THERMAL PRINTER
FTP-628MCL101#50

PRODUCT SPECIFICATION
(Corresponds to RoHS)

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Q Q: 343599767; 446317379

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02	07.03.05	M.Tsuchiya		For Vdd=3v (p17, 22, 24, 36change) Y.Mori
Design	06.01.14	Y.Takabatake	Inspect.	Approv. Y.Mori

Name: FTP-628MCL101#50 SPECIFICATION

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1. Guideline for product recycling

- Fujitsu Component Co., Ltd. is making an effort to promote the environmental management per ISO 14001 with a policy "Better corporate activities while valuing the environment"
- The below lists the components and their materials used in this printer. Refer this list when the printer is to be recycled.

FTP-628MCL101#50 List of materials

No.	Name of components	Material
1	Printer frame	Zinc alloy
2	Gear cover	POM resin
3	Rubber roller	Silicone rubber + SUS
4	Platen gear, middle gears 1, 2 and 3	POM resin
5	Pulse motor	SPCC + iron + copper wire
6	Paper guide	PC resin
7	Thermal head	Aluminum + ceramic ubstrate
8	Head pressuring spring	SUS
9	FPC	PI, Sn+Cu plating

【Abbreviations for the materials used】

SUS: Stainless steel
POM: Polyacetal resin
PC: Polycarbonate
SPCC: Rolled steel plate
PI: Polyimide

・This product corresponds to RoHS restriction.
・Please refer to the product specifications (drawing number:A1NA02265-1002) for tolerance of the RoHS restriction.

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2. Product design, warnings and cautions for using the product

2-1. Handling the printer

(1) When handling this printer, be sure to take any preventive measure against static electricity such as Disposable Wrist Strap in order to prevent damages of inner parts of the printer caused by the static electricity.

(2) When attaching the platen part to the platen retainer, pay attention not to flaw or damage or smear the rubber part of the platen, the platen gear, and the bearing part (particularly, do not attach any oil or grease and foreign material on the rubber part).

(3) Never attempt to touch the thermal head surface with bear hands. Attaching any oil or grease such as oils from palms on the heating element part may be shorten the lifetime of the thermal head. In case that any oil and grease or foreign materials are attached on it, perform the cleaning immediately. (Section 2-4 describes the cleaning.) In addition, pay attention not to hit it with something hard such as a driver.

(4) When attaching the platen to the platen retainer of the casing, make sure that the attaching orientation of the right and left is correct.

(5) The thermal head and FPC are shipped as they are connected. When installing the printer, do not pull or apply any extra force in order to avoid the connected part of the thermal head and FPC from being disconnected or deviated. Using the printer with the part is deviated may destroy the head. If it is deviated or disconnected, contact us.
In addition, for the connection of FPC and the control circuit side, as shown in the figure below, the checking mark for attachment is seen on FPC; therefore, follow the mark and make sure not to deviate when attaching.

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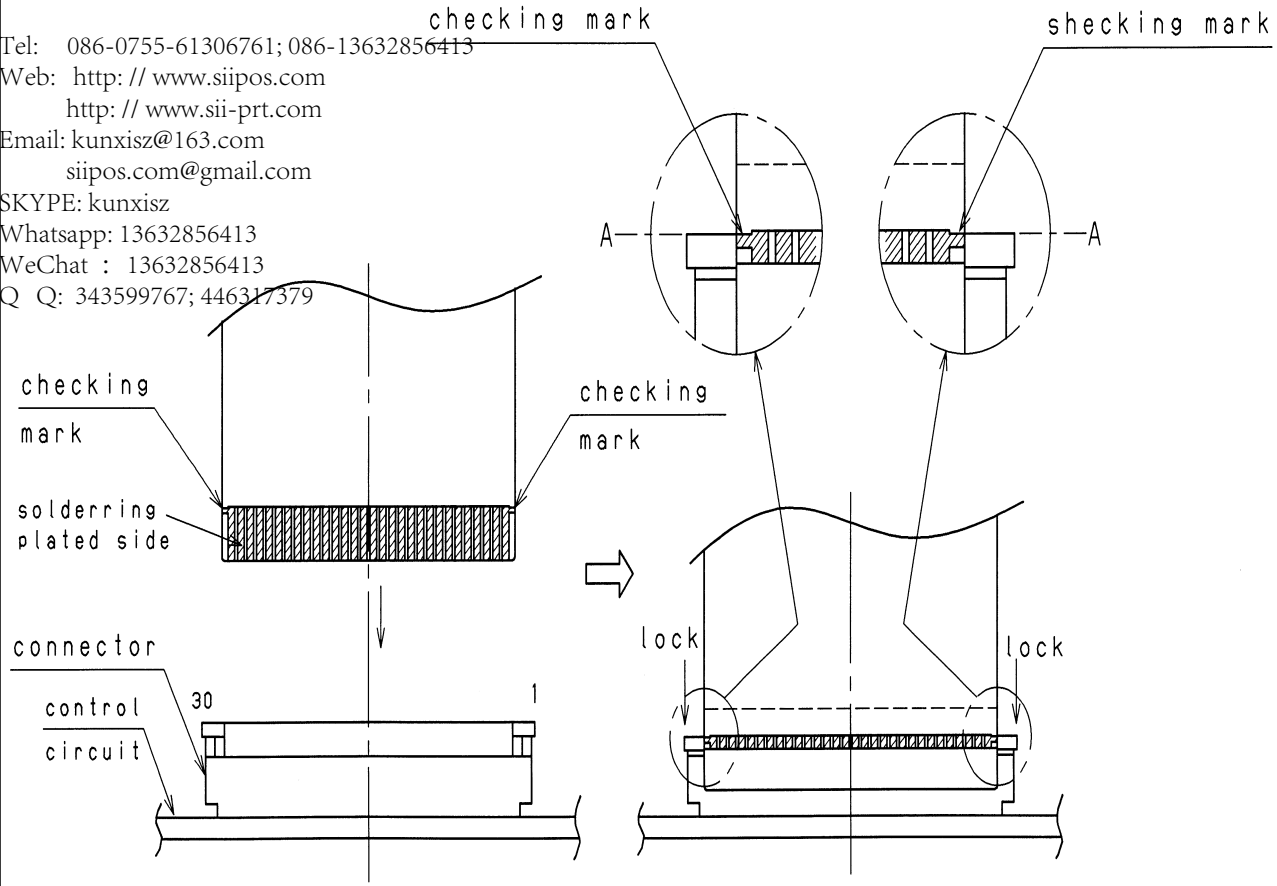

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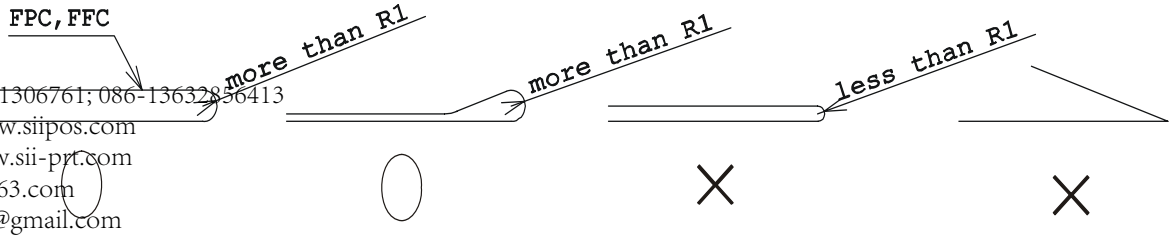
(6) Never attempt to touch FPC and the probe part of the signal line of FFC (parts which are soldering-plated) and not to hit them with something hard.

(7) Do not perform the contact bending of FPC because it may cause the disconnection. If FPC requires to be bent, the bending should be more than R1. Once it is bent, do not rework (straighten or bend backward).



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(8) This printer has a structure such that the platen part is removed from the printer cabinet; therefore, applying the load on the platen part allows removal of the part from the cabinet. Therefore, if any paper ejected from this printer is pulled away with an unnecessarily strong force, it may cause the platen gear to get off the track and damage the gear. Do not attempt to pull any paper ejected from the printer. In addition, when stopping the paper feeding with the hand cutter attached on the main body side, take extra care not to let the gear get of the track. Furthermore, installing any licking system on the casing side of the main body side is recommended (refer to the lock mechanism on the next page).

(9) If any voltage is applied to the thermal head when the head or paper is wet due to condensation, it may be damaged by electrolytic corrosion; therefore, when using the printer, pay attention to the following items.

* Do not apply any electric power to the printer when it is not used.
* Do not perform the printing with any wet paper.
* Do not apply any electric power to the printer under any environment where any dew condensation is possible to occur.
* Turn off all electric power to the head immediately when condensation occurs. Use the head only after the head is completely dried.
* Depending on the environment where the printer is used (the low temperature or high humidity), condensation may be caused by water vapor generated from the used paper when performing the printing of the high printing rate (solid fills, zigzag printing); therefore, the environment should be considerably evaluated.

(10) When any paper is not set at the printer, be sure to separate the head and the platen. If the paper is run out during the printing, stop all actions of the printer in order to prevent the printing without the paper fed. If the printing is continued without any paper fed, it may cause the trouble of the printer.

(11) When using this printer for the continuous actions, the temperature of the head printer board (the detected temperature with the thermistor) should be equal or less than 65 degrees Centigrade for the temperature protection of IC inside of the printer as well as the surface temperature of the motor should be equal or less than 90 degrees Centigrade for he temperature protection of the motor coil.

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(12) Never attempt to any back feeding action of the paper.

(13) This printer is using the infrared photo-sensor for paper-end detection and mark detection. For this reason, if it is used in a strong light like sunlight, a sensor may incorrect-operate. When you use it in such an environment, please evaluate enough. And if needed, please cope with it to prevent from such light.

(14) When a printer is used near a mobile terminal or a radio, there is a possibility that the obstacle occurs by the electromagnetic radiation noise. When using a printer in such an environment, please evaluate enough. And if needed, please cope with it with a shield or grounding reinforcement etc.

2-2. Casing design

☐Platen retainer

(1) Refer to Attached Paper, Section 2-8 "The figures of the platen retainer and the paper insertion area" for attachment of the platen part. If it is used with any different size from the recommended ones, it may cause uneven printing, unfavorable removal of the platen, and troubles such as damages due to the lack of the strength; therefore, be sure to conform with the recommendation. The recommended dimension of the retainer is in a range where the angle is 11° ±0.5° and the size of the X-direction is 50-200 mm.

(2) Cover the platen gear part so that it is not exposed. The platen has some play against the retainer part; therefore, the gap between the platen gear and the cover should have sufficiently play.

(3) Materials of the platen retainer should have high strength and high impact-resistance as the ones for the platen retainer (equivalent to PC or PC+ABS).

(4) Avoid removing the platen from the platen retainer as much as possible after having attached it to the platen retainer.

(5) Please install the cover on the case side so that neither garbage nor the foreign body may enter the PLATEN open and close detection switch of the printer in the gear box as much as possible. When garbage and the foreign body, etc. enter, it causes the breakdown.

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(6) Please give the stopper of the case as a bearing of the roller and a bearing intuition combination ditch bottom of the main body of the printer when you close the case to maintain the roller (The roller is set in the printer). (The space of the bearing of the roller and the bearing intuition combination ditch of the main body of the printer must become 0 as shown in figure below A). The bearing and the ditch bottom of the combination of intuition of the bearing of the printer of the main body of the roller are by the stopper installed in the case etc. before the bearing falls into the ditch and it crowds and there is a possibility that the print fineness decrease and the roller coming off, etc. occur when space is generated (figure B).

[OK]

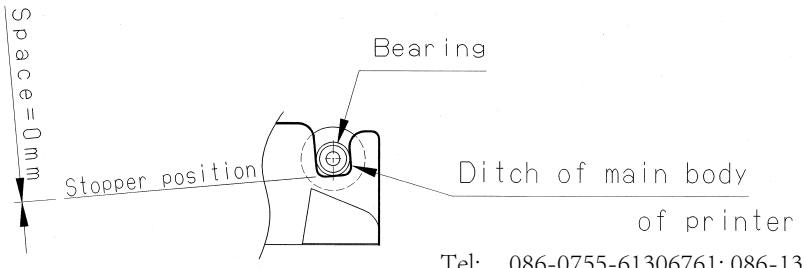

Figure A

[NG]

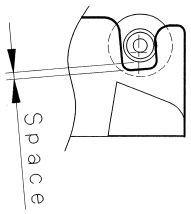

Figure B

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□Positions of the cover and the fulcrum

(1) Refer to the figure in Section 2-8 for the fulcrum position of the cover. Make sure to set so that the position is surely above more than 10° from the centerline of the platen (the recommended angle value is 11° ±0.5°). In addition, the recommendation value of the X-direction dimension should be within a range of 50-200 mm. If the printer is used with different values from the recommended angle and X-direction dimension, contact us in advance.

(2) The fulcrum of the cover should be parallel to the platen of this printer as much as possible (make sure to set the position of the fulcrum so that the standard line of this printer S is the reference when setting the dimension).

(3) When having set the platen in the printer, pay attention if any load is applied to the platen part due to effects of the twisted cover or deviation of the dimensions. If any load is applied to the platen part, it will give unfavorable effects to the printing quality, the paper feeding property, and the lifetime. Confirm that the bearing does not float form the bearing part of the printer cabinet when the platen part is closed.

(4) Materials of the cover should have high strength, high durability, and high torsional strength as the ones for the cover (equivalent to PC or PC+ABS).

(5) To improve the detachability of the platen, attach guides for preventing the strike slip on the both sides of the cover as well as the shape of the cover should be torsional-resistant. When removing the platen, carefully check that any platen gear is lacked or deformed because the platen gear contacts to the printer. Damages to the platen gear will give unfavorable effects to the printing quality and the paper

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feeding property.

(6) The paper feeding motor (a pulse motor) of the printer and the thermal head may have the hot temperature, depending on the running time. When designing the casing, consider the heat radiation property. Be sure to design the casing so that no one is allowed to directly touch with bear hands such as adopting a cover structure, etc.

☐Lock mechanism of the casing

(1) The platen retainer part of this printer provides an easy retaining (locking) mechanism (the printer as a single unit can perform the printing action), which comprises of the pressure of the head and the shape of the bearing part of the sideboard. However, if the following items are considered, the lock mechanism is recommended to mount on the casing side.

(2) When using with a portable terminal, the casing may be opened and the rolled paper inside may jump out when it is dropped or moved (particularly, while it is being carried).

(3) Depending on the attaching orientation of the printer, loads of the cover or the rolled paper may work to directions to which the platen is removed. Due to that, the platen gear may get off the track or the platen may be detached during the printing.

(4) When cutting the paper ejected from the printer with a manual cutter or depending on the pulling direction of the paper, the platen gear may get off the track or the platen may be detached (when locking, minimize the play of the platen as much as possible).

☐Installing the printer

(1) When installing the printer, fix the edge part with a hook at one place and fix the rear part with screws of M2 at two places. Flatness of the installing surface of the printer should be within equal or less than 0.1mm. It is recommended that the printer is connected to the main body FG with screws of M2 at two places (refer to the figure of the installation dimension). Pay attention not to apply any extra force to the printer main body and FPC since any of such force will give unfavorable effects to the printing quality, paper traveling property (meandering, running short of the paper, and the paper jam), and life time.

(2) When installing the printer, install it so that the printer and the rolled paper should be parallel as much as possible. When designing the casing, it should be designed so that the printer and the holder part of the roller paper are located at the place shown in the Fig (6) in Section 2-8. The roller paper should be ejected smoothly so that the paper does not hit anything such as the cover. If the above is not conformed, troubles such as meandering of the printing paper, the running short of the paper, and the paper jam may occur.

(3) The paper detection sensor is provided on the main body side of the printer; therefore, be sure to design the paper holder so that the printing paper surely contact to the sensor (refer to Section 2-8). If the printing paper floats on the sensor equal or greater than 0.7mm, the sensor may determines the paper is not fed; therefore, attach paper holding guides on the casing side for preventing the paper from floating. In addition, when the roller paper is close to the end and the last part of it comes to the paper opening paper of the printer, the paper jam may occur at the opening. This paper holding guide works as the preventive measure of this paper jam; therefore, adding this guide to the casing is recommended.

(4) When plugging in and out FPC to the connector of the control side, be sure that all power is turned off before doing that.

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(5) Use our recommended connector as the one of the control side of FPC. If any other connector is used, fully confirm the properties (the contact resistance, drawing strength, and the allowable power supply voltage) before using.
(6) The back tension of the rolled paper should be equal or less than 0.49N (50g) including the start up. If it exceeds equal or greater than 0.49N, the platen gear may get off the track and causes to damage the gear.

☐Insertion direction of a rolled paper
(1) The roller paper should be inserted under the paper guide and at the direction parallel to the guide as well as the paper should contact to the guide.
(Refer to Fig. (4) in Section 2-8. The paper feeding load (including the back tension) should be equal or less than 0.49N. If the load exceeds equal or greater than 0.49N, the platen gear may get off the track.

☐Closing method and the shape of the casing
(1) Push the central part of the casing to close the platen. To do so, design the casing so that the central part can be pushed.

☐Others
(1) This printer does not provide the dust-tight and drip-proof structure. Take measures for the dust-tightness and drip-proof from the main body casing side, as required.
(2) Surfaces and edge surfaces of metallic parts may change colors; therefore, take measures for discoloration as required, such as covering with a casing.
(3) Smoke may be generated from parts of the printer; therefore, take measures for preventing any foreign conductive materials from entering the inside as required, such as covering with a casing.

2-3. Paper to be used

(1) Regarding the printing quality and lifetime; therefore, carefully confirm the property of the paper before using.
(2) When using the perforated paper, the punching direction of the perforations should be set to face the thermosensitive side. The height of burrs of the perforations and dusts of them may cause troubles such as deterioration of the printing quality, the paper end sensor, the platen gear' s getting off the track, and the lifetime; therefore, carefully check the perforated paper before using.
(3) To reduce the loads during the paper feeding and to improve the sensitivity of the paper end sensor, when rolling the paper, the thermosensitive side of the paper recommends the outside rolling.
(4) Use the rolled paper of which inner diameter should be equal or greater than ϕ 8 (the diameter when there is not core).

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2-4. Cleaning

Adhesion of dusts of the paper and foreign materials may deteriorate the lifetime of the head and platen. When they adhere, clean the head according to the following procedures.

(1) Take measures against the static electricity such as Disposable Wrist Strap for the work.

(2) Cleaning should be done with the cover opened and the platen part separated from the head.
Note) Do not hit the head surface with anything hard.

(3) Wipe off the heating element part of the head surface lightly with cotton swabs which Athyl-alcohol is applied. After Athyl-alcohol has completely been dried, set the platen and perform the action check.
Note) Do not use any thing that may destroy the heating element, such as sandpaper. Do not add any unnecessary force to the thermal head.

2-5. Maintenance

(1) I will do the platen unit for maintenance.

TITLE	: Platen unit.
MODEL No.	: NA02265-V06701.
Minimum order and packing unit	: 100 pieces.

2-6. Storing

(1) When storing the printer for the long-term (equal or longer than six months at the room temperature) store it with the platen separated from the thermal head. If the rubber part of the platen and the head have continued to directly contact for a long term, the rubber part will be deformed and may affect the quality of printing.

(2) Do not store the printer in damp places and places with drastic temperature variations. Condensation on the printer may cause troubles such as thermal head damages and action failures.

(3) Do not store the printer in dusty places. Using the printer with dusts adhered on it may cause troubles to the printing and actions.

2-7. Others

(1) If any trouble occur, it shall be solved by mutual discussion based on this specification.
Only the printer is subject to quality assurance.

(2) Changes and additions that do not have compatibility of this specification shall be carries out according to the mutual discussion.
However, because this printer is the standard model, changes can be carried out without notices within a range where compatibility exists.

(3) This thermal printer comes with an 18-month warranty after the date of production (printer serial No.). Any failure caused by the customer side in the warranty period and after expiry of the warranty shall be serviced with charge. The maintenance service can be available in five year after the date of discontinuation of producing this printer.

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(4) A motor, a head, and a circumference component may become high temperature by continuation operation. Please warn against carrying out a direct feeler and carrying out a burn etc. Furthermore, it recommends sticking a warning label on the position which can be checked enough.

(Example)

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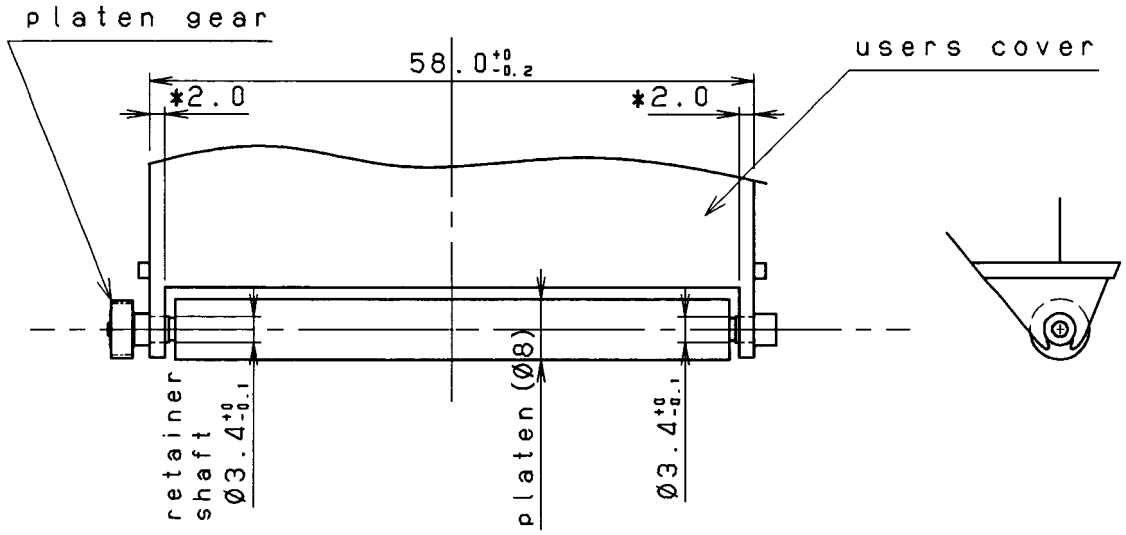
2-8 The figures of the platen retainer and the paper insertion area (including recommended value)

(1) The figure of the retainer dimension (direction of longer length)



Notes)

1. * the dimension is a recommended one.
2. Ⓢ shows the center line of the platen set in the main body of the printer.
3. Install the paper holding guide to achieve the output stabilization of the paper ditection sensor.
4. You are requested to chamfer both outside of the retainer as shown in A-A cross section so that the platen can be easily mounted and demounted to the main body of the printer.

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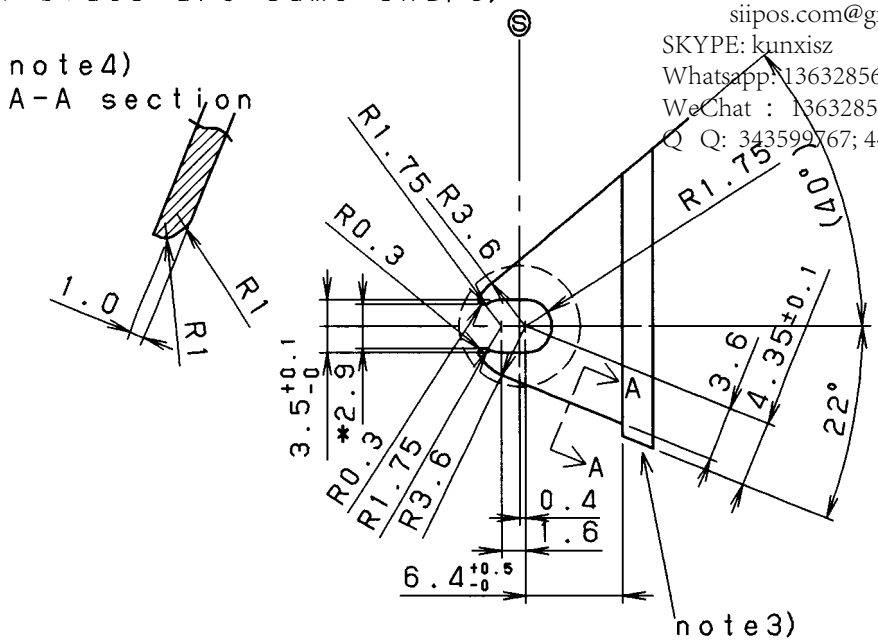
(2) Expansions figure of the retainer. (both sides are same shape)



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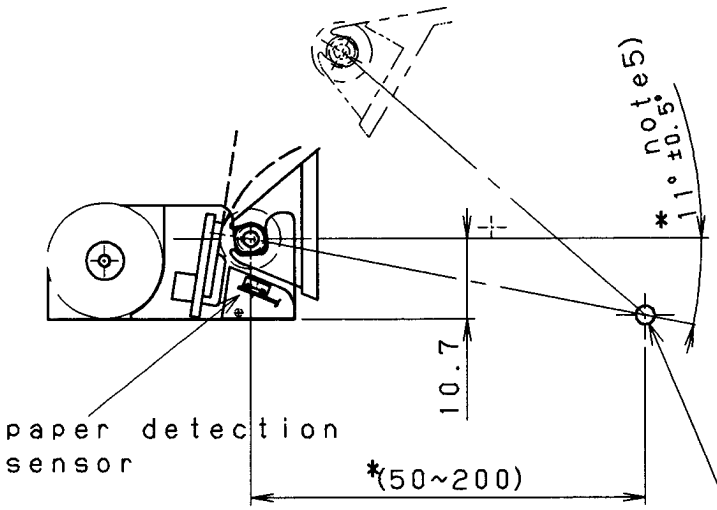
(3) Fulcrum position of the users cover



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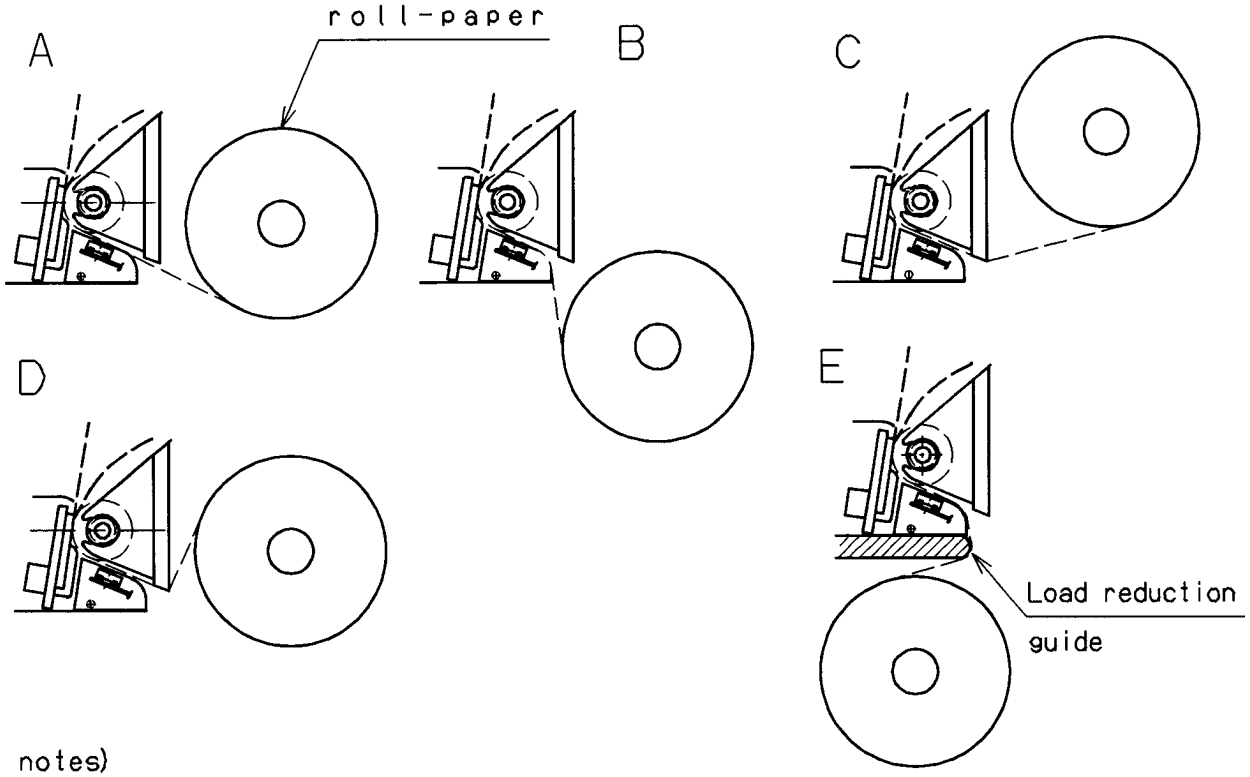
note5) Fulcrum position of the users cover is surely above more than 10° from the center line of the platen (the recommended angle value is 11°±0.5°)

(4) Insertion direction of a roll-paper



notes)
1. The setting position of rolled paper recommends A from which the load at the time of paper conveyance serves as the minimum.
When used by B-E etc., please consider so that conveyance load becomes small as much as possible.
In addition, in E, we recommend you to prepare the guide (slash part) of R form in a paper crookedness part for conveyance load reduction.
2. Please give the back tension of rolled paper as less than [0.49N] including the above-mentioned conveyance load.

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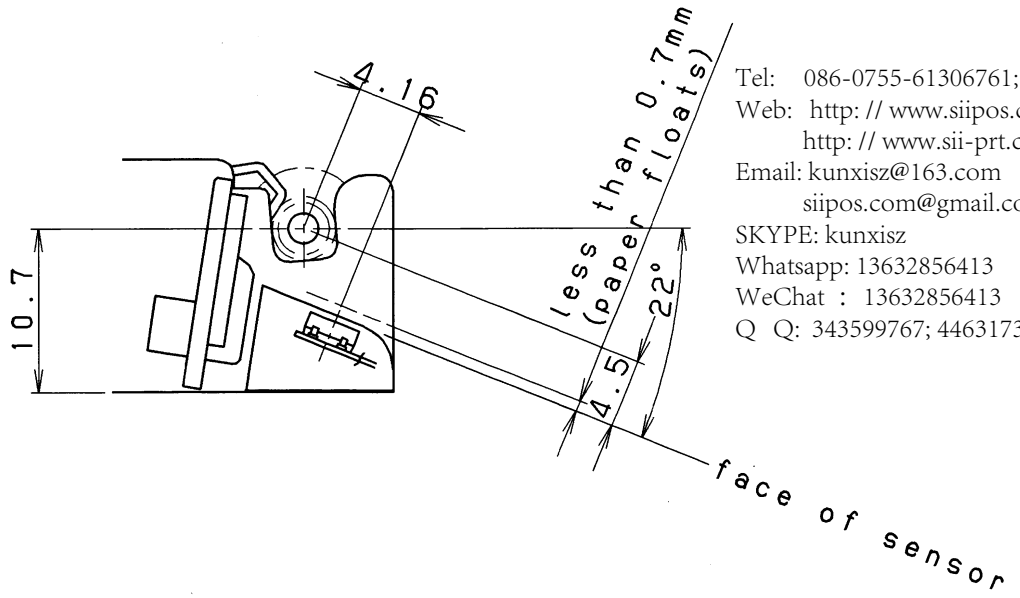
(5) Details figure of the paper ditection sensor



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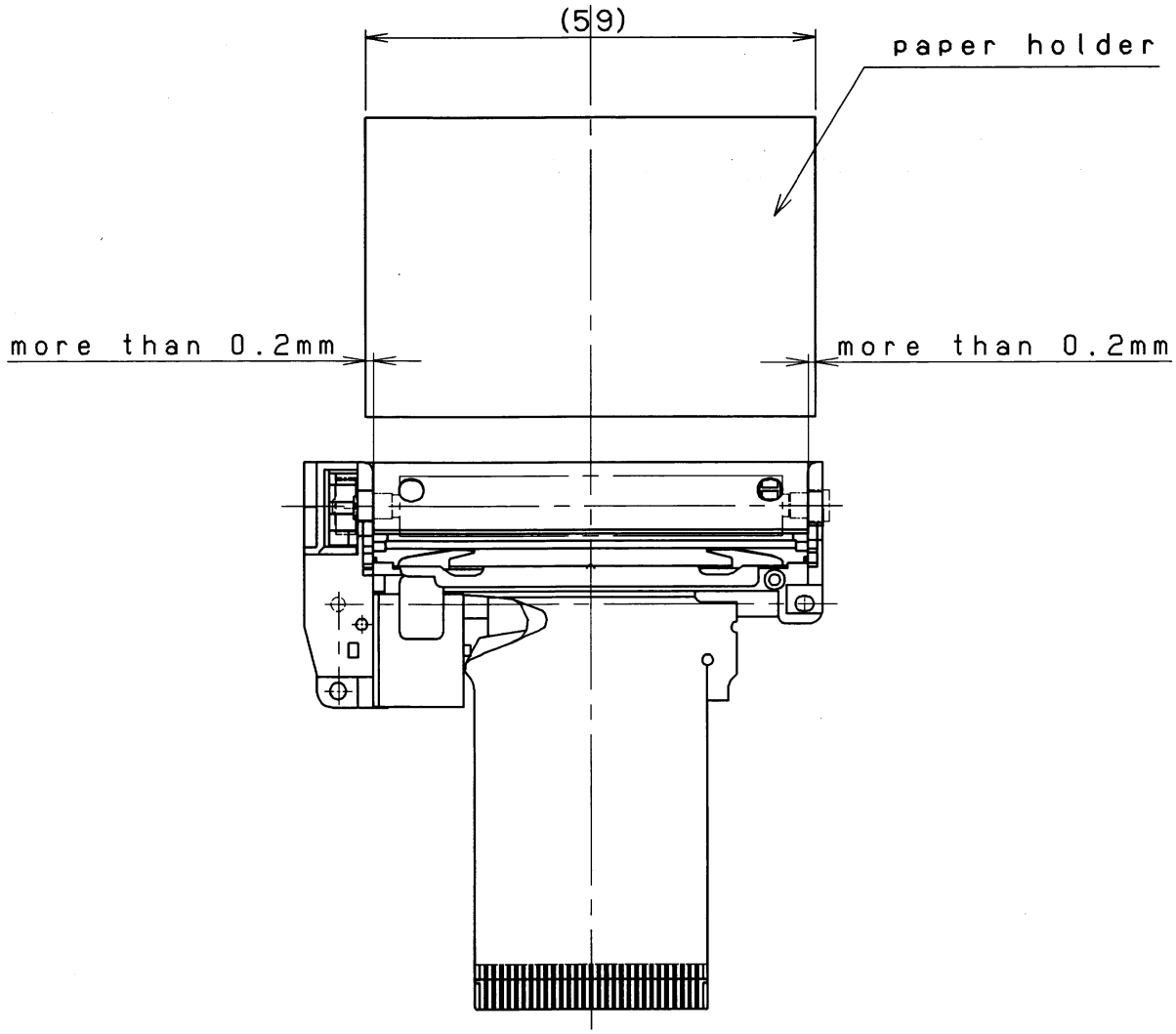
(6) Paper holder position



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3. Specifications

3-1. Application

This specification is applies to FTP-628MCL101#50

Standards by this specification are satisfied by standard interface boards described below or LSI for driving and reference circuits.

(1) Standard interface board: FTP-628DCL201
(2) LSI for driving: FTP-628CU 201

3-2. Overview

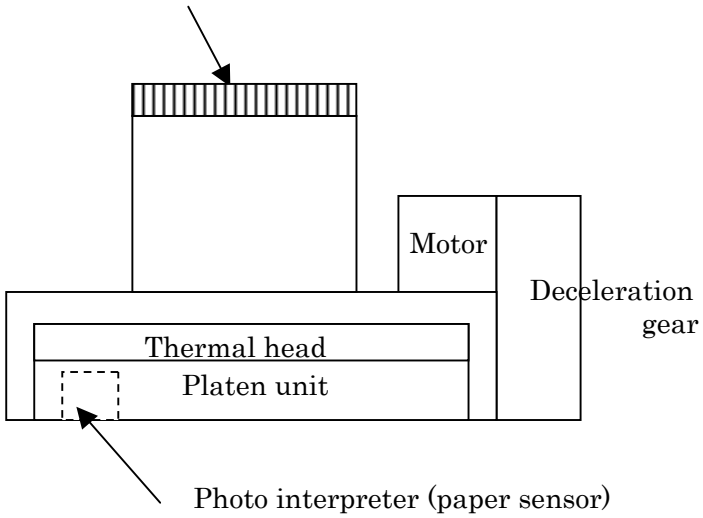
This printer is the small and lightweight printer which build in a line dot thermal head of resolution 8 dots /mm.

To actualize easy insertion of paper, the platen part separates from the printer main body with one action.

3-3. Structure

Below is the figure of this printer's structure (the mechanical part).

Flexible hoses for head, sensor and motor connections. (FPC)
Connect terminal : surface side



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3-4. Standard specifications

Item		Specifications
Printing specifications	Printing method	Direct thermosensitive method
	Valid printing width	48 mm
	Dot structure	384 dots /line
	Dot pitch(resolution)	0.125 mm (8 dots/mm)
	Dot size	0.125mm×0.12mm
	Printing density	OD value greater than 0.8, in use of the specified paper under our standard printing conditions. ※Measuring device: Sakura densitometer, PDA-65, by Konika Co., Ltd.
	Printing speed	60mm/s【At 8.5V drive, Standard paper(PD150R equivalent), Room temperature,64 dots or less, High speed mode】
Specified paper for recording *1	Highly sensitive paper	TF50KS-E4 (width: 58.0 $^{+0}_{-1}$mm), Nippon Paper
	Standard Paper	TF60KS-E (width: 58.0 $^{+0}_{-1}$mm), Nippon Paper
		PD150R (width: 58.0 $^{+0}_{-1}$mm), Oji Paper
	Middle-term preservable	TP60KS-F1 (width: 58.0 $^{+0}_{-1}$mm), Nippon Paper
		P220VBB-1 (width: 58.0 $^{+0}_{-1}$mm), Mitsubishi Paper
		PD170R (width: 58.0 $^{+0}_{-1}$mm), Oji Paper
	Long-term preservable	TP50KJ-R (width: 58.0 $^{+0}_{-1}$mm), Nippon Paper
		AFP-235 (width: 58.0 $^{+0}_{-1}$mm), Mitsubishi Paper
		PD160R-N (width: 58.0 $^{+0}_{-1}$mm), Oji Paper
		HA220AA (width: 58.0 $^{+0}_{-1}$mm), Mitsubishi Paper
Paper feeding method		Friction feeding (1 dot line/4 pulses, bi-polar 1-2 phase excitation)
Paper feeding precision		±5% At fixed-speed feed with the back tention of 0.49N or less (±2% at 25℃ and RH 60%)
Line gap in one print line by enable drive		Less than 0.125 mm, the step difference between the right and left printing lines.
Detective functions	Thermal head temperature detection	Thermistor
	Paper detection Mark detection	Photo interrupter
External dimensions (W x D x H)		70.2±1.5mm×33±0.5mm×15.5±0.5mm (excluding FPC) Refer to the outer dimension drawing in section 2-5 for details.
Weight		Approx 40.2g
Average resistance of the thermal head		176 Ω ±4%

*1: If any other paper except for the specified above is used, through the mutual discussion, the paper shall be evaluated, checked and adoption shall be determined.

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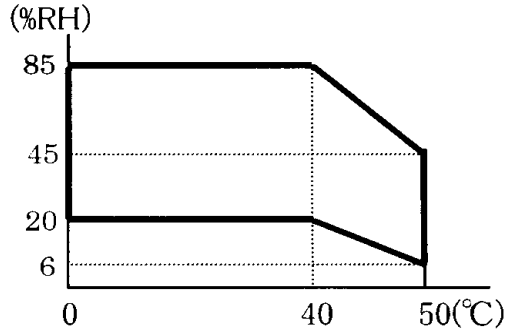
Item			Specifications
Drive power	Head	For printing	Voltage: DC 4.2 V～8.5V Current: Approx. 2.3 A (at 25℃, Rav=176Ω, 7.2V, concurrently electrified with 64 dots)
		For logic	Voltage: DC ②3.0～5.25V ~~5±5%~~ Current: 0.1A Max.
	Motor drive		Voltage: DC 4.2V～8.5V Current: 1.0 A Max. (by the our company standard constant-current drive circuit)
Environmental characteristics	Operating temperature and humidity *1		0～50℃ The figure below shows humidity. No dew should be allowed.
	Temperature and humidity in storage		-20℃～60℃, 5～95%RH. No dew should be allowed. Yet, the paper is not included.
	Noise		Should not exceed 60dB at a point 1 m above from the printing mechanism position level.
Reliability characteristics*2	Vibration (non-operation)		10～55～10Hz. Amplitude is 0.15mm. An 1 octave/min, 1G Max. 20 cycle each to X, Y, and Z directions.
	Inpact (non-operation)		50G, 11m/s, half-sine wave, 5 times each to X, Y and Z direction
	Package drop		75 cm of 6 faces, 75 cm of corners and ridges as it is packed.
	Temperature & humidity cycling (non-operation)		2 continuous cycles as a unit cycles: -25℃ (2H) ～10℃,85%RH(2H) ～65℃,22%RH (2H)～40℃,95%RH(2H)～room temp.
Life	Head	Electric life	1 hundred-million pulses (under our standard printing conditions.)
		Wear life	Paper feed length, 50 km (printing rate 25% max.)
	Platen open life		More than 5000 times (regarding opening and closing as one time.)
	Photo interpreter life		1.2×10^4 hours (electrified time) with the recommended circuit.
Printing start position on the left edge			5±1mm (by paper width 57.5 mm) from the paper edge to the left printing edge. However, 1) 1PLY, when the specified paper for long-term record storage is used. 2) When no paper jam or no paper empty is present.

*1: The print density guarantee is +5～+40℃. Refer to the figure below for the relation of the temperature and humidity. (The range is in a fat line)

*2: After the test, it shall satisfy the printing specification



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3-5. External Dmensions and Mounting Position

(1) External dimensions

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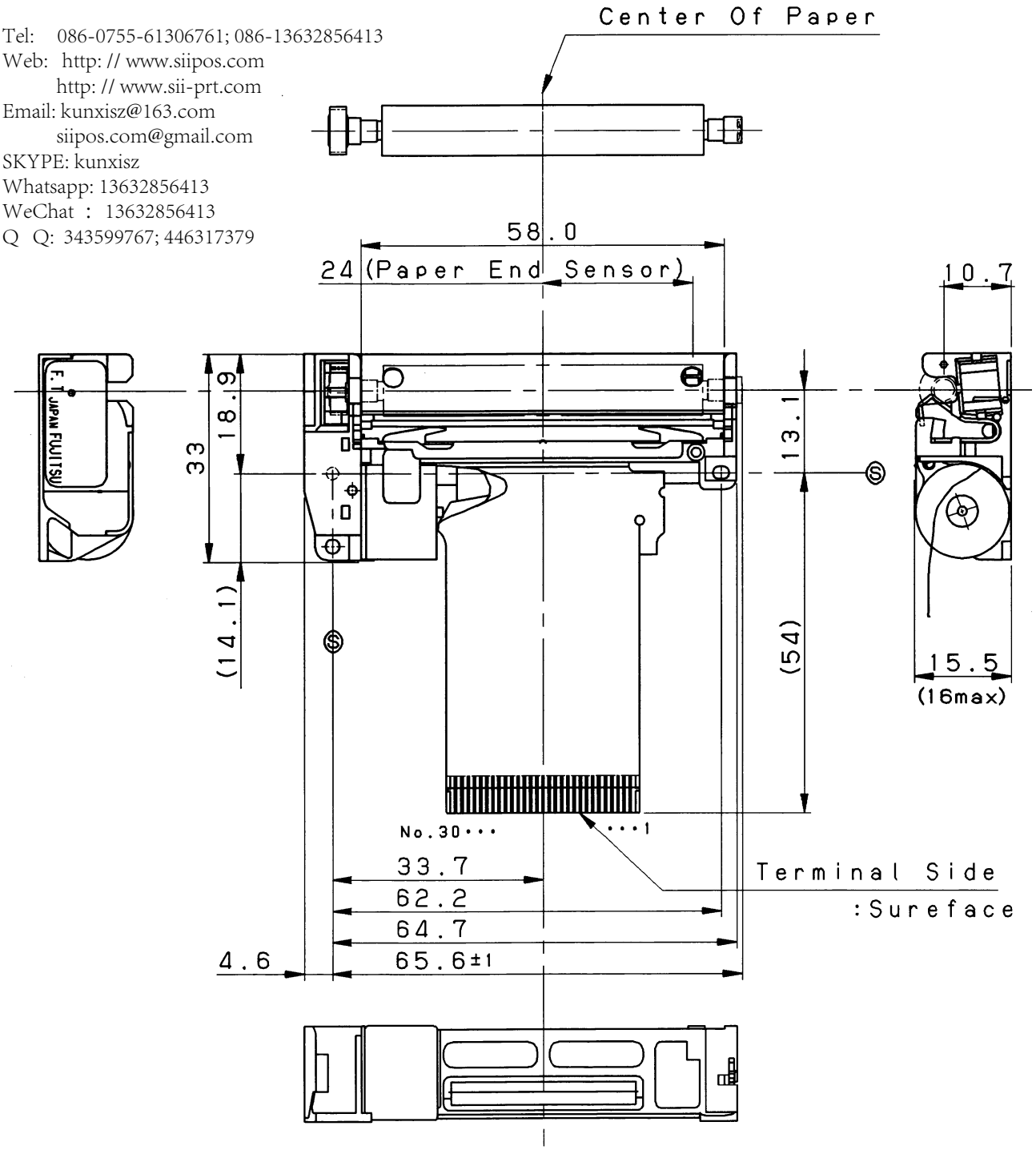

note:
1. The dimensions tolerance is ±0.5mm unless specified.
2. Dimensions in parenthesis are referene dimensions.
3. Ⓢ shows the standard center line.

Figure 1

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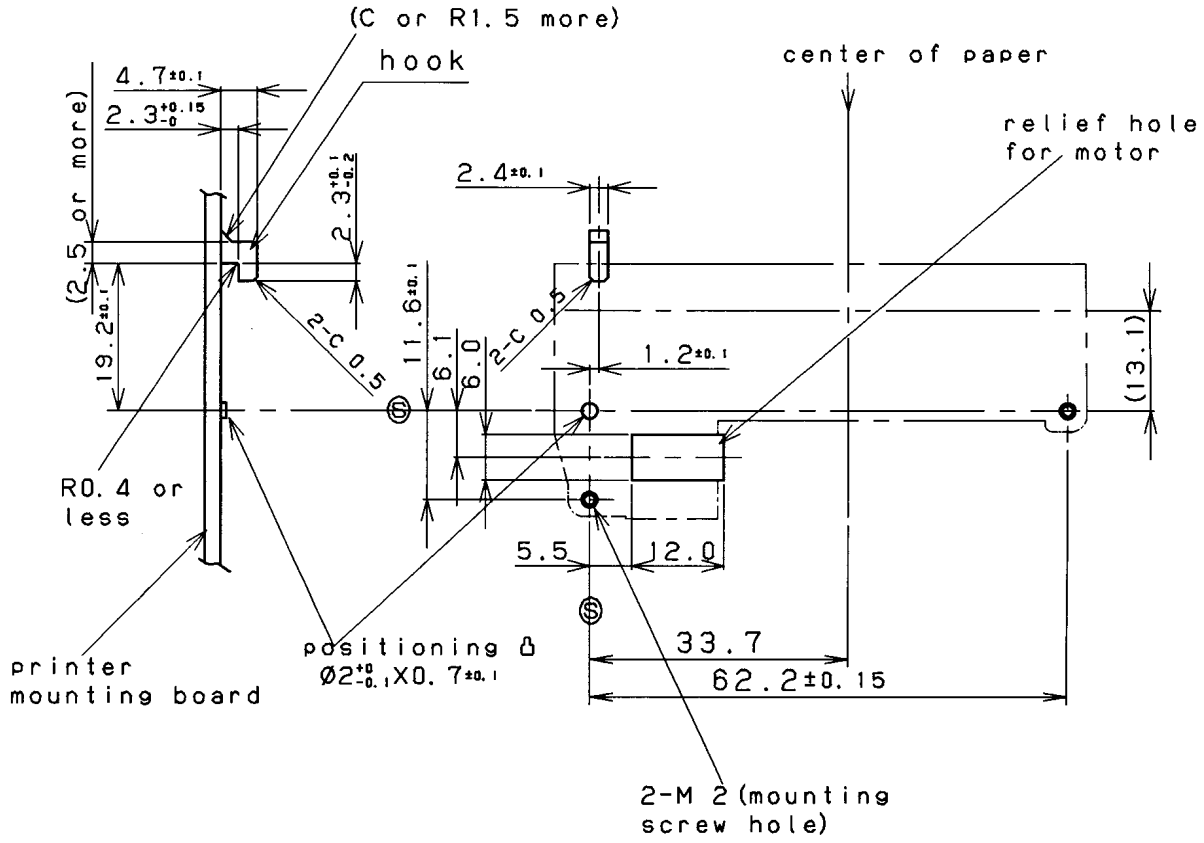
(2) Mounting position



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note:

1) The flatness of the printer mounting plate shall be with in 0.1mm
2) mounting screw (2-M2) is contact the frame ground.

Figure 2

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3-6. Connector (flexible) specifications

(1) Connector of the control circuit side

52610-3090 (molex) lead type

52610-3071 (molex) no lead type

(2) Pin assignment (flexible) of the printer mechanical side

The pulse motor side is defined as No30.

No.	Symbol	Signal name
1	PHK	Cathode for photo interrupter
2	VSEN	Paper sensor power
3	PHE	Emitter for photo interrupter
4	N.C	Non contact
5	N.C	Non contact
6	VH	Head drive power
7	VH	Head drive power
8	DI	Data in
9	CLK	Clock
10	GND	Head ground
11	GND	Head ground
12	STB 6	Strobe 6
13	STB 5	Strobe 5
14	STB 4	Strobe 4
15	Vdd	Logic power
16	TM	Thermistor
17	TM	Thermistor
18	STB 3	Strobe 3
19	STB 2	Strobe 2
20	STB 1	Strobe 1
21	GND	Head ground
22	$\overline{GND}$	Head ground
23	$\overline{LAT}$	Data latch
24	DO	Data out
25	VH	Head drive power
26	VH	Head drive power
27	MT /$\overline{A}$	Excitation signal $\overline{A}$
28	MT /A	Excitation signal A
29	MT /$\overline{B}$	Excitation signal $\overline{B}$
30	MT /B	Excitation signal B

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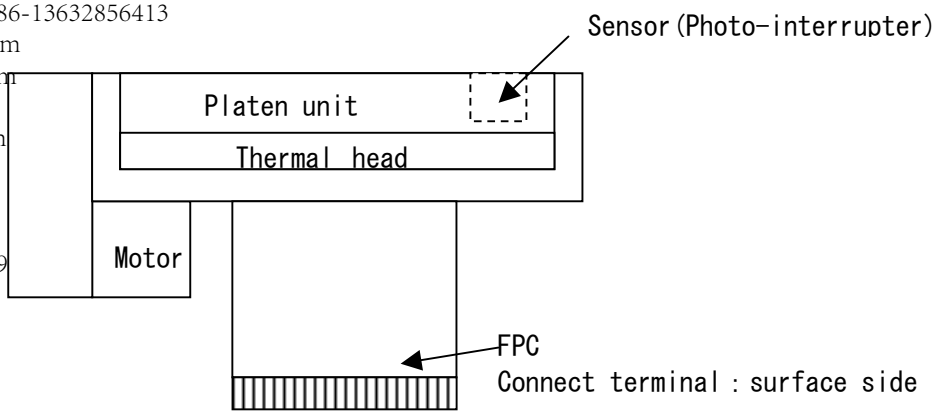

connector No. 30, 29·····2, 1
(FPC pin numbers)

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(3) Cautions

1) Do not plug in and out any flexible connector when the power is being supplied.
2) Do not add any unnecessary force to the flexible connector.
3) Plugging in and out FPC of the control circuit side shall be equal or less than 10 times. Do not plug in and out FPC of the head side.
4) GND of terminal No. 10 and 11 and GND of terminal No. 21 and 22 are separated in the head. Make them common near the flexible connector as close as possible.

3-7. Thermal head specifications

(1) General characteristics

System	:	Thermosensitive line dot system
The total number of dots	:	384dots/line
Heating resistor dot pitch	:	0.125mm
Average resistance value of a heating element	:	176Ω ± 4%
Heat generation method	:	Half pitch mode

(he heating unit moves in the direction of the form sending only in the amount of 1/2 dot line for one heat generation resistor and it energizes twice.)

(2) Maximum rating (at 25 degrees centigrade of the surrounding temperature)

Item	Max. rated value	Unit	Conditions
Printing cycle (S.L.T.)	1.25	ms/line	Tsub=25℃
Printing energy	0.2	mj/dot	
Printing power voltage: (VH)	8.5	V	Right after the buttery charge. Normally, voltage is 7.2 V.
Board temperature	65	℃	Thermistor temperature.
Concurrent printing dot number	64	Dot	
Logic power voltage: (Vdd)	7	V	Including the peak voltage.
Logic input voltage: (Vin)	-0.5～Vdd+0.5	V	

(2) Electrical characteristics

① Electrical characteristics: Table 1
② Timing chart: Fig. 3-1
③ Equivalent circuit: Fig. 3-2
④ Driver structure: 64 bits×6 drivers

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(3) Conditions for electrical actions

Item	Symbol	Electric conditions	Unit	Conditions
Power consumption	Po	0.23	W/dot	Rav=176Ω、Vdd=5V Concurrent applied dot number. With 64 dots
Supply voltage	VH	7.2	V	
Recording cycle	S.L.T	1.25	ms/line	
Energy consumption (Record pulse width) (Note 2)	Eo (Ton)	0.16	mj/dot	5℃
		(0.69)	ms	
		0.13	mj/dot	25℃
		(0.56)	ms	
		0.11	mj/dot	45℃
		(0.47)	ms	
Current consumption	Io	2.3	A	
Division number		1		

Note 2) The printing interval (SLT) is defined as the time in which strobes are sequentially driven and the printing of one line has all been completed. The relation of the applied voltage and the electric power application time (Ton) is calculated with calculation formula as shown below.

$$Po=Io^2 \times Rav=\frac{VH^2 \times Rav}{(Rcom \times N + Rav + Ric + Rlead)^2}$$

$$Ton=Eo \div Po$$

or

$$Po=Eo \div Ton$$

$$VH=\sqrt{(Po \div Rav) \times (Rcom \times N + Rav + Ric + Rlead)}$$

Rav	:Average resistance value	(example)	176	[Ω]
N	:The number of simultaneous printing dot	(example)	64	[dot]
Rcom	:Common resistance		0.05	[Ω]
Ric	:Driver-On resistance	9(②at Vdd=5V), ②20(at Vdd=3v)		[Ω]
Rlead	:Lead resistance		10	[Ω]

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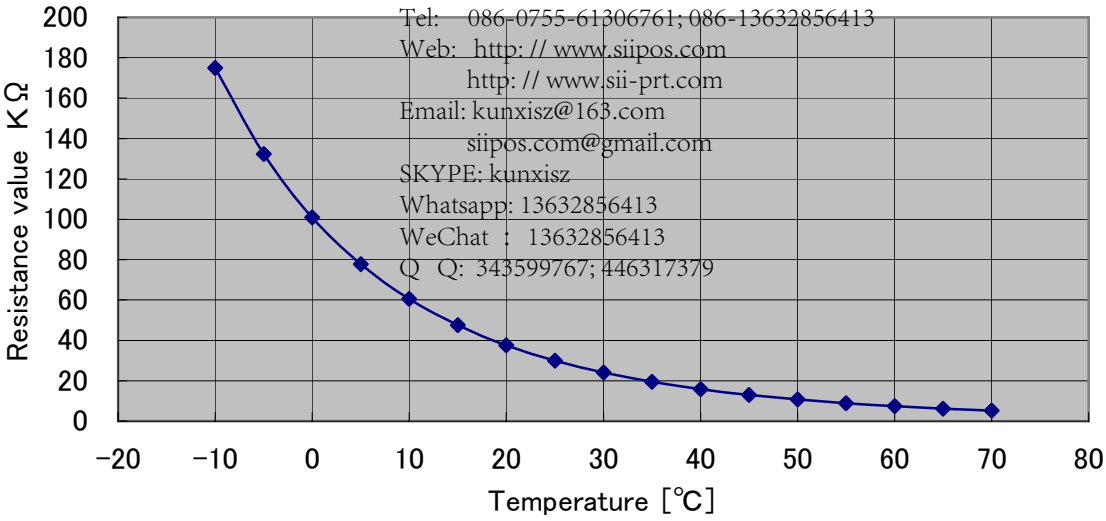
(5) Thermistor characteristics

B constant	:3950K±2%
Resistance value R25	:30KΩ±5% at25℃
Thermistor calculation formula	: RX=R25×EXP{B×(1/TX-1/T25)}
	T=Absolute temperature
Operating temp. range	:-20～+80℃
Thermal time constant	:Within 30sec (in the air)



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(6) Cautions on operation

1) When performing the continuous printing with high printing rate, regulate the head base (thermistor) temperature so that it does not exceed the standard value.
2) For the waiting time, control (circuit design) the printer so that VH (power supply of the heating element) is turned off (the GND level) in order to prevent thermal head damages caused by ions and noises.
3) When the thermistor is disconnected, control (circuit design) the printer so that the thermal head is not overheated.
4) Do not input any pulse noise of equal or more than 2V, 20ns in each signal terminal.
5) Control signals of CLK, LAT, DIN, and STB with C-MOS (equivalent to 74HC240). In addition, when the power supply is on/off and for the non-printing time, maintain the STB signal in the "DISABLE" state.
6) Surge noise to prevent, the cable length of VH and GND shall be equal or shorter than 100mm. Mount an aluminum electrolytic capacitor of 47 μF between VH and GND of the head side, which should be as close to the head side as possible. In addition, mount a laminating ceramic condenser of 0.1 μF between VDD and GND.
7) When the power supply is on, the order shall be VDD → VH. When the power supply is off, it shall be VH → VDD.
8) Make sure not to condense dews on the head. If condensation occurs on the head, maintain the VH power supply in the off state until condensation has been solved.

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Ta＝25±10℃

Item		Symbol	Min.	Standard	Max.	Unit	Conditions etc.
Printing power voltage		VH	—	—	8.5	V	
Circuit power voltage		Vdd	②3.0 ~~4.75~~	5.00	5.25	V	
Circuit power current		Idd	—	—	54	mA	fDI=fCLK/2
Input voltage	H	VIH	0.8Vdd	—	Vdd	V	STB, DI, LAT, CLK
	L	VIL	0	—	0.2Vdd	V	〃
Data input current (DI)	H	IIH DI	—	—	0.5	μA	VIH=5V
	L	IIL DI	—	—	-0.5	μA	VIL=0V∨
STB input current (HIGH-ACTIVE)	H	IIH STB	—	—	30.0	μA	
	L	IIL STB	—	—	-0.5	μA	
Clock input current (CLK)	H	IIH CLK	—	—	3	μA	
	L	IIL CLK	—	—	-3	μA	
Latch input current (LAT)	H	IIH LAT	—	—	3	μA	
	L	IIL LAT	—	—	-3	μA	
Data out (DO)	H	VDOH	4.45	—	—	V	OPEN status, Vdd=4.5V
	L	VDOL	—	—	0.05	V	
Output voltage		VOL	—	(1.0)	—	V	Reference value, Driver output
Clock frequency		fCLK	—	~~—~~②5	8	MHz	Vdd=~~5V~~②3～5V
			—				
Clock pulse width		tw CLK	~~30~~②95	—	—	ns	Refer to the timing chart. ②Vdd=3～5V
Data setup time		testup DI	~~30~~②100	—	—	ns	
Data hold time		thold DI	~~10~~②85	—	—	ns	
Data out delay time		td DO	—	—②50	②~~120~~	ns	Vdd=~~5V~~②3～5V
			—	—			
Latch pulse width		tw LAT	~~100~~②150	—	—	ns	
Latch setup time		testup LAT	200	—	—	ns	
Latch hold time		thold LAT	~~50~~②80	—	—	ns	
STB setup time		testup STB	300	—	—	ns	
Output delay time		tdo	—	—	10	μs	Vdd=~~5V~~②3～5V
			—	—			
②Hold time of STB		Thold STB		—	10	ns	Reference

Please use CLK with duty50±10% when using with fCLK=5MHz or more.
Moreover, please give a Data setup time and a Data hold time ratio as 1 : 1. And, please design to put in one cycle of CLK.

Table-1 Electrical characteristics

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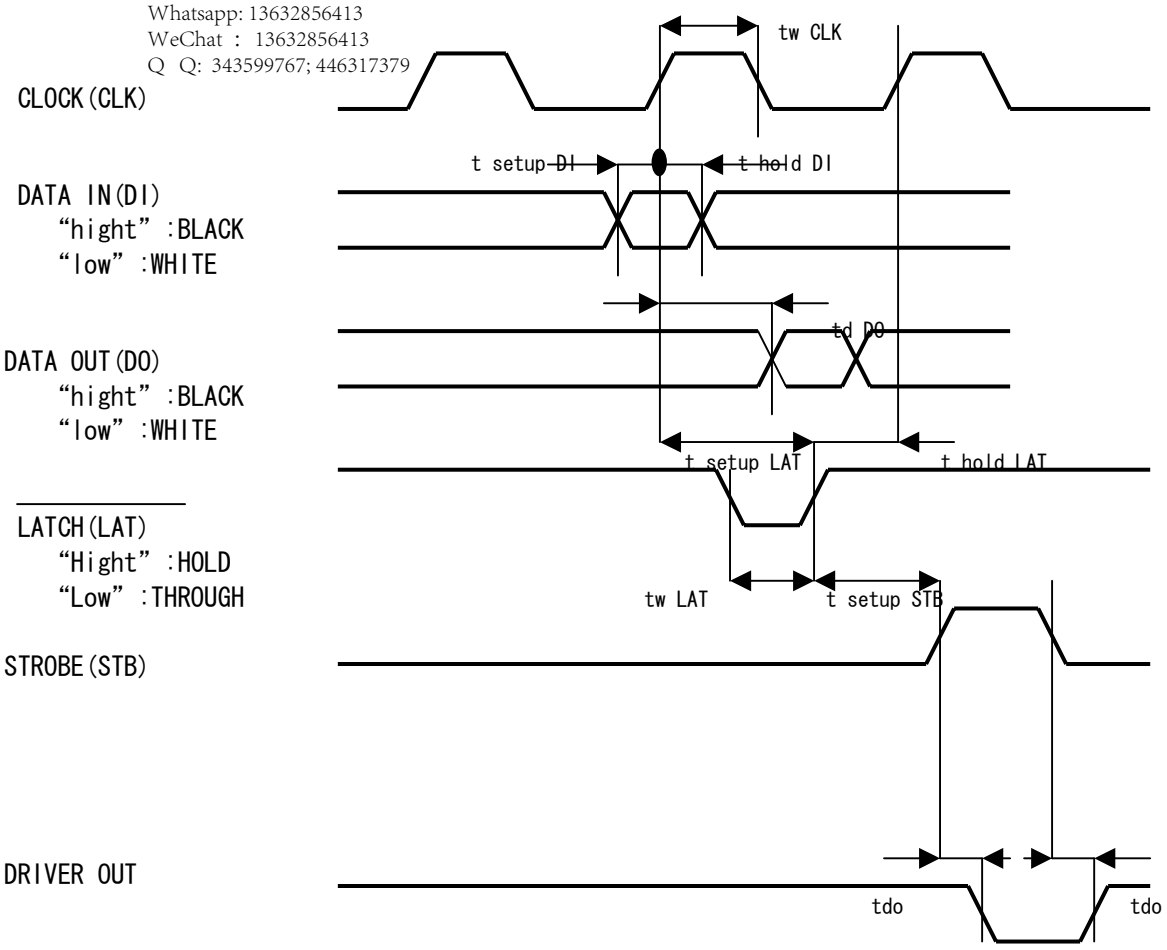

Figure 3-1 Timing chart

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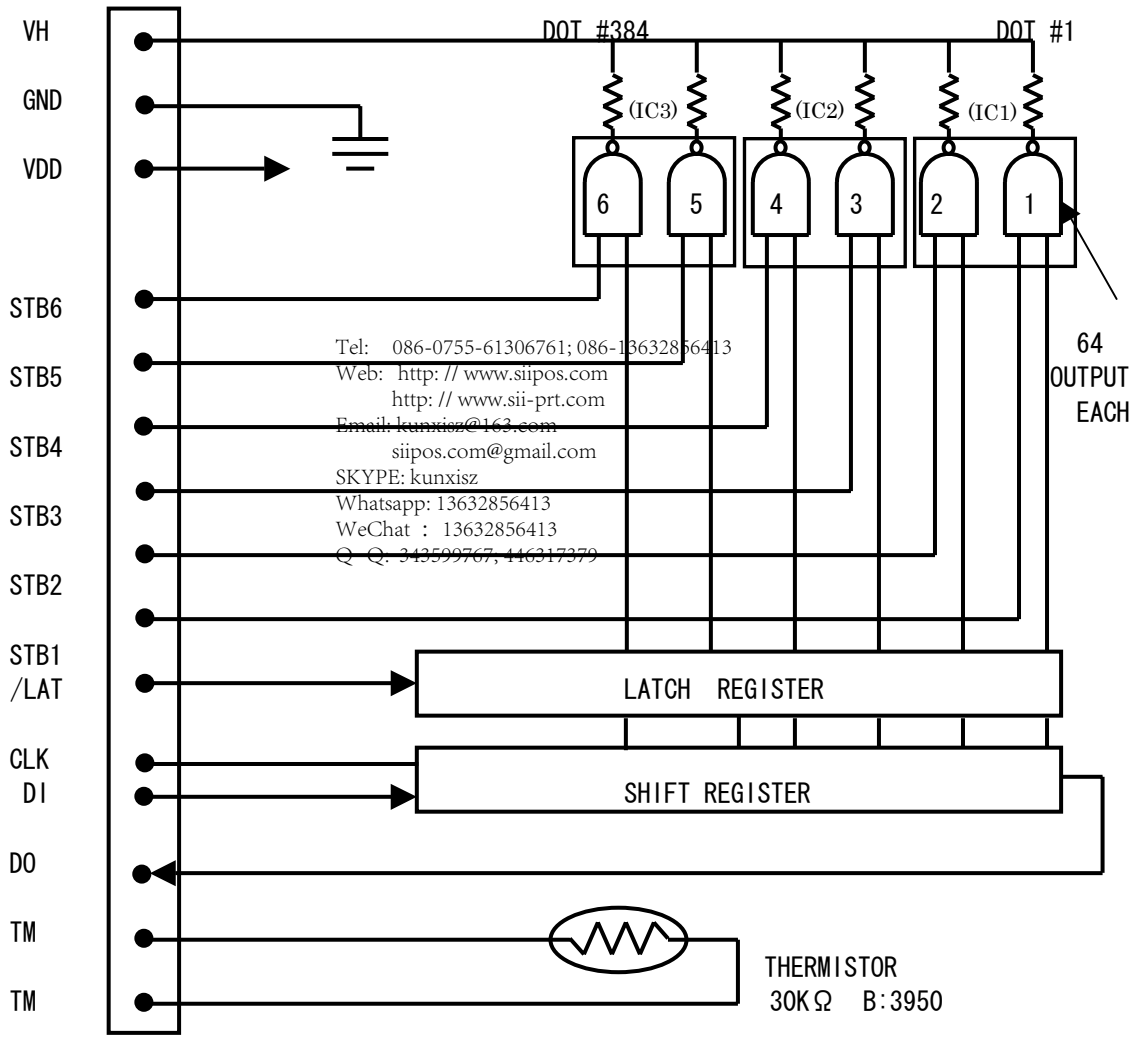

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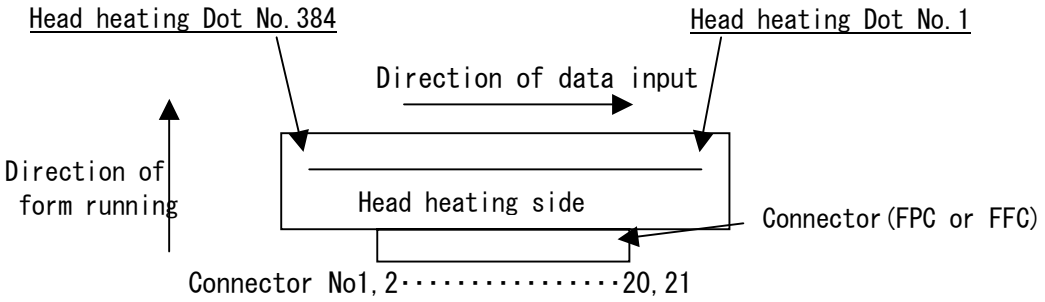
STB No.	Dot No.	dots/STB
1	1 ～ 64	64
2	65 ～ 128	64
3	129 ～ 192	64
4	193 ～ 256	64
5	257 ～ 320	64
6	321 ～ 384	64

Figure 3-2 Equivalent circuit



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3-8. Stepping motor specifications

(1) General specification (motor only)

Item	Specifications
Model	Permanent magnet type
Phase	Two phase (bi-polar specification)
Step angle	9 degrees by 1-2 phase excitation
Winding resistance / phase	10Ω
Rated voltage	DC4.2～8.5 V

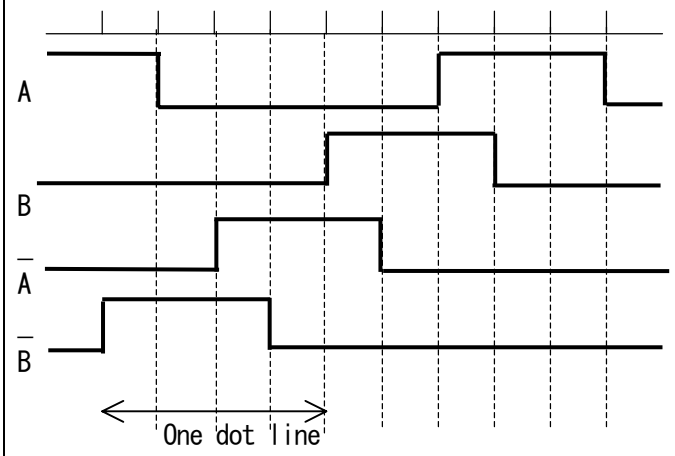
(2) Driving procedures of the stepping motor

①Drive the motor with the 1-2 phase excitation of the bipolar.

②The number of steps per dot line of printing

Excitation method	Step No.	Rotation angle
1-2 phase excitation	4	9 degrees /step

③The reference excitation method is described below.

Method	Excitation sequence (H: ON, L: OFF)
The 1-2phase excitation	

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(3)Driving the bipolar transistor

1) Drive the motor by the fixed current control for the output torque stabilization to the applied voltage change. This reference excitation current is 375mA.
2) Applying any excessive electric current will cause the abnormal generation and the excessive torque, which will end in mechanical damages; therefore, do not apply any electric current that exceeds the requirement.
3) Determine the motor driving requirements after confirming effects of load variations caused by temperature, the humidity, and types of paper. If the motor is driven by any excessive torque, the gears may be damaged when the paper is locked; therefore, attention should be paid.
4) In the low-speed drive (the low driving frequency), abnormal noises and the torque reduction may occur due to resonance of the motor. In the low-speed drive, be sure to perform sufficient evaluation and confirmation.
5) At the start of the high-speed printing and the start of the printing after turning off the motor excitation, perform the speedup control.

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(5)Cautions

1) If the motor is stopped and its excitation is turned off while the printing is being performed, because of the elasticity of the rubber roller, troubles may occur at the restart of the motor: the order of the printing may be disconnected, the printing may be smudged, white lines may be inserted. When the printing contents are necessary to be continued, complete the printing without interrupting once it is started. In addition, applying the slight electric current in the waiting state can reduce effects such as deformation of the rubber roller, as shown above. In this case, the reference electric current should be 150mA. slight irregular sending goes out of a no load because of the elasticity deformation of the rubber inker when a slight current is thrown. When the form is pulled, the influence of send irregular grows.
2) When leaving the printer for the long term, turn off the excitation. Failure to do so, it may cause heat generation of the motor and the driving elements.
3) The motor side wall temperature shall be equal or less than 90 degrees centigrade. If the temperature exceeds 90 degrees centigrade, the coil inside of the motor may be damaged.
4) When any abnormal state occurs, stop driving the printer at once
5) This printer performs one paper feeding operation of one dot line with four steps. Therefore, for power saving and stable actions, when driving the motor with the 1-2 phase excitation, control the motor so that it is stopped in the 1-phase excitation state and started in the 2-phase excitation.
6) Any printing action with the platen closed and no paper fed may wear the rubber roller and damage the head. Do not perform the printing in this state.
7) Constant "Backlash" is caused in the deceleration gear. Therefore, if the print is executed from the first dot line because it is delayed <backlash of the gear> to transmit immediately after the motor drive, "Print collapsing" might be generated. Please print after doing the form sending of 12 dot line(1.5mm) (blank) when printing to evade the print collapsing after the following operations are done.
   *Excitation of the motor in case of "OFF"
   *In case of the power OFF
   *When you detach PLATEN
   *When you pull the exhausted form
   * When the form backs and is fed
8) Please inclusion 0.49N(50g) and make the during starting the backing tension regulator of machine glazed paper as follows. When the load of 0.49N(50g) or more hangs, the influence might be exerted on the print quality.

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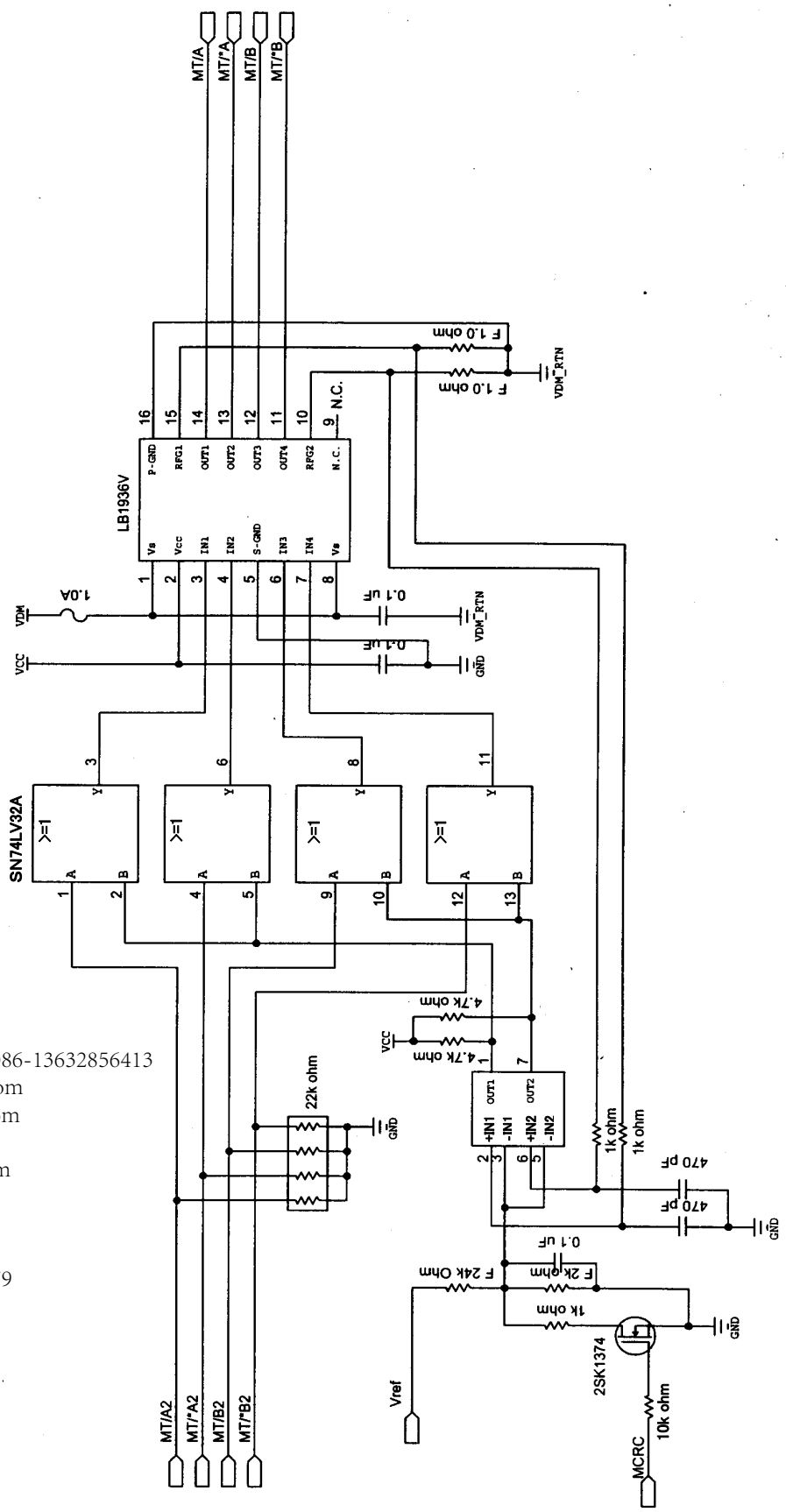
(6)Example of stepping motor drive circuit
(Example of bipolar fixed current drive)



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3-9. Sensor specifications (Photo-interrupter specification)

This photo-interrupter is mainly used for detecting whether the paper is set.
In addition, it can be used as the paper-positioning tool by seeking the mark.

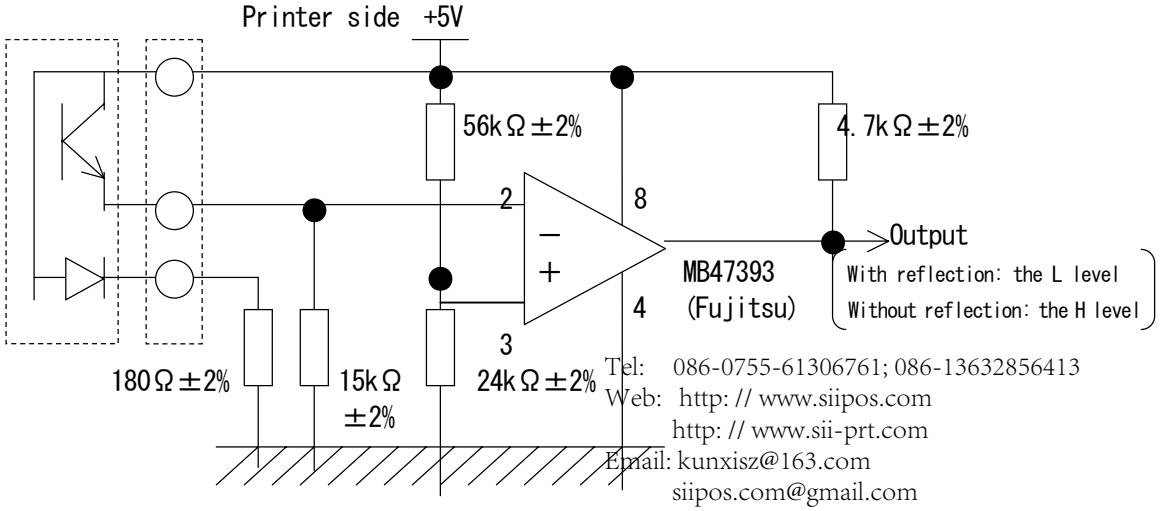
(1) Absolute maximum rating

Item		Symbol	Rated value	Unit
Input	Forward current	I_F	50	mA
	Reversed voltage	V_R	5	V
	Loss of capacity	P	70	mW
Output	Voltage between the collector and emitter	V_{CEO}	20	V
	Voltage between the emitter and collector	V_{ECO}	5	V
	Collector current	I_C	20	mA
	Loss of collector	P_C	70	mW

(2) Electric optics characteristics (25℃)

Item		Mark	Min. value	Ref. value	Max. value	Unit	Requirement
Input	Forward voltage	V_F	1.0	1.2	1.6	V	I_F=10mA
	Reverse current	I_R	—	—	10	μA	V_R=5V
Output	Dark current	I_{CEO}	—	—	200	nA	V_{CE}=10V, I_F=0mA
Transfer characteristics	Photocurrent	I_C	150	—	600	μA	V_{CE}=5V, I_F=10mA
	Leakage current	I_{LEAK}	—	—	1	μA	V_{CE}=5V, I_F=10mA
	Response time (rising)	tr	—	5	—	μs	V_{CE}=5V, I_F=1mA R_L=100Ω
	Response time (dropping)	tf	—	5	—	μs	

(3) Connecting circuit (Reference)



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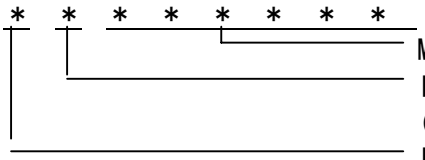
4.Product model plate

(1) Contents to be indicated :The model, manufacturing additional No., and version No.
(2) Indicating locations :Labels are plated on the gearbox side.
(3) Indicating methods :The model, additional and version numbers are stamped.
(4) Indication of the additional No. :The indicating method is described as follows.



(5) Indication of the version No :It indicates the version No. of the printer.

5.Packing

(1) Packing state :It is individually packed in an anti-static bag and contained in an exclusive packing box.
(2) Dimensions :They are conformed to our standard.
(3) Number of boxes to be piled up :If it is placed horizontally, up to three boxes can be piled up in maximum.
(4) Indication :The model and quantity is plated on the outside of the packing box.

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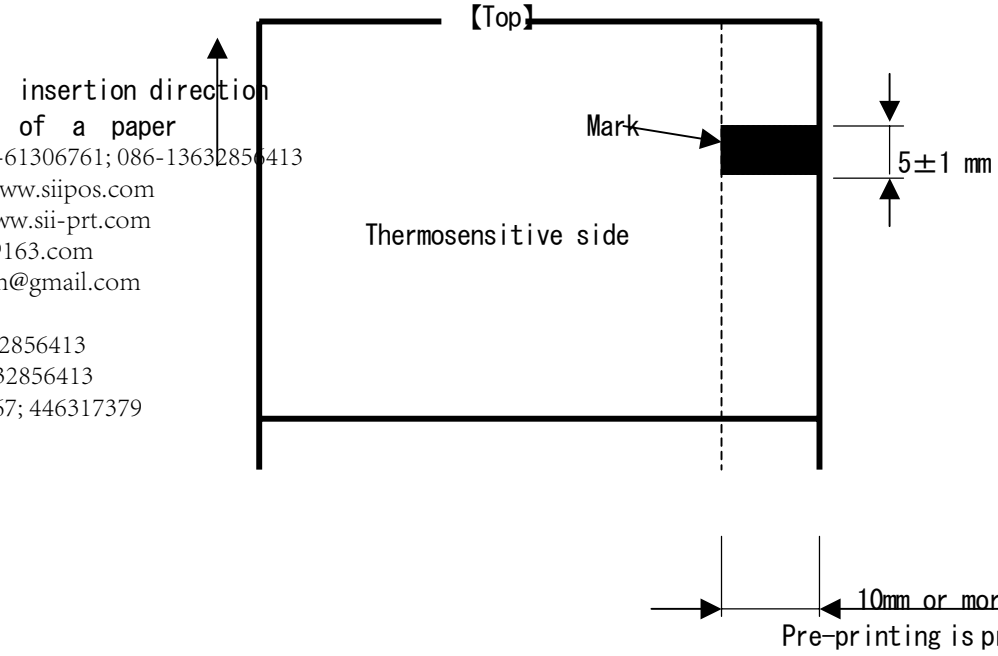
6. Pre-printing specifications

6-1. Position of the detecting mark

When printing, the mark should be the width equal to or more than 5 ± 1mm x10mm and printed on the thermosensitive side, as shown below.



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6-2. Pre-printing the positioning mark

The positioning mark should be printed as follows: the color is black, the reflection rate is equal or less than 7 % and PCS is equal or more than 0.9 for the deepness.
To eliminate the light and shade, use the oil-base ink for printing the mark. To improve the PCS value, overprinting is recommended.
The measuring apparatus and value for deepness are described below.

・PCS measuring apparatus: GretagMacbeth reflection type densitometer PCM-II
(Filter used: D-range of 900nm)

6-3. Prohibiting the pre-printing

Pre-printing in the range where the mark is detected (10 mm from the right edge) is prohibited; however, if pre-printing is required for absolute necessity, select the used ink so that the reflection rate is equal or more than 80% within the range where the wavelength band of the photo-interrupter is used (700-1000 nm).

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6-4 Cautions on pre-printing

The thermosensitive paper has different characteristics from those of general printed paper and non-carbon paper. In the print process, pay attention to the followings.

A Printing method

Print the thermosensitive paper by the UV print method because the drying characteristics of the ink is bad.

B Ink to be used

(1) Select the ink that does not give unfavorable effects to the thermal printer, such as adhesion of work-up, wear of the head, and sticking.

(2) The quantity of the ions, Na and K in the ink should be respectively equal to or less than 50ppm. In addition, the quantity of ion of Cl should be equal to or less than 100ppm.

Recommended ink: RNC type by F&K TOKA

(3) The surface strength of the thermosensitive layer is weaker than that of the general printed paper; therefore, pay attention to tacks of the ink. Set the tack of the ink to about 6.0 for the general thermosensitive paper, to the same level as the non-carbon paper for the high saving type thermosensitive paper. However, when reducing the tuck with a reducer, the quantity of addition should be equal to or less than 5%. (Failure to do so, the drying characteristics will be worse.)

(4) Do not introduce too much quantity of the ink. Excessive amount of the ink may cause defectiveness of the printing color development and sticking of the thermal printer.

(5) Materials used for the ink should be heat-resistant and have cooling effects. The same ink should be used for the non-thermosensitive paper side.

(6) After the printing has been completed, confirm if the ink is contacted to the paper. Furthermore, the UV ink is generally weak to the water; therefore, care should be taken for controlling the dampening solution.

(7) Make sure that transcription and blocking of the ink do not occur.

(8) Do not remove the pre-printing with water or alcohol.

C Dampening solution

(1) The thermosensitive paper is water-repellent; therefore, care should be taken for controlling the dampening solution.

(2) Excessive amount of IPA of the dampening solution may cause color development fog; therefore, the amount should be equal to or less than 5% for the general thermosensitive paper, equal to or less than 10% for the high saving type thermosensitive paper, respectively.

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D Others

(1) When a large number of UV lamps are used, care should be taken for paper shrinkage due to heat (the flow direction, the width direction) and the color development fog.

(2) The paper surface is quite smooth; therefore, set the rolling pressure to be strong.

(3) When increasing in the PCS value of the positioning mark, perform the overprinting.

(4) Sticking may occur in some pre-printing results; therefore, be sure to perform evaluation and confirmation with the actually operated unit.

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7. Revision history table

MODEL：FTP-628MCL101#50

PECIFICATION REVISION	PRODUCT REVISION	ITEM／CHANGE-CONTENTS	APPLIED -TIME	A REMARKS COLUMN
REV.0	02B	Corresponds to RoHS		
REV.02	02B	It changes to the Vdd=3V correspondence.		

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02				Vdd=3V change

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