LTP2000 SERIES

LINE THERMAL PRINTER MECHANISM

TECHNICAL REFERENCE

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PREFACE

This reference manual describes the specifications and basic operating procedures for the LTP2000 Series Line Thermal Printer Mechanism.

The LTP2000 (RoHS supporting) Series has six models of the line thermal printer mechanisms according to the paper width supported as follows:

- LTP2242C-S432A-E
- LTP2242D-C432A-E
- LTP2342C-S576A-E
- LTP2342D-C576A-E
- LTP2442C-S832A-E
- LTP2442D-C832A-E

In this reference manual, the information mentioned as LTP2000 is common to all models unless otherwise noted, and if the information is different depending on the model, specific model name is mentioned clearly.

Chapter 1 "Precautions" describes about safety, design and operational precautions. Read it thoroughly before designing so that you are able to use the LTP2000 Series properly.

SII has not investigated the intellectual property rights of the sample circuits included in this manual. Fully investigate the intellectual property rights of these circuits before using.

SII has the intellectual property rights of the heat storage simulation described in **Chapter 3**. Using the heat storage simulation described in **Chapter 3** for other printer mechanisms without notice is violation of the intellectual property rights.

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CHAPTER 1

PRECAUTIONS

To use the printer properly, read through this manual.
Also, design the product with in consideration of the detail precautions described in each section.

1.1 SAFETY PRECAUTIONS

To use the printer safely, design the product with in consideration of the following precautions.
Additionally, caution users by describing some directions in the instruction manual or paste the caution labels on the product.

- **Precautions to prevent the thermal head from over heating**
  If the thermal head heat element, which is always supplied electricity by the CPU, malfunctions, the thermal head may over heat and cause smoke and fire. To prevent personal injury, design to perform detection of abnormal temperatures of the thermal head as described in **Section 3.6.8**.
  Power off the printer immediately at abnormal conditions.

- **Precautions to rising the temperatures of the thermal head**
  Be sure to design the outer case to prevent user from burning himself/herself by touching the thermal head directly since the thermal head is hot during and immediately after printing. Regarding paper insertion and head cleaning, prepare caution descriptions in the manual to perform these operations after the head temperature drops. To allow cooling, place clearance between the head and the outer case in designing the outer case.

- **Precautions to the rising temperatures of the motor**
  Give warning to prevent user from burning himself/herself by touching the thermal head directly since the motor is hot during and immediately after driving. To allow cooling, place clearance between the head and the outer case in designing the outer case.

- **Precautions for sharp edges of the printer body**
  The printer body or some parts may have some sharp edges. Be sure to design the outer case to prevent the user from injuring himself/herself by touching the sharp edges and give warning.

1.2 DESIGN AND HANDLING PRECAUTIONS

To maintain the initial level of performance of the LTP2000 Series and to prevent future problems from occurring, observe the following precautions.

1.2.1 Design Precautions

- If too much energy is applied to the thermal head, it may overheat and become damaged. Always use the printer with the specific energy.
  Do not input a pulse over than 2V and 20 nsec to each signal terminal of the thermal head.

- Use C-MOS IC chips (74HC240 or equivalent) for CLK, LATCH, DAT and DST signals of the thermal head.

- When turning the power on or off, always DISABLE (put in “high” state) the DST terminals.

- To prevent the thermal head from being damaged by static electricity:

  - Fix the printer to the Frame Ground (FG) by FG connection parts shown in **Figure 7-1** to **Figure 7-3**.
  - Connect the GND terminal (SG) to FG through an approximately 1 MΩ resistor.

- Keep the VP power off while not printing in order to prevent the thermal head from being electrically corroded.
  In addition, design the printer so that the signal GND of the thermal head and the frame GND of the printer mechanism become the same electric potential.

- Make the wire resistance between the power supply and the VP as well as GND terminals on the thermal head controller as small as possible (below 15 mΩ and 30 cm). Keep distance from signal lines to reduce electrical interference.

- A surge voltage between Vp and GND should not exceed 32 V.

- For noise countermeasure, connect a following capacitor between Vdd and GND pins near the thermal head control connector.
  Capacitor : 33 μF/15 V (aluminum electrolytic)

- Apply power in the following manner:
  At power ON: 1) Vdd (5 V) → 2) Vp (24 V)
  At shut down: 1) Vp (24 V) → 2) Vdd (5 V)

- Cut surfaces of the metallic parts may be caused discoloration and rust due to the operational environment. Consider it for appearance.

- Always detect the outputs of the head down and paper sensors. Incorrect activation of the thermal head may reduce the life of the thermal head and the platen and damage them.

- Make sure that variation in the drive frequency does not lead to noise or a loss of paper feed force before designing.

- Do not apply any stress to the thermal head control cable and ground terminals.
  The stress may become a cause of print problems.

- The head activation time period may become longer according to the printing condition. If so, hold the phase of the motor and keep the pause time of the head activation for 0.1 msec or more. A continuous printing without a pause time may damage the thermal head.

- Design the outer case to prevent the paper feed out from being caught in the platen.

- In storage and shipment of the printer, always do not place the thermal head in down position. If the thermal head is remained in contact with the platen, the platen may become deformed.

- There are two paths for the paper inlet. Specified papers differ according to the each path.

1.2.2 Handling Precautions

Incorrect handling may reduce efficiency of the printer and cause damage. Handle the printer with the following precautions.
Also, press operators for precautions.

- To prevent the heat elements, ICs, etc. from being damaged due to static electricity, take both prevention of electrification and human body earth before handling the printer.
  Especially, the thermal head control terminals are sensitive.

- Do not apply any stress to the thermal head control terminals; otherwise connectors and FPC for the thermal head may be damaged. When the connector is inserted in the thermal head control terminals, place the thermal head in down position.

- If any paper other than that specified is used, high print quality and long life of the thermal head cannot be guaranteed.
  Possible problems that may occur:
  - Poor print quality due to low-sensitive paper
  - Abrasion of the thermal head due to a paper surface which is too rough
  - Sticking between the thermal layer of the paper and the thermal head resulting in excessive noise during printing
  - Print fading due to low print preservation
  - Corroded thermal head due to poor thermal layer of the paper

- Do not print without paper; otherwise, the platen or thermal head may become damaged.

- Do not hit or scratch the surface of the thermal head with any sharp or hard object. It becomes cause for damage of the heat element.

- When the printer is not in use, place the thermal head in up position.
  The head down, neutral and head up positions can be set with head up/down lever.
  If the thermal head is remained in contact with the platen, the platen may become deformed.

- Connect or remove the connectors after powering off the printer.

- When printing at a high print rate (black or zigzag pattern) in a low temperature or high humidity environment, the vapor from the paper during printing may cause condensation to form on the printer or may soil the paper itself. Prevent the thermal head from a drop of water. It may become cause for corroded thermal head.
  If condensed, power off the Vp until dried.

- The LTP2000 Series is not water-proof printer. Prevent water and operation with a wet hand. It may become cause for damage in short circuit, overheat and fire.

- The LTP2000 Series is not dust-proof printer. Using in the dusty place may cause damage of the thermal head and paper feed problems.

- Do not perform the back feed with a die cut label paper. The attachment of the label paper to the edge of the thermal head may cause the paper feed problems.
  Do not use such a poor label paper which has sticking out of paste.

1.2.3 Disposing Precautions

- Dispose of the printer in accordance with the regulations or rules of each self-govering body.

CHAPTER 2

FEATURES

The LTP2000 Series Line Thermal Printer Mechanism is a compact, high-speed thermal line dot printing mechanism. It can be used with a measuring instrument and analyzer, a POS, a communication device, or a data terminal device.

The LTP2000 Series has the following features:

- High resolution printing
  A high-density print head of 8 dots/mm produces clear and precise printing.

- Long life [1]
  The mechanism is maintenance-free device with a long life of 50 km print length or 100 million pulses.

- High speed printing [2]
  A maximum print speed of 720 dot lines per second (90 mm per second) is attainable for the LTP2242.
  A maximum print speed of 600 dot lines per second (75 mm per second) is attainable for the LTP2342 and LTP2442.

- Paper loading path [3]
  Both a curled path and a straight path are prepared as paper paths.
  Printing on the thick paper is available with a straight path.

- Low noise
  Thermal line dot printing is used to guarantee low-noise printing.

- Automatic paper load
  A paper detector enables the LTP2000 Series to load paper automatically.

- Thermal head cleaning
  The TPH Up/Down lever enables the thermal head of the LTP2000 Series to be cleaned easily.

- Anti-static electricity function
  All metal parts of the printer can be connected to Frame Ground (FG).
  The secondary radiation can be reduced.

[1] Based on the life span judgment in the general specifications.

[2] Print speed differs depending on working conditions.

[3] Paper load path (curl or straight) is preset at the factory. To determine which path is used, contact a Seiko Instruments sales representative.

CHAPTER 3

SPECIFICATIONS

3.1 GENERAL SPECIFICATIONS

Table 3-1 General Specifications

Item		Specification					
		LTP2242		LTP2342		LTP2442	
Print method		Thermal dot line printing					
Dots per line		432 dots		576 dots		864 dots	
Printable dots per line		432 dots		576 dots		832 dots	
Common activatable dots per line		432 dots		576 dots		720 dots	
Resolution		8 dots/mm					
Print speed [1]		90mm/sec		75mm/sec			
Print width		54mm		72mm		104mm	
Paper width		60mm		80mm		112mm	
Paper feed pitch		0.125 mm					
Head temperature detection		Via a thermistor					
Head-down detection		Via a mechanical switch					
Out-of-paper detection		Via a photo interrupter					
Operating voltage range VP line Vdd line		 24 V±10 % 5 V±5 %					
Current consumption for driving the head (Vp)	Print ratio	max.	rated	max.	rated	max.	rated
	100 %	6.3 A	5.2 A	8.4 A	6.9 A	10.6 A	8.6 A
	50 %	3.2 A	2.6 A	4.2 A	3.5 A	6.1 A	5 A
	25 %	1.6 A	1.3 A	2.1 A	1.7 A	3.1 A	2.5 A
Motor drive (Vp) Head Logic (Vdd)		0.5 A max. 0.1 A max.					
Operating temperature range		0 °C to 50 °C [2] (noncondensing)					
Storage temperature range		-20 °C to 60 °C (noncondensing)					
Life span (at 25 °C and rated energy) [3] Activation pulse resistance Abrasion resistance		 100 million pulses or more [3] 50 km or more (excluding damage via aline substances)					

[1] Print speed changes according to the processing speed of the controller and print pulse width.

[2] Use thermal 2-ply paper under 5 to 40 °C range.

[3] ① Changing rate of average head resistance : ±15% or less
② The life span of the 2-ply thermal paper is 50 milion pulses or equivalent because 2 pulses per 1 dot are used for printing.

Table 3-1 General Specifications (Continued)

Item	Specification		
	LTP2242	**LTP2342**	**LTP2442**
Paper feed force	0.98N (100gf) or more		
Paper hold force	0.98N (100gf) or more		
Dimensions (excluding the lever) (width×depth×height)	85.2×61.4×27 mm	106.4×61.4×27 mm	138.2×61.4×27 mm
Mass	Approx. 115g	Approx. 135g	Approx. 160g
Specified thermal paper	TF50KS-E2D 59 μm paper Nippon Paper Industries PD160R-N 75 μm paper Oji Paper Co., Ltd. TW80KKS 2-ply paper Nippon Paper Industries AFP235 65 μm paper MITSUBISHI PAPER MILLS LIMITED TL69KS-R2 90 μm paper Nippon Paper Industries [4] TL69KS-HW76B label paper Nippon Paper Industries [4] TC98KS-T1 125 μm paper Nippon Paper Industries [4]		

[4] Can not be used for curled path.

3.2 HEAT ELEMENT DIMENSIONS

3.2.1 Heat Element Dimensions for the LTP2242

The LTP2242 contains a thermal head with 432 heat elements (dot-size).

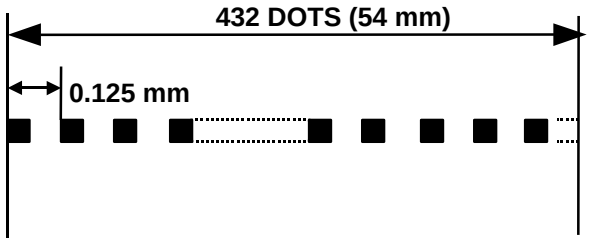


Figure 3-1 Heat Element Dimensions (LTP2242)

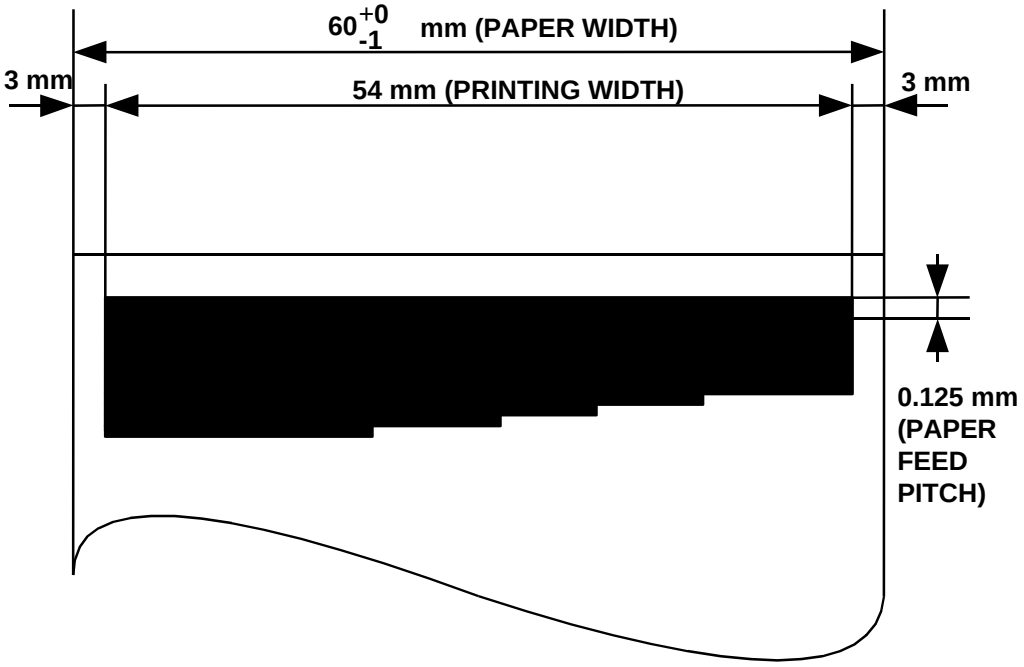


Figure 3-2 Print Area (LTP2242)

3.2.2 Heat Element Dimensions for the LTP2342

The LTP2342 contains a thermal head with 576 heat elements (dot-size).

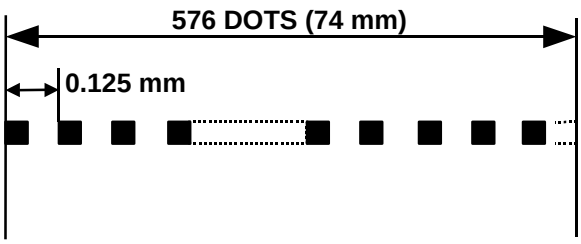


Figure 3-3 Heat Element Dimensions (LTP2342)

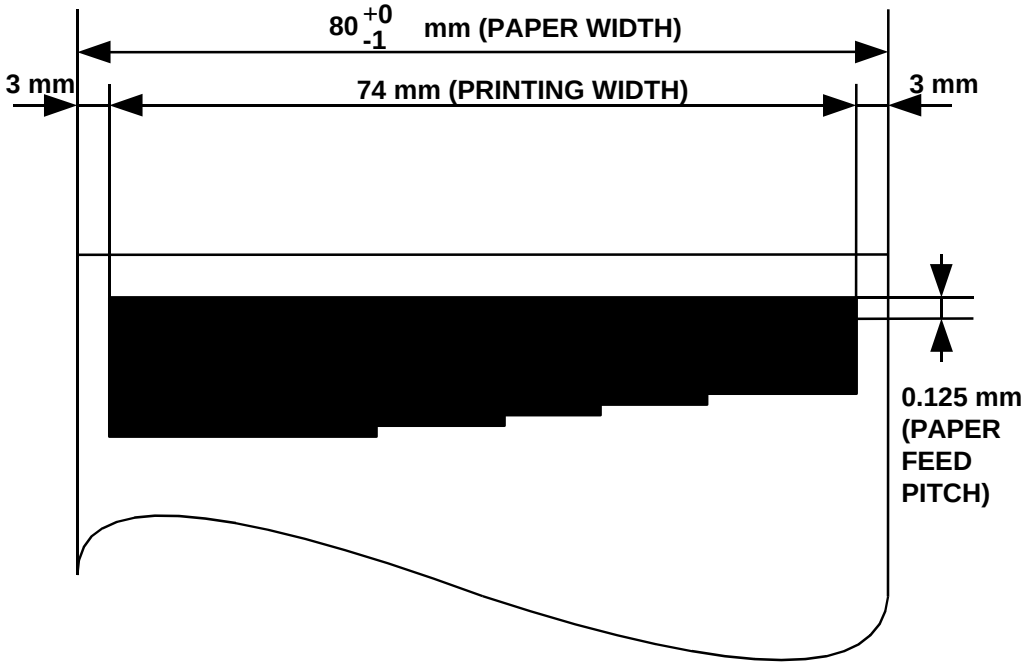


Figure 3-4 Print Area (LTP2342)

3.2.3 Heat Element Dimensions for the LTP2442

The LTP2442 contains a thermal head with 864 heat elements (dot-size).
However the actual printing width is 832 dots (16 dots on the right and left side edge are not used) because of paper width.
Transfer blank (NUL) data to both 16 dots on the right and left side edges.

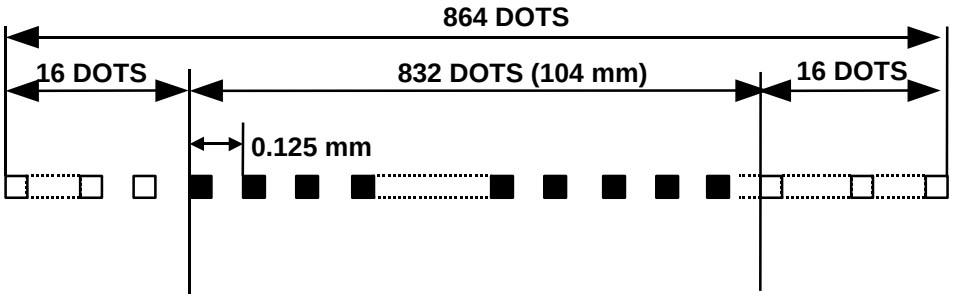


Figure 3-5 Heat Element Dimensions (LTP2442)

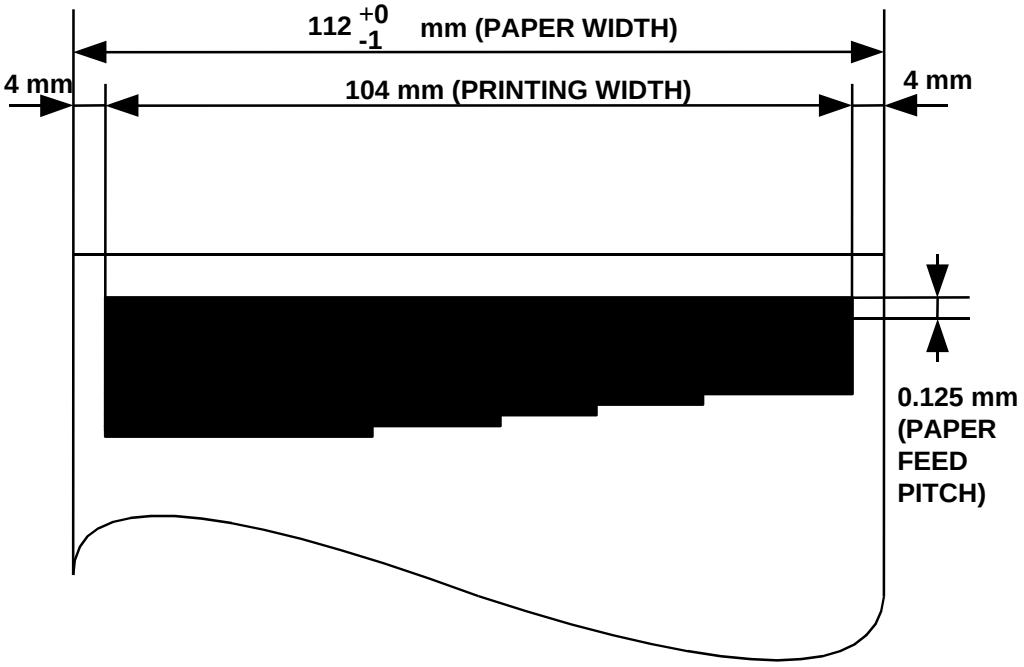


Figure 3-6 Print Area (LTP2442)

3.3 PAPER FEED CHARACTERISTICS

- The bipolar chopper driving method should be used for driving.
- Any type of design for the drive circuit other than the example described in **Section 3.4.1** may affect the standard function of the printer.
- Paper is fed in the forward direction when the motor shaft is rotating in the normal direction (clockwise) as seen from the motor gear side.
- The motor is driven by a 2-2 phase excitation method and feeds paper by 0.125 mm (equivalent to a single dot pitch) every one step of the motor drive signal.
- To prevent deterioration in print quality due to backlash of the paper feed system, the motor should be driven 16 steps in the reverse direction then 16 steps in the normal direction during initialization or after backward feeding.
- During paper feed, the motor should be driven at the motor drive frequency shown in **Table 3-2** through the motor acceleration control.
- During printing, the motor drive frequency should be adjusted so the head activate pulse width does not exceed the motor step time. (For details, see **Chapter 5**.)
- To automatically load paper, the motor should be driven at 150 pps.
  Refer to **"3.8.3 Automatic Paper Load"** for how to control the automatic paper loading.
- It is not possible to print while the motor is rotating in the reverse direction.
- If the motor is driven at 350 pps or lower continuously, noise may occur.

Table 3-2 Motor Drive Frequency

Printer model	Motor drive frequency
LTP2242	720PPS
LTP2342	600PPS
LTP2442	600PPS

3.4 STEP MOTOR CHARACTERISTICS

Table 3-3 General Motor Specifications

Item	Specification
Type	PM
Drive method	Bipolar chopper
Excitation	2-2 phase
Winding resistance per phase	36 Ω±10%
Rated voltage	Vp : 24 V±10 % Vcc : 5 V±5 %
Set current	Approximately 180 mA / phase[1]

[1] Set current for LTP2342 and LTP2442 is 250 mA when auto paper loading.

3.4.1 Motor Drive Circuit

(1) Sample Drive Circuit

A sample drive circuit for the motor is shown in **Figure 3-7**.

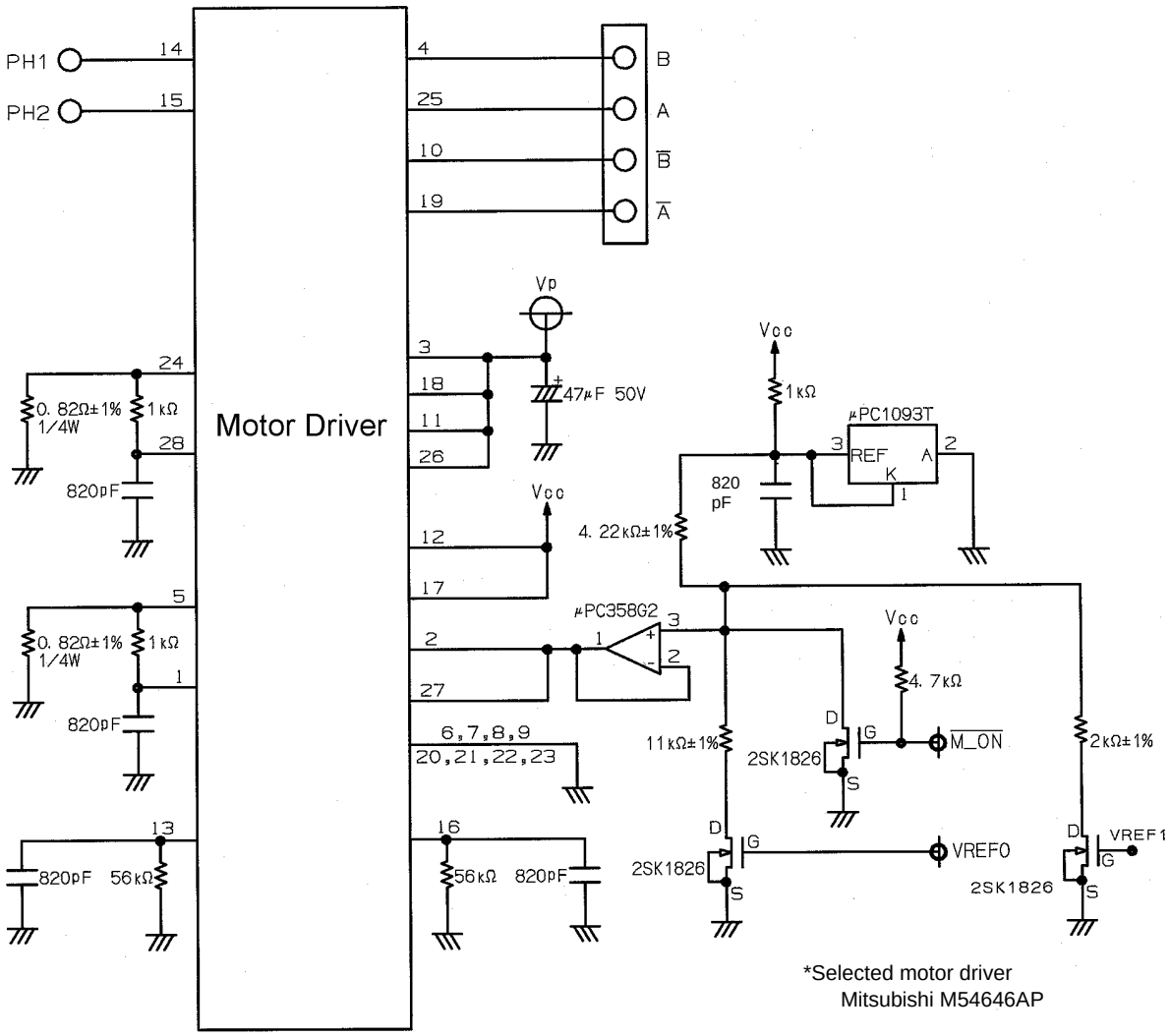


Figure 3-7 Sample Drive Circuit (Motor)

(2) Excitation Sequence

When the voltage shown in **Figure 3-8** is input to the motor drive circuit shown in **Figure 3-7**, as shown in **Table 3-4**, the LTP2000 Series feeds the paper in the normal direction when the motor is excited in the order of step 1, step 2, step 3, step 4, step 1, step 2, ... On the other hand, to rotate the motor in the reverse direction, drive the motor in the reverse order: step 4, step 3, step 2, step 1, step 4, step 3, ...

Table 3-4 Excitation Sequence

	Input Signal		**Output Signal**			
	PH1	PH2	B	A	$\overline{B}$	$\overline{A}$
Step 1	L	H	L	H	H	L
Step 2	H	H	H	H	L	L
Step 3	H	L	H	L	L	H
Step 4	L	L	L	L	H	H

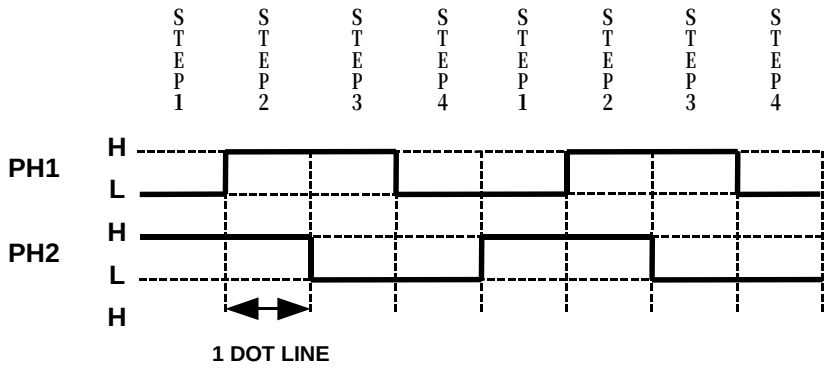


Figure 3-8 Input Voltage Signals for the Sample Drive Circuit (Motor)

3.4.2 Motor Timing

Refer to the time chart in **Figure 3-9** when designing the control circuit or software for starting and stopping the motor. Also note the following precautions:

Precautions for Designing the Motor Control Circuit and Software

(1) Stop step

- To stop the motor, excite for 10 msec with the same phase as the last one in the printing step.

(2) Pause state

- In the pause state, do not excite the step motor by having $\overline{\text{M\_ON}}$ go high so as to prevent the motor from heating. Even when the step motor is not excited, it maintains force to prevent the paper from sliding.

(3) Start step

- To restart the motor from the stop step, immediately shift the motor into the print sequence.
- To restart the motor from the pause (no excitation) state, shift the motor into the print sequence after outputting the same phase as that of the stop step for the first step term of the acceleration step.

Input signals for a sample drive circuit are shown in **Figure 3-9**.

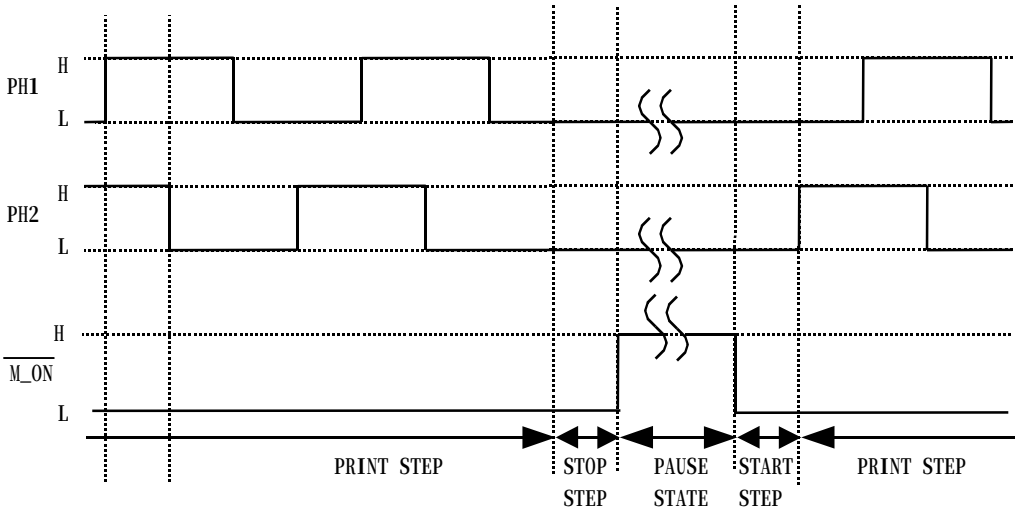


Figure 3-9 Motor Start/Stop Timing

3.4.3 Motor Driving Precautions

Acceleration Control

When driving the motor, acceleration control is needed to get start up in order to maintain the power force. Drive the motor to the driving speed, according to acceleration steps shown in **Table 3-5** and **3-6**.

The method for accelerating the motor is as follows;

1. Output the start step time.
2. Output the first step for the first acceleration step time
3. Output the second step for the second acceleration step time
4. Output the nth step for the nth step acceleration time
5. After output for motor driving speed, the motor is driven at constant speed.

Can print during acceleration.

Table 3-5 Acceleration Steps (LTP2242)

Number of Steps	Speed (pps)	Step Time (μsec)
Start	¾	**8000**
1	**125**	**8000**
2	**202**	**4950**
3	**261**	**3831**
4	**311**	**3215**
5	**355**	**2817**
6	**394**	**2538**
7	**430**	**2326**
8	**464**	**2155**
9	**495**	**2020**
10	**524**	**1908**
11	**553**	**1808**
12	**579**	**1727**
13	**605**	**1653**
14	**630**	**1587**
15	**653**	**1531**
16	**676**	**1479**
17	**698**	**1433**
18	**720**	**1389**

Table 3-6 Acceleration Steps (LTP2342 and LTP2442)

Number of Steps	Speed (pps)	Step Time (μsec)
Start	¾	**9615**
1	**104**	**9615**
2	**168**	**5952**
3	**217**	**4608**
4	**259**	**3861**
5	**296**	**3378**
6	**328**	**3049**
7	**358**	**2793**
8	**386**	**2591**
9	**412**	**2427**
10	**437**	**2288**
11	**460**	**2174**
12	**483**	**2070**
13	**504**	**1984**
14	**525**	**1905**
15	**544**	**1838**
16	**564**	**1773**
17	**582**	**1718**
18	**600**	**1667**

Motor Current Control

To drive the motor effectively, it is necessary to control the current supplied to the motor.

Change the value of the current supplied to the motor, by switching between the V_{REF0} and V_{REF1} in the **Figure 3-7** Sample Drive Circuit (Motor) in accordance with the current value shown in **Table 3-7**.

Table 3-7 Motor Supplied Current Value

$\overline{M\_ON}$	V_{REF0}	V_{REF1}	Current value
LOW	LOW	LOW	250mA
LOW	HIGH	LOW	180mA
LOW	LOW	HIGH	80mA
HIGH	—	—	0mA

(1) LTP2242 and LTP2342

Activate 180 mA in each motor during printing. After activating until T1 (time), switch the current value to 80 mA. If the period of the motor step is shorter than T1, it is not necessary to switch to the 80 mA.

T_1= 2000 (μs)

Active 180 mA at start step

(2) LTP2442

Activate 180 mA in each motor during printing.

(3) When paper is inserted automatically

Activate 250 mA as a current value for LTP2342 and LTP2442. For LTP2242, activate 180mA. Though the period of the motor step is over T1, it is not necessary to switch to 80mA.

3.5 THERMAL HEAD

The thermal head consists of heat elements and a head driver which drives and controls the heat element.

Serial print data input from the DAT terminal is transferred to the shift register synchronously with the CLK signal, then stored in the latch register at the timing of the LATCH signal.

Input of the head activation signal (DST1 and DST2) activates the heat elements in accordance with the print data stored in the latch register.
The LTP2000 Series allows for individually divided printing up to 2 blocks.

The divided printing is effective for a high print ratio printing because it can cut down the peak current with the reduction of the average print speed.

3.5.1 Structure of the Thermal Head (LTP2242)

Figure 3-10 shows the thermal head block diagram for the LTP2242.

Table 3-8 shows the relationship between DST blocks and activated heat elements.

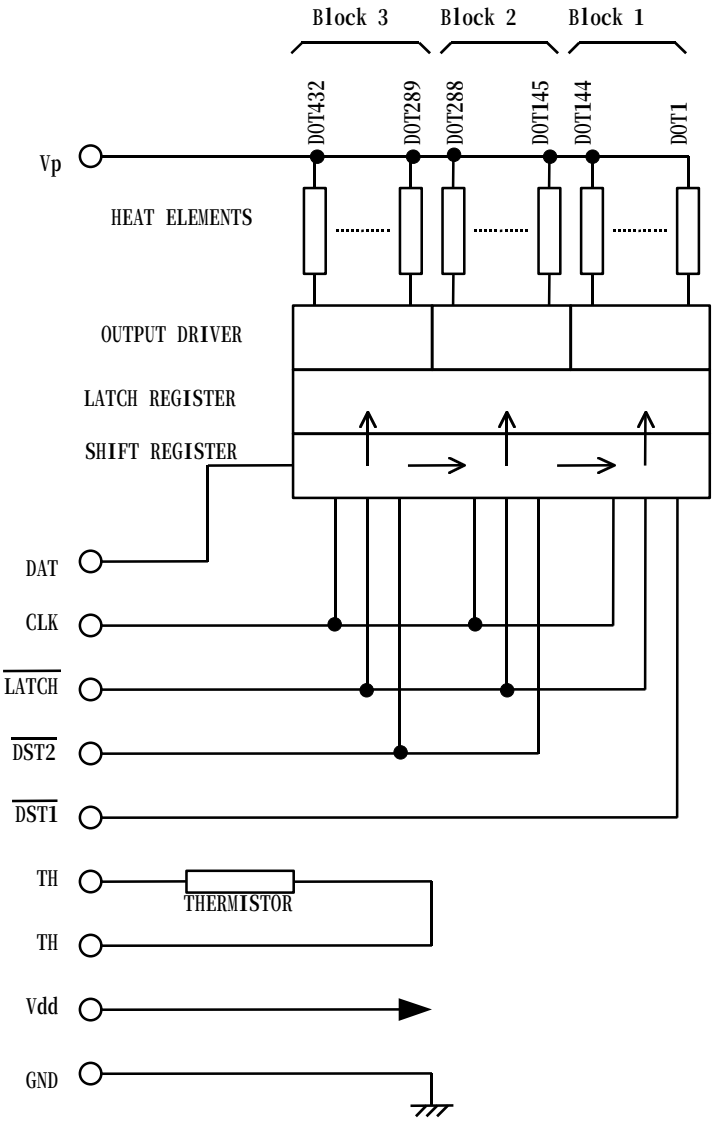


Figure 3-10 Thermal Head Block Diagram (LTP2242)

Table 3-8 DST Blocks and Activated Heat Elements (LTP2242)

DST Number	Heat Element Number	Dots / DST
DST 1	1 - 144	144
DST 2	145 - 432	288

3.5.2 Printed Position of the Data (LTP2242)

Data dots from 1 to 432 which are transferred through DAT terminal are printed as shown in **Figure 3-11**.

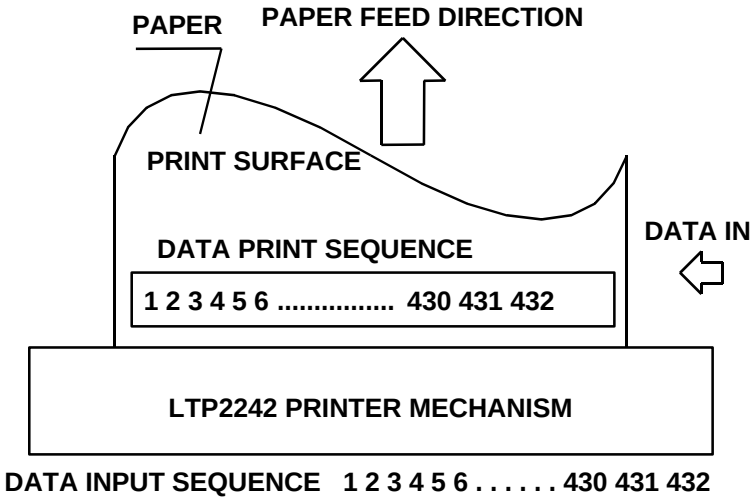


Figure 3-11 Printed Position of the Data (LTP2242)

3.5.3 Thermal Head Electrical Characteristics (LTP2242)

Table 3-9 Thermal Head Electrical Characteristics (LTP2242)

(Vdd=4.75 to 5.25 V, Ta=0 to 50 °C)

Item		Symbol	Conditions		MIN	TYP	MAX	Unit
Head resistance		RH			1800	2000	2200	Ω
Head drive voltage		Vp			21.6	24.0	26.4	V
Head drive current		Ip	at max. common activated dots number=288		3.14	3.46	3.84	A
Logic block voltage		Vdd			4.75	5.00	5.25	V
Logic block current		Idd	Ta= 25 °C	Waiting	-	-	2	mA
				fclk=4MHz,DAT=fixed	-	-	25	mA
				fclk=4MHz,DAT=1/2fclk	-	-	51	mA
"High" input voltage		Vih	CLK,DAT,LATCH,DST		0.8×Vdd	-	Vdd	V
"Low "input voltage		Vil	CLK,DAT,LATCH,DST		0	-	0.2×Vdd	V
"High"input current	CLK	Iih	Ta=25 °C Vdd=5.0(V) Vih=5.0(V)		-	-	3	μA
	DAT				-	-	1	μA
	LATCH				-	-	3	μA
	DST				-	-	12	μA
"Low "input current	CLK	Iil	Ta=25 °C Vdd=5.0(V) Vil=0(V)		-	-	-3	μA
	DAT				-	-	-1	μA
	LATCH				-	-	-3	μA
	DST				-	-	-219	μA
Driver leak current		Ileak	Vp=27(V), for 1 bit		-	-	10	μA
CLK frequency		fclk			-	-	4	MHz
CLK pulse width		t1	See Timing Chart		100	-	-	ns
DAT setup-time		t2	See Timing Chart		70	-	-	ns
DAT hold time		t3	See Timing Chart		30	-	-	ns
LATCH setup time		t4	See Timing Chart		300	-	-	ns
LATCH pulse width		t5	See Timing Chart		200	-	-	ns
LATCH hold time		t6	See Timing Chart		50	-	-	ns
DST setup time		t7	See Timing Chart		1500	-	-	ns

3.5.4 Structure of the Thermal Head (LTP2342)

Figure 3-12 shows the thermal head block diagram for the LTP2342.

Table 3-10 shows the relationship between DST blocks and activated heat elements.

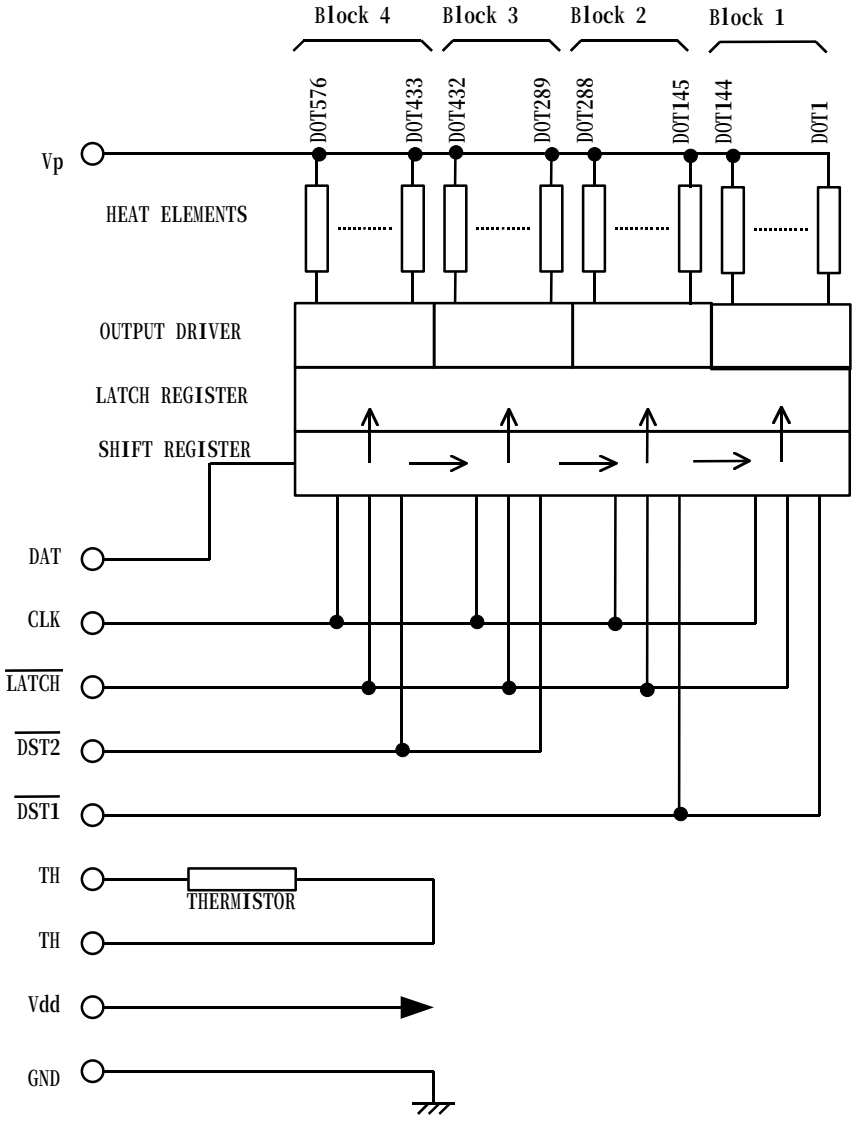


Figure 3-12 Thermal Head Block Diagram (LTP2342)

Table 3-10 DST Blocks and Activated Heat Elements (LTP2342)

DST Number	Heat Element Number	Dots / DST
DST 1	1 - 288	288
DST 2	289 - 576	288

3.5.5 Printed Position of the Data (LTP2342)

Data dots from 1 to 576 which are transferred through DAT terminal are printed as shown in **Figure 3-13**.

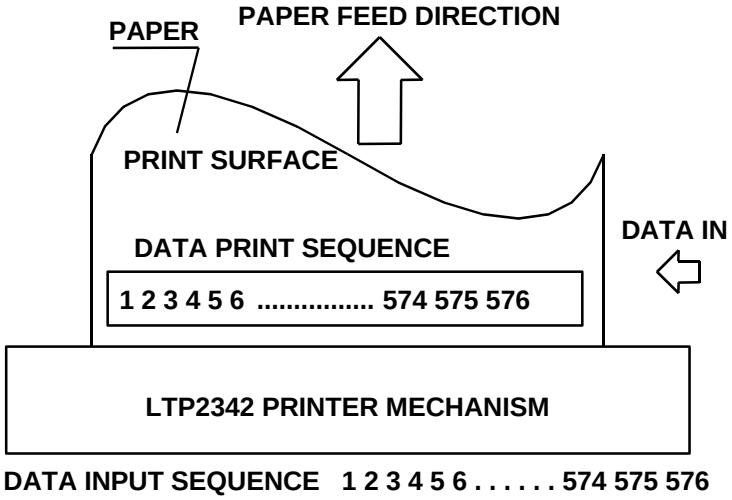


Figure 3-13 Printed Position of the Data (LTP2342)

3.5.6 Thermal Head Electrical Characteristics (LTP2342)

Table 3-11 Thermal Head Electrical Characteristics (LTP2342)

(Vdd=4.75 to 5.25 V, Ta=0 to 50 °C)

Item		Symbol	Conditions		MIN	TYP	MAX	Unit
Head resistance		RH			1800	2000	2200	Ω
Head drive voltage		Vp			21.6	24.0	26.4	V
Head drive current		Ip	at max. common activated dots number=576		6.28	6.91	7.68	A
Logic block voltage		Vdd			4.75	5.00	5.25	V
Logic block current		Idd	Ta= 25 °C	Waiting	-	-	3	mA
				fclk=4MHz,DAT=fixed	-	-	31	mA
				fclk=4MHz,DAT=1/2fclk	-	-	63	mA
"High" input voltage		Vih	CLK,DAT,LATCH,DST		0.8×Vdd	-	Vdd	V
"Low "input voltage		Vil	CLK,DAT,LATCH,DST		0	-	0.2×Vdd	V
"High"input current	CLK	Iih	Ta=25 °C Vdd=5.0(V) Vih=5.0(V)		-	-	4	µA
	DAT				-	-	1	µA
	LATCH				-	-	4	µA
	DST				-	-	16	µA
"Low "input current	CLK	Iil	Ta=25 °C Vdd=5.0(V) Vil=0(V)		-	-	-4	µA
	DAT				-	-	-1	µA
	LATCH				-	-	-4	µA
	DST				-	-	-292	µA
Driver leak current		Ileak	Vp=27(V), for 1 bit		-	-	10	µA
CLK frequency		fclk			-	-	4	MHz
CLK pulse width		t1	See Timing Chart		100	-	-	ns
DAT setup-time		t2	See Timing Chart		70	-	-	ns
DAT hold time		t3	See Timing Chart		30	-	-	ns
LATCH setup time		t4	See Timing Chart		300	-	-	ns
LATCH pulse width		t5	See Timing Chart		200	-	-	ns
LATCH hold time		t6	See Timing Chart		50	-	-	ns
DST setup time		t7	See Timing Chart		1500	-	-	ns

3.5.7 Structure of the Thermal Head (LTP2442)

Figure 3-14 shows the thermal head block diagram for the LTP2442

Table 3-12 shows the relationship between DST blocks and activated heat elements.

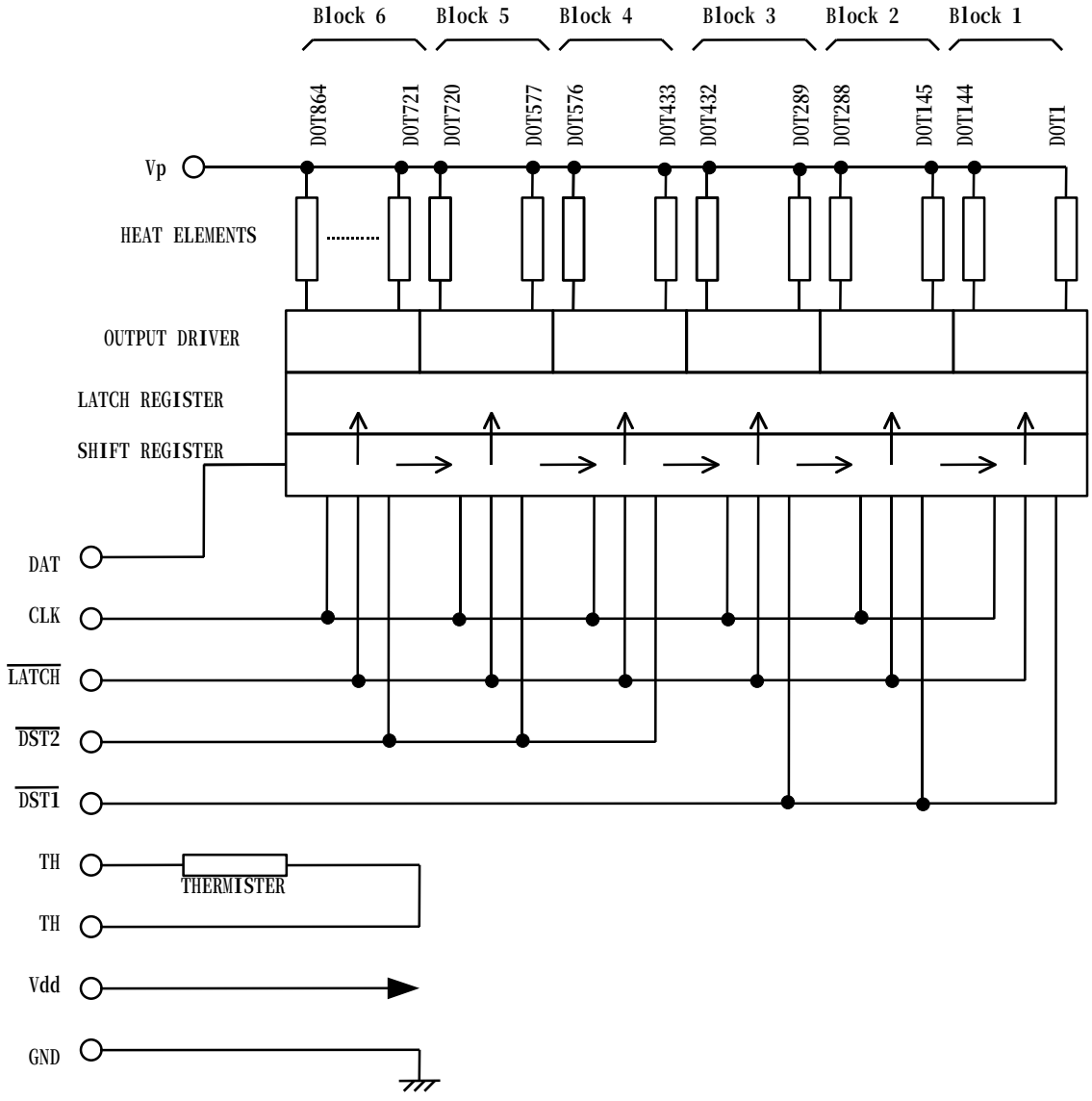


Figure 3-14 Thermal Head Block Diagram (LTP2442)

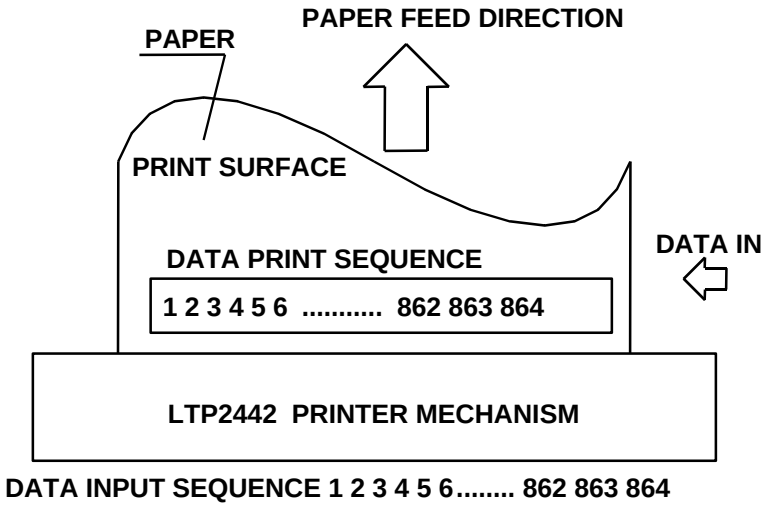
Table 3-12 DST Blocks and Activated Heat Elements (LTP2442)

DST Number	Heat Element Number	Dots / DST
DST 1	1 to 432	432
DST 2	433 to 864	432

3.5.8 Printed Position of the Data (LTP2442)

Data dots from 1 to 864 which are transferred through DAT terminal are printed as shown in **Figure 3-15**.

Transfer blank (NUL) data to 1 to 16 and 849 to 864.



NOTE: 16 dots on the right and left edges are out of the printing area.

Figure 3-15 Printed Position of the Data (LTP2442)

3.5.9 Thermal Head Electrical Characteristics (LTP2442)

Table 3-13 Thermal Head Electrical Characteristics (LTP2442)

(Vdd=4.75 to 5.25 V, Ta=0 to 50 °C)

Item		Symbol	Conditions		MIN	TYP	MAX	Unit
Head resistance		RH			1800	2000	2200	Ω
Head drive voltage		Vp			21.6	24.0	26.4	V
Head drive current		Ip	at max. common activated dots number=720		7.85	8.64	9.60	A
Logic block voltage		Vdd			4.75	5.00	5.25	V
Logic block current		Idd	Ta= 25 °C	Waiting	-	-	4	mA
				fclk=4MHz,DAT=fixed	-	-	51	mA
				fclk=4MHz,DAT=1/2fclk	-	-	102	mA
"High" input voltage		Vih	CLK,DAT,LATCH,DST		0.8×Vdd	-	Vdd	V
"Low "input voltage		Vil	CLK,DAT,LATCH,DST		0	-	0.2×Vdd	V
"High"input current	CLK	Iih	Ta=25 °C Vdd=5.0(V) Vih=5.0(V)		-	-	6	μA
	DAT				-	-	1	μA
	LATCH				-	-	6	μA
	DST				-	-	24	μA
"Low "input current	CLK	Iil	Ta=25 °C Vdd=5.0(V) Vil=0(V)		-	-	-6	μA
	DAT				-	-	-1	μA
	LATCH				-	-	-6	μA
	DST				-	-	-438	μA
Driver leak current		Ileak	Vp=27(V), for 1 bit		-	-	10	μA
CLK frequency		fclk			-	-	4	MHz
CLK pulse width		t1	See Timing Chart		100	-	-	ns
DAT setup-time		t2	See Timing Chart		70	-	-	ns
DAT hold time		t3	See Timing Chart		30	-	-	ns
LATCH setup time		t4	See Timing Chart		300	-	-	ns
LATCH pulse width		t5	See Timing Chart		200	-	-	ns
LATCH hold time		t6	See Timing Chart		50	-	-	ns
DST setup time		t7	See Timing Chart		1500	-	-	ns

3.5.10 Timing Chart

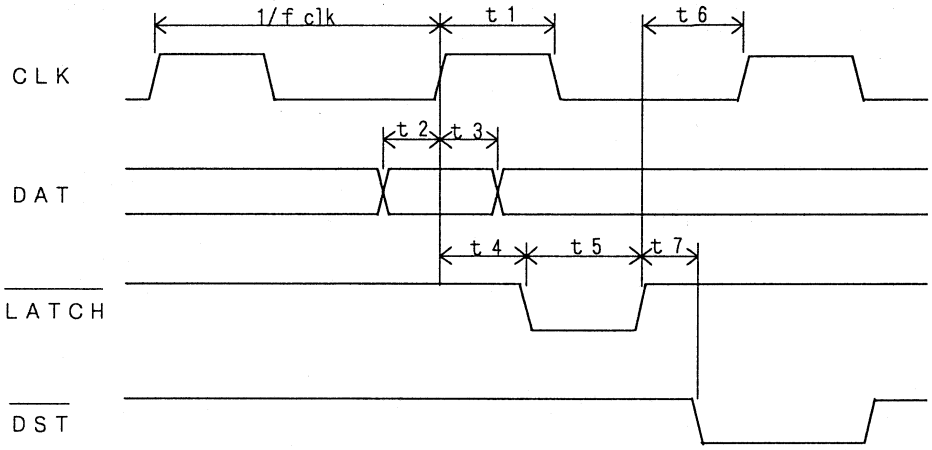


Figure 3-16 Timing Chart

3.5.11 Head Resistance

The LTP2000 Series head resistance is classified into four ranks as shown in **Table 3-14**. Head resistance ranks are also indicated on the label on the back side of the LTP2000 Series.

Table 3-14 Head Resistance Ranks

Rank	Head Resistance
1	1800 to 1900 Ω
2	1901 to 2000 Ω
3	2001 to 2100 Ω
4	2101 to 2200 Ω

Sample Label showing the Head Resistance Rank

In this example, the head resistance rank is 2.

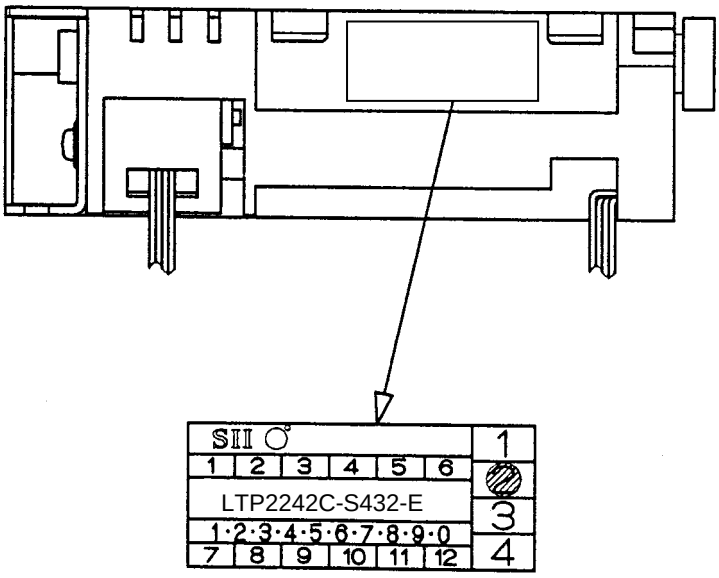


Figure 3-17 Sample Indication for the Thermal Head Resistance Rank

3.5.12 Head Voltage

The LTP2000 Series has a built-in head driver IC. **Table 3-15** shows the head voltage.

Table 3-15 Head Voltage

Item		Voltage Range
Head drive voltage	V_P	21.6 to 26.4 V
Head logic voltage	V_{dd}	4.75 to 5.25 V

3.5.13 Peak Current

Since the peak current (maximum current) may reach the values calculated using equation (1) when the thermal head is driven, make sure that the allowable current for the cable material and the voltage drop on the cables are well within the specified range.

Equation 1:

$$I_P = \frac{N \times V_P}{RH}$$

I_P : Peak current (A)
N : Number of dots that are driven at the same time
V_P : Head drive voltage (V)
RH : Head resistance (Ω)

3.6 CONTROLLING THE HEAD ACTIVATION (DST) PULSE WIDTH

3.6.1 Calculation of the Head Activation Pulse Width

The head activation pulse width is calculated using the following equation (2).
To execute high quality printing using the LTP2000 Series, the value that is calculated using the following equation (2) must be adjusted according to the printer installation environment. Calculate each value used according to the steps in **Sections 3.6.2** to **3.6.5** and control so that the pulse width with the t (msec) value obtained by substituting each value into the equation (2).
Printing using too high of voltage or too long of pulse width may shorten the life of the thermal head.

Equation 2:

$$t = \frac{E \times R}{V^2} \times C \times D$$

t	:	Heat pulse width (ms)	
V	:	Applied voltage (V)	
E	:	Standard applied energy (mJ)	Refer to **Section 3.6.2**.
R	:	Head resistance (Ω)	Refer to **Section 3.6.3**.
C	:	Head activation pulse term coefficient	Refer to **Section 3.6.4**.
D	:	Heat Storage coefficient	Refer to **Section 3.6.5**.

3.6.2 Calculation of the Applied Energy

The applied energy should be according to the temperature of the thermal head and operational environment.
The thermal head has a built-in thermistor. Measure the temperature using the thermistor resistance.
The applied energy also differs according to the thermal paper used.
The applied energy is calculated by substituting a temperature coefficient and thermal paper coefficient into the equation (3).

Equation 3:

$$E = (E_0 - Tc\ (Tx - 25)) \times P$$

E : Print energy (mJ)
E_0 : Standard applied energy at 0.202 (mJ)
T_X : Detected temperature using the thermistor (°C) [1]
P : Thermal paper coefficient

TF50KS-E2D (65μm paper)	: 1.1
PD160R-N (75μm paper)	: 1.2
TW80KKS (2-ply paper)	: 2.2
AFP235 (65μm paper)	: 1.3
TL69KS-R2 (90μm paper)	: 1.5
TL69KS-HW74 (label paper)	: 1.5
TC98KS-T1 (125μm paper)	: 1.25

T_C : Temperature coefficient

TW80KKS, TC98KS-T1	: 0.00303
TL69KS-R2	: 0.001616
Other specified thermal papers	: 0.002424

[1] The thermistor resistance value at TX (°C). Refer to **Section 3.6.6**.

3.6.3 Adjustment of the Head Resistance

Adjustment of the head resistance is according to equation (4). Due to wiring resistance there is a drop in voltage.

Equation 4:

$$R = \frac{(RH + Ri + (R_C + r_c) \times N)^2}{RH}$$

RH : Head resistance
- rank 1 1900 Ω
- rank 2 2000 Ω
- rank 3 2100 Ω
- rank 4 2200 Ω

Ri : Wiring resistance in the thermal head (Ω), Ri=25 Ω
R_C : Common terminal wiring resistance in the thermal head, R_C=0.2 Ω
r_c : Wiring resistance between VP and GND (Ω) [1]
N : Number of dots driven at the same time

[1] This resistance value is equal to the resistance of the wire used between the thermal head control connector and the power supply including the resistance of switching circuit of relay, etc.

3.6.4 Head Activation Pulse Term Coefficient

According to equation (5), calculate the compensation coefficient of the head activation pulse term (equal motor drive frequency) to get the constant printing density even when changing the printing speed such as start up acceleration control.

Equation 5:

$$C = \frac{1-1650 / (1800+W)}{1-1650 / 3467}$$

W: Head activation pulse term of one line (μs)

Calculate W in the following manner with an upper limit of 5,000:
- When the motor drive frequency is 200 pps or more:
  W = 1,000,000 / (motor drive frequency (pps))
- When the motor drive frequency is 200 pps or less:
  W = 5,000 (fixed)

3.6.5 Heat Storage Coefficient

A difference between an actual rise in temperature of the thermal head due to the head activation and the detected temperature by the thermistor occurs in the high speed printing.
Therefore, a correction of the activation pulse through the simulation of a rise in thermal head temperature is needed.
A correction may not be needed when the print ratio is low. Set “1” as the heat storage coefficient at this time.

The heat storage coefficient is calculated with the manner as follows:

① Prepare the heat storage software counters for each block to simulate the heat storage.
A block means a common activation unit of the thermal head.
This printer has two blocks corresponding to DST 1 and DST 2.

Prepare two heat storage software counters for output of both DST1 and DST2 signals at the same time even when the division drive is not used.

(a) Heat storage due to the head activation
The heat storage counter counts up in each print period as follows.

$$T' = T + \frac{(128 \times N)}{B}$$

T : Heat storage counter value
N : Number of the activated dots
B : Total dot number of each block

(b) Radiation due to time
The heat storage counter value is multiplied by the radiation coefficient in each 1 msec.

$$T' = T \times K$$

K : Radiation coefficient 0.997

② Calculate the heat storage coefficient with the following equation.

$$D = 1 - \frac{T}{56224}$$

3.6.6 Thermistor Resistance

The resistance of the thermistor at the operating temperature T_X (°C) is determined using the following equation (6).

Equation 6:

$$R_X = R_{25} \times \mathrm{EXP}\left\{ B \times \left(\frac{1}{273+T_X} - \frac{1}{298} \right) \right\}$$

R_X:	Resistance at operating temperature Tx (°C)
R_{25}:	30 kΩ±10% (25 °C)
B:	3950 K±2 %
T_X:	Operating temperature (°C)
EXP (A) :	The Ath power of natural logarithm e (2.71828)

[Rating]

Operating temperature range: -40 °C to +125 °C

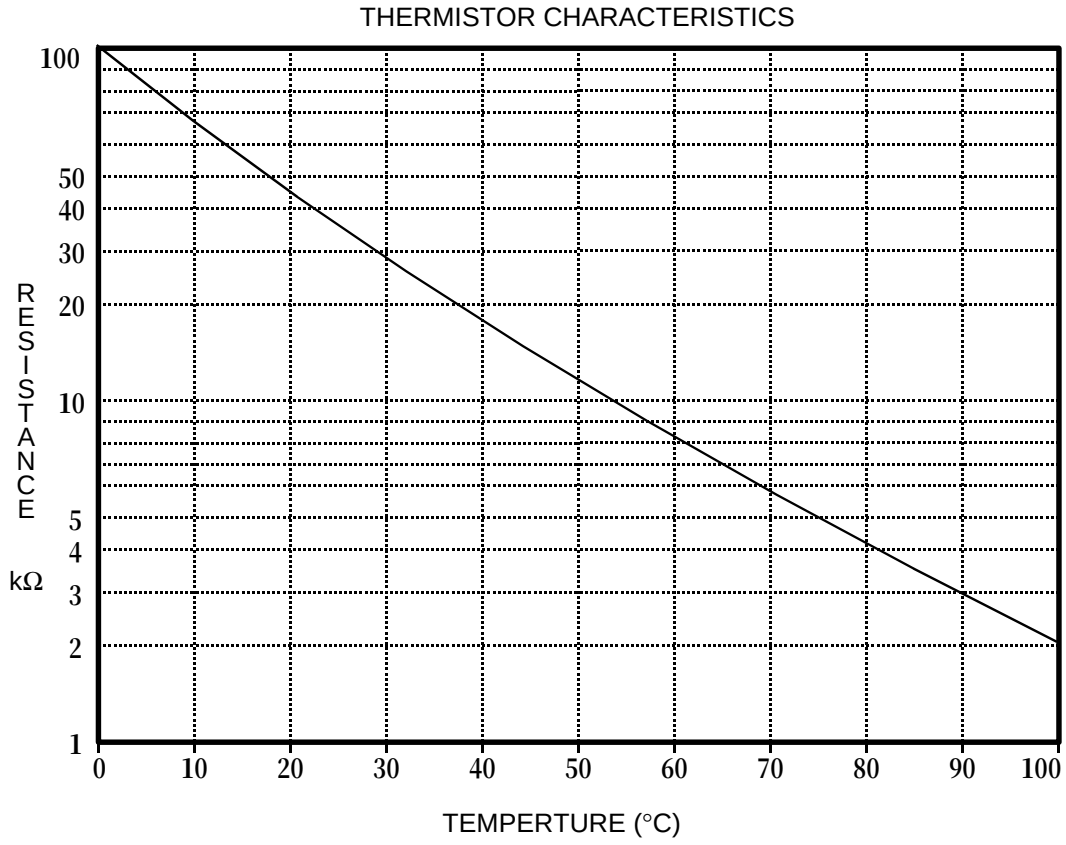


Figure 3-18 Thermistor Resistance vs. Temperature

Table 3-16 Temperature and Corresponding Thermistor Resistance

Temperature (°C)	Thermistor Resistance (kW)
0	100.99
5	77.85
10	60.57
15	47.53
20	37.61
25	30.00
30	24.11
35	19.51
40	15.89
45	13.03
50	10.75
55	8.92
60	7.45
65	6.25
70	5.27
75	4.47
80	3.80
85	3.25
90	2.79
95	2.41
100	2.09

3.6.7 Head Activation for 2-ply Thermal Papers

Activate the heat elements with two 1/2 pulse width of the head activation pulse calculated through the equation (2) in **Chapter 3.6.1** as shown in the following figure to get the good print quality on the 2-ply thermal paper.

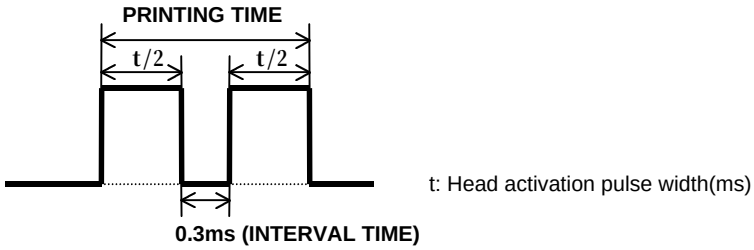


Figure 3-19 Head Activation for 2-ply Thermal Papers

3.6.8 Detecting Abnormal Temperatures of the Thermal Head

To protect the thermal head and to ensure personal safety, abnormal thermal head temperatures must be detected by both hardware and software as follows:

- Detecting abnormal temperatures by software

  Design software that will deactivate the heat elements if the thermal head thermistor (TH) detects a temperature higher than 80 °C (thermistor resistance RTH ≤ 3.80 kΩ), and reactivate the heat elements when a temperature lower than 60 °C (RTH ≥ 7.45 kΩ) is detected. If the thermal head continues to be activated at a higher temperature than 80 °C, the life of the thermal head may be shortened significantly.

- Detecting abnormal temperatures by hardware

  If the control unit (CPU) malfunctions, the software for detecting abnormal temperatures may not function properly, resulting in overheating of the thermal head. The overheating of the thermal head may cause damage to the thermal head or cause skin burns.
  Always use hardware in conjunction with software for detecting abnormal temperatures to ensure personal safety (this may not prevent damage to the thermal head).

- Using a window comparator circuit or similar detector, design hardware that detects the following abnormal conditions:

(a) Overheating of the thermal head (approximately 100 °C or higher (RTH ≤ 2.09 kΩ))

(b) Faulty thermistor connection (the thermistor may be open or short-circuited).

If (a) and (b) detected, immediately deactivate the heat elements. Reactivate the heat elements after they have returned to normal.

3.7 HEAD-DOWN DETECTOR

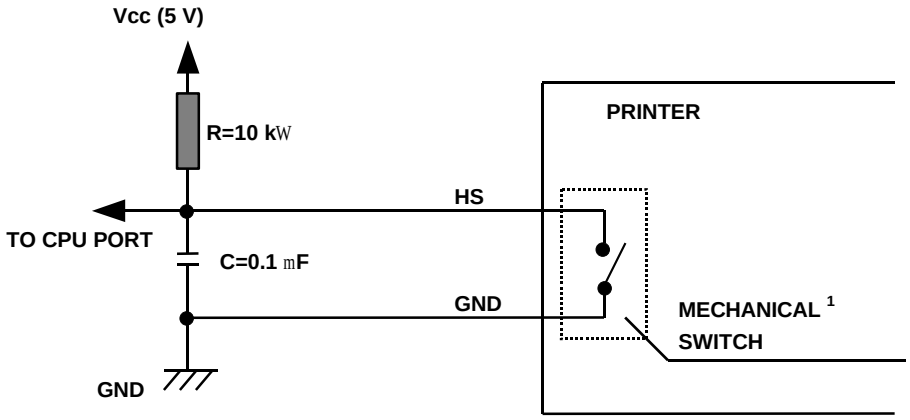
LTP2000 Series has a built-in head-down detector to detect whether the head is up or down. This detector is a mechanical switch which is designed to close when the head is in the down position (printing state) and to open when in the up and neutral positions.

The external circuit should be designed so that it detects the output from the head-down detector and does not activate the thermal head when the head is in others of the down position. Otherwise, the thermal head may be damaged or the life of the head may be shortened significantly.

3.7.1 General Specifications

Maximum rating : 7 V DC, 1 mA
Contact resistance : 70 mΩ maximum

3.7.2 Sample External Circuit



[1] **The mechanical switch is closed when the head is in the down position.**

Figure 3-20 Sample External Circuit of the Head-Up Detector

Note that there is a time lag between the time when the thermal head stays completely up or down and when the head-up detector starts to operate.

Always use the capacitor shown in **Figure 3-20** to prevent the switch from malfunctioning as a result of chattering.

3.8 PAPER DETECTOR

The LTP2000 Series has a built-in paper detector (reflection type photo-interrupter) to check for the presence or absence of paper.

The external circuit should be designed so that it detects the output from the paper detector and does not activate the thermal head when paper runs out. Otherwise, the thermal head or platen roller may be damaged or the life of the thermal head may be significantly shortened.

3.8.1 General Specifications

Table 3-17 Absolute Maximum Ratings of the Paper Detector (at 25 °C)

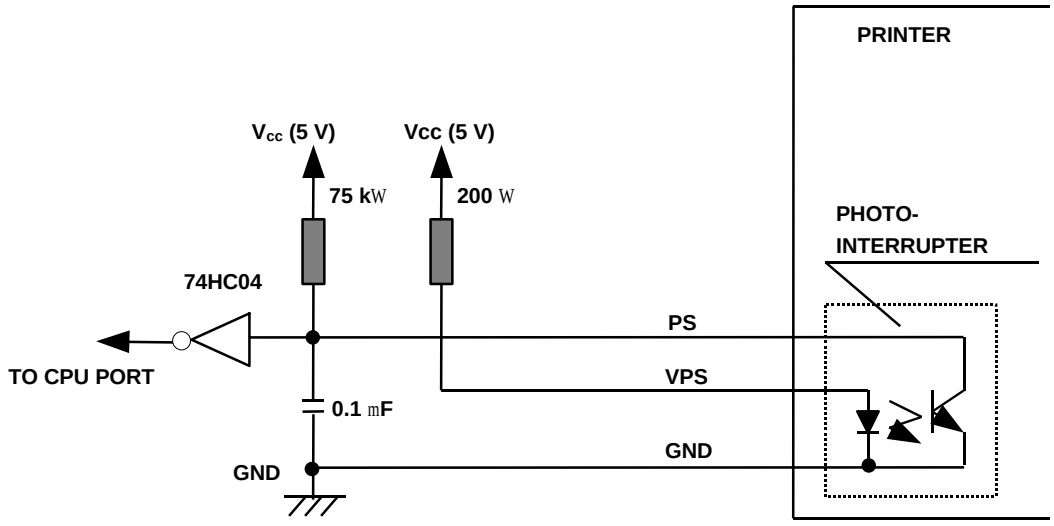
Item		Symbol	Maximum Rating
LED (input)	Forward current	I_F	50 mA
	Peak forward current	I_{FM}	1A
	Reverse voltage	V_R	6 V
	Allowable current	P	75 mW
Photoransistor (output)	Collector-to-emitter voltage	V_{CEO}	35 V
	Emitter-to-collector voltage	V_{ECO}	6 V
	Collector current	I_C	20 mA
	Collector loss	P_C	75 mW
Total allowable loss		P_{tot}	100 mW
Operating temperature		T_{opr}	-25 to +85 °C
Storage temperature		T_{stg}	-40 to +100 °C

Table 3-18 Paper Detector Input / Output Conditions

Item		Symbol	Conditions	Std.	Max.
LED (input)	Forward voltage	V_F	I_F=20 mA	1.2 V	1.4 V
	Peak forward voltage	V_{FM}	I_{FM}=0.5A	3.0 V	4.0 V
	Reverse current	I_R	V_R=6 V	———	10 µA
	Capacity between terminals	Ct	V_R=0 V, f=1 kHz	50 pF	100 pF
Photo-transistor (output)	Dark current	I_{CEO}	V_{CE}=20 V	10^{-9}A	10^{-7}A
Transfer char.	Photoelectric current	I_C	I_F=4 mA, V_{CE}=2 V	45 µA	120 µA
	Response time (at rise)	t_r	Ic=100 µA, V_{CE}=2 V	20 µs	100 µs
	Response time (at fall)	t_f	R_L=1 KΩ, d=1 mm[1]	20 µs	100 µs
	Leak current	I_{LEAK}	I_F=4 mA, V_{CE}=2 V	———	0.1 µA

[1] d = Detect distance

3.8.2 Sample External Circuit



The PS signal is high when paper is exhausted.

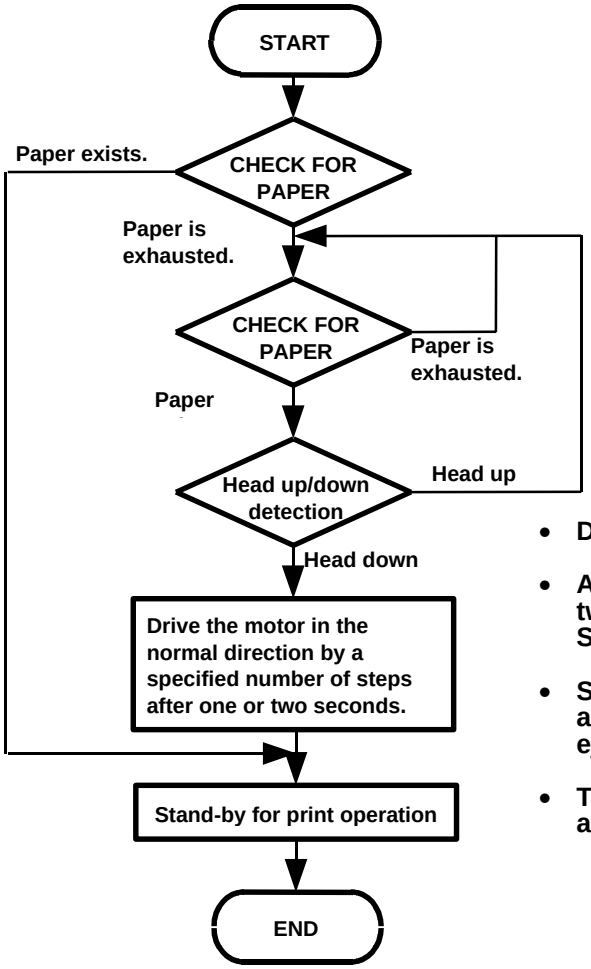
Figure 3-21 Sample External Circuit of the Paper Detector

3.8.3 Automatic Paper Load

Paper can be automatically loaded when used in conjunction with the paper detector. When performing automatic paper load, set the printer to exhausting of paper and head up state. Then, feed the paper until the paper ran into the bottom. To prevent paper from skewing, cut the edges at right angles with respect to the paper feed direction before loading it.

If skewed, feed the paper until it is straight, or place the head in the up position and adjust the paper so that it is fed straight.

Figure 3-22 shows a flowchart for automatically loading paper.



- **Drive the motor at 150 pps.**
- **After passing the sensors, it takes one or two seconds to catch the paper to platen. Set the appropriate time to it.**
- **Set the number of motor drive steps according to the distance to the paper eject.**
- **The distance between the paper detector and the heat elements is:**
  approximately 9 mm (curl path)
  approximately 11 mm (straight path)

Figure 3-22 Flowchart for Automatic Paper Load

CHAPTER 4

CONNECTING EXTERNAL CIRCUITS

Use the recommended connectors for connecting the external circuits of the LTP2000 Series as shown in **Table 4-1**.

Table 4-1 Recommended Connectors

No.	Function and Model Number	Number of Pins	Recommended Connectors (External Circuit)
1	Thermal head control connector (KYOCERA ELCO : 60-8283-1613-00-000)	16	KYOCERA ELCO: 60-8283-3168-45-000
2	Motor connector (MOLEX: 51090-0400)	4	MOLEX: 53324-0460 (horizontal type) 53325-0460 (vertical type)
3	Detector connector (MOLEX : 51090-0500)	5	MOLEX: 53324-0560 (horizontal type) 53325-0560 (vertical type)

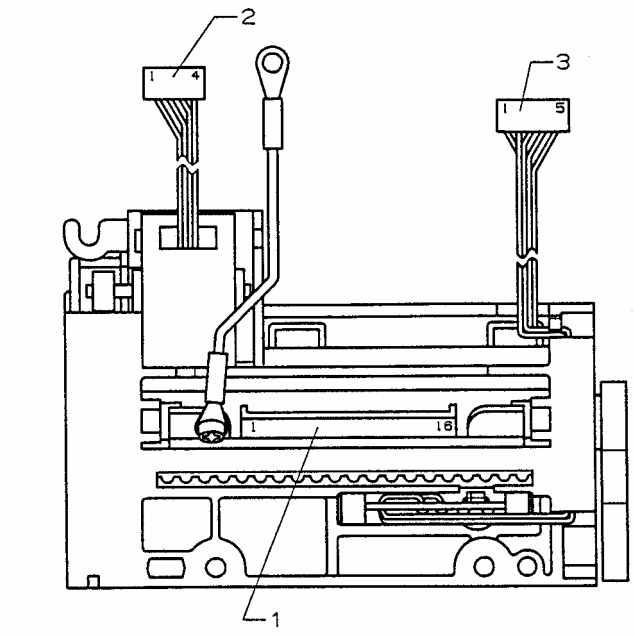


Figure 4-1 External Circuit Connecting Terminals

4.1 THERMAL HEAD CONTROL CONNECTOR

Figure 4-2 shows the terminal configuration of the thermal head control connector.

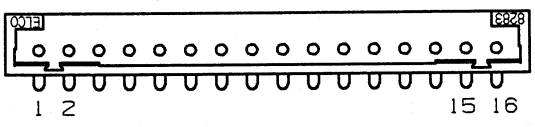


Figure 4-2 Thermal Head Control Terminals

Table 4-3 Thermal Head Control Terminal Assignments

Terminal Number	Signal Name	Input/Output	Function
1	Vp	Input	Head drive power
2	Vp	Input	Head drive power
3	TH	—	Thermistor
4	TH	—	Thermistor
5	DST1	Input	Head activation signal
6	GND	—	GND
7	GND	—	GND
8	GND	—	GND
9	GND	—	GND
10	Vdd	Input	Head logic power (5V)
11	DST2	Input	Head activation signal
12	LATCH	Input	Transferred data latch (memory)
13	CLK	Input	Data transfer synchronize signal
14	DAT	Input	Print data input (serial input)
15	Vp	Input	Head drive power
16	Vp	Input	Head drive power

* Use the following lead wires for the housing side:

- AWG#26 for LTP2242 and LTP2342
- AWG#24 for LTP2442

4.2 MOTOR CONNECTOR

Figure 4-3 shows the motor control connector.

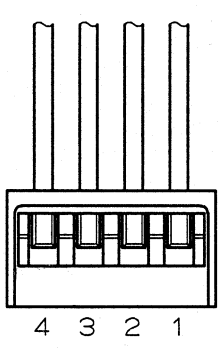


Figure 4-3 Terminals on the Motor Connector

Table 4-3 shows the terminal assignments of the motor connector.

Table 4-4 Terminal Assignments of the Motor Connector

Terminal Number	Signal Name	Function
1	B	Motor drive signal
2	A	Motor drive signal
3	$\overline{B}$	Motor drive signal
4	$\overline{A}$	Motor drive signal

4.3 DETECTOR CONNECTOR

Figure 4-4 shows the detector connector.

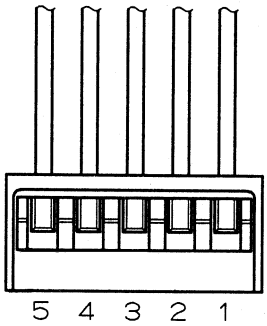


Figure 4-4 Terminals on the Detector Connector

Table 4-5 Terminal Assignments of the Detector Connector

Terminal Number	Signal Name	Function
1	Vps	LED anode (Power supply side)
2	PS	Photo transistor collector (Output side)
3	GND	Paper detector GND
4	GND	Head down detector GND
5	HS	Head down detector output

(Note) Terminal numbers 4 and 5 can be reversed because the head down detector is a mechanical switch.

CHAPTER 5

DRIVE METHOD

Drive the motor and the thermal head at the same time for printing. **Figure 5-1** is a timing chart for driving using two divisions. **Figure 5-1** is an example of acceleration control of the motor, data transfer to the head and two-divisions of the head.

Output DST1 and DST2 at the same time when not using two divisions driving.

A: Pause state
Transfer the data which are printed in the first dot line to the SHIFT REGISTER of the thermal head.

B: Start step output
Output the same phase to the motor as that having been output just before the motor stopped. The step time is the first acceleration step term.

C: First step
① Output a LATCH signal and store the one dot line data transferred in step A in the LATCH REGISTER. And then, start activating the thermal head by DST1 and DST2 signals.
② Transfer the next print data to the thermal head.

D: Second step
① Output a LATCH signal and store the one dot line data transferred in step C in the LATCH REGISTER. And then, start activating the thermal head by DST1 and DST2 signals.
② Transfer the next print data to the thermal head.

Repeat the steps in the same way. Transfer the data which will be printed in the next step to the thermal head while starting the activation of the thermal head.
The data transfer time and head activation time may be longer than the motor step time according to the type of the thermal paper, printing data and operational environment.
In this case, hold the motor step until completion of printing.
Keep 0.1 msec for the pause time after head activation.
The print data in the First step can be transferred while outputting the Start step (B). However, the print data is transferred before outputting the Start step in **Figure 5-1**.

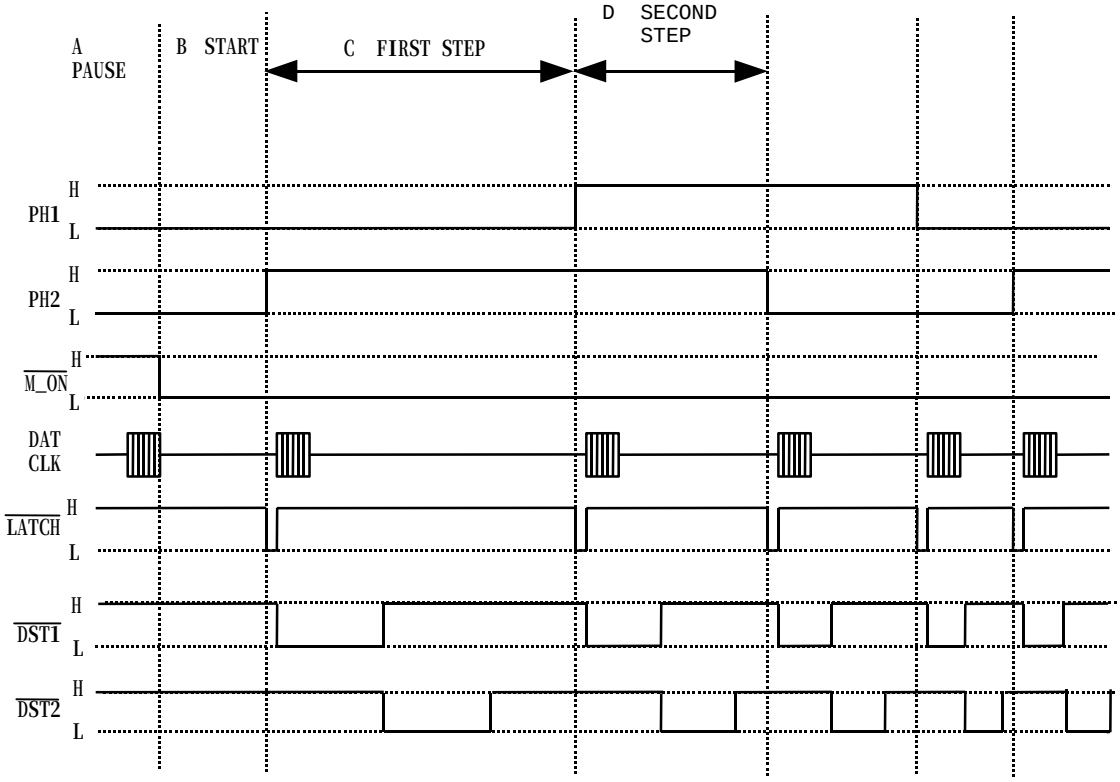


Figure 5-1 Timing Chart for Driving Using Two Divisions

CHAPTER 5

DRIVE METHOD

Drive the motor and the thermal head at the same time for printing. **Figure 5-1** is a timing chart for driving using two divisions. **Figure 5-1** is an example of acceleration control of the motor, data transfer to the head and two-divisions of the head.

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② Transfer the next print data to the thermal head.

D: Second step
① Output a LATCH signal and store the one dot line data transferred in step C in the LATCH REGISTER. And then, start activating the thermal head by DST1 and DST2 signals.
② Transfer the next print data to the thermal head.

Repeat the steps in the same way. Transfer the data which will be printed in the next step to the thermal head while starting the activation of the thermal head.
The data transfer time and head activation time may be longer than the motor step time according to the type of the thermal paper, printing data and operational environment.
In this case, hold the motor step until completion of printing.
Keep 0.1 msec for the pause time after head activation.
The print data in the First step can be transferred while outputting the Start step (B). However, the print data is transferred before outputting the Start step in **Figure 5-1**.

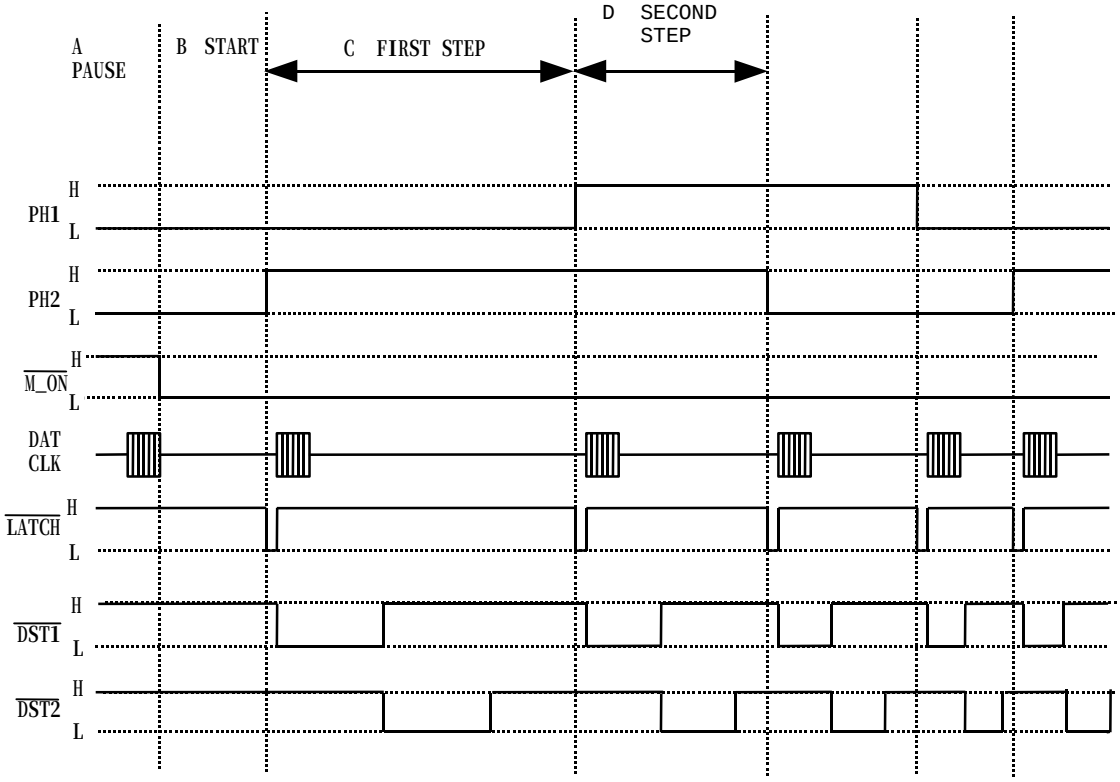


Figure 5-1 Timing Chart for Driving Using Two Divisions

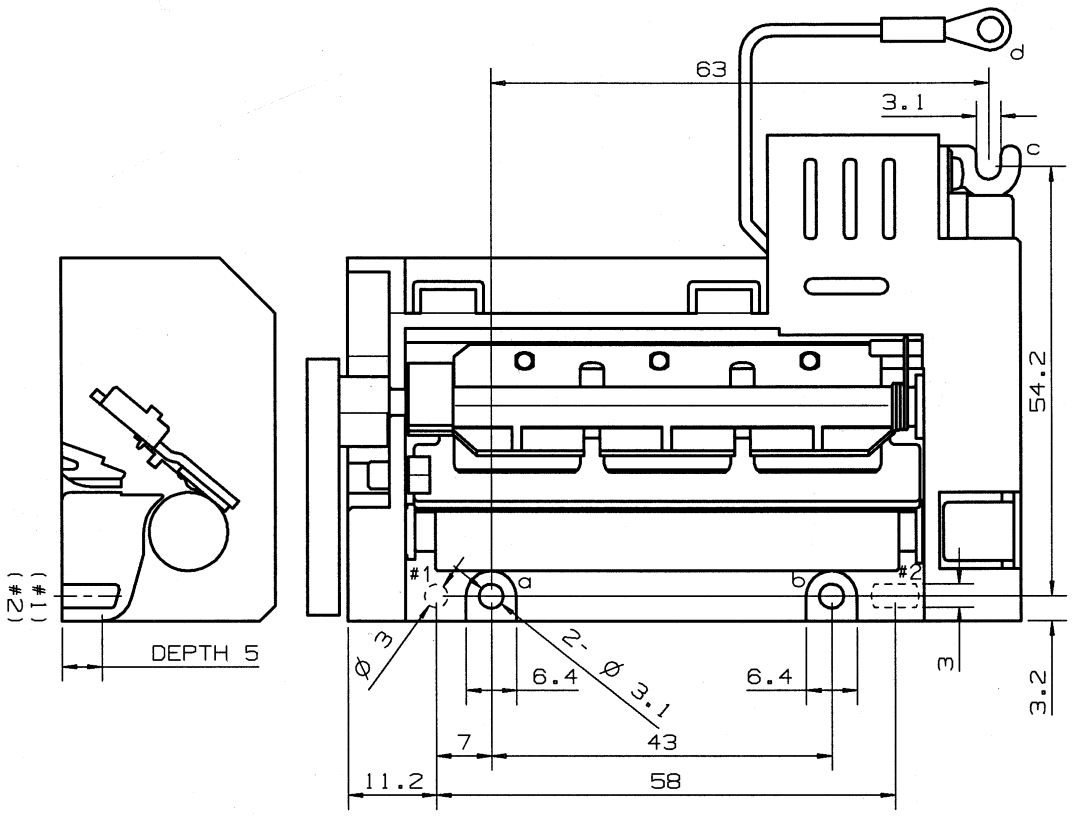
CHAPTER 6

HOUSING DESIGN GUIDE

6.1 SECURING THE PRINTER

6.1.1 Printer Mounting Dimensions (LTP2242)

As shown in **Figure 6-1**, secure the LTP2242 at three mounting holes: a, b and c.
The indents #1 and #2 are for positioning.

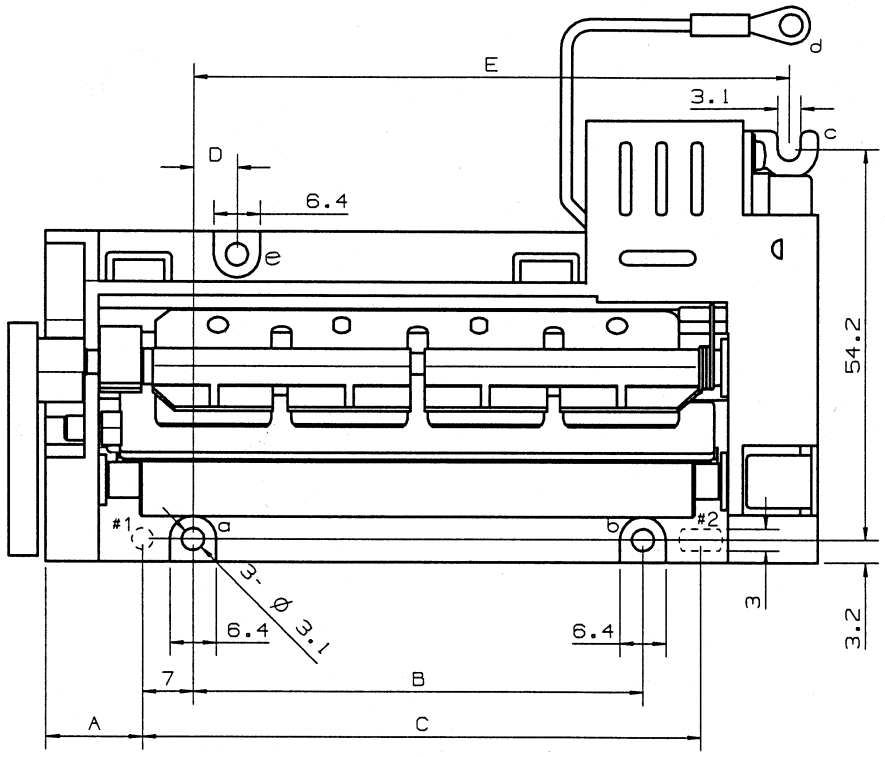


(Unit: mm)

Figure 6-1 Printer Mounting Dimensions (LTP2242)

6.1.2 Printer Mounting Dimensions (LTP2342 and LTP2442)

As shown in **Figure 6-2**, secure the LTP2342 and LTP2442 at four mounting holes: a, b, c and e. The indents #1 and #2 are for positioning.



	LTP2342	LTP2442
A	13.3	11.7
B	62.0	96.0
C	77.0	111.0
D	6.0	0.0
E	82.1	115.5

(Unit: mm)

Figure 6-2 Printer Mounting Dimensions (LTP2342 and LTP2442)

Recommended Screws

Recommended mounting screws are as follows:

① JIS B1111 M2.6 and M3 pan head Phillips screw

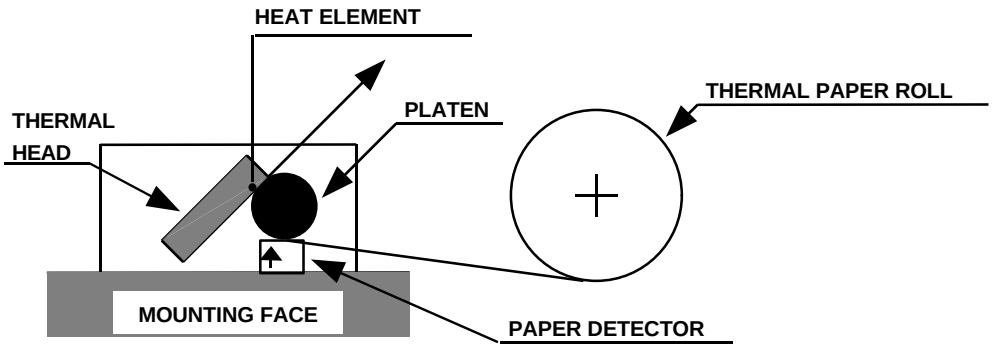
② Small P Tight 2.6 screw for plastic

6.1.3 Precautions for Securing the Printer

- Make sure that no excessive force, deformation, nor torsion acts on the printer while securing it. Otherwise, abnormalities such as deterioration of print quality, paper skew, paper jam and/or excessive noise may occur.
- Mount the printer on the flat mounting face and use the printer in a place where vibration is not occurred. A rubber vibration isolator is also effective to prevent vibration.
- Connect both U shaped gutters c and circular terminal d to Frame Ground (FG) on the circuit board with metal screws to prevent damage to the thermal head due to static electricity.
- Make equipotential between frame ground and signal ground by connecting both with an approximately 1 MΩ resistor.
- Do not damage the lead wires when securing the printer.

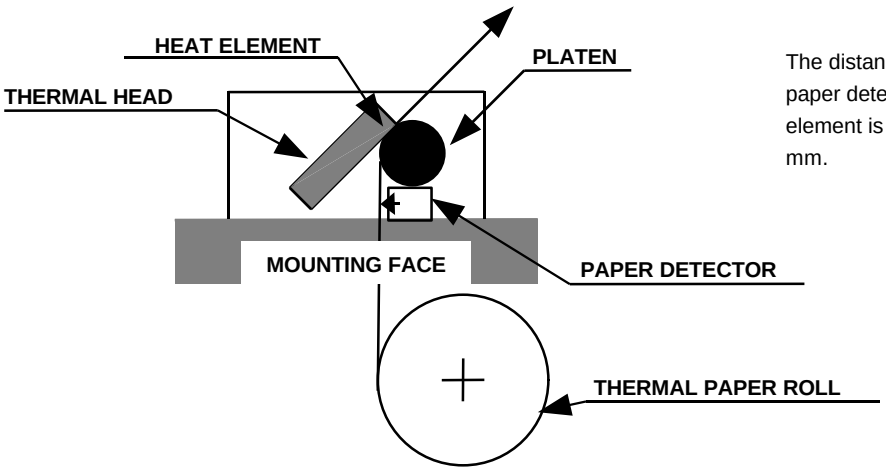
6.2 LAYOUT OF PRINTER AND PAPER

The LTP2000 Series can be laid out as shown in **Figure 6-3** or **6-4** according to the loading direction of the paper. When ordering, make your selection between the two models based on the desired use.



The distance between the paper detector and the heat element is approximately 9 mm.

Figure 6-3 Curled Path

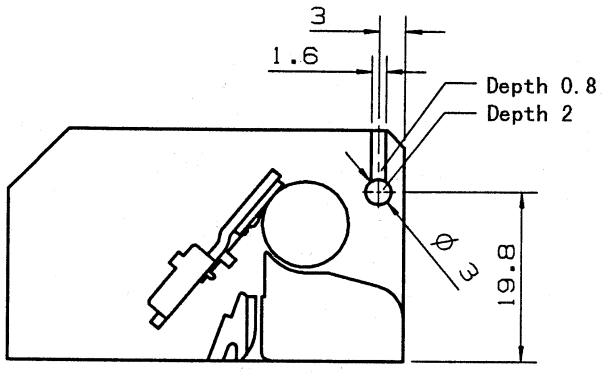


The distance between the paper detector and the heat element is approximately 11 mm.

Figure 6-4 Straight Path

6.3 PAPER CATCH PROTECTION GUIDE

Design the outer case not to catch the paper fed in the platen roller.
Use the mounting holes shown in **Figure 6-5** when installing the paper catch protection cover on the printer side.



(Unit: mm)

Figure 6-5 Mounting holes for the Paper Catch Protection Cover

(Note)

1. SII will not supply a paper catch protection cover.
2. The mounting holes shown in **Figure 6-5** can not be used when the paper cutter unit is installed to the printer.

6.4 WHERE TO MOUNT THE PAPER HOLDER

When determining the layout of paper holder, note the following:

- When you use a paper roll, set the holder so that the paper is in alignment with the paper intake with no horizontal offset, and that the center axis of the paper roll is parallel with the printer.
- Adjust the load by the paper holder when paper is supplied to the printer to 0.49N (50 gf) or less.

6.5 WHERE TO MOUNT THE PAPER CUTTER

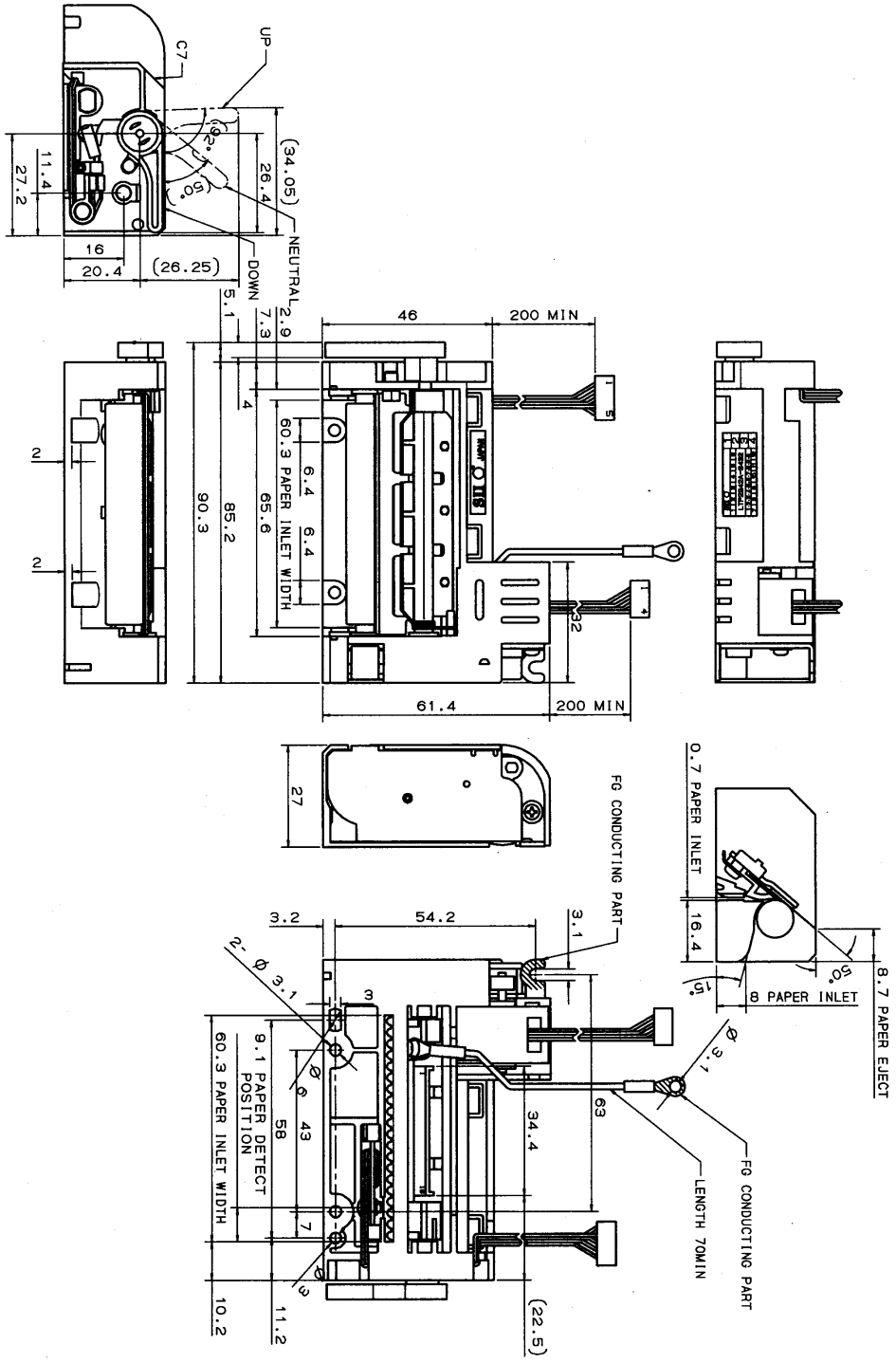
Install the paper cutter so that it does not interfere with the paper feed. The angles and positions for feeding paper are shown in **Chapter 7**.

- If the distance between the edge of the thermal head and the edge of the fed paper is too small, the paper may be caught in the platen. Please take this into account when designing the outer case.
- Use a cutter with a sharp edge so that paper is cut with the paper hold force or less.

CHAPTER 7

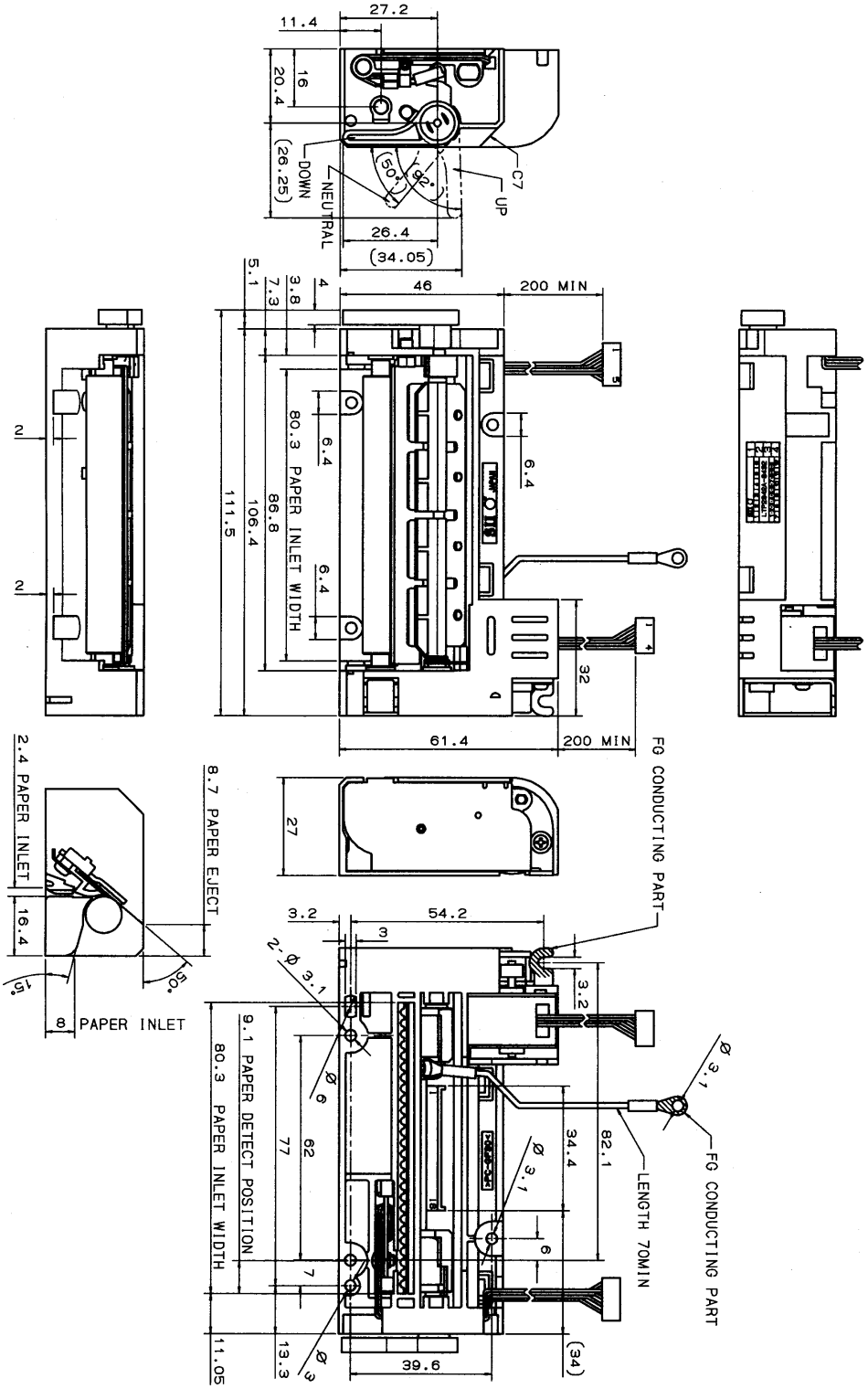
APPEARANCE AND DIMENSIONS

Figure 7-1 shows the appearance and external dimensions of the LTP2242.
Figure 7-2 shows the appearance and external dimensions of the LTP2342.
Figure 7-3 shows the appearance and external dimensions of the LTP2442.



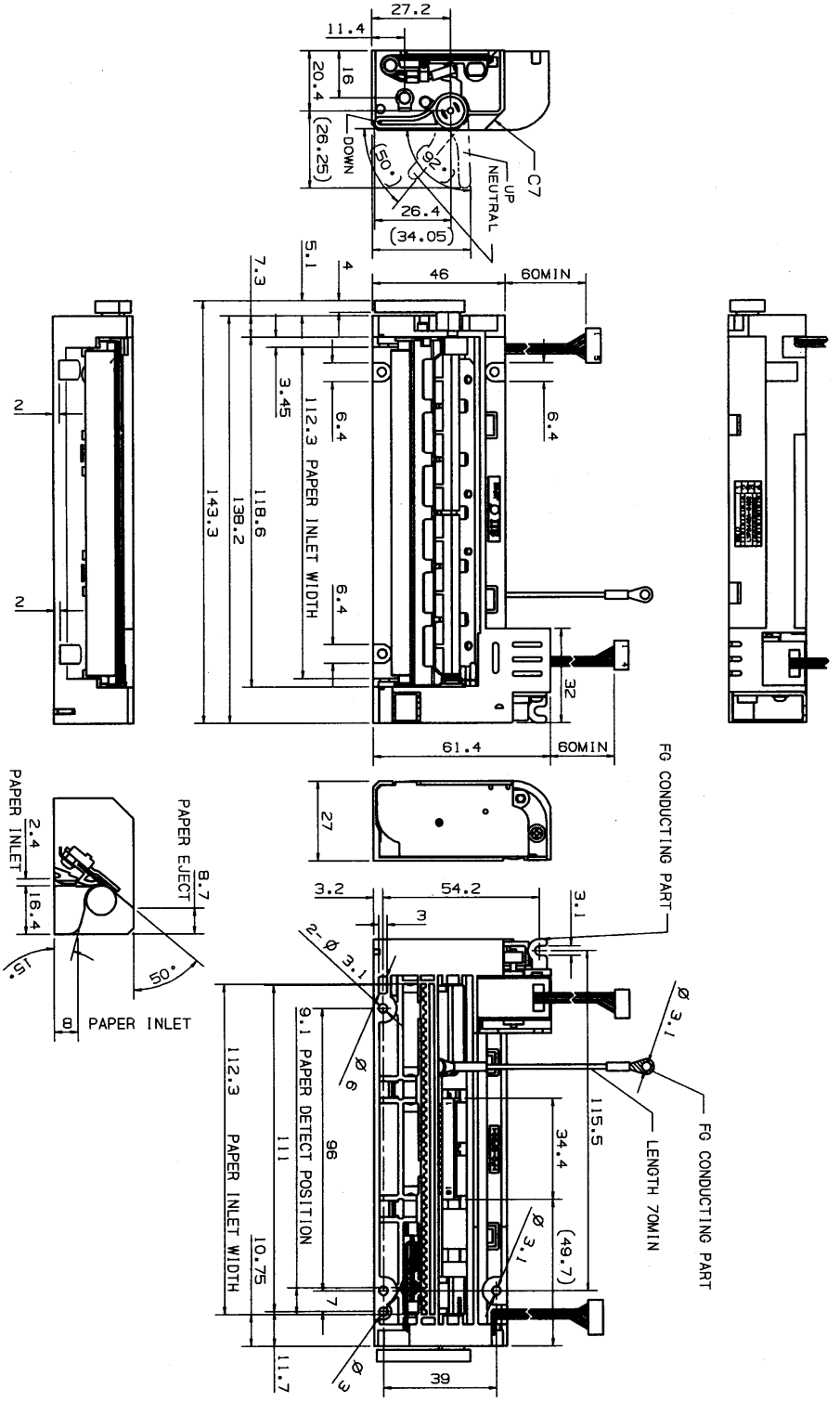
(Unit: mm)

Figure 7-1 Appearance and Dimensions (LTP2242)



(Unit: mm)

Figure 7-2 Appearance and Dimensions (LTP2342)



(Unit: mm)

Figure 7-3 Appearance and Dimensions (LTP2442)

CHAPTER 8

LOADING/UNLOADING PAPER AND HEAD CLEANING

8.1 LOADING/UNLOADING PAPER PRECAUTIONS

① Loading paper

- Lift the head up/down lever until clicking. The thermal head is held in up position.
- Insert the paper straight into the paper insert position.
- When the edge of the paper comes up from between the thermal head and the platen, pull the edge of the paper, check whether the paper is aligned correctly, and place the thermal head into the down position.

② Unloading paper

- Unload paper with the thermal head in the up position.
- Pull the paper straight up by hand in the direction in which the paper is normally fed.
- If the paper is bonded on the core of the paper roll, separate the paper from the core and then pull the paper out.

③ Cleaning a paper jam

- Pull the paper slowly to the direction in which the paper is normally fed with the thermal head in up position.

④ Automatically loading paper

- See **"3.8.3 Automatic Paper Load"** for control.
- Leaving the printer in head down state for a long time may not be done the automatically loading due to the thermal head and platen getting stuck together.
  In this case, try again after solving the stuck through head up operation.
- Load paper with the thermal head in the down position.
- Cut the edge of paper in the manner as shown in **Figure 8-1**.

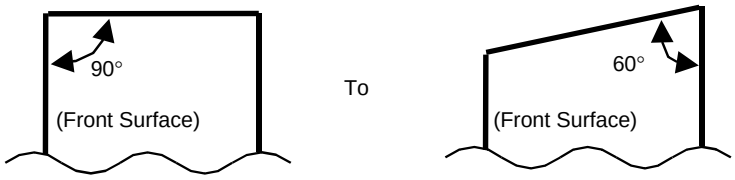


Figure 8-1 Paper Edge

NOTE: The paper sensor is located on the same side as the head-up lever. If the paper is cut in a direction opposite to that as shown in **Figure 8-1**, then it will not detect the paper.

- Insert the paper straight into the printer until it stops. The side edge of paper is hit the guide of the frame for the slanting prevention of paper and paper is inserted.

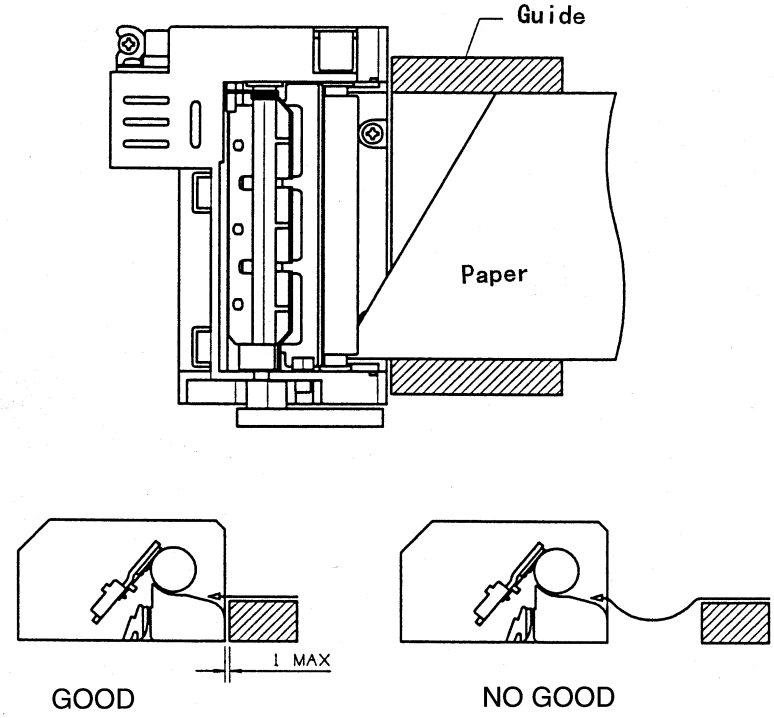


Figure 8-2 Example of the paper guide mounting

- When the paper slants after being inserted, either feed paper until it straightens out or pull up the head and reset the paper.

- In a high temperature, high humidity environment, the paper may lose its stiffness resulting in a loss of efficiency of the automatic paper insert or a paper jam. Confirm the printer works well under the environment it is intended to be used.

- There may be a loss of efficiency of the automatic paper insert when the diameter of the paper roll is small.

8.2 HEAD CLEANING PRECAUTIONS AND PROCEDURE

8.2.1 Head Cleaning Precautions

① Do not clean the head directly after printing because the head unit and pressure unit are hot.

② Do not use sandpaper, cutter, etc. when cleaning. They will damage the heat elements.

8.2.2 Head Cleaning Procedure

① Lift the head up/down lever until clicking. The thermal head is held in the up position.

② Clean the heat elements with a cotton bud immersed in ethyl alcohol or isopropyl alcohol.

③ After the alcohol has compleately dried, down the head up/down lever.

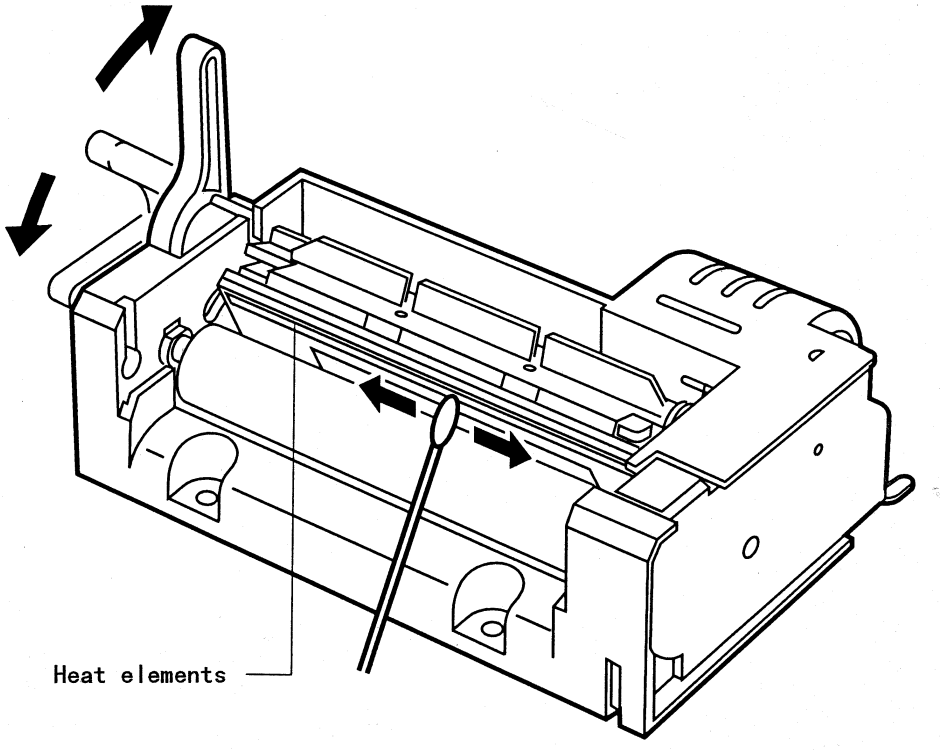


Figure 8-3 Head Cleaning Procedure

CHAPTER 9

PERIPHERALS

9.1 PAPER CUTTER

The paper cutter units can be installed on the LTP2000 Series as shown in **Table 9-1**.

The ACU 2000 Series paper cutter units are guillotine type of cutters that can be selective the paper cutting types through the selection of the motor direction (clockwise or counter-clockwise).
Please refer to the **"ACU2000 Series Autocutter Unit Technical Reference"** for the specifications and drive method of each.

Table 9-1 Installing the Paper Cutter

LTP2000 Series	ACU2000 Series
LTP2242	ACU2224A-A-E
LTP2342	ACU2324A-A-E
LTP2442	ACU2424A-A-E

9.1.1 Installation Method

① Put ribs of the cutter unit to two holes on the printer frame.

② Push the paper cutter to direction of the an arrow shown in the figure and lock it to the printer frame.

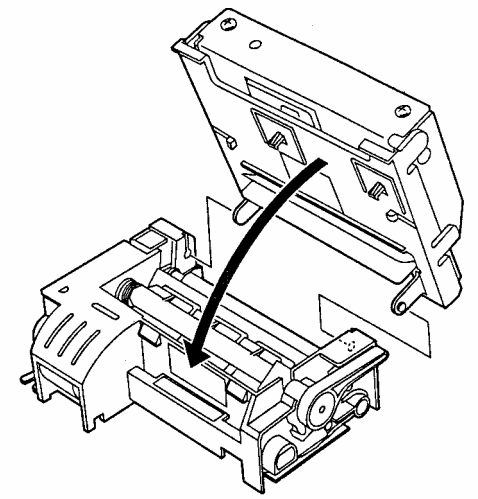


Figure 9-1 Installing the Paper Cutter

9.1.2 Paper Insertion

(1) Inserting the paper manually:

① Put the printer to the head up state.

② Cut the edge of the paper as shown in **Figure 9-2**.

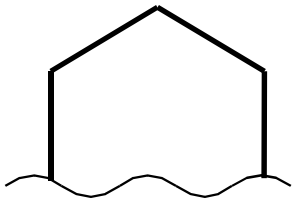


Figure 9-2 Paper Edge (Manual Load)

③ Insert the edge of the paper straight into the paper insert position and feed the paper until it emerges from the paper cutter.

④ Pull on the edge of the paper and check to make sure it is properly set, then put the head down.

(2) Loading the paper automatically:

① Put the printer to the head down state.

② Cut the edge of paper in the manner as shown in **Figure 9-3**.

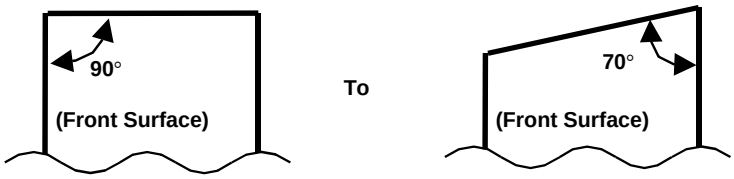


Figure 9-3 Paper Edge (Automatic Load)

③ Insert the edge of the paper straight into the paper insert position until it stops.

④ Insert the paper with the paper feed operation of the printer.
If the paper is slanted, put the head up and straighten out the paper.

Note: 1) The paper sensor is located on the same side as the head-up lever. If the paper is cut in a direction opposite to that as shown in **Figure 9-3**, then it will not detect the paper.
2) There may be a loss of efficiency of the automatic paper insert when the diameter of the paper roll is small.
3) In a high temperature, high humidity environment, the paper may lose its stiffness resulting in a loss of efficiency of the automatic paper insert or a paper jam. Confirm the printer works well under the environment it is intended to be used.

9.1.3 Clearing a Paper Jam in the Paper Cutter

Follow these steps to clear a paper jam in the paper cutter.

① Stop the power to the paper cutter and the printer.

② Put the printer to the head up state.

③ When the blade of the paper cutter is locked and is blocking the outlet of the paper, insert a Phillips screwdriver through the slot as shown in **Figure 9-4** and into the screw in the worm gear of the motor axis. Then, turn the screw until blade retreats.

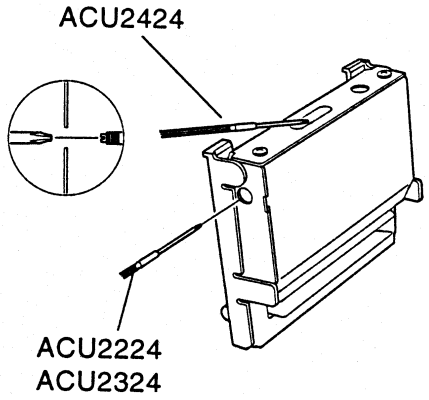


Figure 9-4 Clearing a Paper Jam in the Paper Cutter (1)

④ Open the paper cutter with expanding the part-A slightly as shown in the figure.

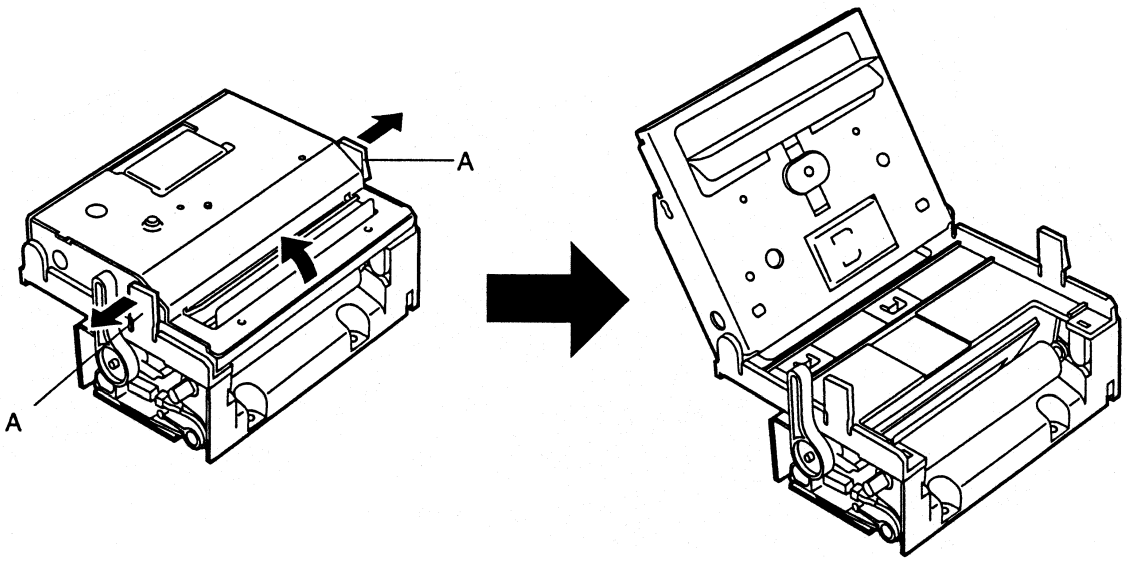


Figure 9-5 Cleaning a Paper Jam in the Paper Cutter (2)

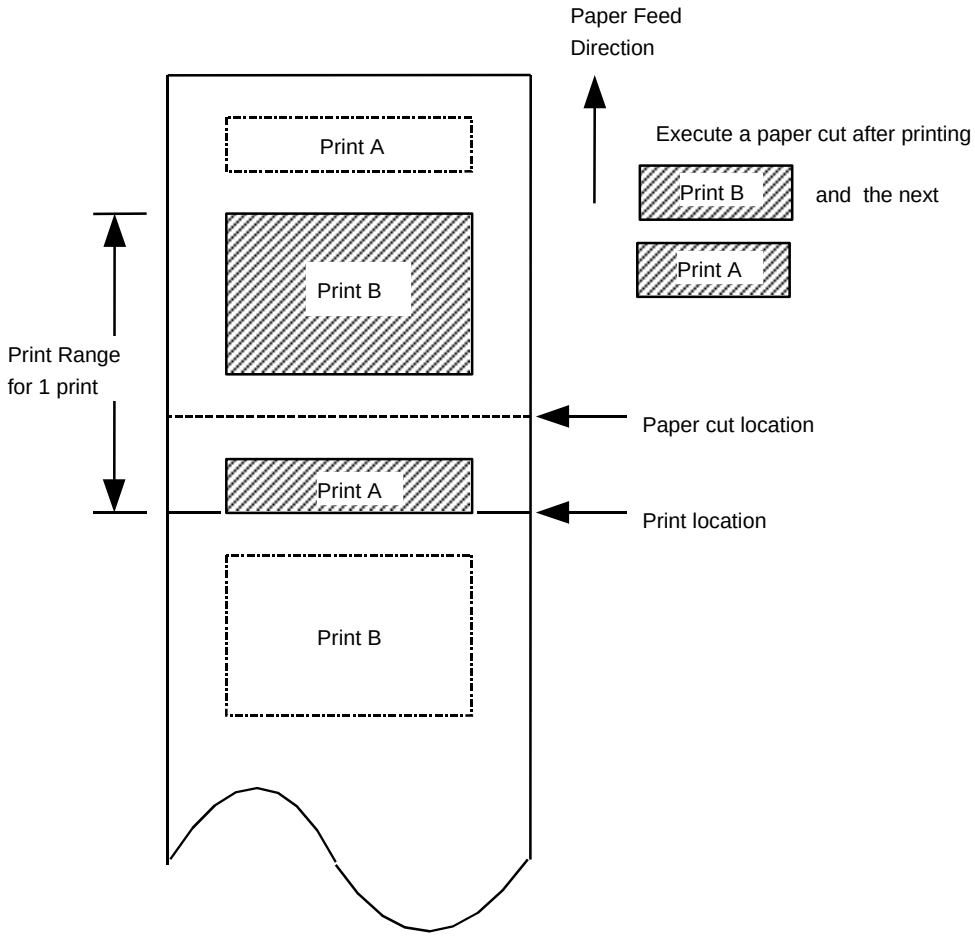
⑤ Clear a paper jam in the paper cutter.
Refer to **Section 8.1** for instructions on clearing a paper jam in the printer.

9.1.4 Points to Remember when Using the Paper Cutter

(1) Never execute a back feed after the paper is cut by the autocutter because it may cause a paper jam.

(2) In order to prevent paper jams, always execute a paper feed or print of about 3 mm.

(3) As shown in **Figure 9-6**, it is possible to use the margins from the print area to the cut area more effectively by cutting the paper after printing print A following the printing of print B.



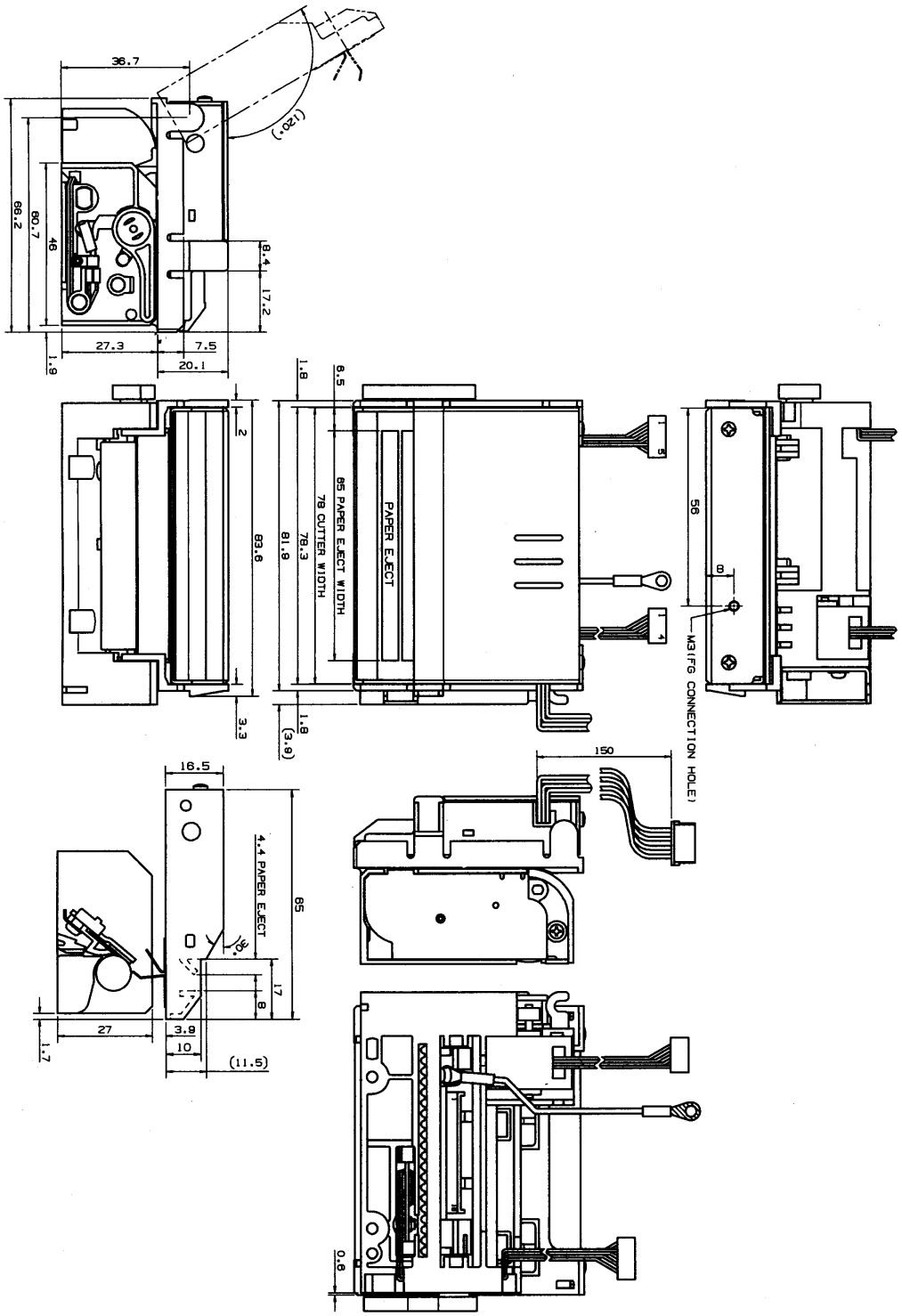
* The distance between the print location and cut location on the ACU2000 Series Paper Cutter is approximately 14.5 mm.

* Do not do a consecutive print across that A and that B.

Figure 9-6 Using the Paper Effectively When Cutting

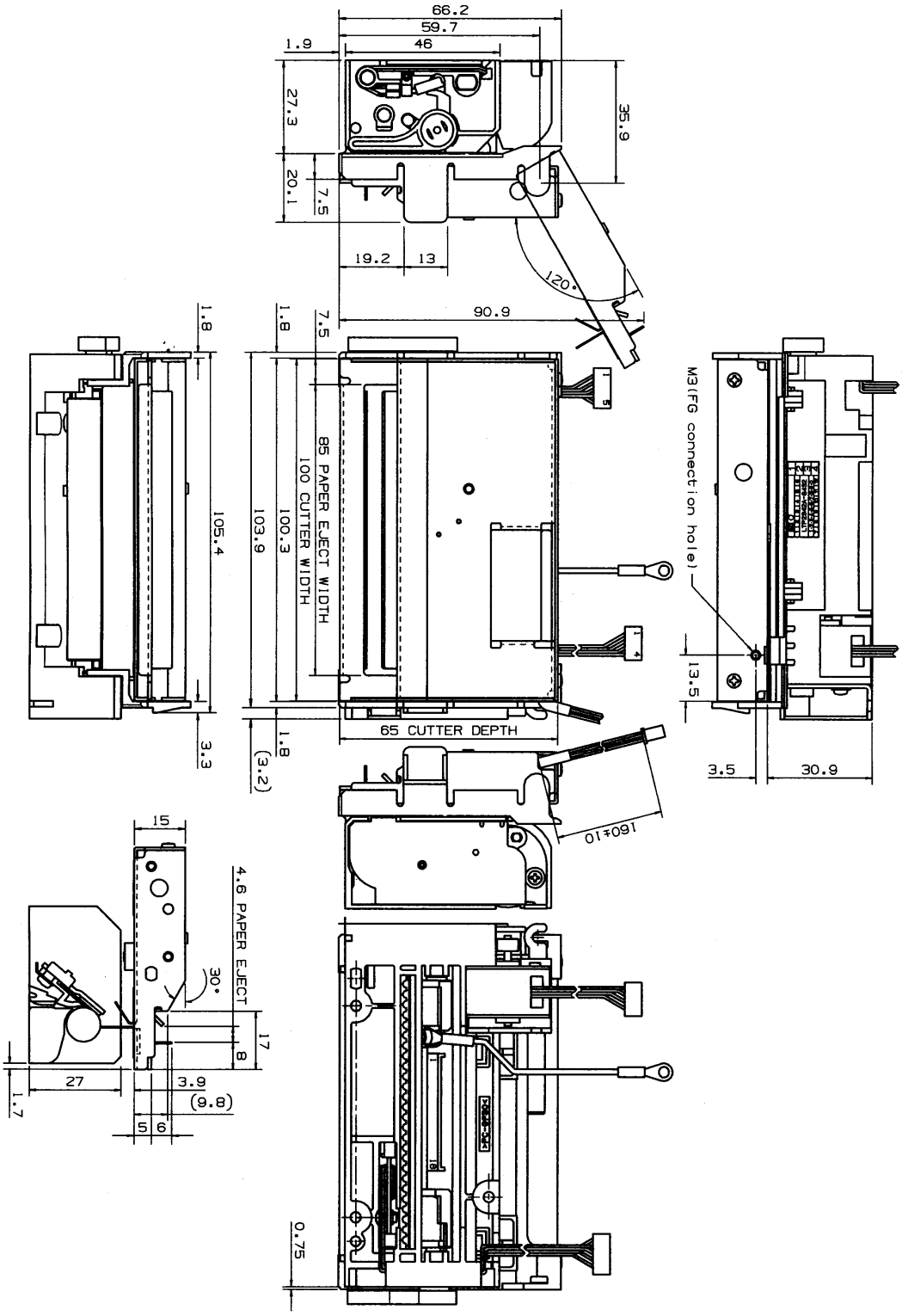
9.1.5 Appearance of the Printer with the Paper Cutter Installed

Figure 9-7 shows an appearance and external dimensions of the LTP2242 with the paper cutter installed.
Figure 9-8 shows an appearance and external dimensions of the LTP2342 with the paper cutter installed.
Figure 9-9 shows an appearance and external dimensions of the LTP2442 with the paper cutter installed.



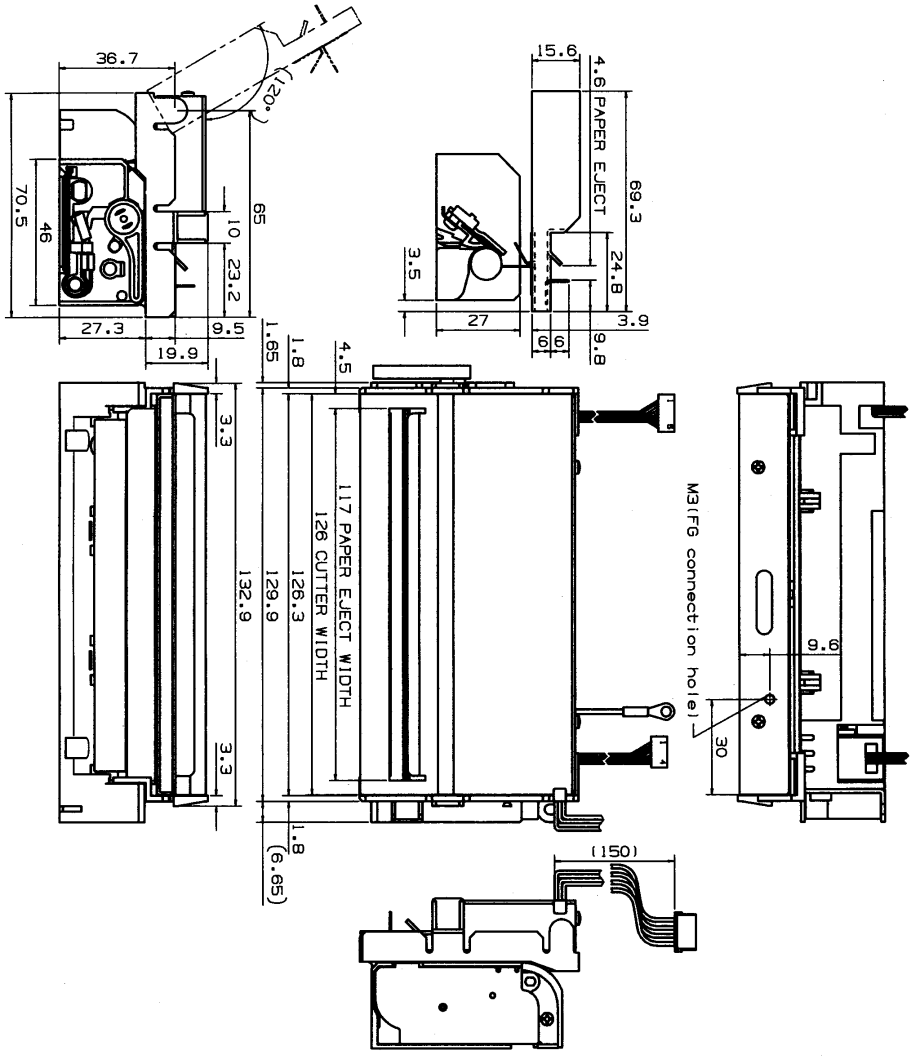
(Unit: mm)

Figure 9-7 Appearance of the Printer with the Paper Cutter Installed (LTP2242)



(Unit: mm)

Figure 9-8 Appearance of the Printer with the Paper Cutter Installed (LTP2342)



(Unit: mm)

Figure 9-9 Appearance of Printer with Paper Cutter Installed (LTP2442)

Mouser Electronics

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