the increase of paper feed motor temperatures is minimized.

(5) Paper feed motor abnormally heating

The paper feed motor may run out of order (due to CPU malfunction etc). Heating the paper feed motor may cause burning or fire and you may get burnt if you touch the heated paper feed motor. To avoid this situation be sure to adopt an abnormality detection circuit integral as hardware that breaks the current to the paper feed motor in abnormal situations.

(6) Precautions when designing the exterior case around the paper feed gear

The paper feed gear is exposed so the exterior case should be designed so that it does not allow the user to touch the feed gear resulting in injuries etc.

(7) The printer should be so designed that the power to the printing mechanism, including the paper cutter if any, is shut off whenever the user attempts access to its internal mechanism for maintenance or paper replacement.

(8) The printer equipped with the paper cutter should be so designed that the power to the paper cutter is shut down whenever the platen is opened, in order to prevent possible cutter malfunction in case of CPU runaway or other rare events.

(9) The paper cutter's stationary blade is exposed on the platen holder ass'y. To prevent direct physical contact, be sure to hide the blade behind a safety cover. Also apply a warning label on the safety cover to alert the operator to potential danger.

1.3 Designing precautions

(1) For designing thermal head, see Section 4.11 Precautions on Using Thermal Head..

(2) For designing exterior case, see Section 13 NOTES ON DESIGNING EXTERIOR CASE AND PLATEN OPENING MECHANISM.

(3) To prevent damage to the thermal head caused by static electricity, use the tap for the earth to the thermal head and connect the earth with the frame ground.

(4) Minimize the wiring resistance as much as possible between power source and FFC terminal and motor connector.

(5) Do not apply the current when the recording paper is out or when the head is up. Doing so may affect the print quality or break the thermal head. Control the printer with the paper and head-up sensors.

(6) Do not allow static electricity to enter the signal terminals that is brought by transferring the recording paper.

(7) Connect between the frame ground and the signal ground through the resistance of approx. 1M.

(8) Design the exterior case so that it can shut out foreign matter such as dust and paper chips.

1.4 Handling precautions

(1) If paper other than the recommended recording paper is used, the print quality, the printer's life etc may not be guaranteed. Also, the paper within allowable range of paper width should be used.

(2) Do not impose shock on the head PCB surface (heating element surface) (including no foreign matter entering).

(3) To prevent damage to the heating element, IC etc caused by static electricity, take care not to be charged with electricity and be sure to earth the human body.

(4) Do not place the printer on a surface covered with dirt and dust. Doing so will affect the printer's life.

(5) Use a cotton swab dipped in ethanol etc and dab it lightly to remove built-up substances stuck to the heating element surface.

(6) Do not touch the head surface directly with the hand, tweezers etc.

(7) Have the head up during transporting or storing for long periods. Leaving the thermal head making contact with the platen may cause deformation of the platen and variation of print density.

(8) Applying the current to the thermal head while the printer is condensing may cause a breakdown. If the printer is condensing, fully dry it to perform printing.

1.5 Before purchase

The model name of this printer is shown by the purpose of use. The code of the model name is set in the following. Be sure to confirm the model name before purchase.

LT12	*	*	*	*	*
(1)	(2)	(3)	(4)	(5)	(6)

(1) Means LT1200 series.

(2) Means drive voltage.
1: –
2: 24V

(3) Means printer mechanism type
0: Standard type
1: Clamshell type

(4) Means paper path.
H: Curl path
V: Straight path

(5) Means paper pressure.
BLANK: Standard paper pressure (60-105µm)
A: Thick paper pressure (110-150µm)

(6) Means paper cutter
C: Install paper cutter
BLANK: Not install paper cutter

2 INSTRUCTIONS

This printer is small sized and lightweight, employing the thermal dot line printing system with a line thermal head, that has been developed as terminals such as POS terminals, measuring instruments, medical equipment, and data communications equipment.

[Features]

(1) Small-sized and lightweight.

(2) Easy to load the thermal recording paper.

(3) High-speed printing (maximum speed : 640-dot line per second).

(4) Clear printing with high resolution of 8dot/mm

(5) Paper width of 58mm.

(6) With simple mechanism, longer print head's life and high reliability are ensured.

(7) Thanks to head cleaning mechanism, the maintenance of the head is simple.

(8) Compatible for many kinds of paper such as normal paper, high sensitivity preservation paper , two-color paper and 2 copies paper.

3 GENERAL SPECIFICATIONS

Table 3-1 General Specifications

Item		Specification	Note
1. Printing method		Thermal dot line printing	
2. Total dots		432dots/line	
3. Dot density		8dots/mm	
4. Print width		54mm	
5. Printing speed		MAX. 640dots-line/s	Less than 288 dots per dot line at simultaneously energizing and printing energy of 0.36mJ or less
6. Paper feed pitch		0.125mm	Per one motor step.
7. Sensor	Head temperature Paper presence Head up	Thermistor Photo-sensor Photo-sensor	
8. Voltage range	Vp system Vdd system	DC24V±10% DC5V±5%	
9. Current Consumption	Head (Vp)	Max.: approx. 5.2A (288dots printing at one time) Average: approx. 0.53A (12.5% print)	At max. voltage, min. resistance and 25°C. At 24V, average resistance, and 25°C.
	Motor (Vp)	Max.: approx. 0.41A Average: approx. 0.15A	At max. voltage(26V). At 640pps, 24V
10 Recommended thermal recording paper Width Thickness Paper maker and brand		 58 $^{+0}_{-1}$ mm 60~150µ Nippon paper industries: TF50-KS-E2C Nippon paper industries: TC98KS-T1 Mitsubishi paper mills: HP220AB-1 Mitsubishi paper mills: P220AC Nippon paper mills: TC11KH-ET	Note that the model varies according to the thickness of paper to use
11. Paper thickness	Normal Paper	60~105µm	LT1220H (V)
	Thick Paper	110~150µm	LT1220H (V)A
12. Paper feed force		100gf or more	
13. Paper holding force		100gf or more	
14. Print head's life	Pulse-resistance Wear-resistance	50 million or more(12.5% print) 50km or more	Under room temperature of 25°C, and allowable humidity Rated energy and recommended paper (TF50-KS-E2C)
15. Environment	Operation	Temperature: 0~45°C Humidity: 35~85%RH	Printing guaranteed at 5 to 40°C No condensation
	Storage	Temperature: -20~60°C Humidity : 10~90%RH	To be stored in head-up condition
16. Vibration-resistance		1G, at 5 to 100 Hz x, y and z axes, one hour each	
17. Shock-resistance		60G 11ms 6 directions, one time each	
18. External dimensions		91.5(W) ×58(D)×20(H) mm	LT1221H(w/o paper cutter)
19. Weight : w/o paper cutter : with paper cutter		85g 273g	

4 THERMAL HEAD

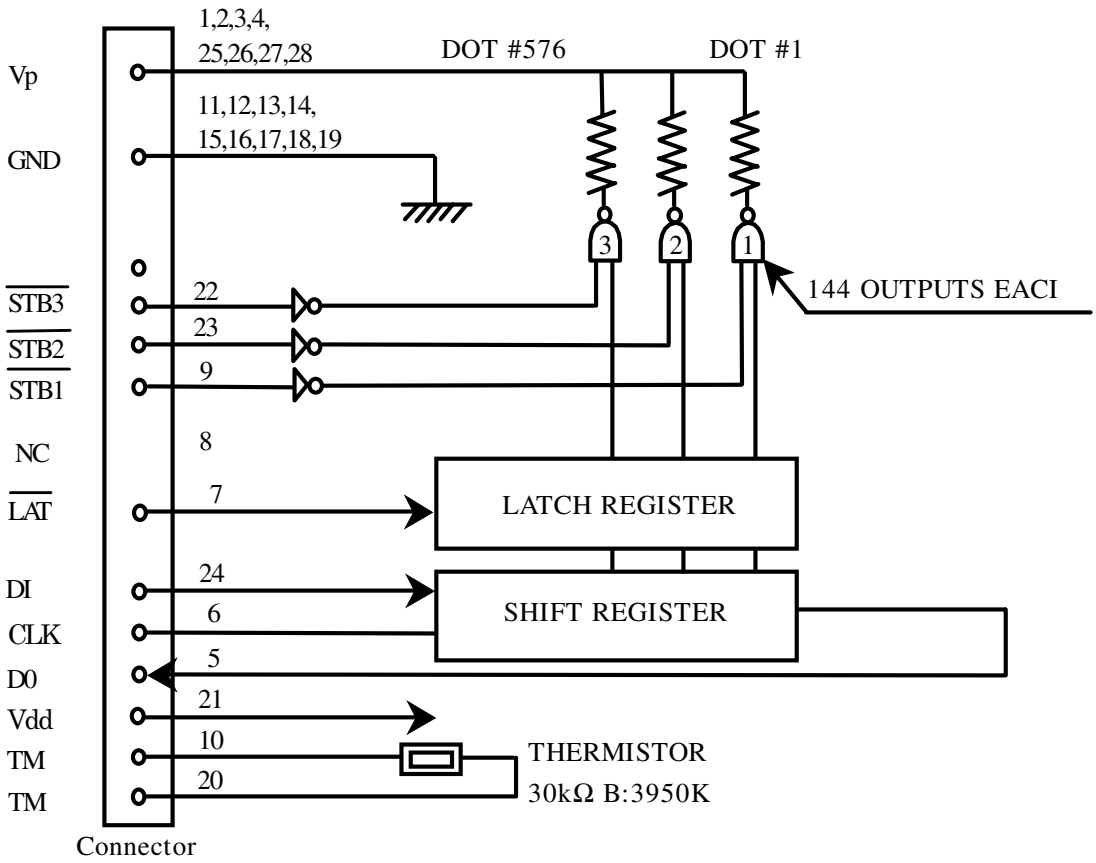
4.1 General Specifications

Table 4-1 General Specifications of Thermal Head

Item			Specification	Note
1.	Print width		54mm	
2.	Total dots		432dots/mm	
3.	Dot density		8dots/mm	
4.	Paper feed pitch		0.125mm	
5.	Resistance		1500Ω ± 3%	
6.	Strobes		3	
7.	Data transfer		1 DATA input type	
8.	Driver		3	
9.	Max. number of dots at simultaneously energizing		288 dots	
10.	Voltage	Vp	DC24V± 10%	
		Vdd	DC5V± 5%	Print quality will be affected when Vdd is 4.5V or less because the standard performance cannot be demonstrated.
11.	Pulse width		1.06ms	Temperature 25°C When 144 dots are activated at one time. Energy 0.36mJ/dot.
12.	Pulse frequency		1.56ms	
13.	Energy	Single energy	0.36mJ/dot	3.12ms
		Continuous energy	0.31mJ/dot	1.56ms

4.2 Thermal Head Construction

The thermal head consists of the heating elements and the head driver to control and drive the heating elements. The serial print data input from DATAIN (DI) synchronize with the CLOCK(CLK) and transferred to the shift register, and stored in the latch register by the LATCH (LAT) signal.
Head energizing signal (print command STR 1 to 3) turns the gate on, and the heating element corresponding to the stored data is energized.



Each $\overline{STB}$ line is pulled - up with in the driver IC.

Figure 4-1 Equivalent Circuit Thermal Head

4.3 Head Division Processing

The thermal head has four strobes.

The relationship between strobe and energizing heating element is shown on Table 4-2.

Table4-2 Strobe and Heating Element

STR. No.	Heating element No.	Dots/STR
1	1 ~ 144	144
2	145 ~ 288	144
3	289 ~ 432	144

4.4 Print Data and Print Position

The data of 432 bits (Nos.1 to 432) transferred by DATAIN (DI) are printed on the position shown in figure 4-2.

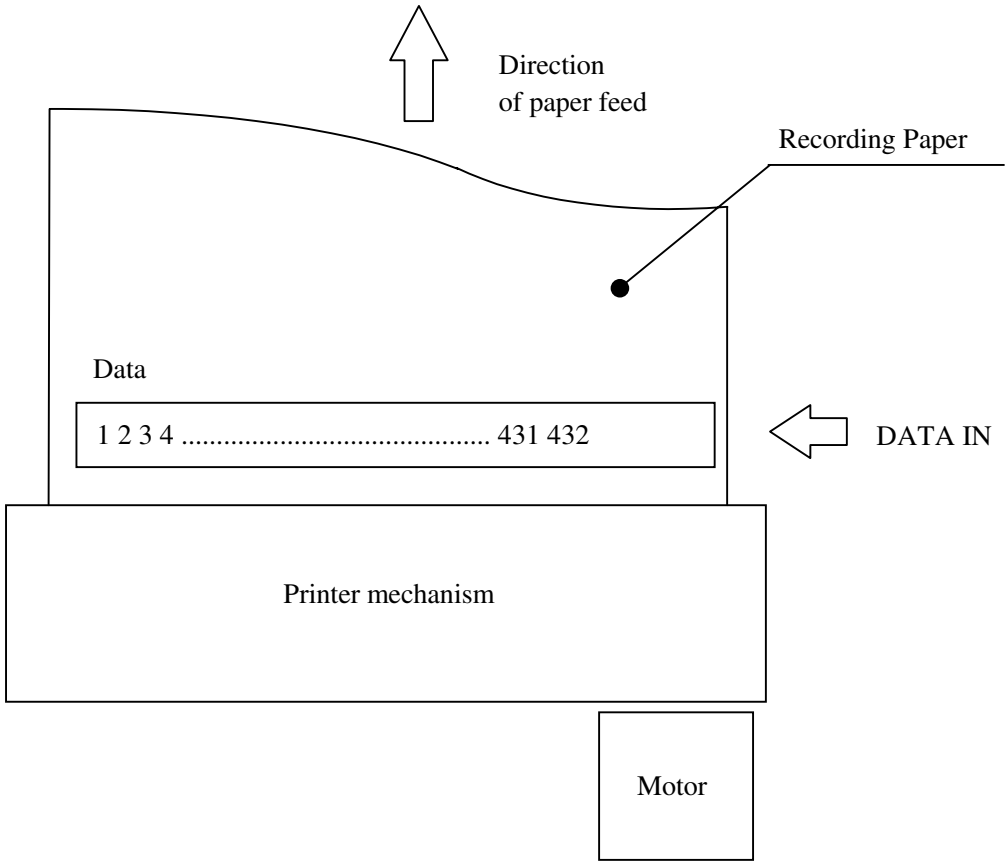


Figure 4-2 Print Data and Print Position

4.5 Head Resistance

The average resistance value of the thermal head is 1500Ω ± 3%.

4.6 Head Energizing Pulse Width

4.6.1 Pulse Width to Driving Voltage

To ensure uniformity of density control the head energizing pulse width according to the head driving voltage. Calculate the head energizing pulse width by the following formula.

$$\text{Ton (25)} = \frac{E_0 \times (N \times Rcom + Rav + Ric + Rlead)^2}{Vp^2 \times Rav}$$

Ton (25)	:	Head energizing pulse width (ms) at 25°C
Eo <Note1>	:	standard applied energy 0.36 (mJ)
Vp	:	Head driving voltage (V)
Rav	:	Head average resistance(1500 Ω)
N	:	Activated dots at a time
Rcom	:	0.05 (Ω)
Ric	:	70 (Ω)
Rlead	:	14 (Ω)

<Note 1> The energy in the case of the designated thermal recording paper.

<Note 2> The head energizing pulse rectangle wave of 1 pulse as the necessity of energizing time

Table 4-3 Example of Head Pulse Calculation (ms)

Head driving Voltage (Vset)	
23V	1.15
24V	1.05
25V	0.97

(1) Temperature 25°C
(2)When 144 dots are activated at one time.
(3) Energy 0.36mJ

4.6.2 Energizing Pulse Width Correction with Temperature

Detect the temperature by the thermistor mounted on the head, and correct the energizing pulse width according to the environment of the printer and the increase in temperature of the thermal head to control the energy to be applied.
When the thermistor temperature exceeds 65°C, it stops the operation.
Make corrections with the following formula.

$$t_x = t_{25} \times \left(1 + \frac{(T_{25} - Tx) \times C}{100} \right)$$

t_x : Head energizing pulse width (ms) at temperature in use (Tx)
t_{25} : Head energizing pulse width (ms) at 25°C of temperature in use
T_{25} : Room temperature (25°C)
Tx : Temperature in use (°C)
C : Temperature correction coefficient
tx ≥ 25°C : C=1.0%/°C
tx< 25°C : C=1.5%/°C

Table 4-4 Relationship Between Temperature and Energizing Pulse Width and Thermistor Characteristics.

Temperature	**Thermistor**	**Head energizing pulse width t × (ms)**		
(°C)	Resistance(KΩ)	22V	24V	26V
0	100.99	1.73	1.45	1.24
5	77.85	1.64	1.37	1.17
10	60.57	1.54	1.29	1.10
15	47.53	1.44	1.21	1.03
20	37.61	1.35	1.13	0.97
25	30.00	1.26	1.05	0.90
30	24.11	1.19	1.00	0.85
35	19.51	1.13	0.95	0.81
40	15.89	1.07	0.90	0.76
45	13.03	1.00	0.84	0.72
50	10.75	0.94	0.79	0.67
55	8.92	0.88	0.74	0.63
60	7.45	0.82	0.69	0.58
65	6.25	0.75	0.63	0.54
Over 65°C		Do not use in this range		

* The values on the table are based on the heating element resistance 1500Ω, printing energy 0.36mJ/dot and simultaneously energizing 144dots.

4.7 Specifications of Thermistor

1) Electric characteristic

(1) Resistance 30kΩ ±5% at 25°C

(2) B constant 3,950K ±2%

2) Rating

(1) Temperature (in use) range –20 ~ +80°C

(2) Thermal time constant Within 30s (in the air)

3) Relationship between temperature and resistance

$$Rx = R_{25} \times RXP\left(B + \left(\frac{1}{Tx+273} - \frac{1}{298}\right)\right)$$

Rx	:	Resistance at temperature in use Tx (°C)
R25	:	30kΩ ±5%(at 25°C)
B	:	3,950K ±2%
Tx	:	Centigrade temperature (°C)
EXP(x)	:	e to the xth power (natural logarithm)

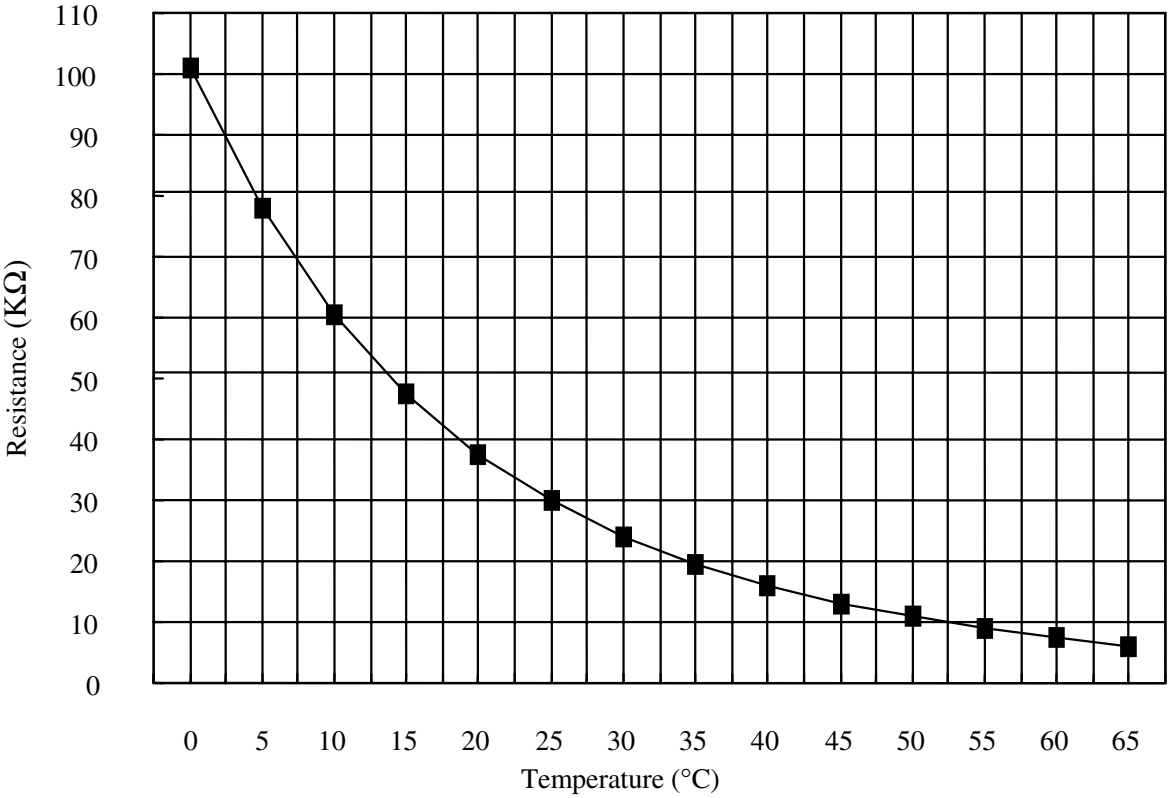


Figure 4-3 Thermal Characteristics of Thermistor

4.8 Electric Characteristics of Thermal Head

Table 4-5 Electric Characteristics of Thermal Head

Ta=25±10°C

Item		Signal	Minimum	Standard	Maximum	Unit	Condition
Average resistance		Rav	1455	1500	1545	Ω	
Output power source voltage		Vp	-	24.0	26.4	V	Standard condition on print
Power source voltage		Vdd	4.75	5.00	5.25	V	
Power source current		Idd	-	-	24	mA	fDI=fcLK/2
Input voltage	H	VIH	0.8Vdd	-	Vdd	V	STR,DI
	L	VIL	0	-	0.2Vdd	V	LA,CP
Input current (DI)	H	IIH DI	-	-	0.5	µA	VIH=5V
	L	IIL DI	-	-	-0.5	µA	VIL=0V
Input current (STB)	H	IIH STB	-	-	0.5	µA	
(LOW-ACTIVE)	L	IIL STB	-	-	-30	µA	
Input current (CLK)	H	IIH CLK	-	-	2	µA	
	L	IIL CLK	-	-	-2	µA	
Input current (LAT)	H	IIH LAT	-	-	2	µA	
	L	IIL LAT	-	-	-2	µA	
Output voltage (DO)	H	VDOH	4.45	-	-	V	OPEN,Vdd=4.5V
	L	VDOL	-	-	0.05	V	
Output voltage of driver		VOL	-	(1.0)	-	V	
Clock frequency (max)		FCLK	-	-	5.0	MHz	
Clock pulse		tw CLK	120.0	-	-	ns	
Data setup time		tsetup DI	50.0	-	-	ns	
Data hold time		thold DI	50.0	-	-	ns	
Data out delay time		td DO	-	-	500.0	ns	
Latch pulse width		tw LAT	100.0	-	-	ns	
Latch setup time		tsetup LAT	200.0	-	-	ns	
Latch hold time		thold LAT	50.0	-	-	ns	
Strobe setup time		tsetup STB	300.0	-	-	ns	
Strobe to driver output delay time		tdo	-	-	5.0	µs	

4.9 Timing Chart

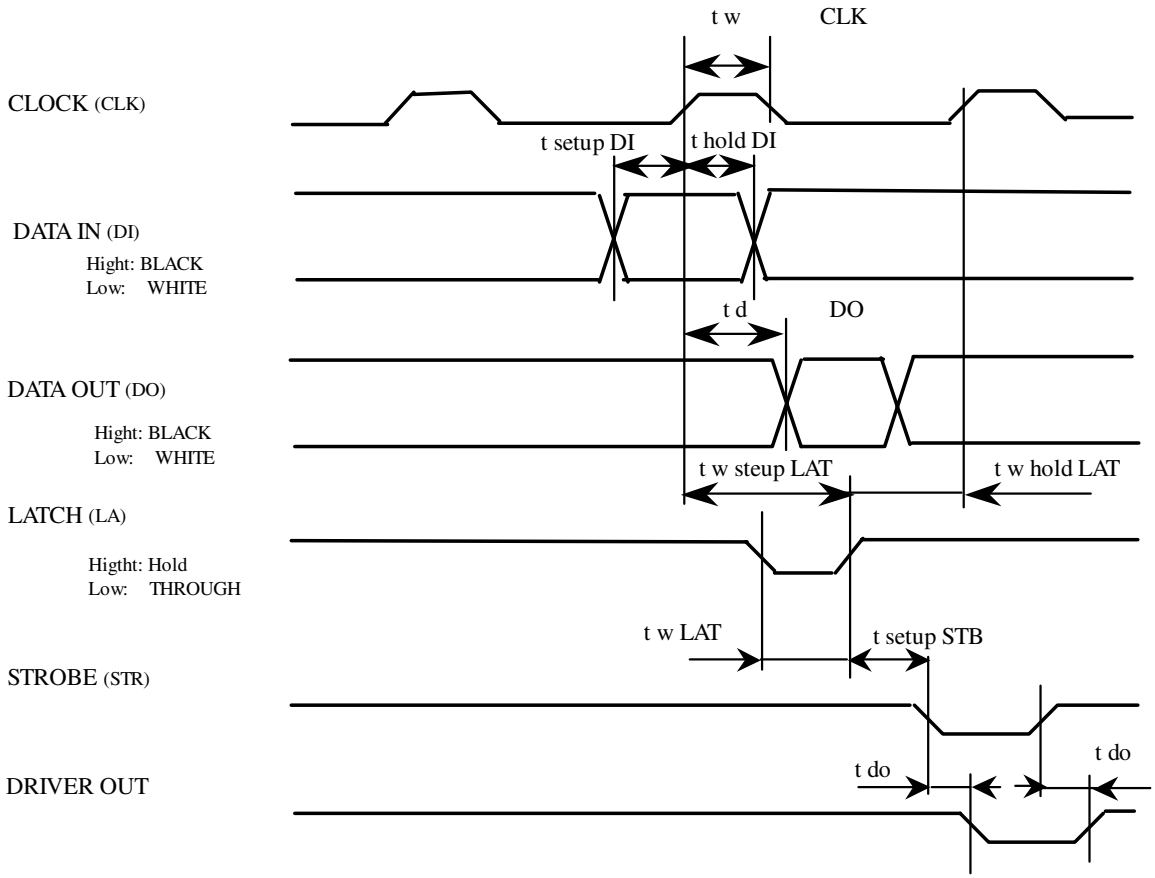


Figure 4-4 Timing Chart

4.10 Peak Current

The peak current at the head driving will be shown on the following table depending on the number of dots energized at one time. Be careful that the voltage does not drop on the wiring route.

Table4-6 Head Peak Current

Number of dots energized at one time	Peak current
	Theoretical
144	2.6A
288	5.2A

Based on average resistance 1455Ω, voltage 26.4V, and temperature 25°C.

4.11 Precautions on Using Thermal Head

(1) When continuous printing is performed, the supply energy should be reduced so that the substrate temperature monitored through the thermistor will below the maximum temperature.

(2) Power on and off sequence must be in the following order to prevent the dot element damage;

Turn on : Apply the logic supply voltage (Vdd) first and the printhead supply voltage.

Turn off : Switch off the printhead supply voltage first and turn the logic supply voltage off.

(3) Please keep STB signal to “Disable” during and no printing condition.

(4) Heat elements and IC’s shall be anti-electrostatic in order to prevent the electrostatic destruction. Do not touch the connector pins by naked hands.

(5) The printhead substrate surface is coated with glass and mechanical stress or shock (including dust scratch damage) should be avoided to prevent damage.

(6) When the printhead operation is finished, print supply voltage (including the charged voltage with capacitor) should be reduced to ground level and remained until next printhead operation.

(7) Condensation should be avoided.

If condensation occurred, do not switch on the printhead power until condensation disappeared.

(8) External force shall not be applied to the connector when it is plugged in or out.

(9) Print quality would be degraded if paper residue were stuck on the heat element area.

For such a case, please use cotton swab with alcohol to clean up.

Do not use the sandpaper destroying the heat elements.

(10) If printing sound, for example sticking sound, occurred please review and adjust and the electrical pulse program to eliminate the sound.

(11) Please pay attention that the paper used dose not include bad factor affect the print head life.

5 PAPER FEED

- Rotating the motor shaft clockwise looking from the motor gear side (normal rotation) feeds the recording paper in the normal direction.
- Drive the motor with 2-2 phase excitation. One step of the motor driving signal feeds paper by 0.125mm (corresponding to 1 dot pitch).
- Be careful not to abnormally heat the motor; use the constant-current circuit if the period of printing is slow, i.e. the motor driving period per pulse is more than 2.0ms or use the non-excited state if the motor excitation is more than 2.0ms.
- When the motor is started from a standstill (non-excited state), first excite one step the same phase as the stopping step then shift to the printing sequence.

At this time, to prevent deterioration of the print quality cause by a backlash of the paper feed drive system, feed the paper 4-dot lines forward or feed the paper 10-dot lines reverse and then feed forward the same pulse. In addition, to minimize the influence of a backlash on the print quality, choose the latter, i.e. feed the paper 10-dot lines reverse and then 10-dot lines forward.

Note: When feeding 10-dot lines reverse and forward, if the transfer of print data is slow, the non-excited state will occur per line (one character line). This not only decreases a throughput of prints but also May affect the paper feed system's life.
Thus consider a suitable way of transferring the print data.

- Drive the motor at 640 pps (period of 1.56ms) when the paper is fed.
- Drive the motor at period of 8ms when the paper is fed automatically. Otherwise, the paper out will increase the friction between the head and the platen.
- Do not drive the motor without paper except for automatic paper feeding (except for the head up).
- The driving period needs to be changed according to the conditions in use. See Section 9.
- When the motor is started from a standstill state, make a back feed operation and a forward feed operation for 10 dot-lines to prevent the deterioration of print quality caused by the backlash of the paper feed driving system.
- For paper feed, drive the motor at 640 pps (1.56 ms period).
- During print, it is necessary to change the drive frequency depending on the conditions such as the voltage, temperature, activated dot number and so on).
- To avoid heat generation of the motor, have the motor non-excited during operation other than the paper feed (including printing), and avoid continuous operation for more than 10 minutes.
- Also to avoid heat generation, recommend to drive motor at low-excited level over the printing period when It become more printing time than standard printing period.

(In case of apart feeding style etc)

- Use a motor driver with low voltage (0.3 V or so) preventing voltage drop.
- Refer to page 28 at 9.3.1- printing energy and motor period when adjusting print density.

5.1 Specifications of Stepping Motor

Table 5-1 Specifications of Stepping Motor

Item	Specifications
Type	PM type stepping motor
Phase	4 phase
Drive system	Bipolar drive
Excitation system	2-2 phase excitation
Winding resistance/phase	130±7%Ω/phase
Insulation class	Class E(Except for leads)
Leads	UL1685 AWG28
Rated voltage	DC24V
Maximum consumption current	Approx. 0.4A (at 26.4V)
Average consumption current	Approx. 0.14A (at 24V)
Driving frequency	900pps Note: Use a 640 pps or less for this printer.

5.2 Excitation Sequence

Switching of the excitation phase in the following order feeds the paper in the normal detection (forward).
Table 5-2 Excitation Sequence

Sequence	Signal name			
	A	B	$\overline{A}$	$\overline{B}$
Step 1	Low	Low	High	High
Step 2	Low	High	High	Low
Step 3	High	High	Low	Low
Step 4	High	Low	Low	High

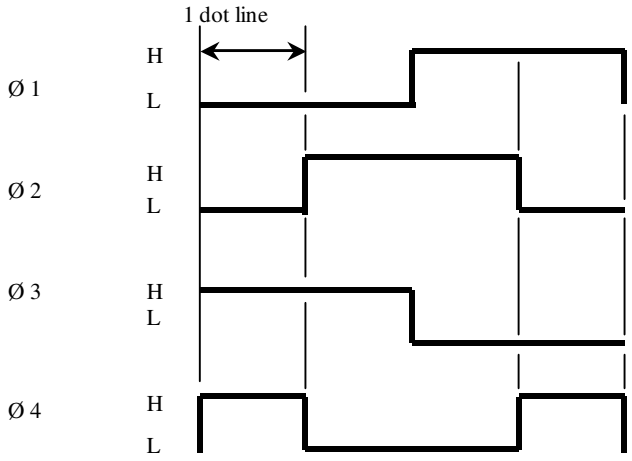


Figure 5-1 Input Power Waveforms

5.3 Example of Driving Circuit

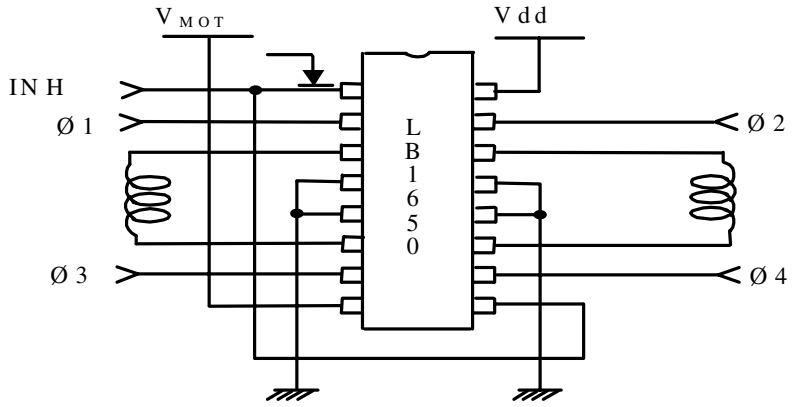


Figure 5-2 Example of Stepping Motor Circuit

When INH signal is “H”, the motor drive is available under excitation.
When INH signal is “L”, the motor is leave under the non-excited condition.
For the constant-current circuit, contact our service personnel.

5.4 Motor Timing

(1) Stopping step

Excite the motor for one step with the same phase as the last phase of the printing step.

(2) Standstill

In a standstill, leave the motor non-excited not to prevent heat generation.

Even under the non-excited condition, the recording paper will not slip owing to the holding torque of the motor and the platen loaded with the head pressure.

(3) Starting step

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

2) To restart the motor from a standstill (non-excited state), first excite one step the same phase as the stopping step, then shift to the printing sequence. At this time, to prevent deterioration of the print quality cause by a backlash of the paper feed drive system, feed the paper 4-dot lines forward or feed the paper 10-dot lines reverse and then feed forward the same pulse. In addition, to minimize the influence of a backlash on the print quality, choose the latter, i.e. feed the paper 10-dot lines reverse and then 10-dot lines forward. Use a 125 pps to run the motor while the head is down when the paper is out.

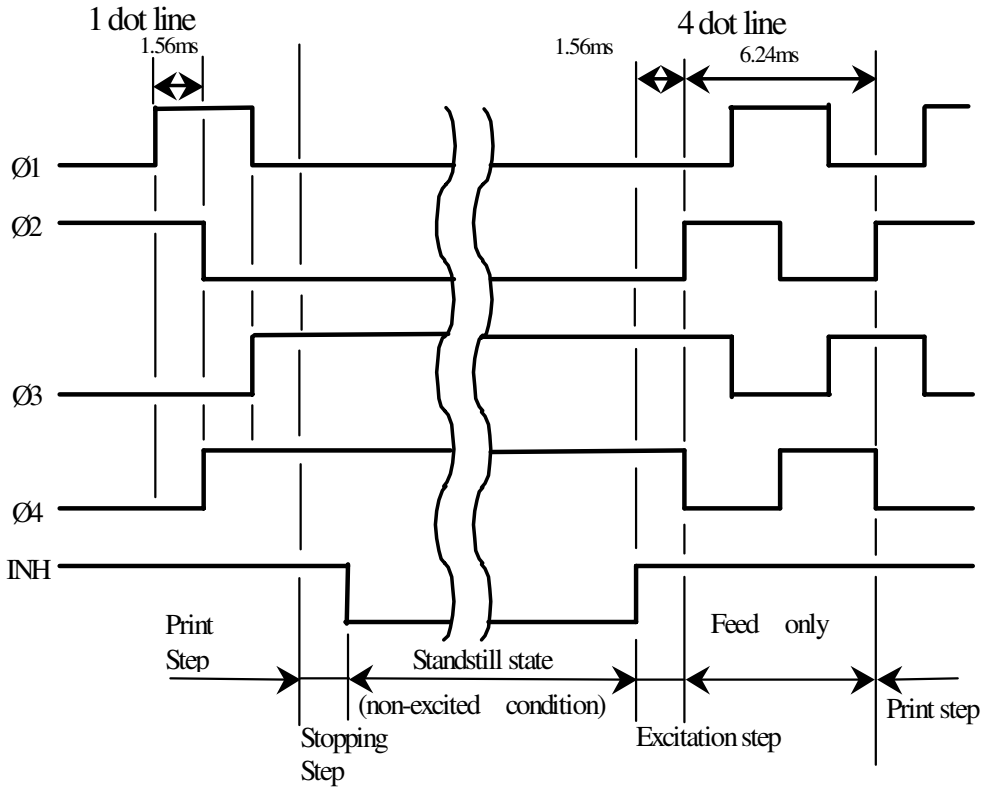


Figure 5-3 Motor timing

6 PLATEN OPEN SENSOR

The printer has a platen position sensing switch. The printer with paper cutter should be so designed that the power to the paper cutter is shut down whenever the platen is opened.

6.1 General Standards

Type : Mechanical switch
When the platen is opened : OPEN
When the platen is closed : CLOSE
Max. ratings: 3.0 VDC, 0.1 A (resistive load)
Contact resistance: No more than 1Ω (initial)

6.2 Example of Recommended Circuit

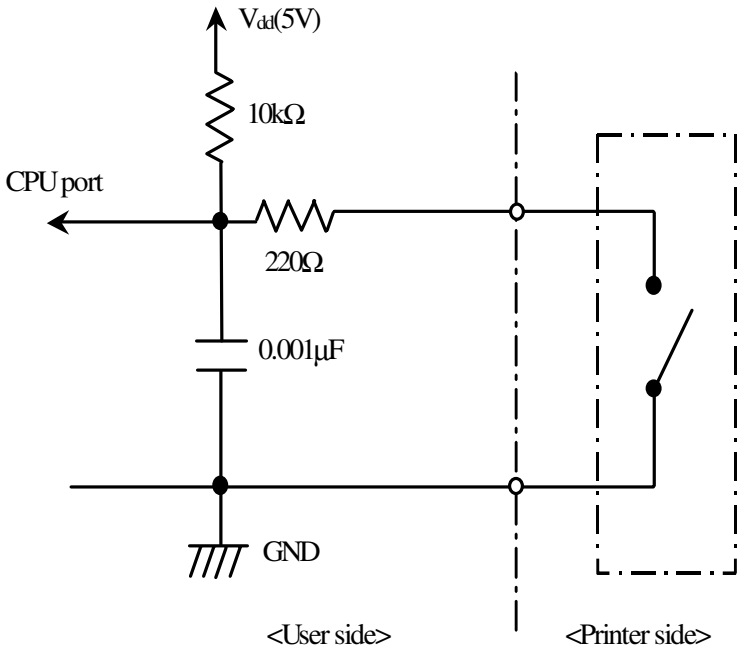


Figure 6-1 Recommended Circuit for Platen Open Sensor

To prevent chattering, use a capacitor across the switch contacts.

7 PAPER SENSOR

The paper sensor is provided to detect the presence of paper.
Energizing the head under the paper-out condition can damage the head to break or affect adversely the head's life.
Construct the outside circuit so that thermal head cannot be energized under the paper-out condition.
For cutterless models, use a paper guide along the platen to control the gap across paper sensor and paper surface to 1.7 mm or less. Also the printer casing should be designed to shut off all ambient light.

7.1 Type of Sensor

Reflective type photo interrupter

SG-105F B, C (Kodenshi)

7.2 General Standards

Table 7-1 Maximum Rating of Paper Sensor (25°C)

Parameter		Symbol	Rating	Unit
Input	Power dissipation	PD	75	mA
	Reverse voltage	V_R	5	V
	Forward current	I_F	50	mA
Output	Collector power dissipation	P_C	50	V
	Collector current	I_C	20	V
	Collector-emitter voltage	V_{CEO}	30	mW
	Emitter-collector voltage	V_{ECO}	3	mA
	Operation temperature range	T_{opr}	-25~85	°C
	Storage temperature range	T_{stg}	-30~100	°C

Table 7-2 Electrical Characteristics of Paper Sensor (25°C)

Parameter		Symbol	Measurement condition	Min.	TYP.	Max.	Unit
Input	Forward voltage	V_F	I_F=10mA	-	-	1.3	V
	Reverse current	I_R	V_R=5V	-	-	10	μA
	Peak wavelength	λ_P	I_F=20mA	-	940	-	nm
Output	Dark current	I_{CEO}	V_{CE}=10V	-	-	0.2	μA
Collector current		I_L	V_{CE}=5V,I_F=10mA	180	-	440	μA
Leakage current		I_{CEOD}	V_{CE}=5V,I_F=10mA	-	-	0.2	μA
Response time	(Rise)	t_r	V_{dd}=2V,I_C=0.1mA	-	30	-	μs
	(Fall)	t_f	R_L=1kΩ	-	25	-	

7.3 Designated Circuit

Construct the circuit using the following designated circuit to ensure perfect detection of the sensor output.

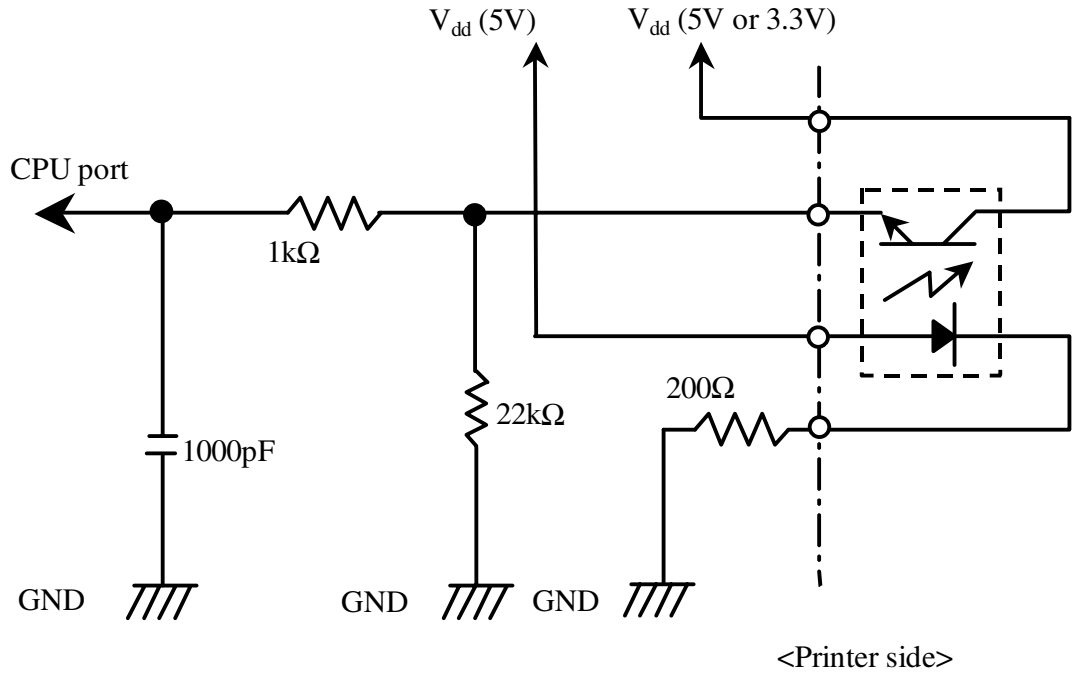


Figure 7-1 Designated Circuit for Paper Sensor

When the designated circuit is not used and the CPU port or gate-array device is connected, construct the circuit referring to Table 7-1 Maximum Rating of Paper Sensor and Table 7-2 Electric Characteristics of Paper Sensor or contact our service personnel.

8 CONNECTING TERMINAL

The connecting terminal consists of three connectors. The details are shown below.

Table 8-1 Connecting Terminal

No.	Function	Pins	Type	Recommended connector of the mate
1	Thermal head	28	FFC (Pitch=1.25mm)	
2	Paper sensor	4	FPC (Pitch=1.25mm)	Molex 52044-0445 52045-0445
3	Platen open sensor	2	Molex 51021-0200	Molex 53047-0210 53048-0210
4	Motor	4	Molex 51021-0400	Molex 53047-0410 53048-0410

8.1 Thermal Head Terminal

Fig. 8-1 shows the layout of thermal head FFC terminal.

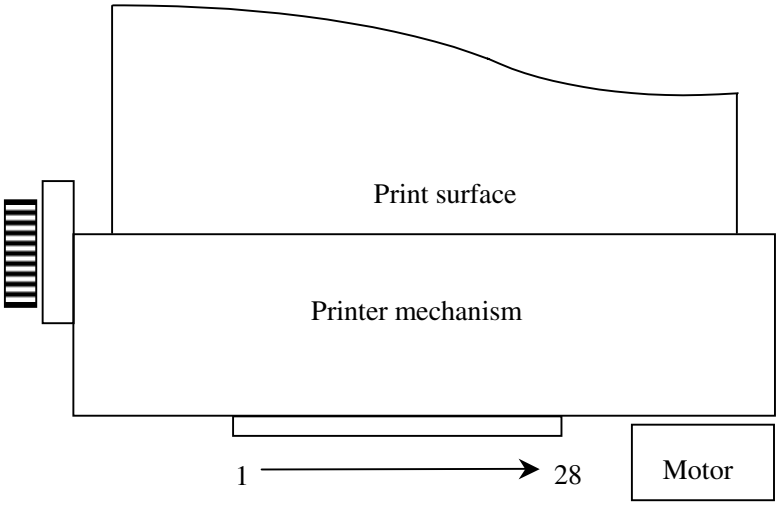


Figure 8-1 FFC terminal layout

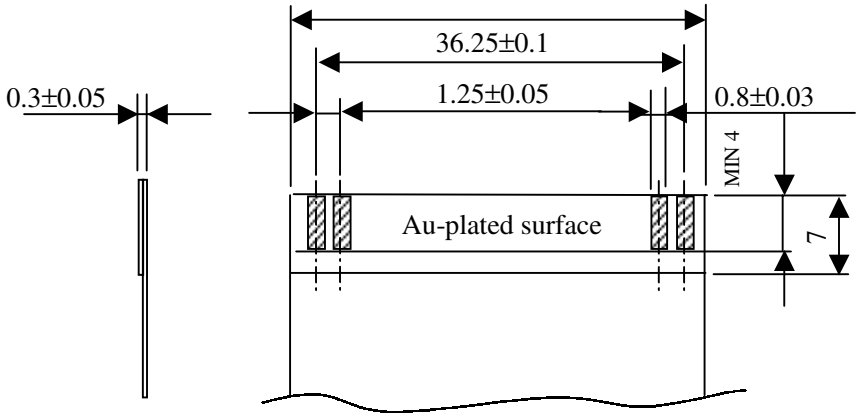


Figure 8-2 FFC Cable

Table 8-2 Thermal Head Terminal Configuration

Terminal No.	Signal name	Function
1	VP	Thermal head common
2	VP	Thermal head common
3	VP	Thermal head common
4	VP	Thermal head common
5	DO	Print data serial output
6	CLK	Clock signal for data transfer
7	LAT	Print data latch signal
8	N.C	N.C
9	STB 1	Strobe 1
10	TM	Thermistor
11	GND	GND
12	GND	GND
13	GND	GND
14	GND	GND
15	GND	GND
16	GND	GND
17	GND	GND
18	GND	GND
19	GND	GND
20	TM	Thermistor
21	V_{dd}	Power source for thermal head driver
22	STR 3	Strobe 3
23	STR 2	Strobe 2
24	DI	Print data serial input
25	VP	Thermal head common
26	VP	Thermal head common
27	VP	Thermal head common
28	VP	Thermal head common

8.2 Sensor Terminal

Fig. 8-3 shows the layout of sensor terminal.

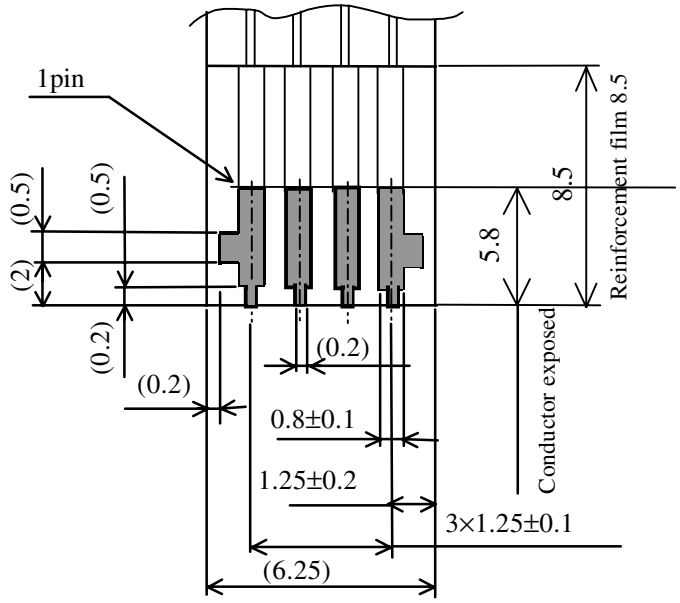


Figure 8-3 Journal Side Paper Sensor Terminal Layout

Table 8-3 Journal Side Paper Sensor Connector Pin Configration

Pin No.	Terminal name	Remark
(1)	Photo-transistor emitter	Journal side Paper sensor
(2)	LED anode	
(3)	LED cathode	
(4)	Photo-transistor collector	

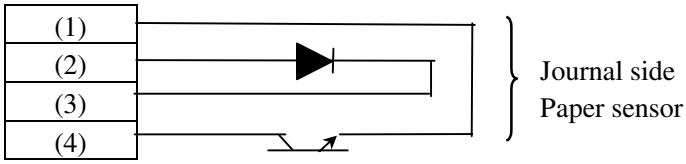


Figure 8-4 Journal Side Paper Sensor Terminal Circuit Diagram

8.3 Platen Open Sensor

Figure 8-5 shows the layout of platen open sensor.

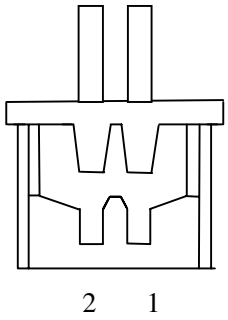


Figure 8-5 Platen Open Sensor Layout

Table 8-4 Platen Open Sensor Connector Pin Configuration

Pin No.	Terminal name	Color of lead
(1)	Platen open sensor output	Red
(2)	Platen open sensor output	Black

8.4 Motor Terminal

Figure 8-6 shows the layout of motor Terminal.

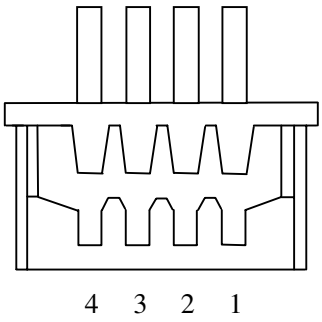


Figure 8-6 Motor Terminal Layout

Table 8-5 Motor Connector Pin Configuration

Pin No.	Terminal name	Color of lead
(1)	A	Black
(2)	B	Yellow
(3)	$\overline{A}$	Brown
(4)	$\overline{B}$	Orange

9 PRINTING ENERGY AND MOTOR DRIVING PERIOD

9.1 Printing Energy

9.1.1 Hysteresis Control

With the hysteresis control, whether all dots on the previous line are printed or not is decided and the printing energy for the next line dots is changed accordingly.
This printer has a one-step hysteresis control so the printing speed of 80mm/s max available.

9.1.2 Single and Continuous Energy

The single energy is used for printing the next line when all dots on the previous line have not been printed.
The continuous energy is used for printing the next line when all dots on the previous line have been printed.

9.1.3 Printing Energy Corresponding to the Kind of Paper

The printing energy is changed according to the color development characteristics of the paper to use. For the printing energy for the recommended paper, see Section 9.2.

9.2 Printing Energy and Motor Driving Period for the Recommended Paper

The printing energy and motor driving period is changed according to the color development characteristics of the paper to use. The following table shows the printing energy and motor driving period for the recommended paper. See this table for maintaining the print quality and the head's life.

Table 9-1 Paper, Printing Energy and Motor Driving Period

Name of paper	Paper maker	Thickness of paper	Printing energy		Motor driving period
TF50-KS-E2C (normal paper)	Nippon Paper	67µm	Single energy	0.36mJ	1.56ms
			Continuous energy	0.31mJ	
HP220AB-1 (high sensitivity preservation paper)	Mitsubishi Paper	75µm	Single energy	0.36mJ	1.56ms
			Continuous energy	0.31mJ	
P220AC (normal thick paper)	Mitsubishi Paper	105µm	Single energy	0.36mJ	1.56ms
			Continuous energy	0.31mJ	
TC98KS-T (overcoat paper)	Nippon Paper	125µm	Single energy	0.46mJ	2.00ms
			Continuous energy	0.41mJ	
TC11KH-ET (normal thick paper)	Nippon Paper	145µm	Single energy	0.40mJ	1.80ms
			Continuous energy	0.35mJ	

Note: For using the two-color developing paper and thermal 2 copies paper, please contact our service personnel.

Note: The model changes according to the thickness of paper so be careful when purchasing the printer.

- LT1221H(V) : 60-105mm (normal paper)
- LT1221H(V)A : 110-150mm (thick paper)

9.3 When Adjusting Print Density

9.3.1 Printing Energy and Motor Driving Period When Adjusting Print Density

The printing energy and motor driving period need to be changed according to the color development characteristics of the recommended paper to use. Furthermore, if printing energy is increased to change the print density, the motor driving period using the printing energy (head energizing pulse width) should be changed to maintain the print quality and the head's life. The formula is shown below.

$$Mstep = t_{xo} \times Cm + t_{xo} \times (Nstb - 1)$$

Note: Set Mstep ≥ 1.56ms.

Mstep : Motor driving period (ms)
Txo : Head energizing pulse width (ms) for single energy at temperature in use (T_{25}).
Nstb : Count of division
Cm : Motor driving correction factor = 1.49

9.3.2 Single and Continuous Energy When Adjusting Print Density

Set the relationship between the single energy and the continuous energy when the print density is adjusted. The formula is shown below.

$$t_{xo} - t_{xc} \geq 0.05$$

t_{xo} : Single energy
t_{xc} : Continuous energy

9.4 No Hysteresis Control

If no hysteresis control is used, provide the single energy at all times and set the motor driving period by using the following formula:

$$Mstep0 = Mstep \times 2$$

Mstep0 : Motor driving period without hysteresis control

10 PAPER INSERTION

10.1 Manual Paper Insertion

(1) Paper insertion

1) Press down Platen Open lever.

2) After loading a roll paper into paper holder, lower platen hold ass'y, with the leading edge of paper pulled out of paper exit in exterior case.

Note1) If paper's either side gets creased from meandering or skew, try proper paper loading again.

Note2) On the printer with paper cutter, manually feed paper until its leading edge protrudes from paper cutter's paper exit.

Note3) Even with our recommended roll paper, paper jam might occur due to large friction or inadequate bends in the paper path within the equipment in which the printer is used. Check for paper jam with the equipment under the expected actual operating conditions.

(2) Paper

1) Remove paper from the printer with the platen opened.

2) The platen may be damaged if paper is forcibly pulled out of the printer with the platen left lowered.

11 CONTROL SYSTEM (PRINT DRIVING SYSTEM)

11.1 Variable Division Driving System

Set the maximum print dot number to 144, or 288. To reduce the current consumption, set the maximum print dot number to 144. Make the division variable so that the sum of the print dot number of each print block does not exceed the maximum print dot number.
Fig. 11-1 shows the timing chart of the variable division driving system for the maximum print dot number of 144.
Follow this timing chart when designing your software, hardware etc.

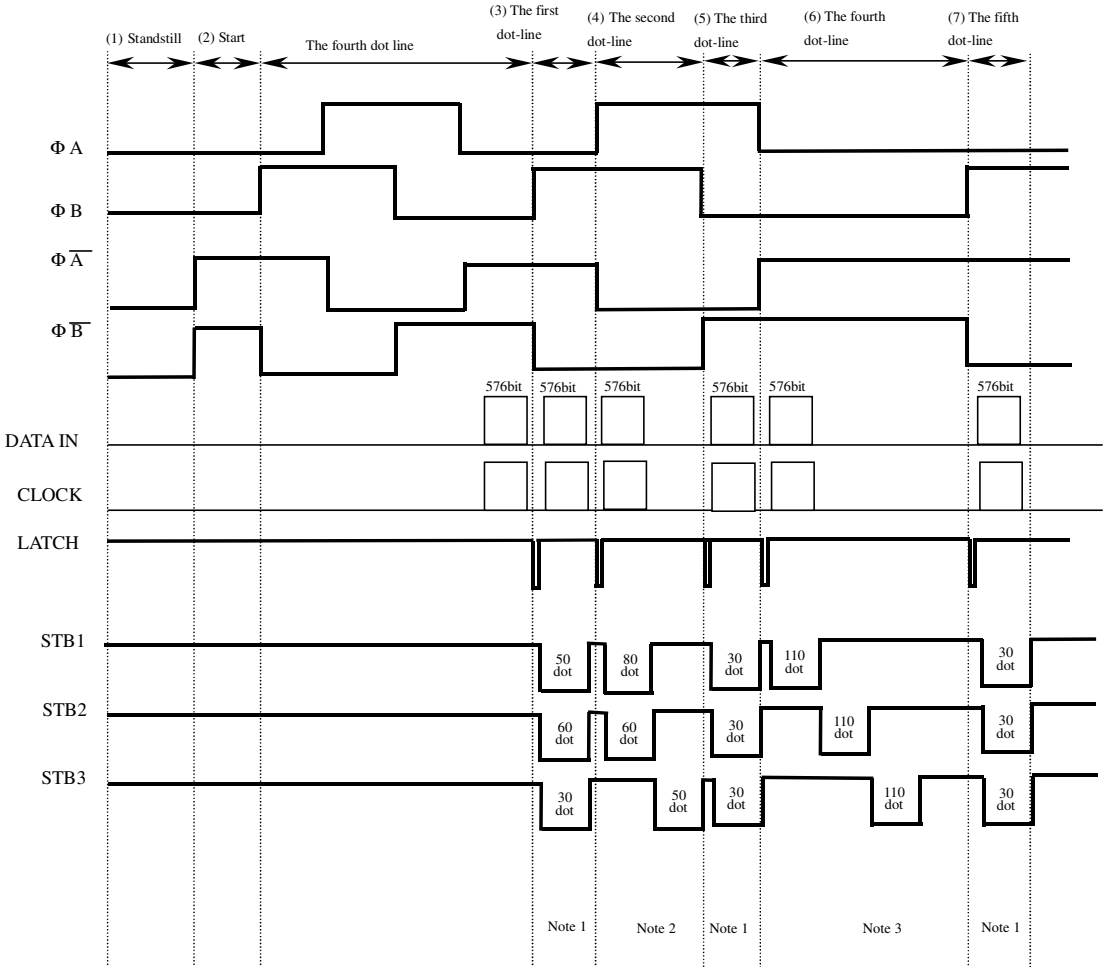
1) Standstill
   The printer is in a standstill and the motor is non-excited.
2) Motor start
   The phase just before the motor stop is output to the motor.
   The print data 1 dot line are sent to the head.
3) Energizing of the first dot line
   The motor phase for 1 step is switched to energize the first dot line.
   The data 1 dot line sent by the above 2) are latched in the register of the head.
   The head is energized by the STB signals.

The data for the second dot line are sent to the head.
Since the total print dot number is 140 at this stage, all STB signals are energized simultaneously.
For energizing period, use the pulse width calculated with Table 4-3 Example of Head Pulse Calculation and Table 4-4 Relationship between Temperature and Energizing Pulse Width and Thermistor Characteristics.
When the energized pulse width exceeds the motor drive pulse width, hold the motor drive until all head energizing pulses are completed.

4) Energizing of the second dot line
   The motor phase for 1 step is switched to energize the second dot line.
   The data 1 dot line sent by the above 3) are latched in the register of the head.
   The head is energized by the STB signals.
   The data for the third dot line are sent to the head.
   Since the total print dot number is 280 at this stage, dots are divided into 140 and 140 to energize the head.
   For energizing period, use the pulse width calculated with Table 4-3 Example of Head Pulse Calculation and Table 4-4 Relationship between Temperature and Energizing Pulse Width and Thermistor Characteristics.
   When the energized pulse width exceeds the motor drive pulse width, hold the motor drive until all head energizing pulses are completed.
5) Energizing of the third dot line
6) Energizing of the fourth dot line
7) Energizing of the fifth dot line

Reference:
In this system (Variable Division Driving System) printing is performed while the motor is running so each strobe energizing timing does not agree with the motor driving timing at all times. As a result, printing accuracy on the paper feed may vary up to approx. 0.125mm and white lines may be mixed.

Therefore, if the printer with high print density or high print quality is required, see Section 11.2 Fixed Division Driving System.



Note 1: Since the print dot number does not exceed 144, printing is carried out without being divided.
Note 2: Since the print number is between 145 and 288, printing is carried out with dots divided by two.
Note 3: Since the print number is between 289 to 432, printing is carried out with the dots divided by Three.

Fig. 11-1 Timing Chart of Variable Division Driving System

Thus printing is carried out with dots divided by one to three according to the number of print dots on 1 dot line. For example, on the timing chart above the number of dots max. at simultaneously energizing is 144. Therefore, 288 dots max. at simultaneously energizing may be used depending on the power (capacity) to use. In this case, however, printing is carried out with dots divided by one or two.

11.2 Fixed Division Driving System

When the high print density for graphics etc or high print quality is required, use the fixed division driving system. For example, Fig.10-2 shows the timing chart of the fixed division driving system with dots divided by four.
Follow this timing chart when designing your software and hardware.

1) Standstill
   The printer is in a standstill, and the motor is non-excited.
2) Motor start
   The phase just before the motor stop is output to the motor.
   The print data 1 dot line are sent to the head.
3) Energizing of the first dot line
   The motor phase for 1 step is switched to energize the first dot line.
   The data 1 dot line sent by the above 2) are latched in the register of the head.
   The head is energized by the STB signals.
   For energizing period, use the pulse width calculated with Table 4-3 Example of Calculation of Head Pulse Width and Table 4-4 Relationship between Temperature and Energizing Pulse Width and Thermistor Characteristics. When the energized pulse width exceeds the motor drive pulse width, hold the motor drive until all head energizing pulses are completed.
4) Energizing of the second dot line
   The motor phase for 1 step is switched to energize the second dot line.
   The data 1 dot line sent by the above 3) are latched in the register of the head.
   The head is energized by the STB signals.
   The data for the third dot line are sent to the head
   For energizing period, use the pulse width calculated with Table 4-3 Example of Head Pulse Calculation and Table 4-4 Relationship between Temperature and Energizing Pulse Width and Thermistor Characteristics. When the energized pulse width exceeds the motor drive pulse width, hold the motor drive until all head energizing pulses are completed.
5) Energizing of the third dot line

Reference:
In this system (Fixed Division Driving System) the printing speed will be relatively slow because printing is carried out with dots fixed. Therefore, if the printer with high printing speed is required, see Section 11.1 Variable Division Driving System.

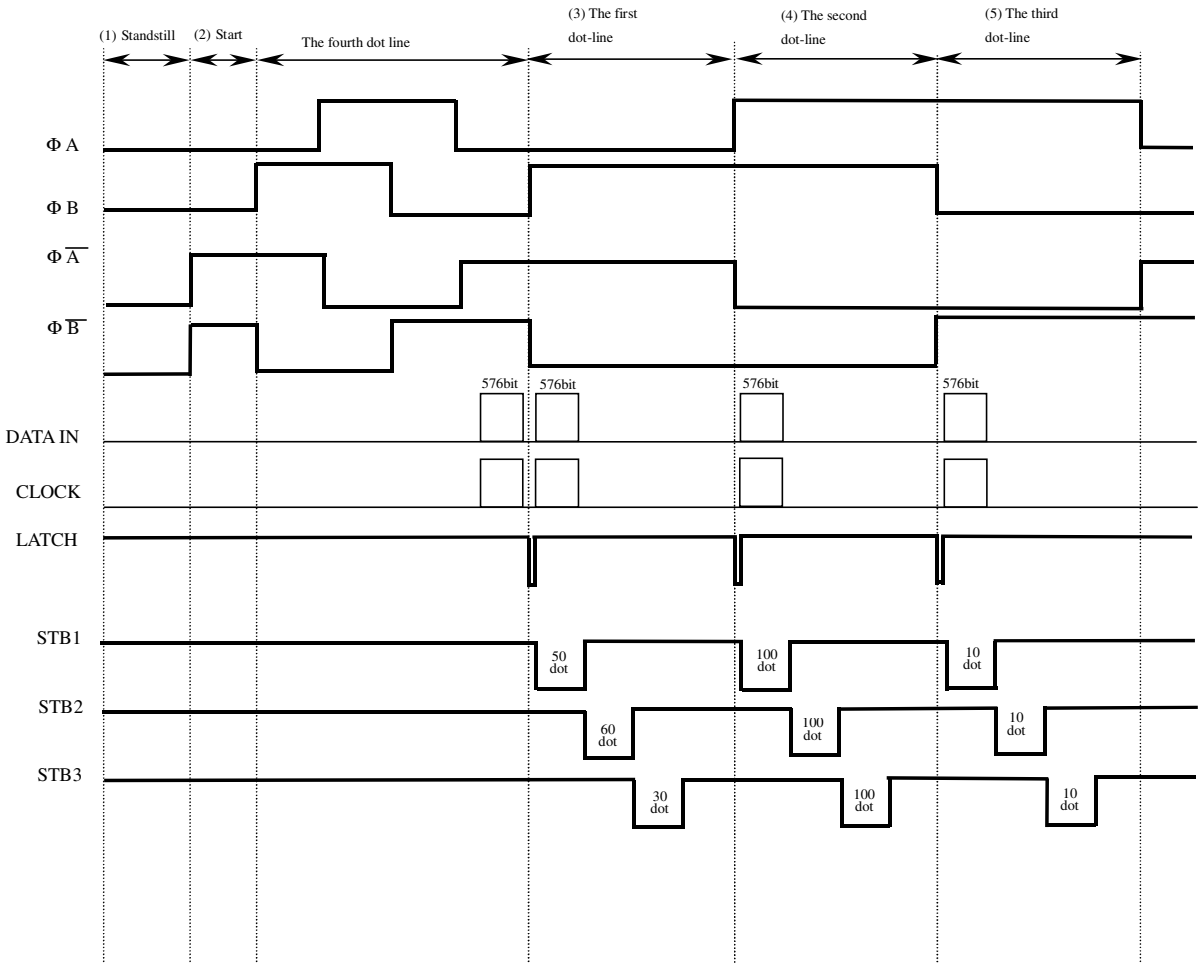


Figure 11-2 Timing Chart of Fixed Division Driving System

Thus printing is carried out with dots divided by three regardless of number of print dots on 1 dot line. For example, on the timing chart above the number of dots max. at simultaneously energizing is 144. Therefore, 288 dots max. at simultaneously energizing may be used depending on the power (capacity) to use.
In this case, however, printing is carried out with dots divided by two.

11.3 Other Print Driving Systems

If print systems other than the above are used, problems may occur such as deterioration of print quality and shortening of printer's life so please contact our service personnel.
Otherwise, it is out of guarantee in regarding deterioration of print quality and shortening printer’s life.

12 EXTERNAL SHAPE

12.1 SA1, PLATEN CLAM

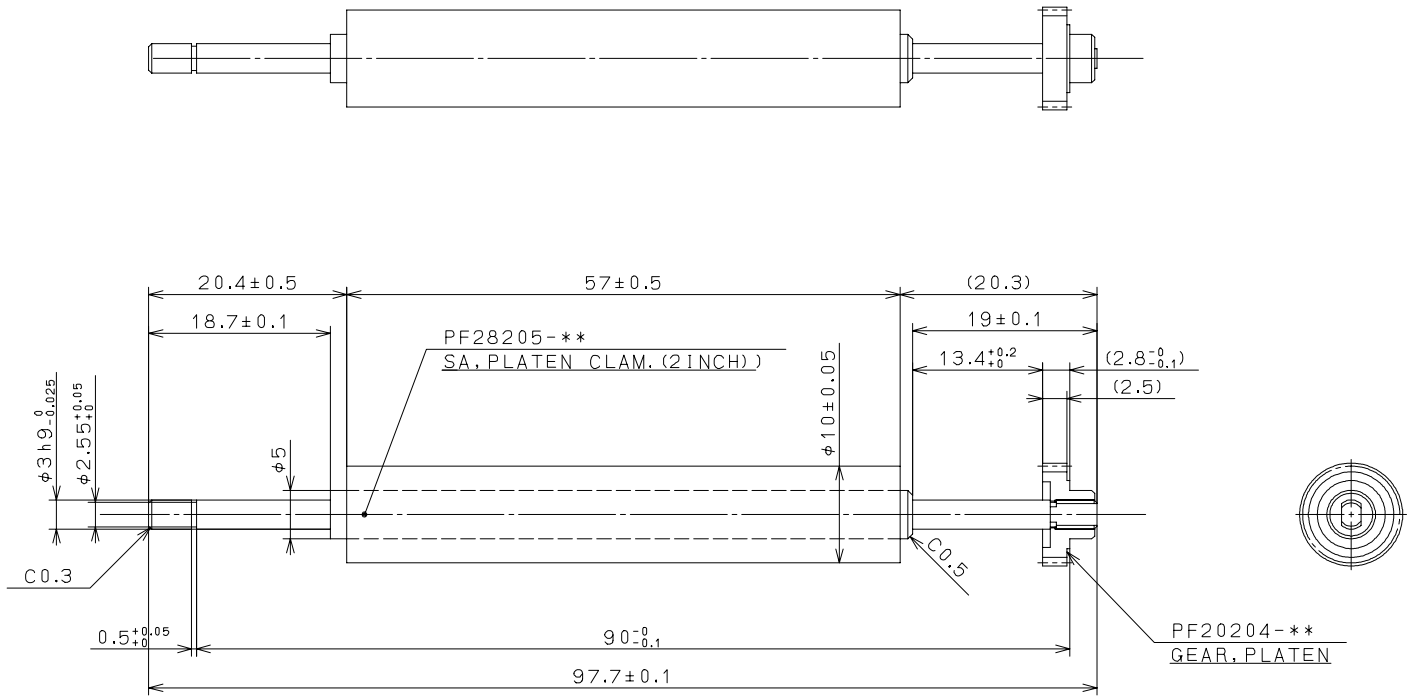


Figure 12-1 SA1, PLATEN CLAM(3INCH)

12.2 UNIT , PLATEN HOLDER (Not install paper cutter)

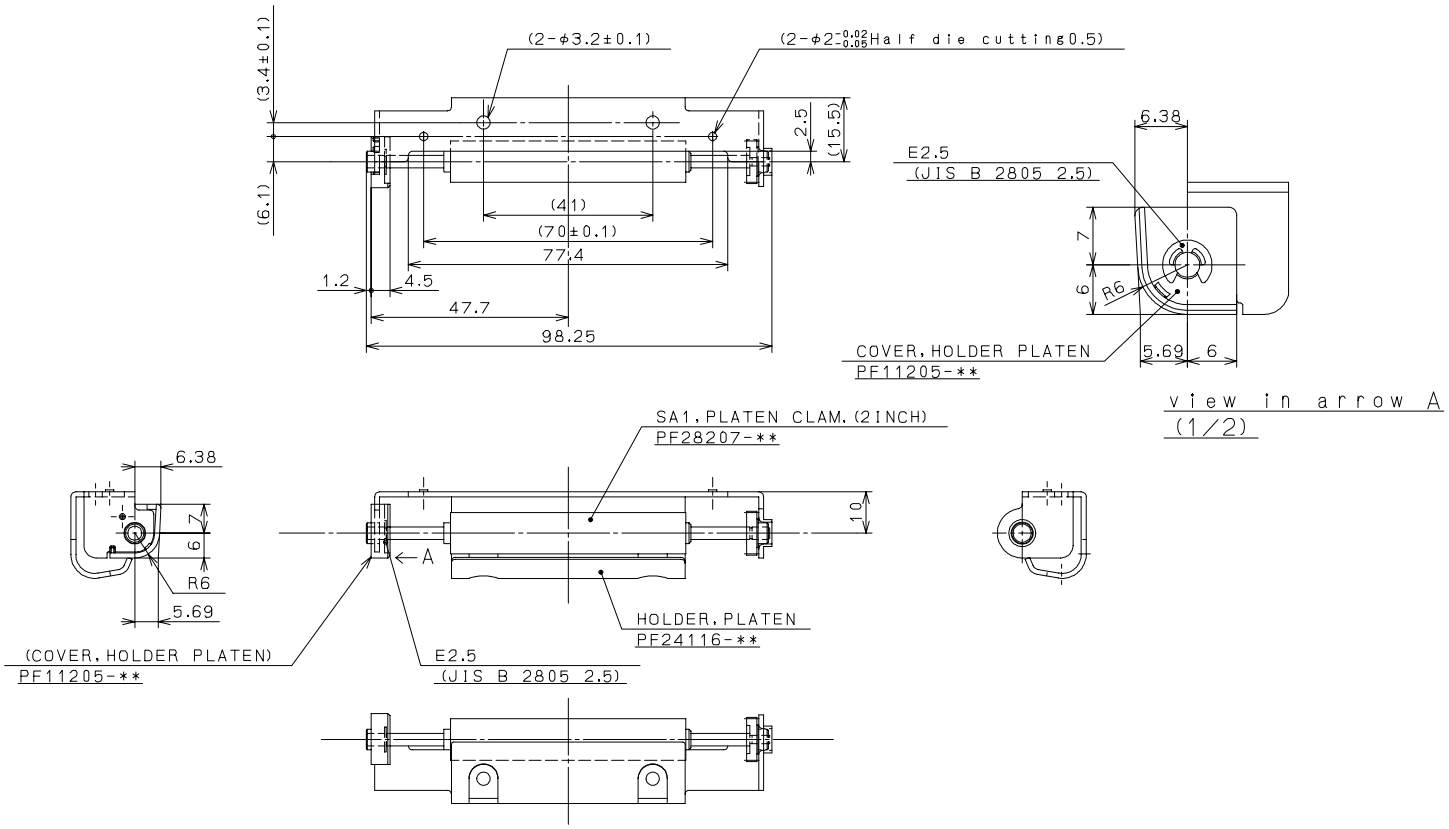


Figure 12-2 Example of Recommended UNIT, PLATEN HOLDER

12.3 HOLDER , PLATEN (Not install paper cutter)

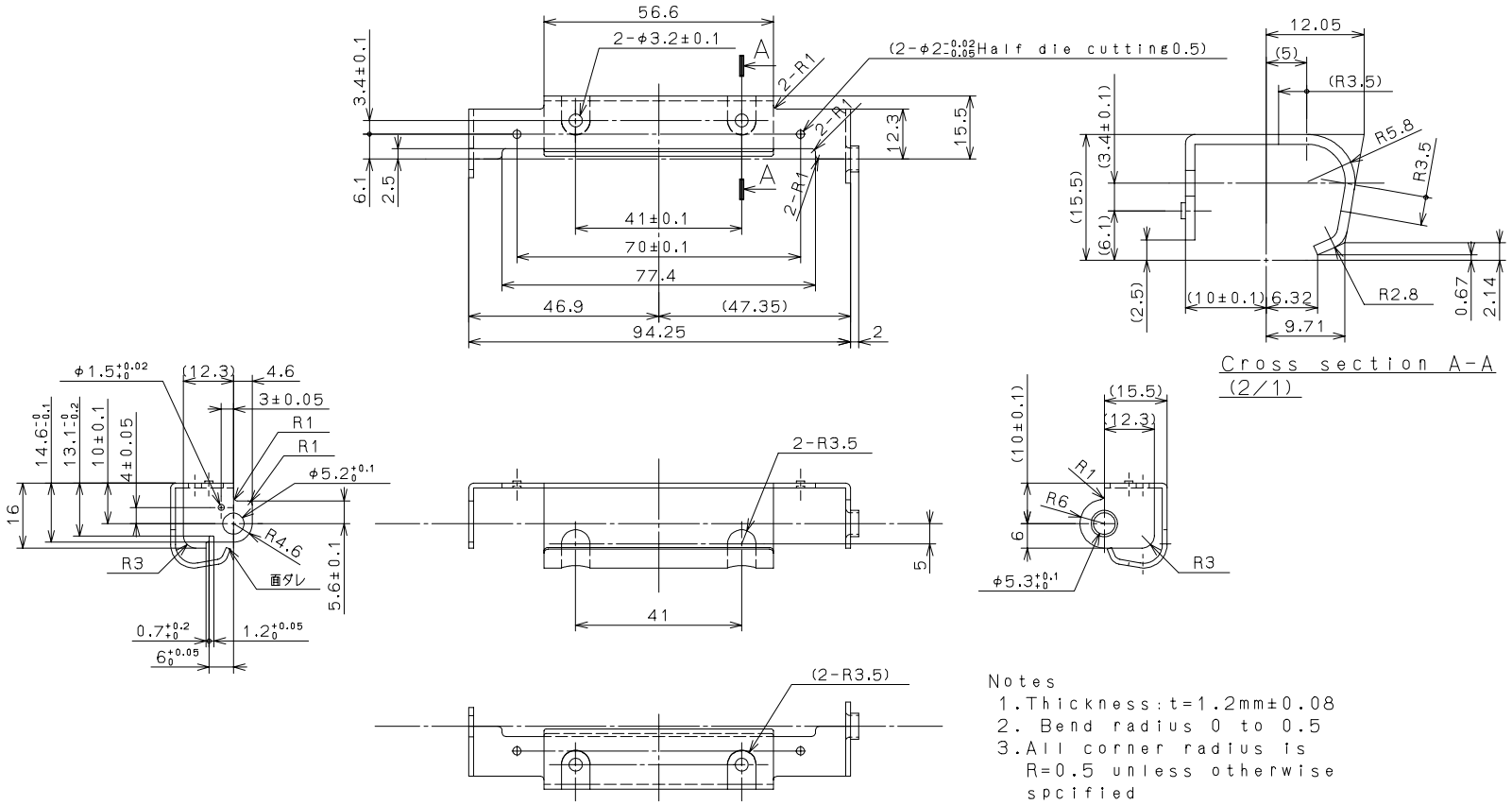


Figure 12-3 Example of Recommended HOLDER, PLATE

12.4 UNIT , PLATEN HOLDER (Install paper cutter)

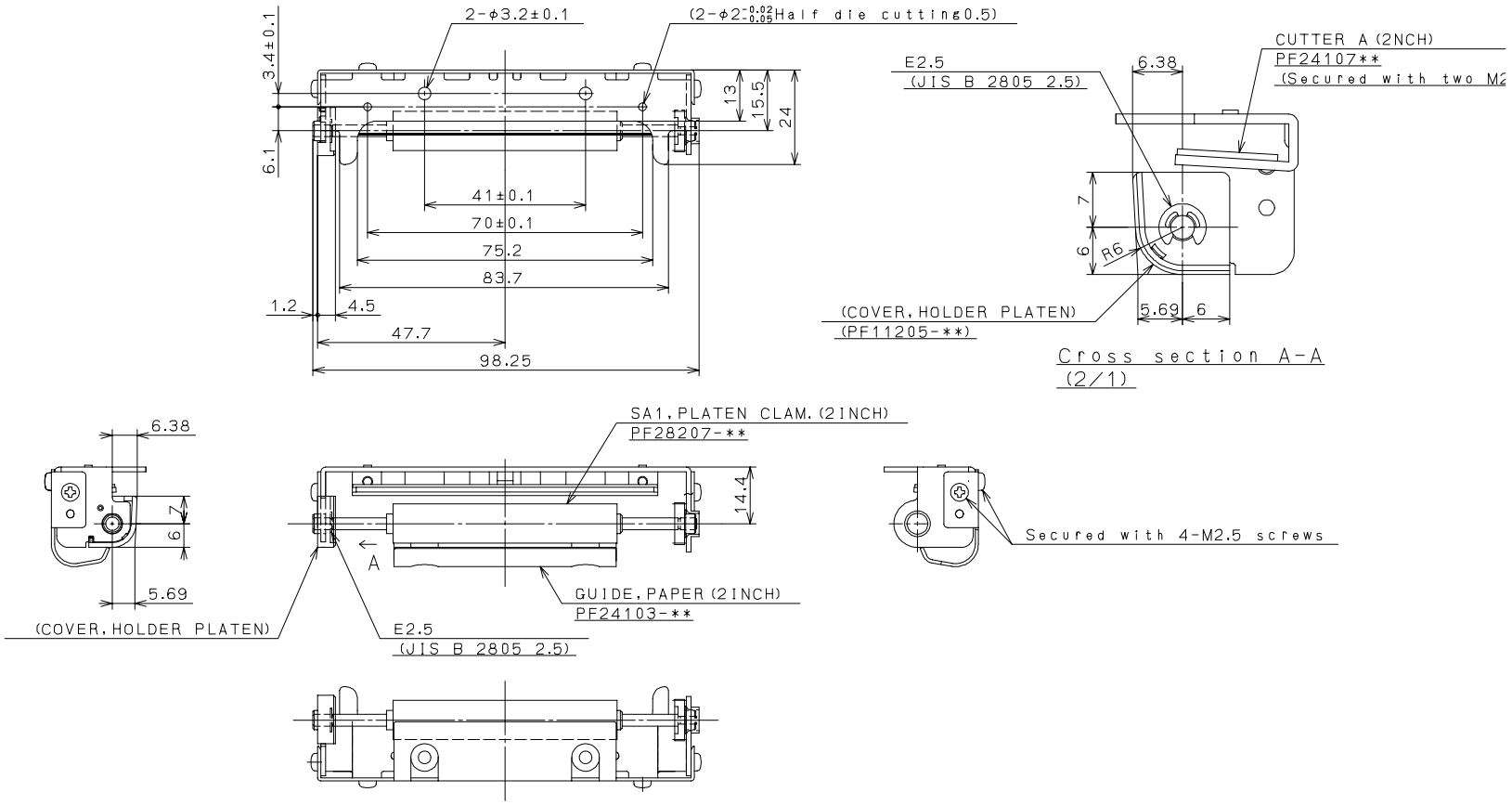


Figure 12-4 UNIT, PLATEN HOLDER

12.5 UNIT , AUTO CUTTER

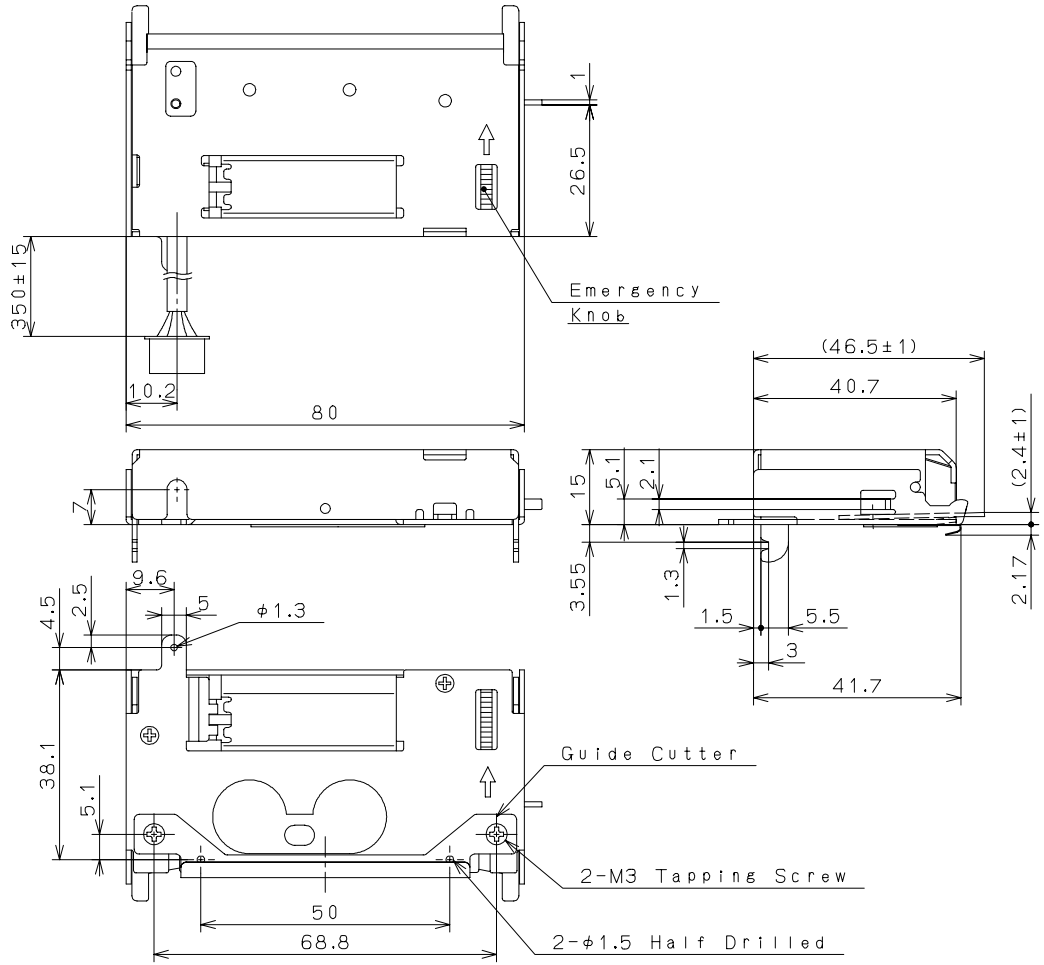


Figure 12-5 UNIT, AUTO CUTTER

12.6 EXTERNAL SHAPE OF (Not Install paper cutter)

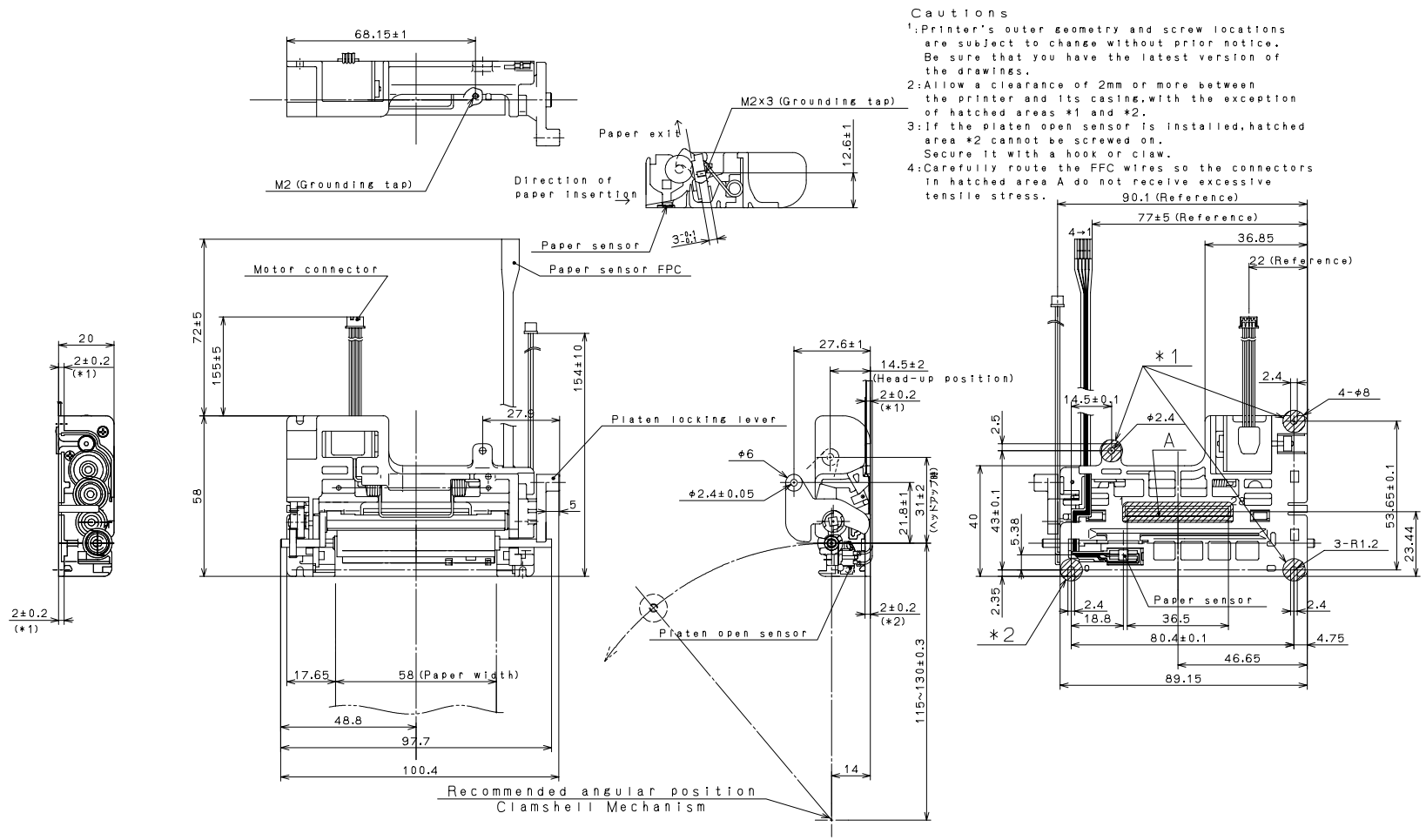


Figure 12-6 EXTERNAL SHAPE OF Not install paper cutter

12.7 EXTERNAL SHAPE OF (Install paper cutter)

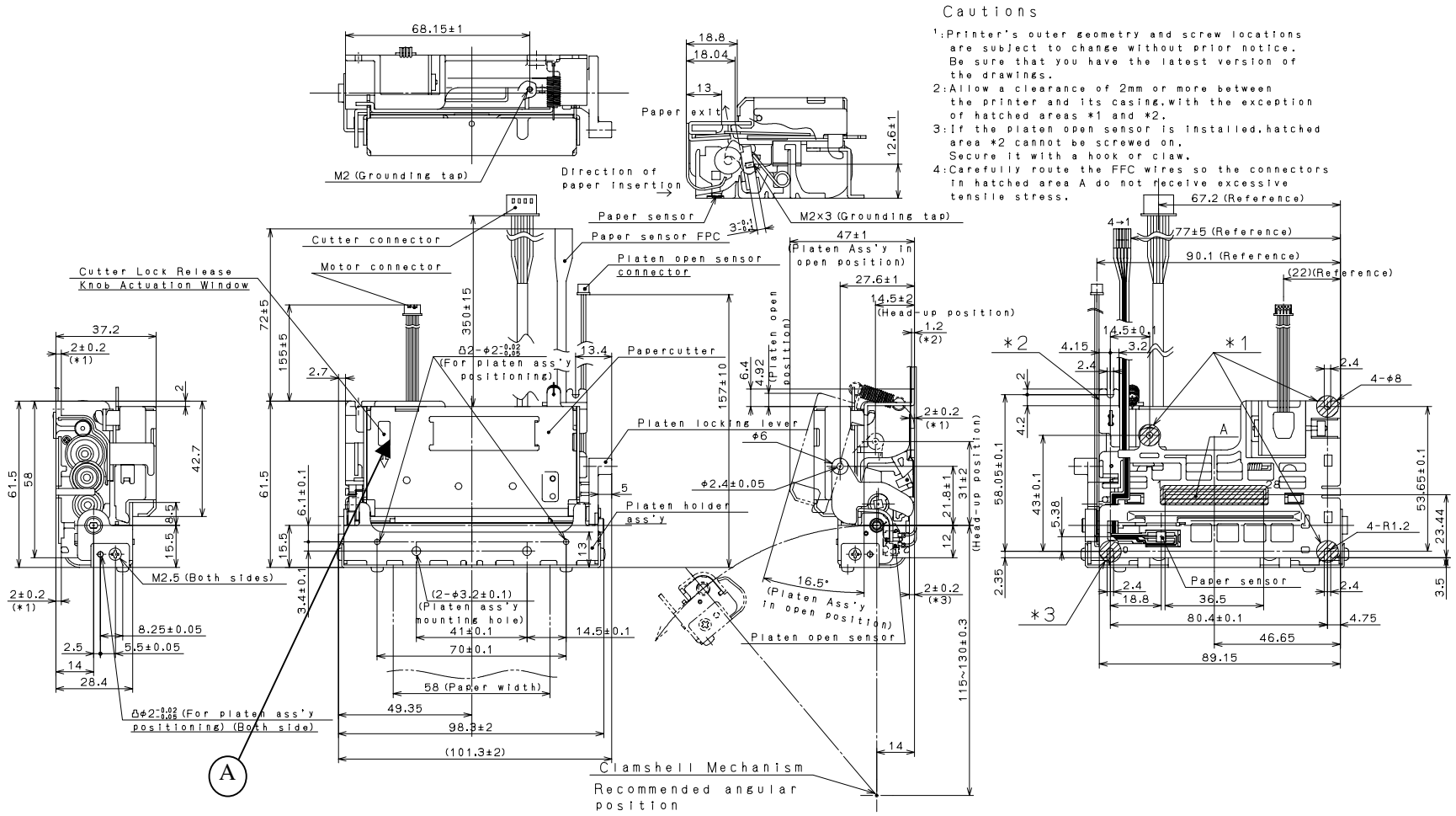


Figure 12-7 EXTERNAL SHAPE OF install paper

13 NOTES ON DESIGNING EXTERIOR CASE AND PLATEN OPENING MECHANISM

13.1 Fixing Printer

The exterior case should be designed to allow a clearance of 2.0 mm or more all around the printer, with the exception of screw pads (approx. ϕ8 mm). If no clearance is allowed at all, the printer might sustain distortion when it is screwed to the casing. (For mounting screw locations, see Fig. 12-4, and Fig. 12-5.)

13.2 Cutterless Models

13.2.1 Paper Sensor and Paper Guide

The paper sensor is located as illustrated in Fig. 13-1. Use a paper guide to control the gap across paper sensor and paper surface to 1.7 mm or less. For paper guide geometry, see Figure 12-2, "UNIT, PLATEN HOLDER". For cutter models, no additional paper guide is needed since the platen holder ass'y has it.

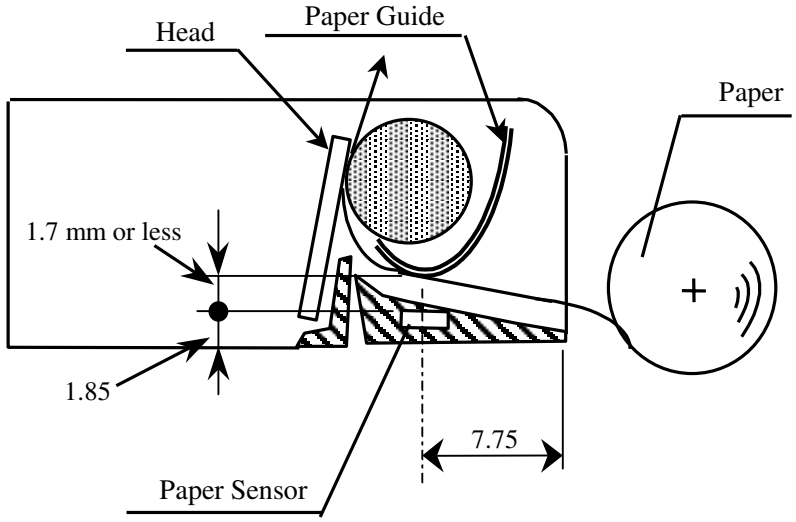
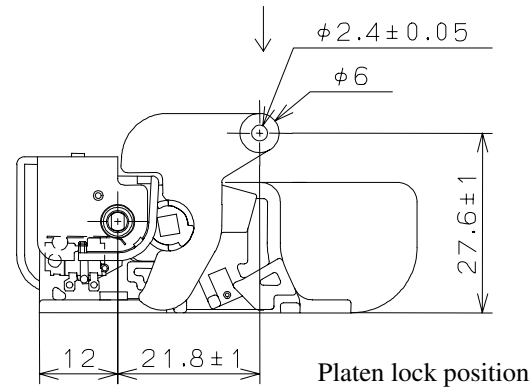


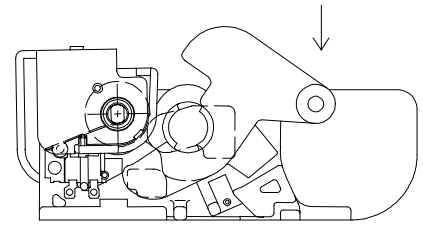
Figure 13-1 Paper Sensor and Paper Guide

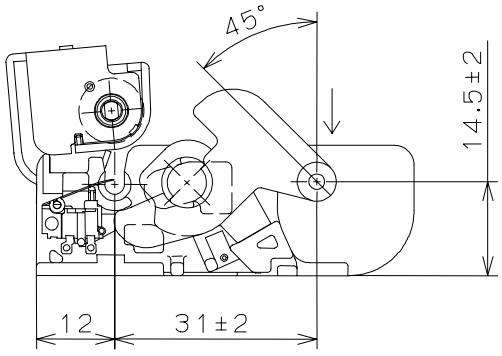
13.2.2 Platen Opening Mechanism

The platen is opened when the platen lock lever is pressed down into the unlock position as shown in Fig. 13-2. The lever pressing mechanism should be so designed that it can firmly lock the platen opening lever.



Platen lock position





Platen open position (lever locked up)

Figure 13-2 Platen Opening Mechanism

13.2.3 Platen Lock

The platen is normally locked up with the platen locking lever described in the previous paragraph, 13.2.1, "Platen Opening Mechanism". The platen holder ass'y with the geometry as shown in "A" in Figure 13-3 is required to unlock the platen. For detailed dimensions of the platen holder ass'y, see Figure 12-2, "Recommended Unit, PLATEN HOLDER".

When section A of platen holder ass'y pushes section B on platen lock lever, the lever is unlocked and the platen is locked up in position to be ready for printing.

For the rotational center of the platen holder ass'y, refer to section 13.4, "DESIGN NOTES ON PLATEN HOLDER ASS'Y COVER".

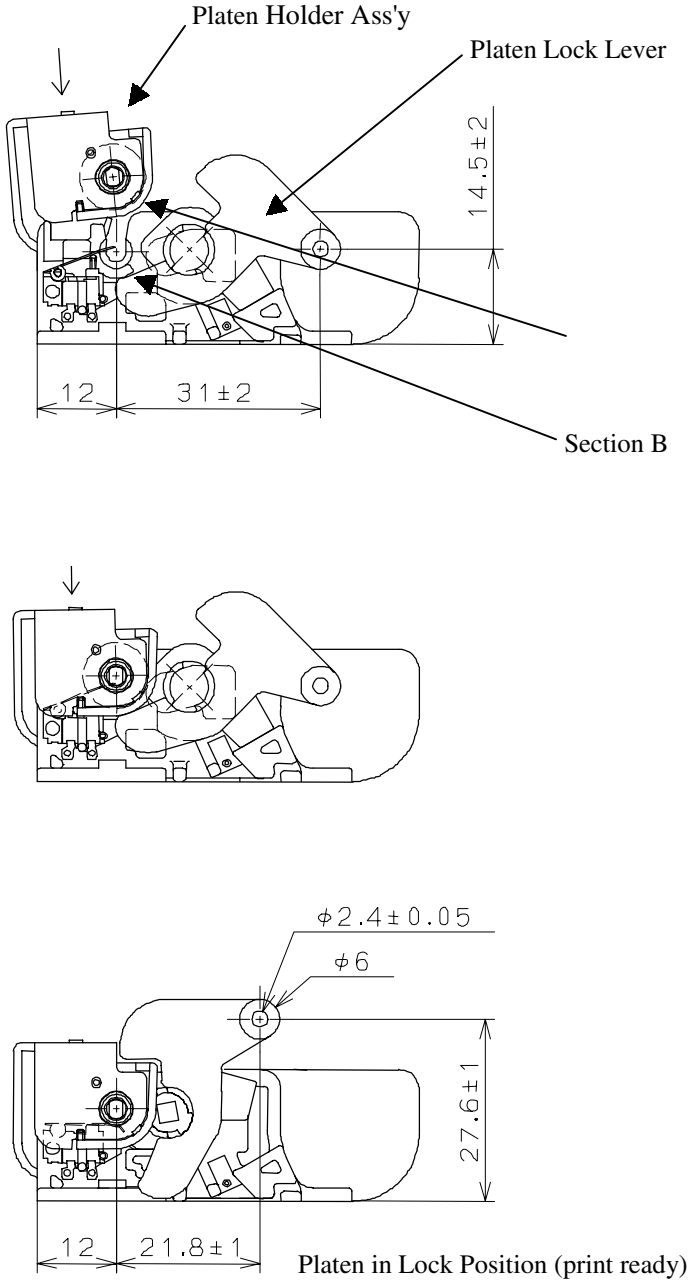


Figure 13-3 Platen Lock

13.3 For Cutter Models

13.3.1 Platen Opening Mechanism

The platen is unlocked when the platen lock lever is pressed down into the Lock position as shown in Fig. 13-2.

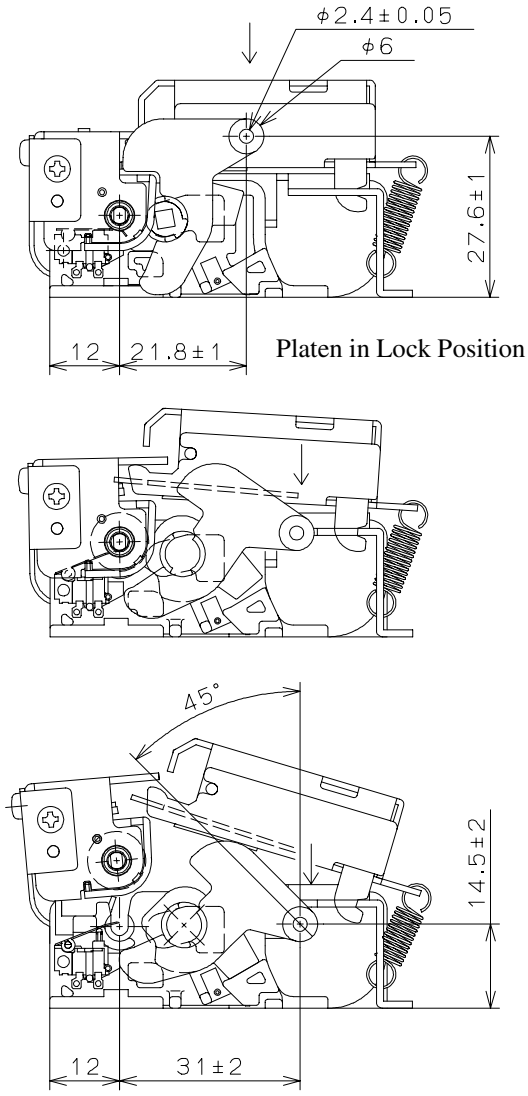


Figure 13-4 Platen Opening Mechanism for the Cutter Models

13.3.2 Platen Lock

The platen is locked up in print ready position when the platen holder ass'y cover is closed, automatically unlocking the platen lock lever. The relative positioning of the platen holder ass'y with printer should be carefully designed by referring to section 13.4, "DESIGN NOTES ON PLATEN HOLDER ASS'Y COVER" in order to make sure that the paper cutter's stationary blade is properly engaged with its moving blade when the platen holder ass'y is closed. If the relative positioning is not adequate, the paper cutter may fail to operate properly.

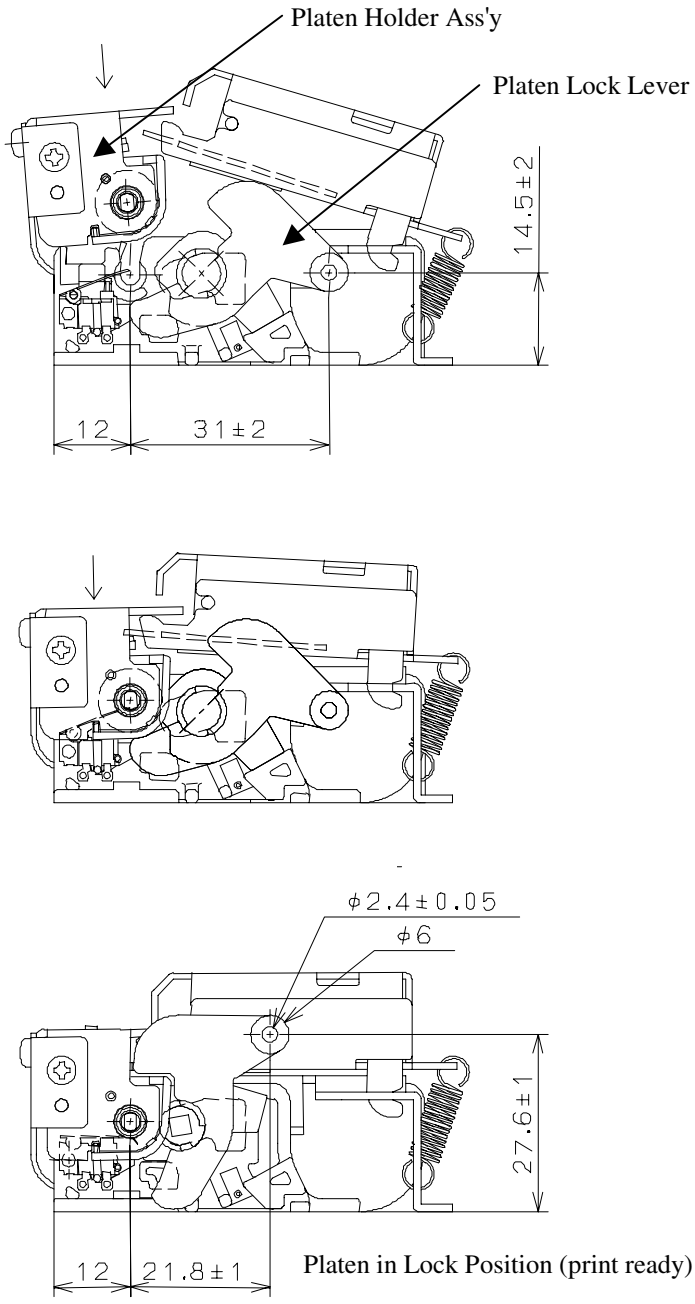


Figure 13-5 Platen Locking Mechanism for the Cutter Model

13.4 Design Notes on Platen Holder Ass'y Cover

13.4.1 Rigidity of the Platen Holder Ass'y Cover

Locking the platen base ass'y into the printer requires a pressure of around 9.8 N (cutter model). To relieve torsional strain to the platen base cover, use an adequate reinforcement across the rotational center of the cover and platen base ass'y. Torsional displacement across the left and right sides of the platen base cover should not exceed 1 mm. If displacement is too large, the platen may not be locked up into position due to cutter blade disengagement.

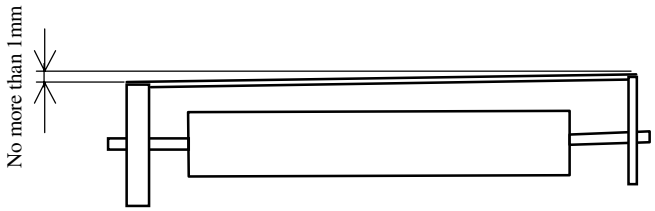


Figure 13-6 Rigidity of Platen Holder Ass'y

13.4.2 Lateral Displacement of Platen Holder Ass'y in Relation to Printer

Lateral displacement of the platen holder ass'y in relation to the printer should not exceed ±0.2 mm.

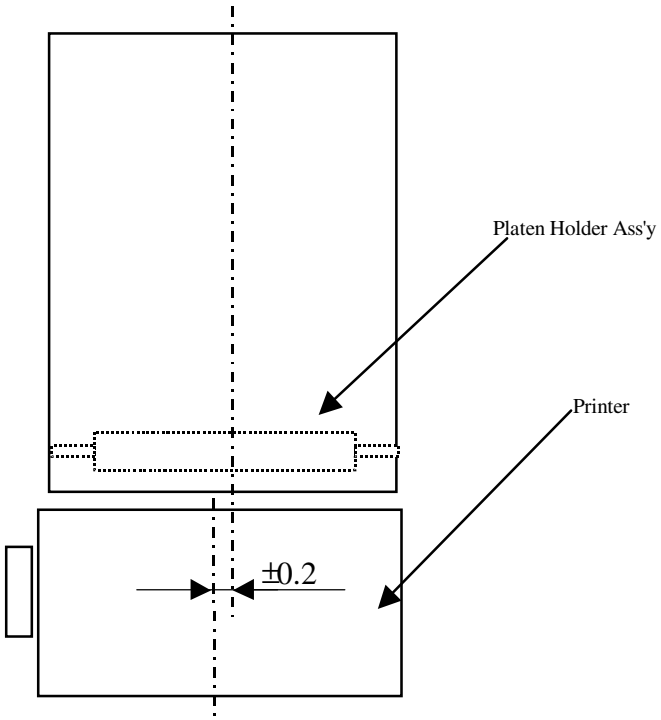


Figure 13-7 Lateral Displacement of Platen Holder Ass'y in Relation to Printer

13.4.3 Rotational Center of Platen Holder Ass'y

The rotational center of the platen holder ass'y should be designed as illustrated in the following. For dimensions other than those given in the following figure, see section 12, "EXTERNAL SHAPE".

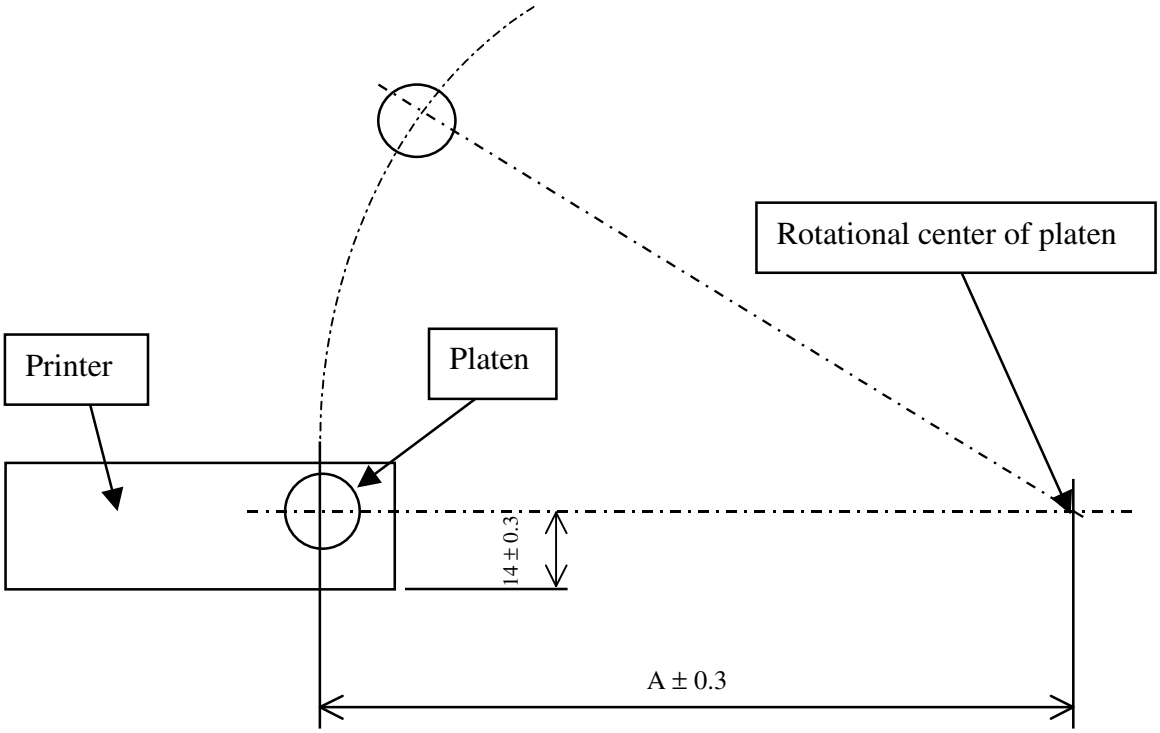


Figure 13-8 Vertical Displacement of Platen Holder Ass'y in Relation to Printer

The distance (A) between the platen center and the rotational center of platen must be 115 to 130 mm.
Tolerance for dimension A should be ±0.3 mm.

13.5 Design Notes on Paper Cutter Mount (Cutter Models)

(1) Because the paper cutter must be lifted whenever the platen is opened, a sufficient marginal space should be allowed above the paper cutter. See Figure 12-7, "12.7 EXTERNAL SHAPE OF (Not Install paper cutter)".

(2) On top of the paper cutter is a manual unlocking lever. The exterior case should be so designed that the lever is easily accessible whenever the cutter is in the Lock position. For the location of the manual unlocking lever, see Figure 12-7, "12.7 EXTERNAL SHAPE OF (Install paper cutter)".". Once the cutter is locked up, the platen will never be opened unless the cutter is manually unlocked with the unlocking knob.

(3) The exterior case should be carefully designed so the cut edge of roll paper will not enter the platen holder ass'y, with care to keep the moving blade of paper cutter from interfering with the casing (dimensions A and B should be as short as possible). See Figure 13-9.

(4) The paper exit in the exterior case should be designed not to block the leading edge of paper discharged from the auto cutter under any circumstance.

(5) The distance (C) between the paper exit in the auto cutter and that in the exterior case g should be no less than 20 mm. The height (D) of the paper exit in the exterior case should be as large as possible yet not so large as to allow an operator's finger. See Figure 13-9.

(6) The paper exit in the exterior case should be designed to keep any foreign object from dropping into the printer. See Figure 13-9 (section E).

(7) The paper exit in the exterior case should have such a construction that the paper discharged from the paper cutter is led out through a straight path without any bends. Otherwise, a paper jam could occur.

(8) The exterior case should have adequate interlocks that will shut off the power to the printer whenever its cover is opened for maintenance or paper loading.

(9) The platen base should have an adequate interlock that will shut off the power to the paper cutter whenever the platen is opened. Otherwise the moving blade of the paper cutter could protrude from the cutter in the event of CPU runaway, possibly causing an injury.

(10) The stationary blade of the paper cutter is exposed on the platen holder ass'y. Be sure to cover the blade with a safety cover to prevent direct physical contacts. Also apply a warning label on the safety cover to alert the operator to potential danger.

(11) Never attempt idle cutter operation with no paper loaded, as it will significantly shorten the cutter life and may cause various other trouble.

(12) To prevent unexpectable injury, never touch the cutter unlocking lever while the cutter is operating.

(13) Under normal printing condition or in the event of paper jam, do not forcibly pull the paper out of the printer as it may damage the printer mechanism.

(14) The paper cutter is not usable with label rolls. If used, paper jam or other trouble may result.

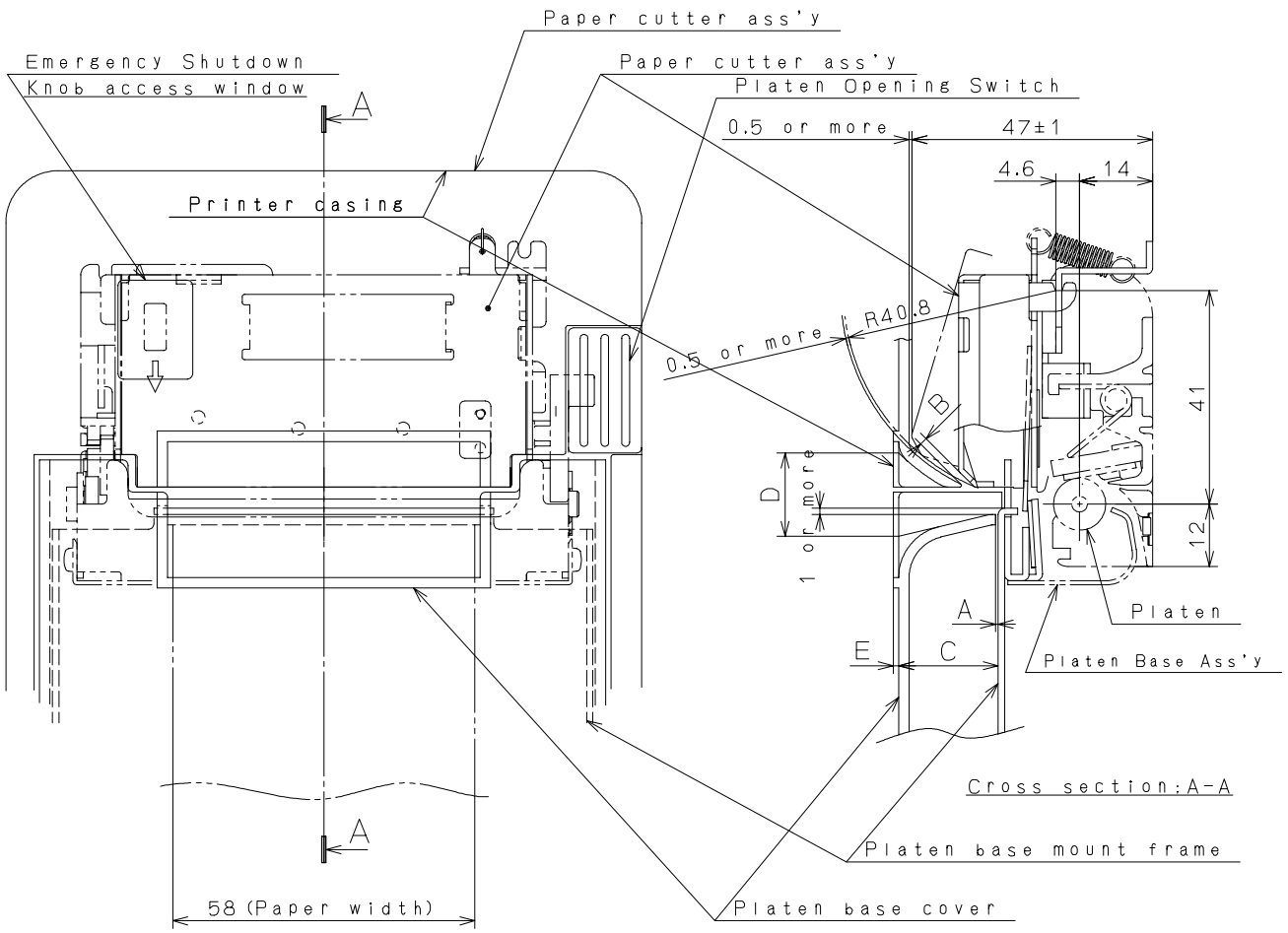


Figure 13-9 Notes on Designing Exterior Case

13.6 Roll Paper Holder

(1) The roll paper holder should hold a paper roll so its center core is in parallel with the platen.
(2) The roll paper holder should hold the center of the paper roll. The tray holder may cause irregular line spacing.
(3) The backward load to the printer should not exceed 50g.
(4) The inner width of the paper holder should be 58.4 ±0.1 mm.
(5) Roll paper's skew angle to the printer should not exceed ±1.5 deg.

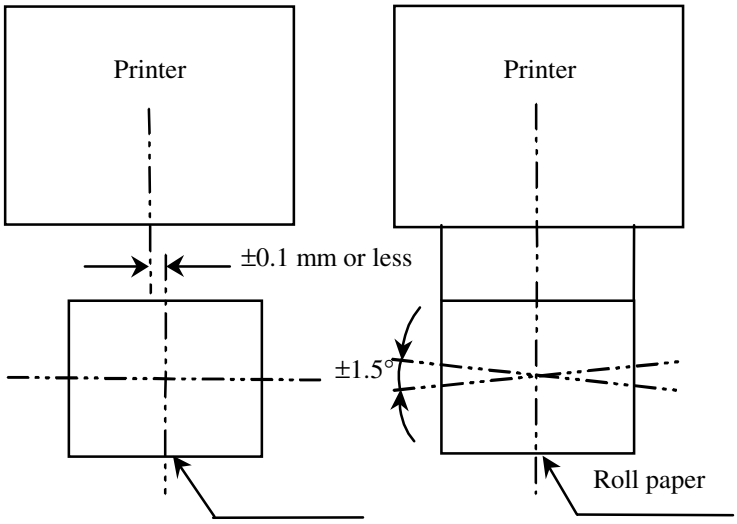


Figure 13-10 Paper Holder Positioning

(6) Paper
Use a paper guide as illustrated in Figure 13-11 across the printer and roll paper holder to prevent possible paper skew. The inner width of the paper guide should be 58.4 ±0.1 mm. The paper guide should guide paper to just in front of the printer's paper guide.

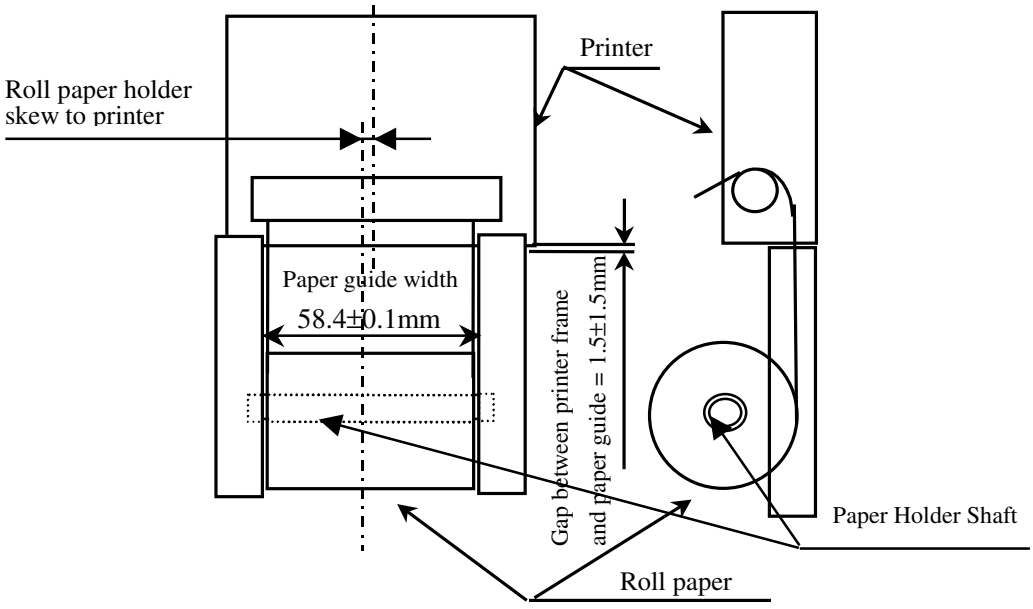


Figure 13-11 Relative Paper Guide Positioning

13.7 Print Surface and Its Orientation

The roll paper's print surface and its orientation should be as specified in Figure 13-12. Normal print quality will not be guaranteed with the roll paper as shown in Figure 13-13.

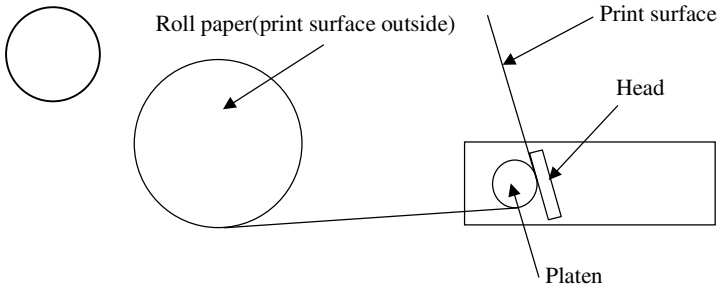


Figure 13-12 Print Surface and Its Orientation

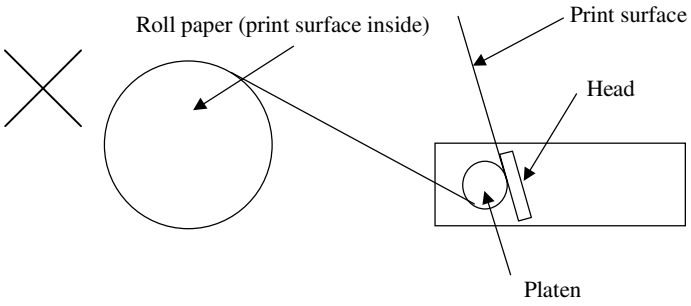


Figure 13-13 Wrong Print Surface and Its Orientation

13.8 Notes on Print Area

The print area on the paper may have lateral displacement due to a tolerance of paper width of 58 +0/-1 to the width of print head (54 mm), print head mounting tolerance (±0.2 mm), and tolerance of paper insertion port (80 0/+0.4). Print data should be created by taking into account the tolerance for print area to the following paper geometry.

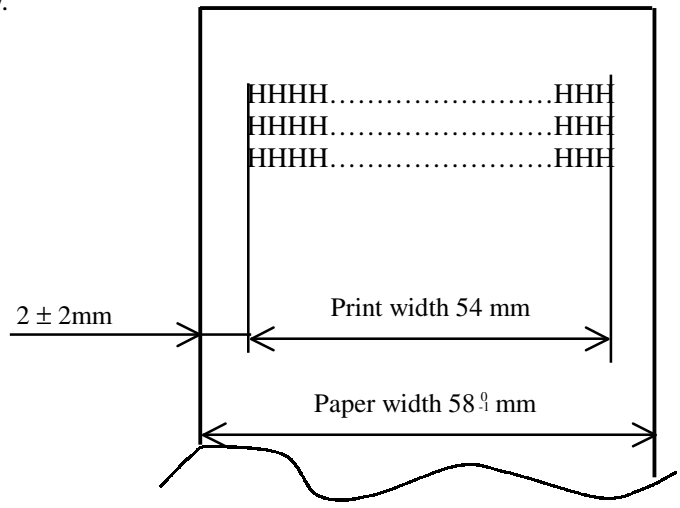


Figure 13-14 Print Area Relative to Paper

13.9 Others

(1) The paper cutter should be carefully designed so it won't interfere with the leading edge of discharged paper.
(2) The exterior case should be carefully designed so the leading edge of printed paper won't enter the paper insertion port again.

14 SPECIFICATIONS FOR AUTO CUTTER (OPTIONAL)

14.1 Features

- Super thin auto cutter unit easily installed on various small printers.
- Little paper dust produced by using the same cutting method as scissors.
- Less troubles and low price due to introduction of a simple mechanism.
- Capable of both full cut and partial cut.

14.2 Specifications

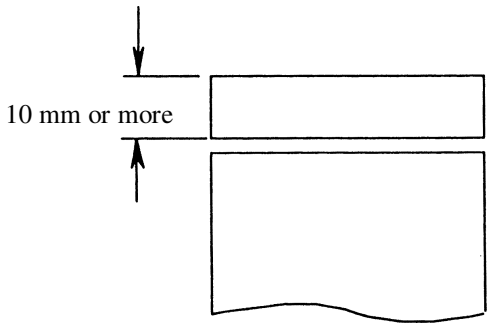
Table 14-1 General Specifications

Model	ACS-220C	ACS-220CF
Cutting method	Slide shearing method	
Printing paper	Paper width: 58 mm	
	Partial cut : Paper width : 0.06 to 0.15 mm Full cut : Paper width : 0.06 to 0.105 mm	Full cut : Paper width : 0.10 to 0.15 mm
Allowable cutting Frequency	20 cuts/min	
Life*	300,000 cuts with thermal paper of 80 mm paper width x 0.15 mm paper thickness.	
Operating temperature and humidity	0 to 45°, 5 to 85% (No dew condensation)	
Outer dimensions	(see 12.7 EXTERNAL SHAPE OF (Install paper cutter).)	
Weight	180g	180g

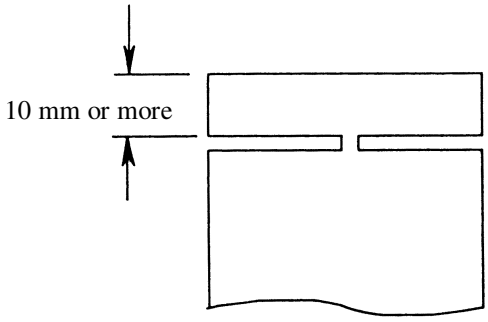
*The life depends on the paper quality, paper width, and paper thickness. Confirm it with the paper actually used.

14.3 Paper Cutting Condition

1) Full cut (Complete cut)



2) Partial cut (One-point remaining cut)



(Note) A cutting length should be 10 mm or more.

14.4 Switch Specifications

1) Type: D2F-01L (Made by OMRON)
2) Contact rating: Rated voltage 5 V DC
   Rated current 2 to 10 mA
3) Chattering

(Note) A chattering time should be fully confirmed with the circuit actually used.

14.5 Motor Specifications

Table 14-2 Specifications for Cutter Motor

Auto Cutter Type	Motor Type	Motor Terminal Voltage	Starting current
ACS220C ACS220CF	DH-515 FN-120-A	24VDC±10%	Approx.0.8A(24V, 25°C)

14.6 Connector Specifications

1) Connector pin layout table

Table 14-3 General Specifications

Pin No.	Wire Color	
1	Red	Motor
2	Black	Motor
3	Gray	Switch
4	Gray	Switch

2) Connector Type

Table 14-4 Terminal Type

No.	Function	Pins	Type	Recommended connector of the mate
1	Cutter motor/Switch	4	MOLEX 5264-04	MOLEX 5267 5268

14.7 Driving Method

14.7.1 Example of Driving Circuit

(Note) Take chattering prevention of the switches into account.

- Recommended motor driver: TOSHIBA TA8428K

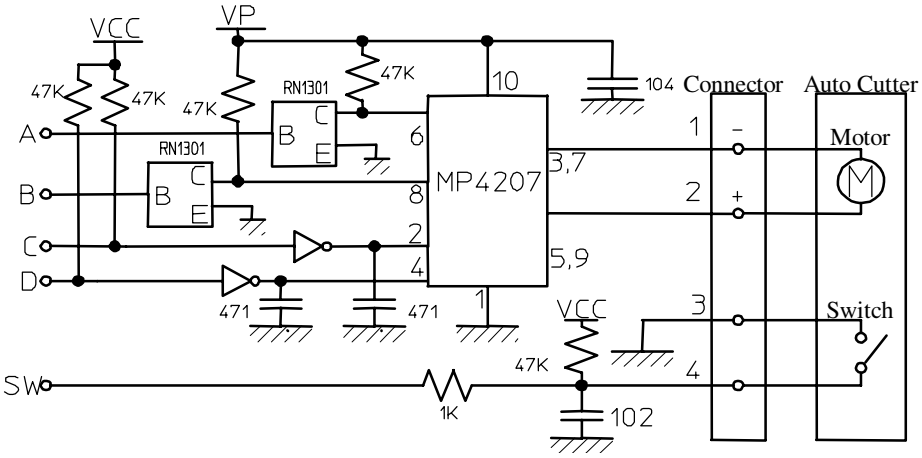


Figure 14-3 Sample Motor Driver Circuitry

14.7.2 Driving the Motor

1) Motor drive sequence

Table 14-5 Motor Drive Sequence

	Forward	Reverse	Brake	Stop
X	H	L	H	L
Y	L	H	H	L

2) Driving from a stop
Apply a specified voltage to the stopping motor to drive it.

3) Reverse
Stop applying a voltage to the rotating motor. Apply a voltage to the opposite side after waiting for about 1 ms.

14.7.3 Drive Flow Chart of Initialization

Whenever the clamshell platen is opened/closed or the printer is turned on, initialize the paper cutter as per the flowchart in Figure 14-4.

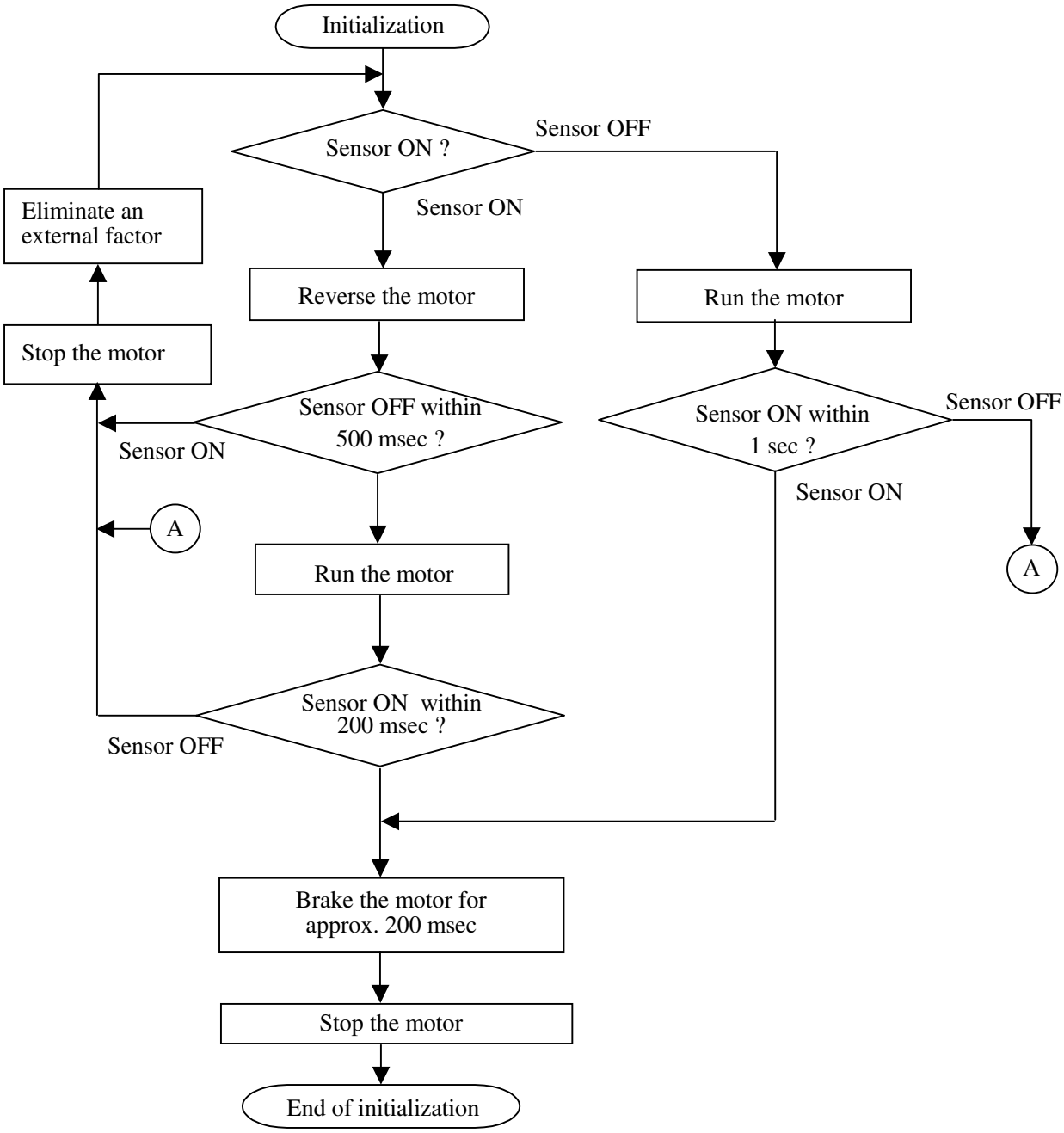


Figure 14-4 Initialization Flow

Note 1. When switching the sensor from ON to OFF and OFF to ON, implement sensor detection, taking chattering into account.

2 When switching a motor drive sequence, be sure to turn on a stop signal (1 ms).

3 Choose the optimal motor braking time depending on your specific operating condition

14.7.4 Drive Flow Chart of Full cut (Complete cut)

Figure 14-5 contains a paper cutter motor driving flowchart for full cut:

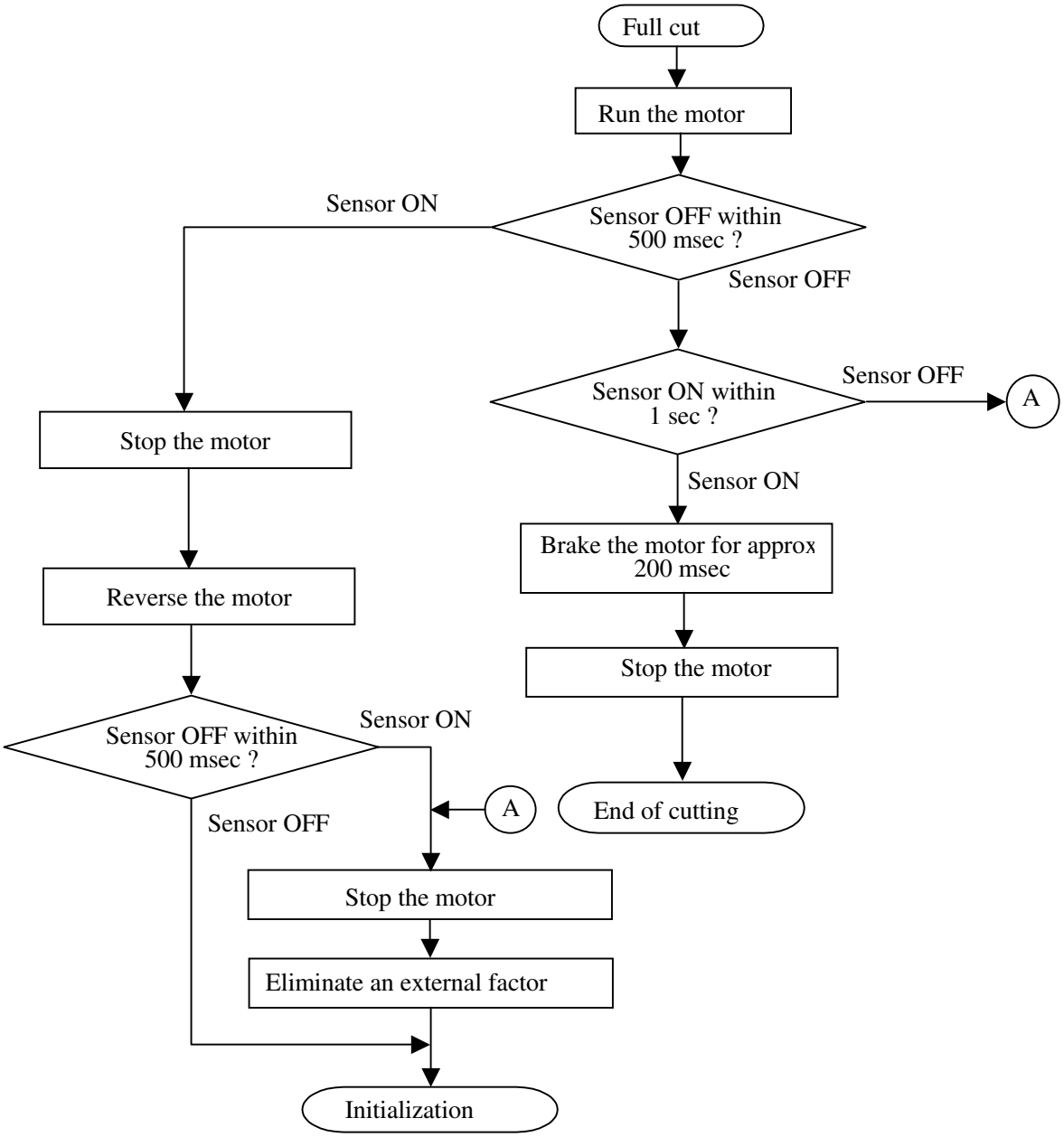


Figure 14-5 Motor Driving Flowchart for Full Cut

Note 1. When switching the sensor from ON to OFF and OFF to ON, implement sensor detection, taking chattering into account.
2. When switching a motor drive sequence, be sure to turn on a stop signal (1 ms).
3. Choose the optimal motor braking time depending on your specific operating condition.

14.7.5 Drive Flow Chart of Partial cut (One-point remaining cut)

Figure 14-6 contains a paper cutter motor driving flowchart for partial cut:

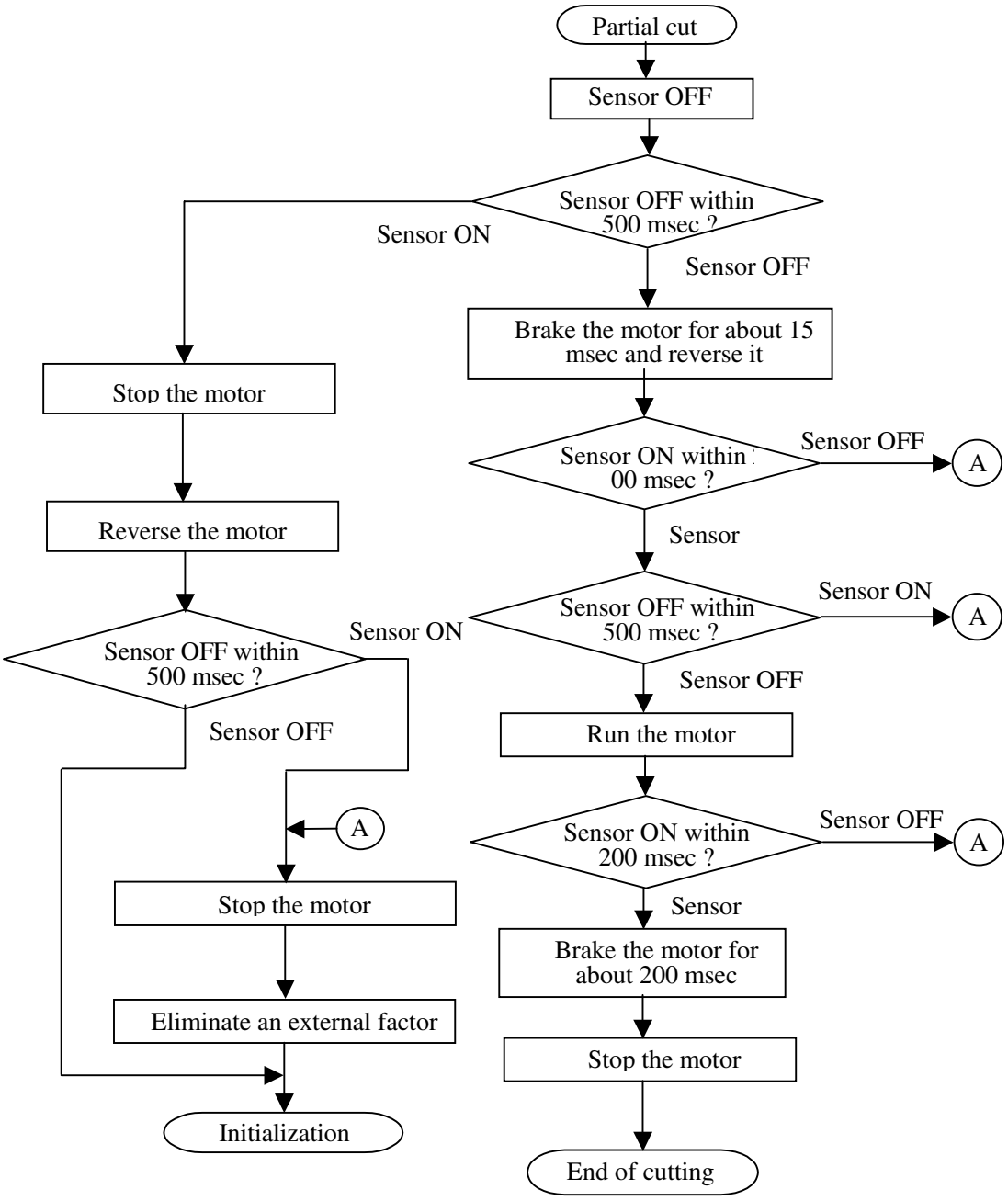


Figure 14-6 Motor Driving Flowchart for Partial Cut

Note 1. When switching the sensor from ON to OFF and OFF to ON, implement sensor detection, taking chattering into account.
2. When switching a motor drive sequence, be sure to turn on a stop signal (1 ms).
3. Choose the optimal motor braking time depending on your specific operating condition.

14.8 Timing Chart

14.8.1 Timing Chart of Full cut

Figure 14-7 contains a motor drive timing chart for full cut:

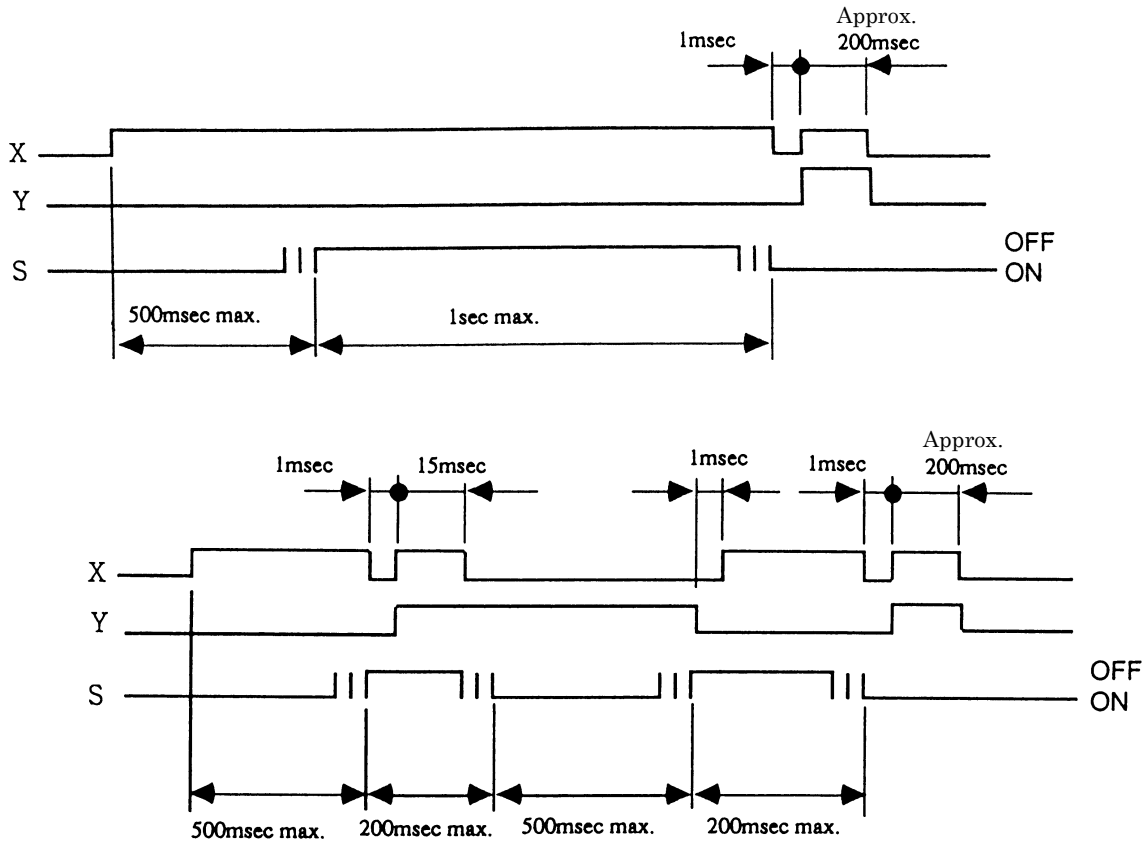


Figure 14-8 Timing Chart for Partial Cut

Note 1. When switching the sensor from ON to OFF and OFF to ON, implement sensor detection, taking chattering into account.

2. When switching a motor drive sequence, be sure to turn on a stop signal (1 ms).

14.9 PRECAUTIONS FOR HANDLING

14.9.1 Unlocking the Motor

When the motor is locked due to a trouble such as jamming of the paper, unlock it in the following procedure.

1) Turn off the motor.
2) Reverse the motor in order to return a cutter blade.
3) After the cutter blade has returned to its home position, turn off the motor and eliminate an external factor.
4) If it does not return to its home position, turn off the motor immediately, turn an emergency knob shown in the figure below in the arrow-indicated direction to return the blade, and eliminate the external factor. In order to prevent a danger, use a pair of tweezers, screwdriver, ball-point pencil, and so on to turn the emergency knob.

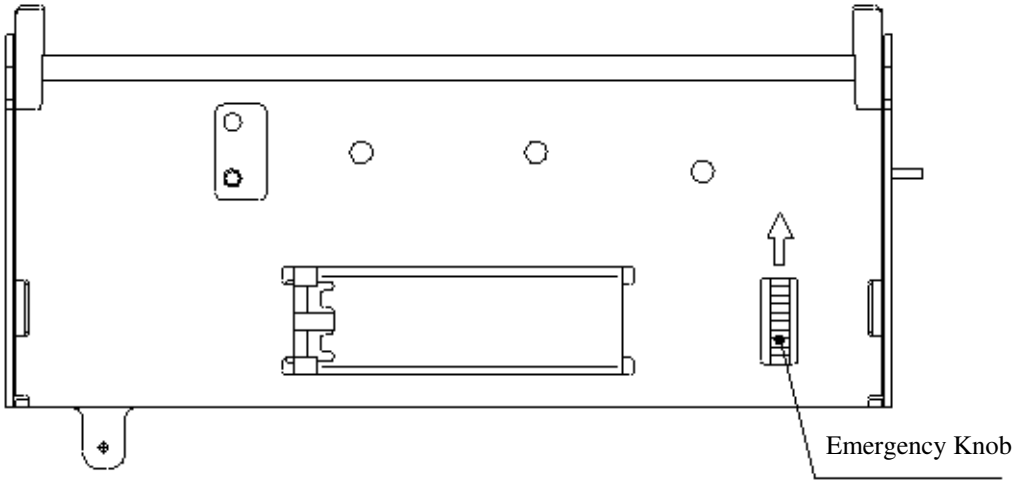


Figure 14-9 Emergency Knob

14.9.2 Precautions for Safety

1) Never touch the blade with your hand.
2) Do not disassemble the cutter unless necessary.
3) When handling the auto cutter unit, turn off the power.
4) When connecting the auto cutter unit, make sure that the polarity is correct.

15 PARTS LIST BY MODELS

Table 15-1 contains a model-dependent parts list for the LT1321 Printer:

Table 15-1 Parts List by Models

	Part	LT1221H	LT1221HC	LT1221HA	LT1221HAC
1	Printer	Yes	Yes	Yes	Yes
2	Paper cutter stand	No	Yes	No	Yes
3	SA1,PLATEN CLAM	Yes	No	Yes	No
4	Platen holder ass'y with stationary blade	No	Yes	No	Yes
5	Auto Cutter ACS220 or ACS220CF	No	Yes	No	Yes
7	Platen open sensor	Yes	Yes	Yes	Yes

Note. For cutter model choice, "see Section 14.2, SPECIFICATIONS".

16 ENVIRONMENTAL CONDITIONS

16.1 Operating temperature

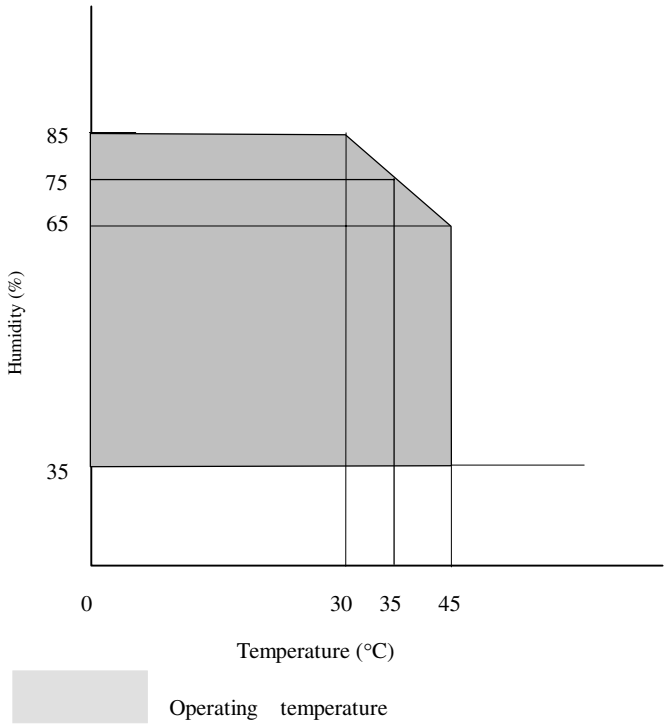


Figure 16-1 Operating temperature

16.2 Print temperature

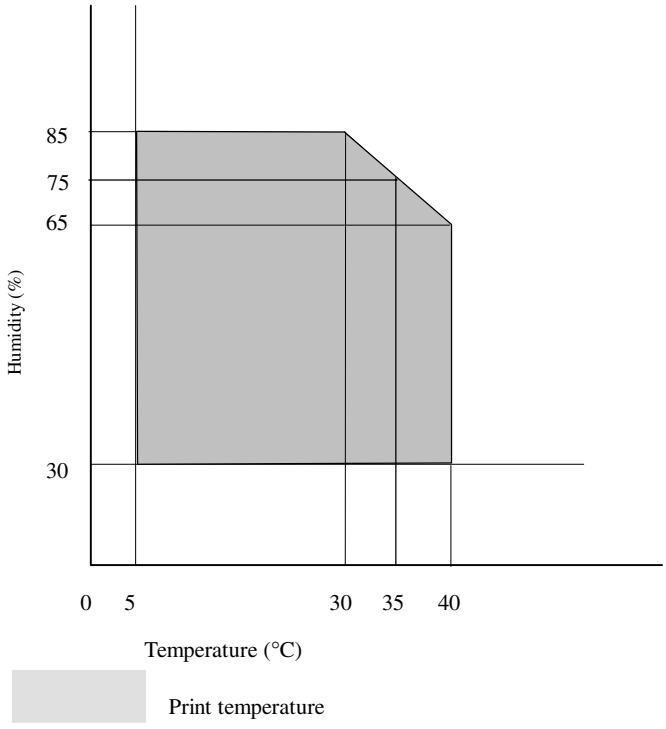


Figure 16-2 Print temperature

16.3 Storage temperature

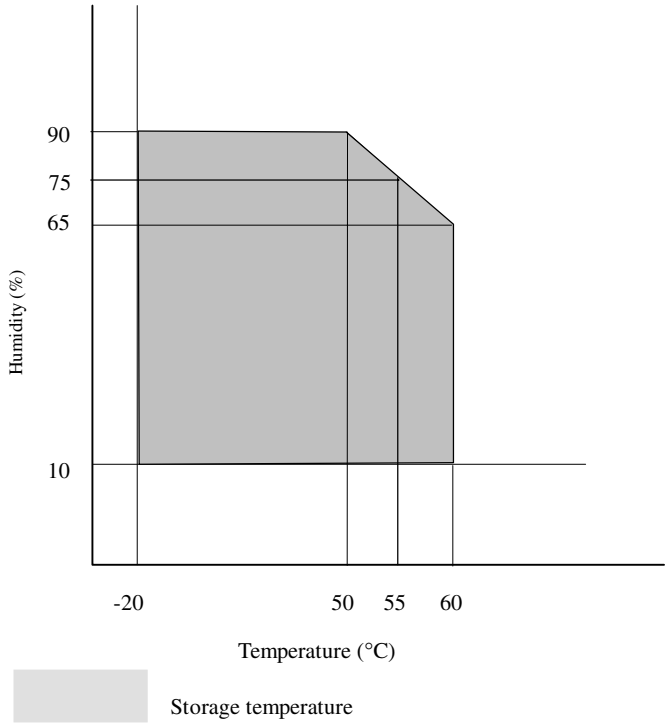


Figure 16-3 Storage temperature