Product Specifications Manual

TMP500 Series

Optional DRU-T500B

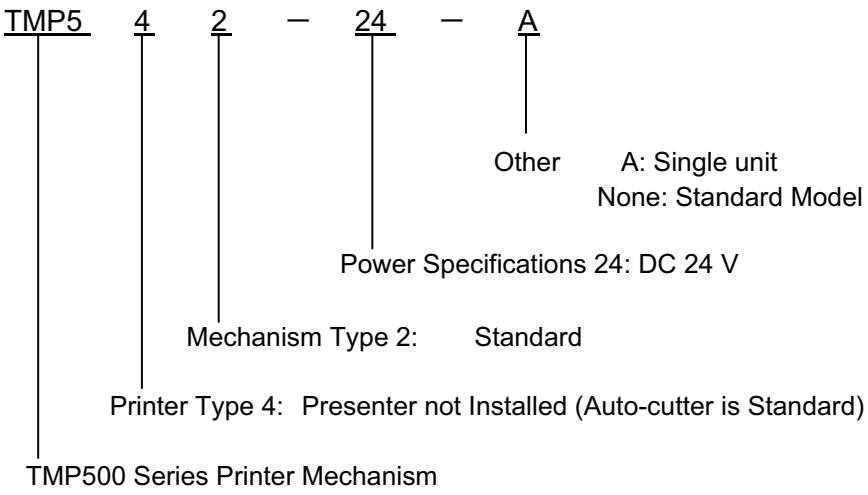
Rev. No. 0.00
Star Micronics Co., Ltd.
Special Products Division

Contents

1. GENERAL DESCRIPTION

The TMP500 series is a thermal printer mechanism capable of high speed printing employing a thermal line dot printing system.

How to Display the Model Name



2. BASIC SPECIFICATIONS

2-1) Printing Method

Themal Line Dot Method

2-2) Dot Configuration

640 Dots/Line

2-3) Number of Printing Dots

640 Dots

2-4) Number of Dots Simultaneously Energized

Maximum of 320 Dots

2-5) Print Density

Dot Position Direction: 8 Dots/mm
Feed Direction: 8 Dots/mm

2-6) Printing Speed

Printing speeds on this printer vary according to the diameter (D) and width (W) of the roll paper being used. Use a print speed that is appropriate for your roll paper type.
Always set roll paper using our recommended layout.

Print Mode		Print Speed	Roll Paper External Diameter (D)		Roll Paper Width (W)	
			D ≦ Ø150 mm	Ø150 mm < D	W < 79.5 mm	79.5 mm ≦ W
Single-Color Mode	Standard	Max 180 mm/s	○	○	○	○
	Middle	Max 120 mm/s	○	○	○	○
	Low	Max 80 mm/s	○	○	○	○
	High	Max 220 mm/s	○	X	X	○
2-Color Mode		Max 80 mm/s	○	○	○	○

Note 1: Print speeds were measured with standard energy with an ambient temperature of 25ºC.
Speeds will vary according to the ambient temperature, the printing pattern and energy setting.

Note 2: For high speed mode, always use paper that is less than 150 mm in diameter and more than 80 mm wide. Use our recommended layout. Paper conveyance may not be pos sible because of excessive wear on the rubber rollers or power swings if roll paper that has an external diameter larger than 150 mm, or that is less than 80 mm in width.

Note 3: Always use the recommended type of paper. Use the print speeds and print density described in the product specifications manual. To use settings that are not recom mended or paper that is not recommended such as paper that has been specially treated on the back or front sides, it is recommended to adequately test the paper prior to use to ensure that there are no problems in its use. Contact us for any unclear points relating to paper.

Note 4: If problems such as paper conveyance length being shorter than specified causing printing to be bunched together when using your selected print speed, it is recom mended to slow the printing speed and confirm the print.

2-7) Print Width

Maximum 80mm

2-8) Recording Paper Width

45 ±0.5 mm to 82.5 ±0.5mm

Note: Printing quality can deteriorate according to the type and thickness of the recording paper. Refer to the section relating to recording paper specifications to use the type appropriate for the mechanism's drive conditions.

2-9) Paper Feed

(1) Paper Feed Method: Friction Method
(2) Paper Feed Pitch: 0.0 625mm
(3) Paper Feed Speed: Maximum mm/s

2-10) Detector Functions

(1) Head Temperature Detection: Thermistor
(2) Paper Out Detection: Reflective Type Photo-interrupter
(3) Platen Position Detection: Microswitch
(4) Cutter Home Position Detection: Microswitch

Note: Because a reflective type photo-interrupter is used as the paper out detector, it can also be used to detect black marks. However, in such cases, there are restrictions in black mark pitches.

2-11) Power Voltage

(1) Drive Power Voltage: 24: V DC ±10% Note 1
(2) Circuit Input Voltage: 5 V DC ±5% Note 2
3.3 V DC ±5% Note 3

Note 1: Applies to the thermal head, paper feed motor and cutter motor drive.
2: Applies to the thermal head control and paper feed motor control.
3: Applies to paper out detector, platen position detector and cutter home position detector.
4: To use a single 5 V power source for the circuit input voltage, contact Star Micronics.

2-12) Thermal Head

(1) Heating Element Density: 8 dots/mm (0.125 mm/dots)
(2) Total Number of Heating Elements: 640 Dots
(3) Effective Print Width: 80 mm
(4) Average Resistance Value: 800 Ω ±3% (initial value)
(5) Number of Strobes: 4

2-13) Motors

(1) Paper Feed Motor: 4-phase Bipolar Stepping Motor
(2) Cutter Motor: DC Brush Motor

2-14) Auto-cutter

(1) Cutting Methods: Slide shearing method Only with full cuts
(2) Full-cut Maximum Paper Width: 82.5 mm
(3) Full-cut Tolerable Recording Paper Thickness: 65 µm ≦ Recording Paper Thickness ≦ 150 µm
(4) Minimum Cutting Length 25 mm

Note 1:To issue vouchers without using the Presenter, always install the discharge guide as described in precautions for designing in section 5-1. Particularly, to cut off receipts to issue vouchers, always install the paper discharge guide to operate the mechanism. Also consider measures for static electricity in the paper path.

2-15) External Dimensions

Approximately 135mm (W) x 101mm (D) x 103mm (H)

Note: The values above do not include accessory parts incorporated in the mechanism when the presenter module is installed.

2-16) Weight

790 g ± 10 g

Note: The values above do not include accessory parts incorporated in the mechanism when the presenter module is installed.

2-17) Operating Environment

(1) Temperature: 0 to 50˚C
However, printing is guaranteed at 5 to 50°C.
(2) Humidity: 10 to 80% RH

However, there must be no condensation. Assumes 80% RH at 34˚C

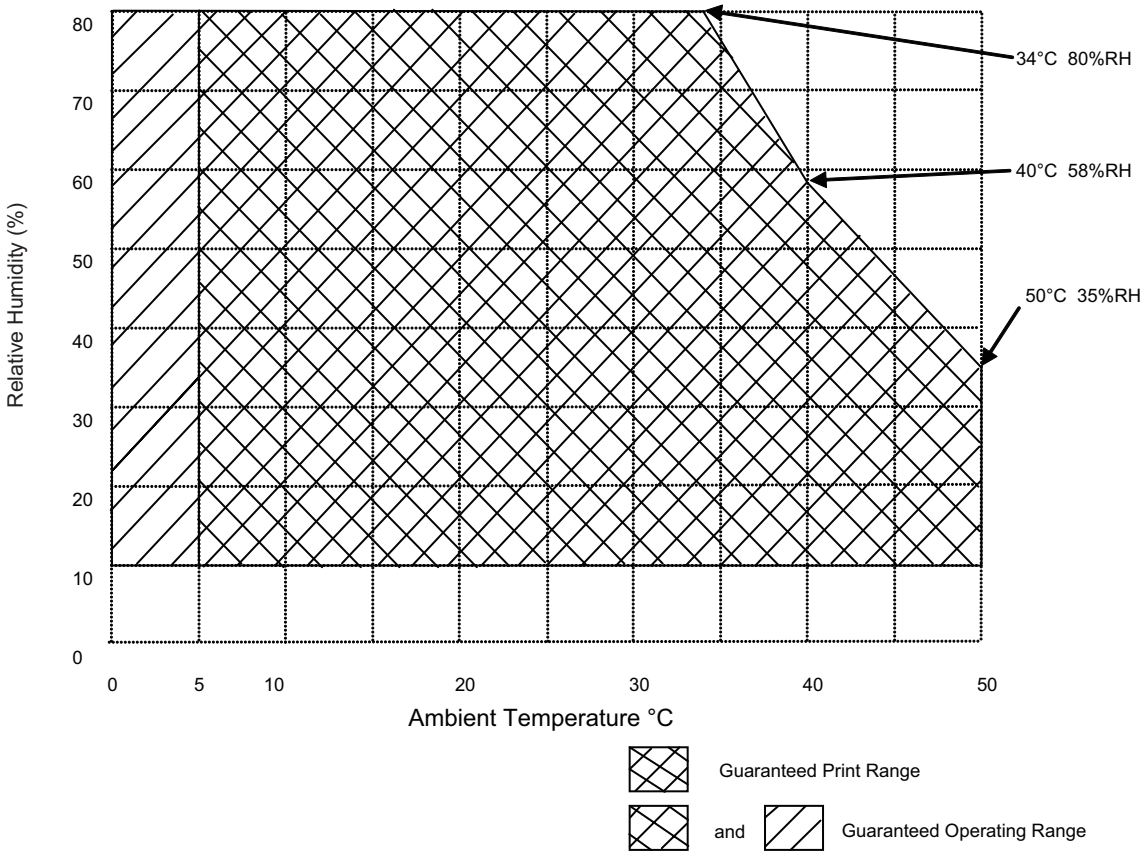


Fig. 2.16.1 Guaranteed Temperature and Humidity Range

2-18) Storage Environment (Excluding Roll Paper)

(1) Temperature: -20 to 60˚C
(2) Humidity: 10 to 90% RH However, there must be no condensation.

Note: The combination of 40°C and 90% RH (no condensation) is considered the worst values regarding high temperatures and humidity.

2-19) Reliability Specifications

(1) Life: See table below.

• Mechanical Life

Paper Thickness	Mechanical Life
65 µm ≦ Paper Thickness ≦ 85 µm	20 million lines
85 µm ≦ Paper Thickness ≦ 150 µm	10 million lines

• Thermal Head

<Printing Conditions> See the table below with average printing rate: 12.5%
(Head average resistance value change rate: Max. ±15%)

Manufacturer	Product Name	Quality Characteristics and Use	Paper Thickness (μm)	Head Life	
				Number of ulses (100 Million)	Distance (km)
Mitsubishi Paper Mills Limited	P220AG	Normal Type	65	1.0	100
	HP220A	Long-storage Type	65	1.0	100
	HP220AB-1	Long-storage Type	75	1.0	100
	P220AGB	Normal Type (For Cards and Tickets)	80	1.0	100
	P220AB	Normal Type (For Cards and Tickets)	85	1.0	50
	P220AC-1	Normal Type (For Cards and Tickets)	95	0.5	50
	P220AC	Normal Type (For Cards and Tickets)	105	0.5	50
	P220AD	Normal Type (For Cards and Tickets)	130	0.5	50
	P220AE-1	Normal Type (For Cards and Tickets)	150	0.5	50
	PB670/PB770	2-Color Type (Red/Black, Blue/Black)	75	0.5	50
Mitsubishi Hitech	F5041	Normal Type	60	1.0	100
Oji Paper Company	PD150R	Normal Type	75	1.0	100
	PD160R	Long-storage Type	65/75	1.0	100
	PD750R/D700R	2-Color Type (Red/Black, Blue/Black)	75	0.5	50
KSP	P320RB/320BB	2-Color Type (Red/Black, Blue/Black)	65	0.5	50
Nippon aper Industries	TF50KS-E2D	Normal Type	65	1.0	100

Note

1: This assumes repeated printing sequences below the printing rate of 12.5% based on STAR's evaluation standards document. Energy supplied to the theremal head uses the standard supplied enerty outlined in section 3-4-8 as a condition.

2: Life of the thermal head is prescribed when more than two adjacent dots are broken. However, this excludes damage caused by the adherence of foreign matter or man-made damages.

3: When repeated printing under extremely high printing rates, the life of the thermal head will notable decrease. Carefully consider your print format before printing.

4: If the recommended paper is not used, the life of the printer cannot be guaranteed. Always use the recommended paper types.

• Auto-cutter

Paper Thickness	Mechanical Life
65 μm ≦ Paper Thickness ≦ 85 μm	1.0 million lines
85 μm ≦ Paper Thickness ≦ 150 μm	0.3 million lines

Note: If the recommended paper is not used, the life of the printer cannot be guaranteed. Always use the recommended paper types.

(2)MCBF: See below.

Paper Thickness	Mechanical Life
65 µm ≦ Paper Thickness ≦ 85 µm	60 million lines
85 µm ≦ Paper Thickness ≦ 150 µm	25 million lines

Note 1: MCBF is defined as overall failures including accidental failures and failures from part wear out leading to the life of the mechanical parts.

Note 2: Mechanical life is expressed as the number of lines in section 3.7.1. The number of lines of MCBF is not intended to represent service life.

Note 3: The above provides the numerical values for reliability specifications when all use the recommended thermal paper. Reliability cannot be guaranteed if different paper is used.

2-20) Options

The TMP542-24-A can add and use the following options.

Option	Part Number/Product Name	
Control Board	39206100	TBD500-24-A
Presenter Unit	39515200	PR521-24-A
Damper Roller B Unit	39591010	DRU-T500B

2-21) Usable Voucher Length

The length of the voucher that can be processed on the TMP500 series varies according to whether an optional presenter has been installed.
Use this mechanism according to the following specifications.

(1) When not using a Presenter
Min. Voucher Length: 25 mm Note 1)
Max. voucher length: 300 mm (When using paper with black marks)

(2) When using the presenter
Min. voucher length: 75mm
Max. voucher length: 300 mm

Note 1: To issue short vouchers without using the presenter, it is necessary to equip a paper discharge guide as indicated in the precautions for design in section 5-1. Particularly, when issuing by cutting the receipt, always setup the paper discharge guide to operate the mechanism. Also consider static electricity measures in the paper path.

2: To operate the printer with black mark paper, operate within the tolerable limits of the black mark pitch prescribed in section 3-10.

3. DETAILED SPECIFICATIONS

3-1) Print Configuration

The thermal head comprises 640 dot heating elements.
The following shows the maximum printing range on the maximum paper width.

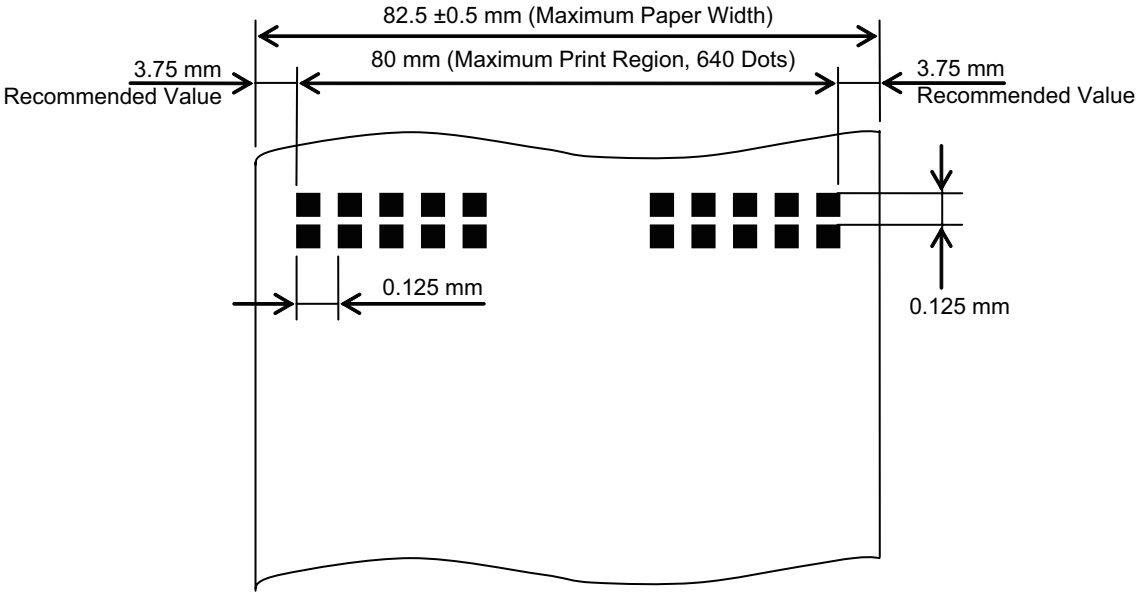


Fig. 3.1.1 Print Region

The mechanism can handle paper widths of 45 ±0.5 to 82.5 ±0.5. However, it is recommended that a print layout is set that allows plenty of print margin on the left and right sides. Also, the standard position of printing to the paper width is center of the paper width.
Left and right margins in the printing region are recommended to be a minimum of 3.75 mm.

Note 1: When using the thermal head with a separate drive, there are cases in which dots are offset in the paper feed direction along the boundary of the separate heating elements. Consider the offset of dots when setting the print layout.

2: When using a paper width that is less than the maximum print width of the thermal head (80 mm), consider the recording paper feeding state so that the print region does not leave both edges of the recording paper.

3-2) Paper Feed Characteristics

3-2-1) Paper Feed System

Friction Method

3-2-2) Paper Feed Pitch

0.0625 mm (Paper feed amount with one motor step)

3-2-3) Paper Feed Speed

Printing speeds on this printer vary according to the diameter (D) and width (W) of the roll paper being used. Use a print speed that is appropriate for your roll paper type.

Print Mode		Print Speed	Roll Paper External Diameter (D)		Roll Paper Width (W)	
			D ≦ Ø150 mm	Ø150 mm < D	W < 79.5 mm	79.5 mm ≦ W
Single-Color Mode	Standard	Max 180 mm/s	○	○	○	○
	Middle	Max 120 mm/s	○	○	○	○
	Low	Max 80 mm/s	○	○	○	○
	High	Max 220 mm/s	○	X	X	○
2-Color Mode		Max 80 mm/s	○	○	○	○

Note 1: Print speeds were measured with standard energy with an ambient temperature of 25ºC.
Speeds will vary according to the ambient temperature, the printing pattern and energy setting.

Note 2: For high speed mode, always use paper that is less than 150 mm in diameter and less than 80 mm wide. Paper conveyance may not be possible because of excessive wear on the rubber rollers or power swings if roll paper that has an external diameter larger than 150 mm, or that is less than 80 mm in width.

Note 3: Always use the recommended type of paper. Use the print speeds and print density described in the product specifications manual. To use settings that are not recom mended or paper that is not recommended such as paper that has been specially treated on the back or front sides, it is recommended to adequately test the paper prior to use to ensure that there are no problems in its use. Contact us for any unclear points relating to paper.

Note 4: If problems such as paper conveyance length being shorter than specified causing printing to be bunched together when using your selected print speed, it is recom mended to slow the printing speed and confirm the print.

3-2-4) Paper Feed Direction

Both forward and reverse feeds are possible. (However, only margin adjustments for top of the printing position are possible with reverse feeds.)

Note 1: The reverse feed for paper can be used only with the margin adjustments for top of the printing position on the recording paper. Never print to the recording paper while reverse feeding paper.

2: Do not directly touch the paper to the thermal head and platen roller and feed in the reverse direction.

3-2-5) Paper Holding Force

Minimum of 2N (Minimum of 204 gf)

3-3) Paper Feed Motor Characteristics

3-3-1) Paper Feed Motor Type

4-phase PM Type Bipolar Stepping Motor

3-3-2) Drive Method

Bipolar Constant Current Drive

3-3-3) Excitation Method

1-2 Phase Excitation

3-3-4) Coil Resistance

6.5 Ω/Phase ±10% (25˚C)

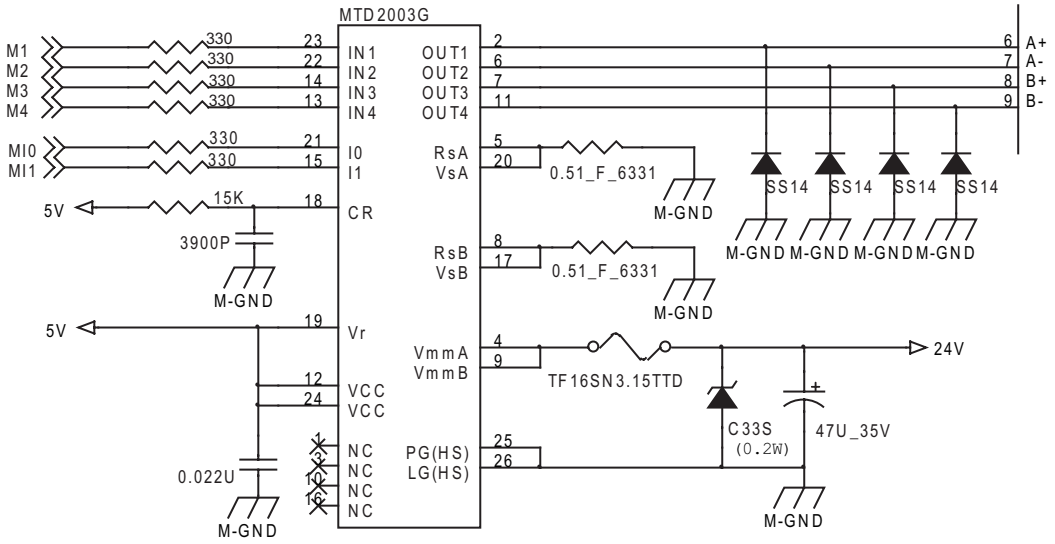
3-3-5) Drive Voltage

24 V DC ±10%

3-3-6) Set Current

Approximately 0.67 A/Phase (Standard)
Approximately 0.96 mA/Phase (With Auto-loading)

3-3-7) Drive Circuit Example



Note: When using circuits other than the drive circuit example, there is the possibility that the standards of the motor are not ensured.

3-3-8) Excitation Sequence

Rotating Direction (Counterclockwise direction rotation when looking from the motor output shaft.)

Step / Pin No.	1	2	3	4
6 (A Phase)	H	H	L	L
7 (A Phase)	L	L	H	H
8 (B Phase)	L	H	H	L
9 (B Phase)	H	L	L	H

The motor transports the recording paper in the forward direction when excited in the steps of the table above.
One motor step feeds the recording paper 0.0625 mm.

3-3-9) Motor Drive Synch and Startup Method

The motor uses a bipolar rated current control. The rated current control set current is 0.67 A/phase.
The control circuit and software for motor drive and stopping should be designed with the timing chart in Fig. 3.3.9 in mind.

Note 1: When feeding paper, drive the motor below 3520 pps.

2: Set the motor drive frequency to meet the usage conditions for printing (voltage, temperature, number of energized dots, etc.).

3: To prevent heating of the motor, set so that it is not energized when it is not feeding paper (including printing).

4: When continuously running the motor for long periods of time, check for motor heating.

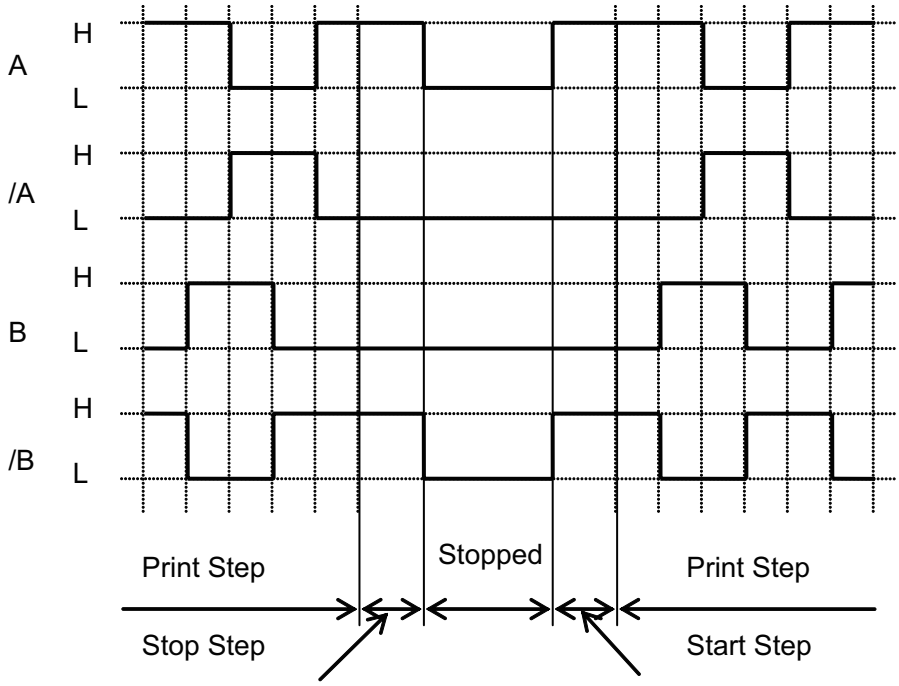


Fig. 3.3.9 Motor Startup/Stop Timing

・Stop Holding:
To stop the motor, energize it with the same phase as the final phase of the drive step for 30 ms.

・Stop Step:
When stopped, do not energize the stepping motor to prevent it from getting hot.
Recording paper does not slip because of the stepping motor holding torque when not being energized.

・Start-up Holding:
When restarting while stopped, shift immediately to the drive step sequence after quitting the stop holding excitation.
To start from a stopped state (non-energized state), shift to the drive step sequence after energizing the same phase as the stop holding for 30 ms.

The acceleration step for the motor drive cycle and starting up when in each of the print modes, should be designed in reference to the following startup methods.
Always set roll paper using our recommended layout.

(1) Print Mode

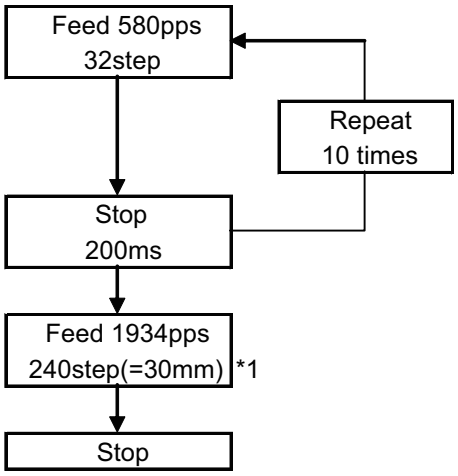
To use the printer in each print mode, it is required to control the acceleration of the motor to ensure paper feed force when starting up.
Table 3.3.9.2 shows the acceleration table. Drive the motor while sequentially accelerating to the motor constant drive cycle. See the table below for maximum speeds in each print mode.

Print Mode		Print Speed	Roll Paper External Diameter (D)		Roll Paper Width (W)	
			D ≦ Ø150 mm	Ø150 mm < D	W < 79.5 mm	79.5 mm ≦ W
Single-Color Mode	Standard	Max 180 mm/s	○	○	○	○
	Middle	Max 120 mm/s	○	○	○	○
	Low	Max 80 mm/s	○	○	○	○
	High	Max 220 mm/s	○	X	X	○
2-Color Mode		Max 80 mm/s	○	○	○	○

Note 1: For high speed mode, always use paper that is less than 150 mm in diameter and less than 80 mm wide. Use our recommended layout. Paper conveyance may not be pos sible because of excessive wear on the rubber rollers or power swings if roll paper that has an external diameter larger than 150 mm, or that is less than 80 mm in width.

(2) Auto-loading Mode

Design with reference to the information below for the control method when using the auto-loading mode. Follow the acceleration table in Table 3.3.3.2 for acceleration control up to the predetermined drive speed.



Note: When using the optional presenter, the step count for *1 should be 800 steps (equivalent to 100 mm).

Table 3.3.9.2 Acceleration Stop (1-2 Phase Excitation)

No. of Steps (step)	Drive Speed (pps)	Drive Cycle (µs)	Drive Feed Speed (mm/s)	Print Mode
1	400	2500	25	2-color Print Mode / HQ Mode / LS Mode / HS Mode
2	580	1724	36	
3	711	1406	44	
4	820	1220	51	
5	915	1093	57	
6	999	1001	62	
7	1076	929	67	
8	1147	872	72	
9	1214	824	76	
10	1277	783	80	
11	1337	748	84	
12	1394	717	87	
13	1448	691	91	
14	1500	667	94	
15	1550	645	97	
16	1599	625	100	
17	1645	608	103	
18	1690	592	106	
19	1734	577	108	
20	1776	563	111	
21	1817	550	114	
22	1857	539	116	
23	1896	527	119	
24	1934	517	121	
25	1971	507	123	
26	2008	498	126	
27	2043	489	128	
28	2078	481	130	
29	2112	473	132	
30	2145	466	134	
31	2177	459	136	
32	2209	453	138	
33	2240	446	140	
34	2270	441	142	
35	2300	435	144	
36	2329	429	146	
37	2358	424	147	
38	2386	419	149	
39	2414	414	151	
40	2442	410	153	
41	2468	405	154	
42	2495	401	156	
43	2521	397	158	
44	2547	393	159	
45	2572	389	161	
46	2597	385	162	
47	2621	382	164	
48	2645	378	165	
49	2669	375	167	
50	2692	371	168	
51	2715	368	170	
52	2738	365	171	
53	2760	362	173	
54	2783	359	174	
55	2804	357	175	
56	2826	354	177	
57	2847	351	178	
58	2868	349	179	
59	2889	346	181	

No. of Steps (step)	Drive Speed (pps)	Drive Cycle (µs)	Paper Conv. Speed (mm/s)	Print Mode
60	2909	344	182	HS Mode
61	2930	341	183	
62	2950	339	184	
63	2970	337	186	
64	2989	335	187	
65	3008	332	188	
66	3027	330	189	
67	3046	328	190	
68	3064	326	192	
69	3082	324	193	
70	3100	323	194	
71	3117	321	195	
72	3134	319	196	
73	3151	317	197	
74	3167	316	198	
75	3184	314	199	
76	3200	313	200	
77	3215	311	201	
78	3231	310	202	
79	3246	308	203	
80	3261	307	204	
81	3276	305	205	
82	3290	304	206	
83	3305	303	207	
84	3319	301	207	
85	3333	300	208	
86	3346	299	209	
87	3360	298	210	
88	3373	296	211	
89	3386	295	212	
90	3399	294	212	
91	3412	293	213	
92	3424	292	214	
93	3437	291	215	
94	3449	290	216	
95	3461	289	216	
96	3473	288	217	
97	3484	287	218	
98	3496	286	219	
99	3507	285	219	
100	3519	284	220	

3-4) Thermal Head

3-4-1) Configuration

(1) Thermal element configuration: 2 Thermal elements/head
(2) Number of thermal elements: 640 Dots
(3) Thermal element main scanning density: 0.125 mm/dots (8 dots/mm)
(4) Maximum print width: 80 mm
(5) Average resistance value: 800 Ω ±3% (initial value)
(6) Drive power voltage: Head drive Vh 24 V DC ±10%
Driver IC V dd 5 V DC ±5%

3-4-2) Maximum Rating (at an Ambient Temperature of 25°C)

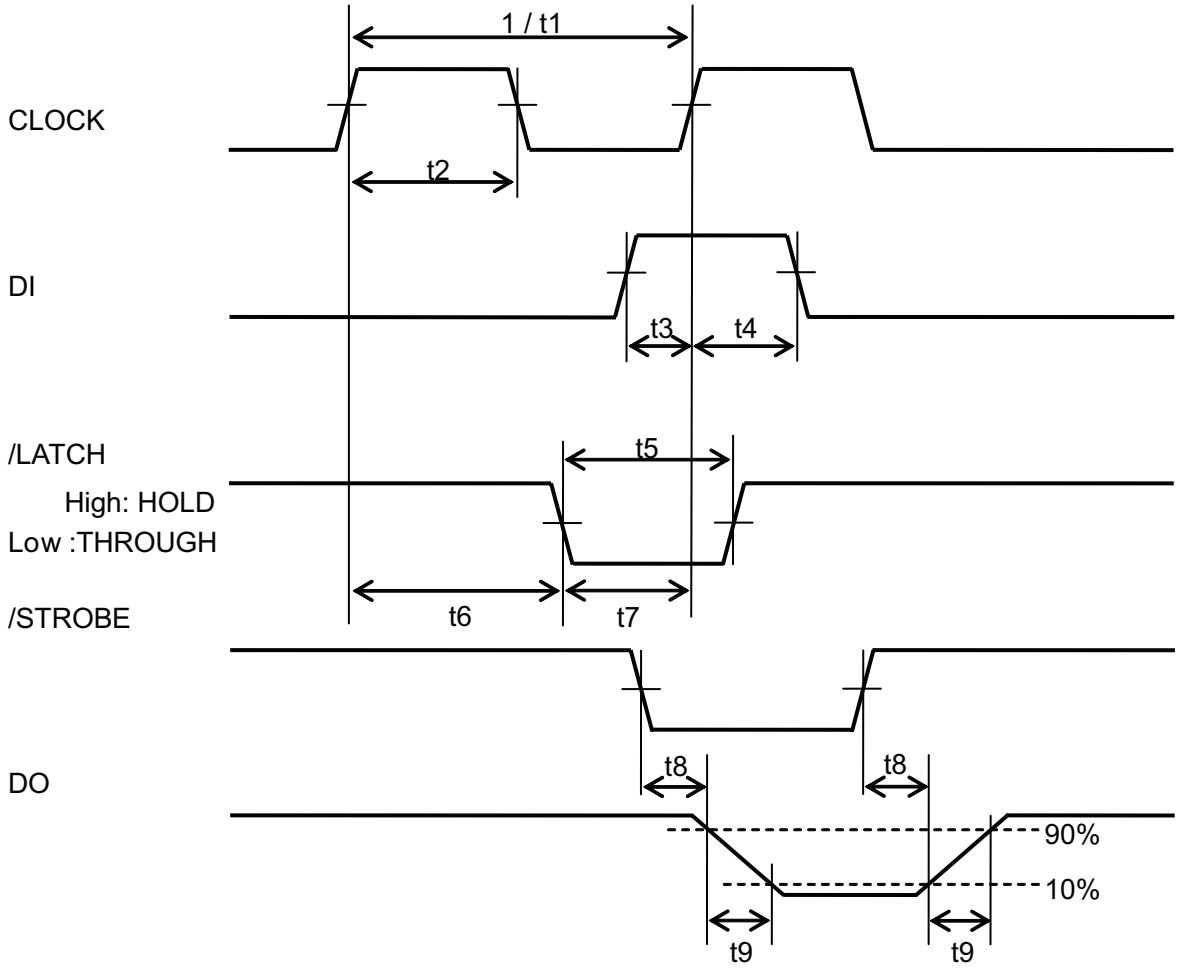
Items		Maximum Rated Value	Units	Conditions
Supplied Voltage	Vsetmax	26.4	V	Voltage between connector terminals
Supplied Power	Pomax	0.79	W/dot	
Maximum Current Consumption	Iomax	10.1	A	ON at the same time as 320 dots
Maximum Strobe Count	STRmax	4	Strobes	
Maximum Simultaneous Print Dots	Ndotmax	320	dots	
Maximum PCB Temperature	Tmax	80	˚C	Thermistor Temperature

3-4-3) Electrical Characteristics

Ta=25 °C

Item	Symbols	Min.	Standard	Max.	Units	Conditions
Printing power voltage	Vset	-	-	26.4	V	
Circuit Power Voltage	VDD	4.75	5.00	5.25	V	
Circuit Power Current	IDD	-	-	70	mA	ALL-HIGH
High Level Input Voltage	VIH	0.7VDD	-	VDD	V	
Low Level Input Voltage	VIL	0	-	0.3VDD	V	
High Level Input Current	IIH	-	-	0.5	µA	VDD=5.0V,VIH=5.0V
Low Level Input Current	IIL	-	-	0.5	µA	VDD=5.0V,VIL=0V
Driver Output Leak Current	ILEAK	-	-	6.4	mA	ALL-LOW
Clock Frequency	t1	-	-	8	MHz	See the Timing Chart
Clock Pulse Width	t2	70	-	-	ns	
SI-CLOCK Setup Time	t3	50	-	-	ns	
CLOCK-SI Holding Time	t4	10	-	-	ns	
Latch Pulse Width	t5	100	-	-	ns	
CLOCK-LATCH Setup Time	t6	100	-	-	ns	
CLOCK-LATCH Holding Time	t7	50	-	-	ns	
STROBE-DO Propagation Delay Time	t8	-	0.5	2.0	ns	
DO Falling Time	t9	-	0.2	0.5	ns	
DO Rising Time	t10	-	1.0	2.0	µs	

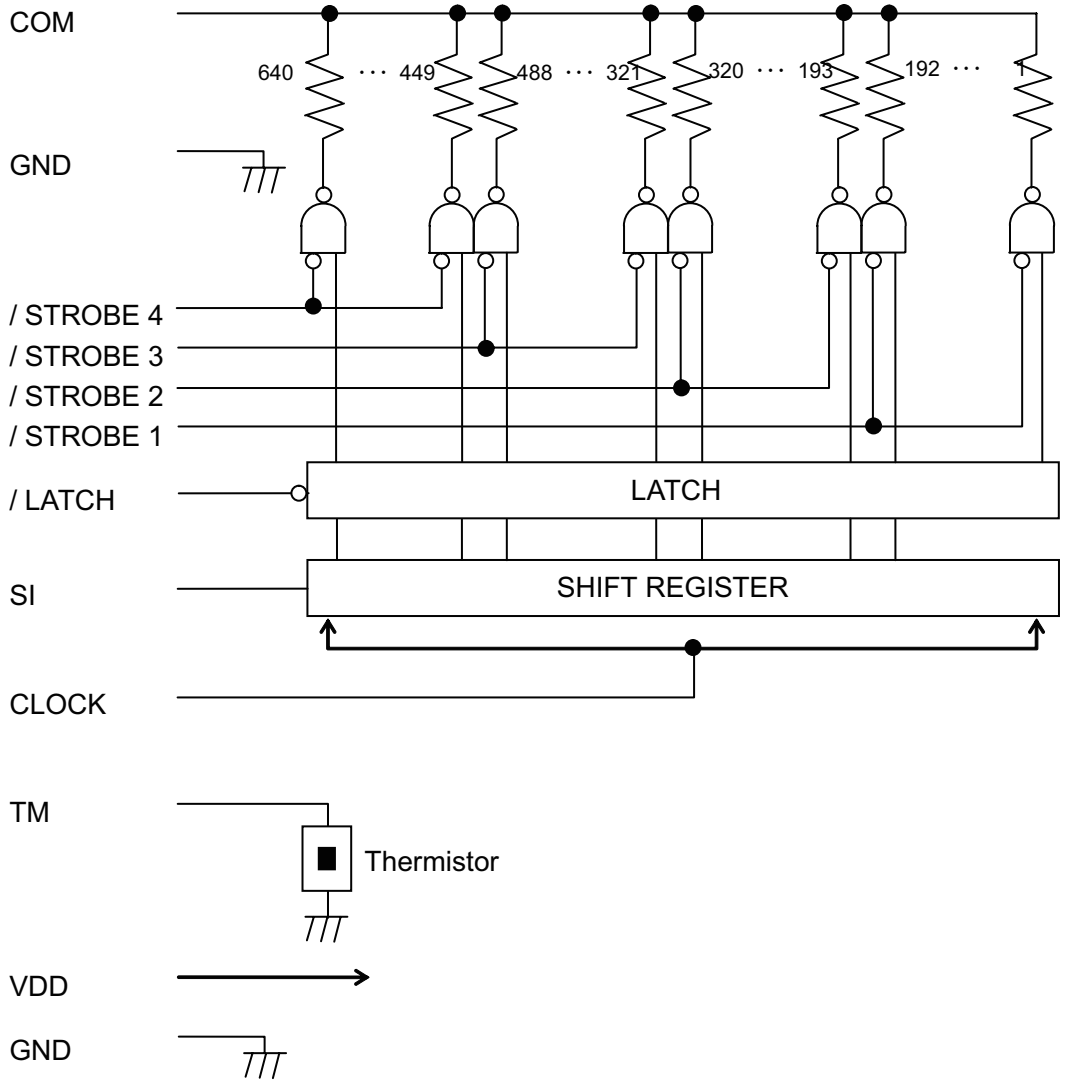
3-4-4) Timing Chart



Connector Pin Assignment

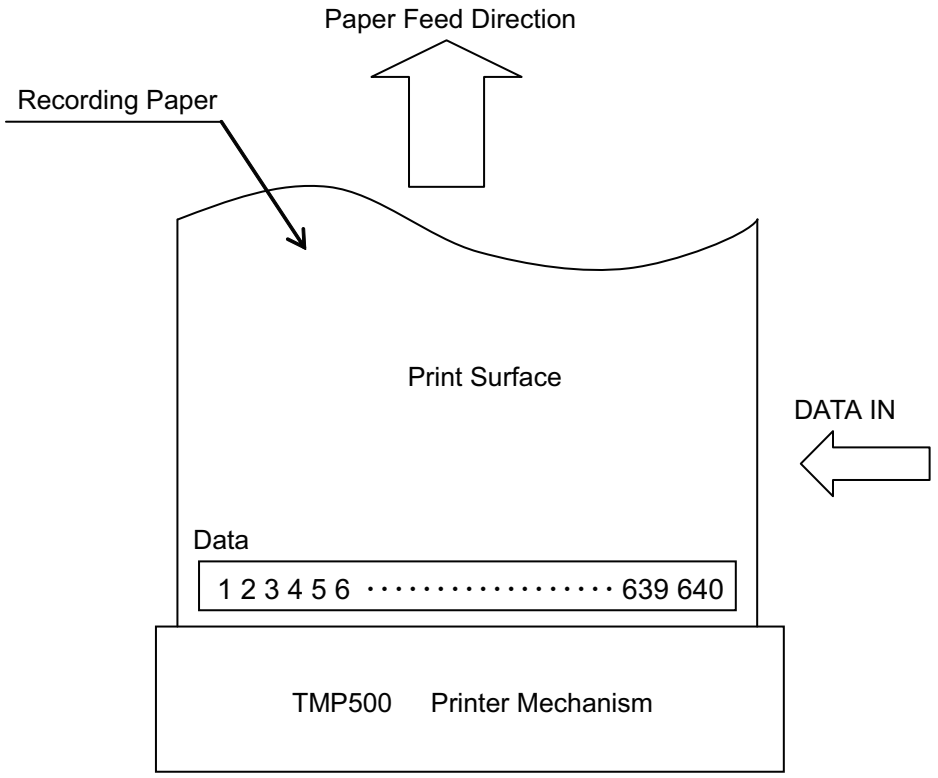
Connector A		Connector B	
Pin No.	Signal Name	Pin No.	Signal Name
1	GND	1	COM
2	GND	2	COM
3	TM	3	/ LATCH
4	/ STROBE 3	4	CLOCK
5	/ STROBE 4	5	VDD
6	SI	6	/ STROBE 1
7	COM	7	/ STROBE 2
8	COM	8	GND
		9	GND

3-4-5) Equivalent Circuit



Strobe No.	Dot No.	Number of Dots
1	1 to 192	192
2	193 to 320	128
3	321 to 448	128
4	449 to 640	192

3-4-6) Relationship Between Transfer Data Printing Position



Data Input Order 1 2 3 4 5 6 7 ... 638 639 640

3-4-7) Peak Current

The peak current of the thermal head substantially reaches the value calculated using the equation below, but be very careful of voltage drops in wiring circuits.

$$IP = \frac{N \times V}{Rav}$$

IP: Peak Current
N: Simultaneous Energized Dot Count
V: Print Power Voltage (V)
Rav: Average Resistance Value of Heating Elements (Ω) (800 ±3%)

Table 3.4.7 Equation for Calculating Peak Current

Number of Dots Simultaneously Energized	Peak Current (A) Calculated Value
128	4.22
192	6.34
320	10.56

Ambient Temperature: 25°C
Print Power Voltage: 26.4V
Resistance Value: 800 Ω

3-4-8) Thermal Head Energizing Pulse Control

Design the energizing time to the thermal head while referencing the following items.
However, the following standard energizing pulse width is set using our standard evaluation paper.

(1) Calculation of energizing pulse width
To get good print images using the thermal head, it is necessary to control the energizing pulse to the thermal head according to the conditions of use.
Therefore, find the calculated value for each using the procedures below and substitute the values in the equation below (1) to control the thermal head and print with the calculated energized pulse width.

$$t = (E \times C \times P) \times ((Rcom \times N + Rav + Ric)^2/(V^2 \times Rav)) \quad \text{• • Equation (1)}$$

t: Energized pulse (ms)
E: Standard supply energy (mJ)
C: Speed correction coefficient
P: Thermal paper correction coefficient
Mitsubishi paper P220AG → 1.0
V: Head charged voltage → 24 V
Rav: Head average resistance value 800 (Ω)
Rcom: Head common resistance 0.07 (Ω)
Ric: Head driver ON resistance → 20 (Ω)
N: Number of Simultaneous Charged Dots 320 Dots

Note 1: It is necessary to adjust the energized pulse width when the charging voltage is within the specifications range. Be careful.

2: The calculation of the energized pulse is when not controlling the thermal head history. To lighten the phenomenon of weak dots when starting printing and accumulated head of the print dots, it is necessary to control the history of the thermal head. Contact us for the detailed drive conditions and methods to perform history control.

(2) Standard supply energy
See Table 3.4.8-1 for the standard supply energy in each print mode.

Table 3.4.8-1 Standard Supply Energy: E

Thermistor Temperature (°C)	Single Color Mode	2-Color Mode	
		Black	Red
-5 to -1 (°C)	0.256mJ	0.387mJ	0.178mJ
0 to 4 (°C)	0.256mJ	0.387mJ	0.178mJ
5 to 9 (°C)	0.242mJ	0.387mJ	0.178mJ
10 to 14 (°C)	0.232mJ	0.387mJ	0.178mJ
15 to 19 (°C)	0.213mJ	0.370mJ	0.170mJ
20 to 24 (°C)	0.209mJ	0.351mJ	0.161mJ
25 to 29 (°C)	0.191mJ	0.318mJ	0.146mJ
30 to 34 (°C)	0.179mJ	0.306mJ	0.141mJ
35 to 39 (°C)	0.168mJ	0.280mJ	0.129mJ
40 to 44 (°C)	0.161mJ	0.261mJ	0.120mJ
45 to 49 (°C)	0.154mJ	0.246mJ	0.113mJ
50 to 54 (°C)	0.149mJ	0.241mJ	0.111mJ
55 to 59 (°C)	0.149mJ	0.230mJ	0.106mJ
60 to 64 (°C)	0.149mJ	0.230mJ	0.106mJ

Note: Be very careful because the life of the thermal head is notable decreased when the thermal head is useed in conditions beyond the standard supply energy above.

(3) Speed correction coefficient
This is a correction value for paper conveyance speed when printing with the mechanism (thermal head). See Table 3.4.8-2 for details.

Table 3.4.8-2 Speed Correction Coefficients

From 220mm/s	From 200mm/s	From 180mm/s	From 150mm/s	From 125mm/s	From 100mm/s	From 75mm/s	From 50mm/s
1.00	1.06	1.10	1.13	1.20	1.27	1.39	1.50

(4) Thermal paper correction coefficient
The thermal paper correction coefficient is 1.0 when using our recommended paper of Mitsubishi Paper P220AG.
Calculate the energized pulse as the thermal paper correction coefficient P = 1.0.

Note: Contact us to use other recommended paper.

(5) Head charged voltage
The charged voltage range to the thermal head is 24 VDC ±10%. Use of the thermal head outside this range is prohibited.
Also the charged voltage to the thermal head is recommended to be used at a central value of 24 VDC. Calculate based on the actual voltage V charged to the thermal head to determine the energized pulse.

(6) Number of Simultaneous Charged Dots
The maximum number of simultaneously charged dots allowed for this thermal head is 320 dots.
Calculate the energized pulse as the number of dots simultaneously charged N=320.

Be careful because it is necessary to print separately to make this withint the tolerable limit using the thermal head strobe, when the maximum number of simultaneously charged dots is more than 320. Also, there are restrictions to the mechanism's maximum print speed when printing separately, so be careful of the print ratio when determining the printing format. Contact us for detailed control methods when performing separate printing.

3-4-9) Thermistor Characteristics

(1) B Constant: 3,950K ± 2%
(2) Resistance Value (at 25°C) R25: 30 k Ω ±5%
(3) Ambient Temperature Range: -40 to +125°C
(4) Heating Constant: Within 5 sec. (in atmosphere)
(5) Maximum Rated Power: 400mW

The resistance value as the temperature function can be calculated using the following equation.
RT = R25 x exp (BX {1/(T +273) –1/ (25 +273)})
T: Temperature (°C)
RT: T °C Resistance Value (Ω)
R25: 25°C Resistance Value (30 Kk Ω ±5%)

Temperature Characteristics

Temp. (°C)	Resistance Value (kΩ)	Temp. (°C)	Resistance Value (kΩ)	Temp. (°C)	Resistance Value (kΩ)	Temp. (°C)	Resistance Value (kΩ)
-40	1205.579	5	77.774	50	10.765	95	2.416
-35	844.731	10	60.524	55	8.935	100	2.093
-30	600.612	15	47.511	60	7.458	105	1.819
-25	432.951	20	37.606	65	6.259	110	1.587
-20	316.154	25	30	70	5.28	115	1.39
-15	233.694	30	24.111	75	4.475	120	1.221
-10	174.737	35	19.517	80	3.811	125	1.077
-5	132.078	40	15.904	85	3.26		
0	100.862	45	13.044	90	2.801		

3-4-10) Precautions Regarding Use of the Thermal Head

(1) When printing continuously, control so that when the temperature of the thermistor is detected to be over 65°C, the energizing of the head is immediately stopped. Continuing to print when the temperature is over 65°C will notably shorten the life of the thermal head.

(2) In the event of a runaway CPU, there are cases in which the thermal head will continue to be energized without the software detecting an error, thereby damaging the head. For that reason, it is essential to dually use error detection by the software to protect the thermal head.

(3) Observe the following sequences (power ON/OFF) so that the thermal elements are not damaged.
At power ON The order of Vdd, VH
At power off: The order of VH, Vdd

(4) Input of each of the signals (CLK, LAT, STB, DI) should be interfaced with C-MOS level (74 HCH240 or the equivalent).
Also, when turning the power ON and OFF and when not printing, the STB signal should be in a “DISABLE” state.

(5) To prevent static electrical damage of the heating elements and IC, never touch the poles of the connector pins, etc., directly with your bare hands.

(6) Do not apply any mechanical shocks (including the introduction of foreign objects) to the head PCB surface.

(7) When not printing, the thermal head VH power (including voltage charged to the capacitor) should be in an OFF state.

(8) There are cases where thermal head life is notably shortened according to the type of heat sensitive paper that is used. Always use the recommended heat sensitive paper.

(9) Because there is the possibility of mis-operation of the thermal head caused by noise, or damage to the thermal head or IC caused by surged voltages, the power line should be stabilized.

(10) Print quality will deteriorate if paper dust accumulates on the thermal elements.
In such a case, use cotton swabs dampened in alcohol to wipe the dust away.
Do not use sandpaper because that will damage the thermal elements.

3-5) Auto-cutter

The TMP500 series has an auto-cutter as standard equipment that can perform a full cut, by the rotation of the cutter motor and cutter home position detector.

3-5-1) Cutter Types

Slide shearing method (Separate type)

3-5-2) Paper Cut States

Full Cut

3-5-3) Cutter Operation Time

Approximately 400 ms (when cutting at 25°C, 24 VDC, and 150 µm thick paper)

Note: The time required for the cutting operation varies according to the thickness of the recording paper being used. Design the cutter control upon checking the actual type of recording paper to be used.

3-5-4) Cutting Positions

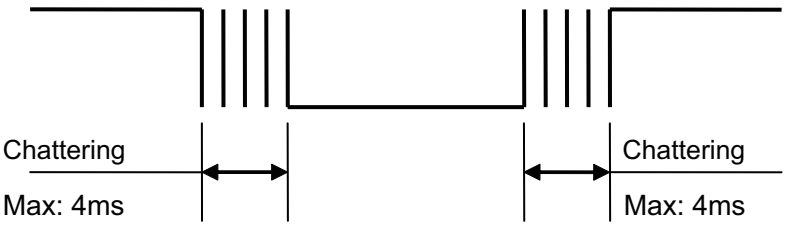
The distance from the thermal head heating element positions (the printing position) to the auto-cutter blade positions (the cutting position) is 11 ±0.5 mm.

3-5-5) Cutter Home Position Detector

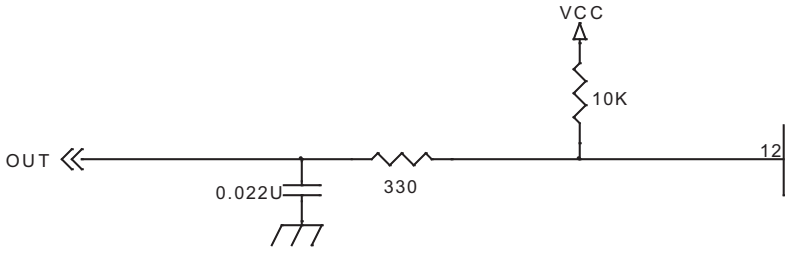
(1) Type: Microswitch

(2) Contact Point Rating: Rated voltage 5 V DC
Rated current 2 to 10 mA

(3) Chattering: Chattering occurs when switching the sensor for ON to OFF and OFF to ON. Detect the sensor considering the chattering phenomenon.



(4) Cutter Home Position Detection Circuit Example



3-5-6) Cutter Motor

(1) Drive power voltage: 24 V DC ±10%

(2) Current Value: Startup Current: Approximately 1.4 A (24 VDC, 25°C)

3-5-7) Auto-cutter Drive Method

The auto-cutter is operated by charging a drive power voltage to the cutter motor (+) and cutter motor (-).
Refer to the following when designing the forward and reverse movement of the cutter and the motor brake.

• Forward rotation

The auto-cutter is rotated forward by a (+) applied to the cutter motor (+) and a (-) applied to the cutter motor (-).

Note: It is prohibited to simultaneously energize to the motor forward and reverse drive circuits.

• Reverse rotation

The auto-cutter is rotated forward by a (-) applied to the cutter motor (+) and a (+) applied to the cutter motor (-).

Note: It is prohibited to simultaneously energize to the motor forward and reverse drive circuits.
To rotate the motor in reverse while it is rotating forward, stop the voltage applied to the motor, wait for approximately 1 ms, then apply the voltage to the reverse rotation side.

• Motor brake

Set the time to apply the motor brake to the time most appropriate for the conditions of use.

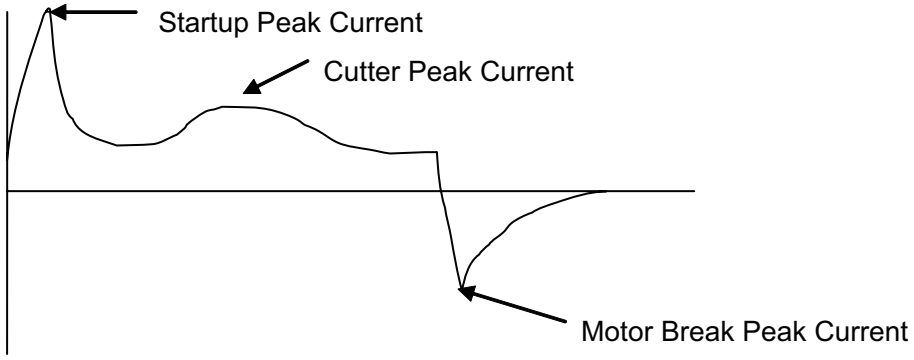
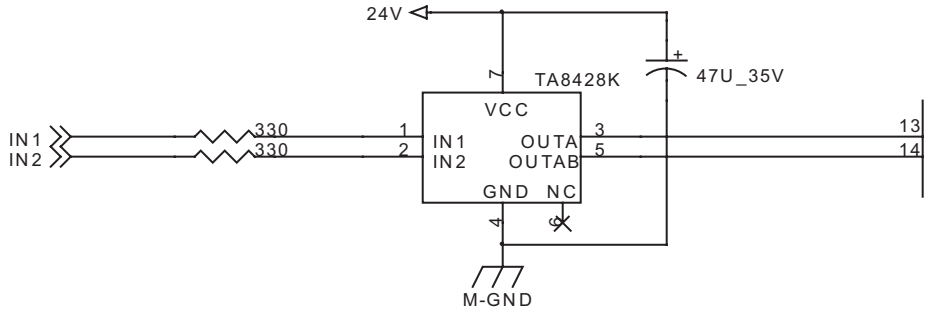


Fig. 3.5.7 Current Waveform

3-5-8) Drive Circuit Example

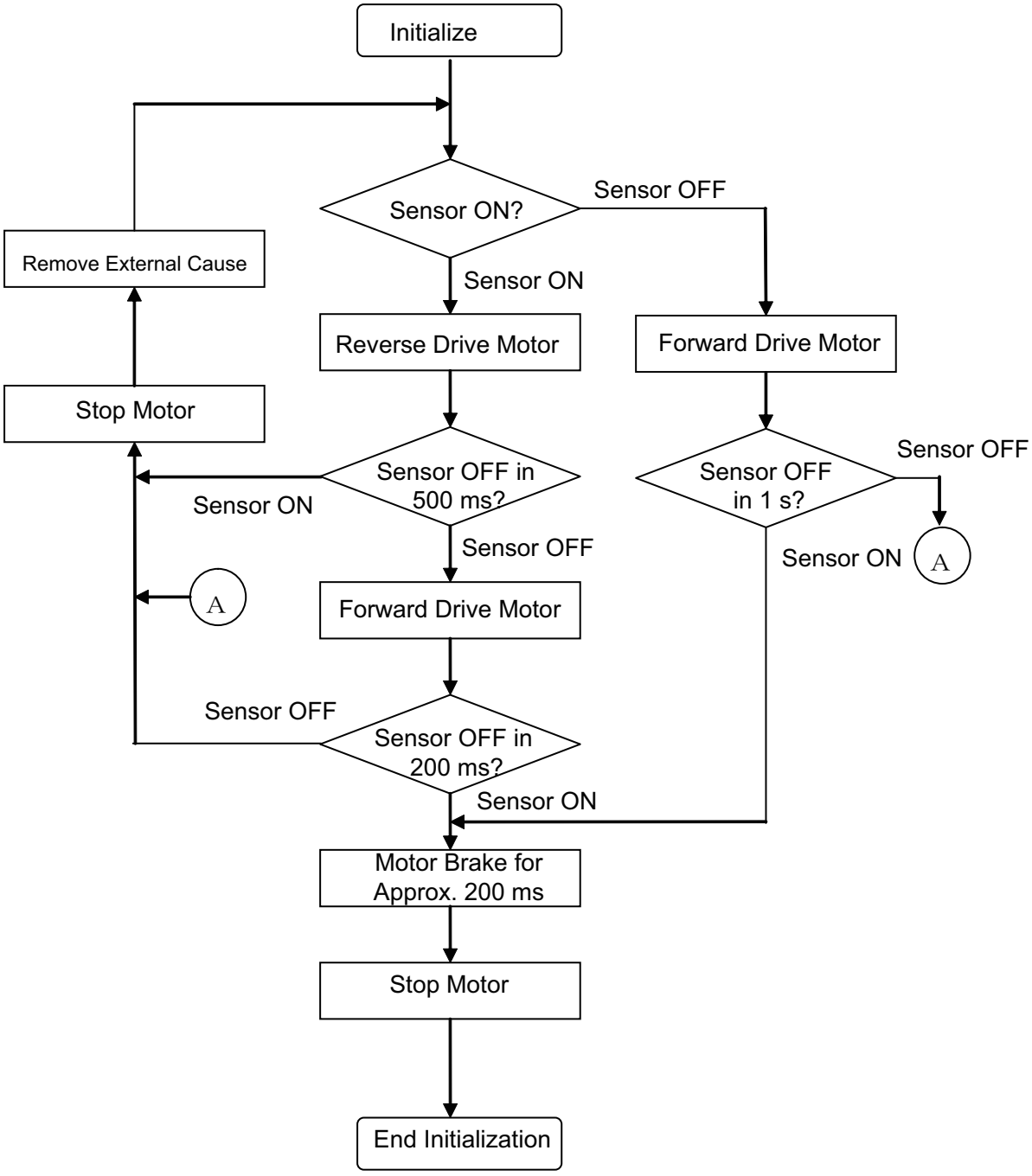


<Motor Drive Sequence>

	Forward	Reverse	Brake	Stopped
IN1	H	L	H	L
IN2	L	H	H	L

3-5-9) Flow Chart

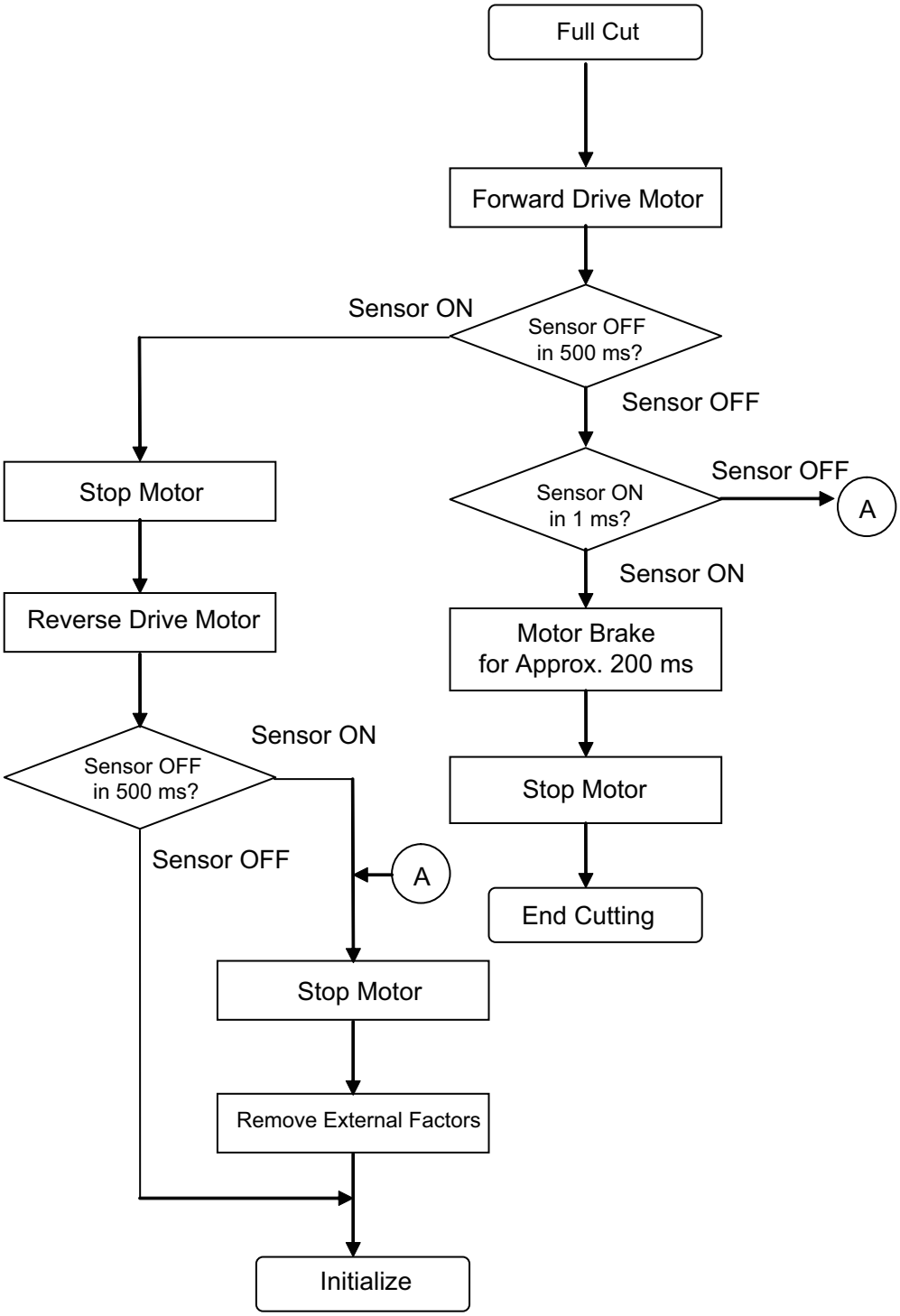
(1) Initializing (Initializing Operation)



Note 1: Perform sensor detection considering the chattering phenomenon that occurs when switching the sensor from ON to OFF and OFF to ON.

2: To switch the motor drive sequency, always insert a 1 msec stopping sequency.

(2) Full Cut

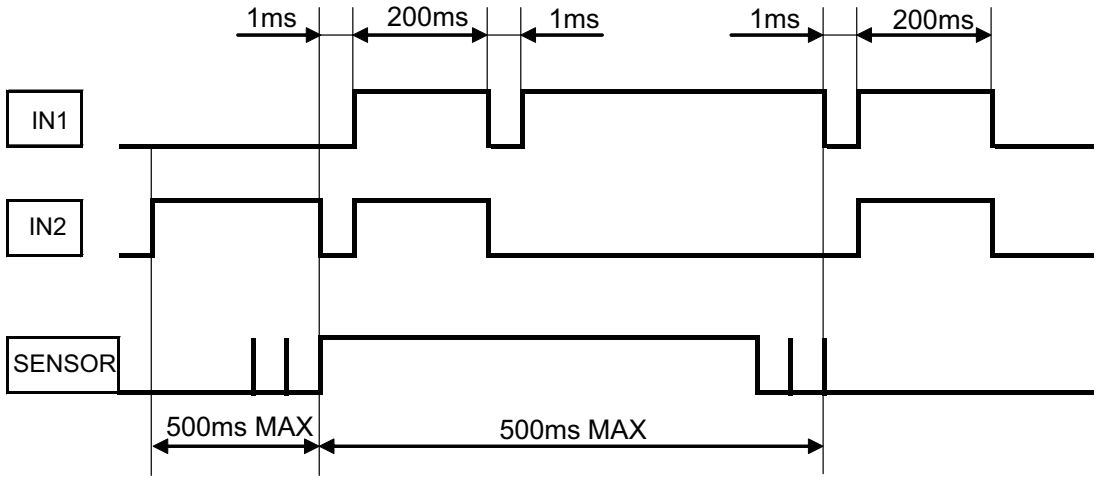


Note 1: Perform sensor detection considering the chattering phenomenon that occurs when switching the sensor from ON to OFF and OFF to ON.

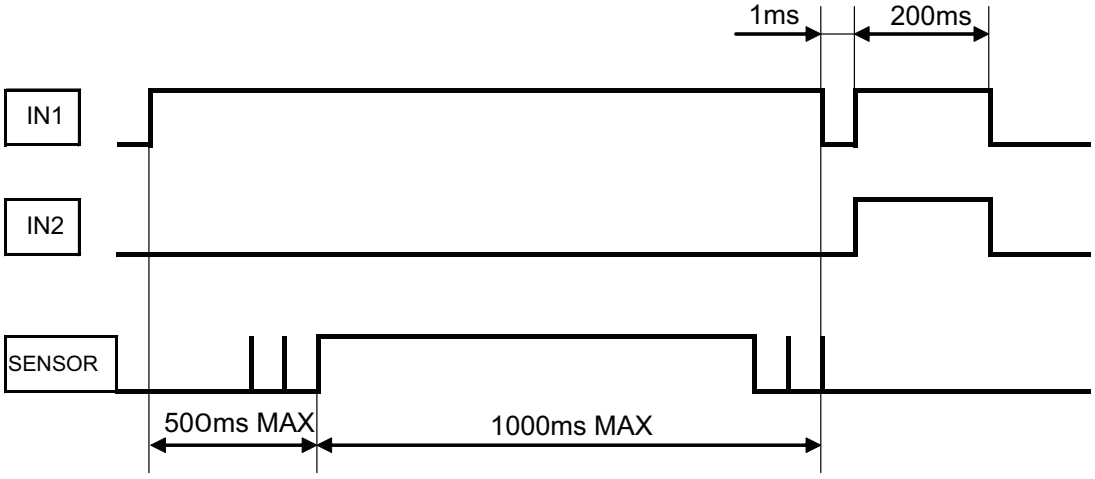
2: To switch the motor drive sequence, always insert a 1 msec stopping sequence.

3-5-10) Timing Chart

(1) Initializing



(2) Full Cut



Note 1: Perform sensor detection considering the chattering phenomenon that occurs when switching the sensor from ON to OFF and OFF to ON.

2: To switch the motor drive sequence, always insert a 1 msec stopping sequence.

3-5-11) How to Release a Motor Lockup

Use the following procedures to release the auto-cutter lock if trouble occurs, such as when paper becomes chewed.

(1) Stop energizing the auto-cutter DC motor.
(2) Stop energizing the auto-cutter DC motor to return the cutter blade.
(3) Stop energizing the auto-cutter DC motor when the cutter blade is returned to its home position and remove the external factor.
(4) If the cutter blade does not return to its home position, stop emerging the auto-cutter DC motor immediately, and follow the arrow of the auto-cutter unit case to rotate the emergency know to return the cutter blade to its home position, then remove the external factor.
The emergency knob should be rotated using a tweezers, screwdriver or ball-point pen to prevent accidents.

3-5-12) Precautions Regarding Use of the Auto-cutter

(1) It is prohibited to operate the cutter while feeding paper or while the platen is open.
The auto-cutter employs sharp cutting blades to cut the recording paper so it is extremely dangerous to operate the cutter particularly while the platen is opened, so that should be strictly avoided.

(2) Absolutely never approach the auto-cutter blades while the cutter is operating because it is extremely dangerous.
Also, if the cutter stops, absolutely never touch the blades directly with your fingers.

(3) Never unnecessarily disassemble the printer or its parts .Also, when handling the auto-cutter unit, always confirm that the power is actually cut.

(4) The cutter can become locked, depending on the thickness of the recording paper. Always use after checking the range of the specifications of the recording paper.

(5) The TUP500 series handles all paper widths within specifications. However, the width of paper on the same mechanism (auto-cutter) is limited to one type.

(6) It is prohibited to use the cutter while there is no paper loaded.

3-6) Paper Out Detector

The TMP500 series of printers are equipped with a paper out detector (a reflective photo-interrupter) to detect the presence of recording paper.
When designing an external circuit, consider a configuration of the circuit that controls the output of the detector and does not energize the thermal head when there is a “paper out” state. If the thermal head is energized while a “paper out” state exists, the life of the platen and thermal head will be notably shortened.

3-6-1) Absolute Maximum Rating (Ta = 25°C)

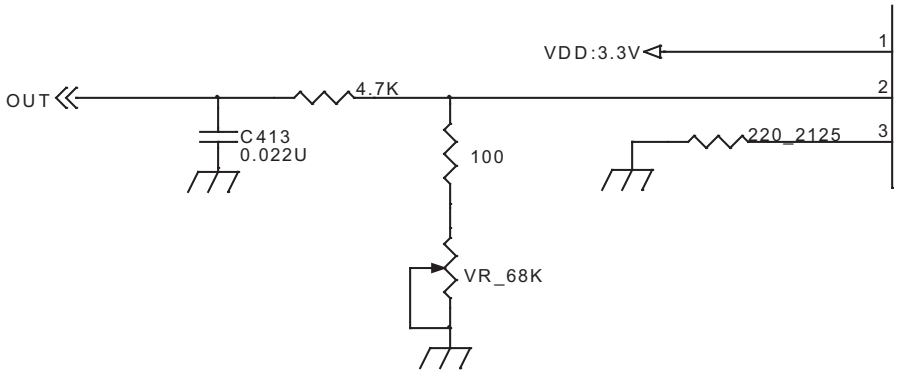
Item		Symbols	Rated Values	Units
Input	Current	IF	50	mA
	Reverse Voltage	VR	6	V
	Tolerance Loss	PD	75	mW
Output	Voltage Between Collector – Emulator	CCEO	35	V
	Voltage Between Emulator – Collector	VECO	6	V
	Collector Current	IC	20	mA
	Collector Loss	PC	75	mW
Total Tolerance Loss		Ptot	100	mW
Operating Temperature		Topr	-25 to +85	˚C
Storage Temperature		Tstg	-40 to +100	˚C

3-6-2) Electrical and Optical Characteristics (Ta = 25°C)

Item			Symbols	Conditions	MIN	TYP	MAX	Units
Input	Forward Voltage		VF	IF = 20 mA	-	1.2	1.4	V
	Reverse Current		IR	VR = 3V	-	-	10	µA
Output	Dark Current		ICEO	VCE = 20 V	-	1	100	nA
Joining Characteristics	Optical Current		IC	VCE = 5 V, IF = 20 mA	1.0	-	3.0	mA
	Leaked Current Note 1		ILEAK	VCE = 5 V, IF = 20 mA	-	-	500	nA
	Response Time Note 2	Rise	tr	VCE = 2 V IC = 100 µA RL = 1 kΩ d = 4 mm	-	50	150	µS
		Fall	tf		-	50	150	µS

Note 1: No reflective objects
2: d is the thickness of the reflective mirror glass.

3-6-3) External Circuit Example

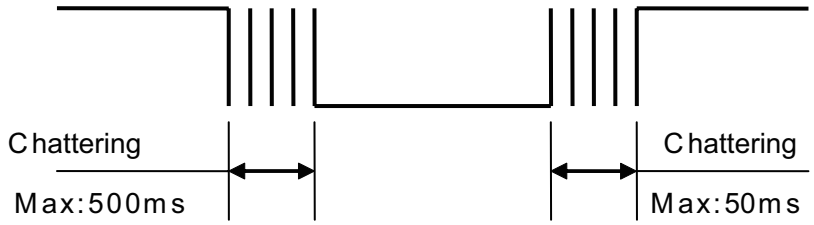


3-7) Platen Position Detector

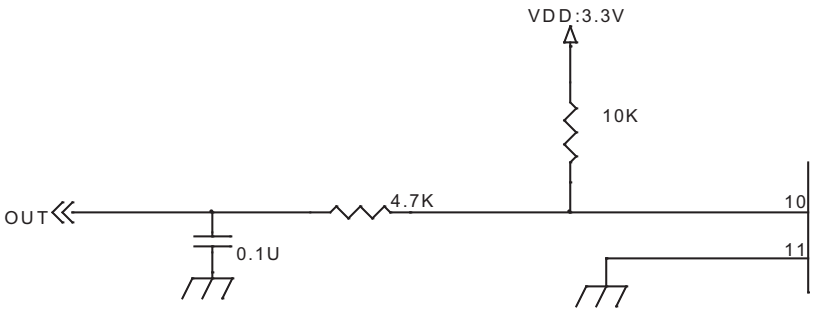
The TMP500 series of printers are equipped with a platen position detector to detect whether the platen is open or closed. This detector is set to detect when the platen is open and closed, using a micro-switch.
When designing an external circuit, consider a configuration of the circuit that controls the output of the detector and does not energize the thermal head when there is a “platen open” state.If the thermal head is energized with a “platen open” state, the life of the thermal head will be notably shortened. Also, it is extremely dangerous to operate the cutter while the printer is in a “platen open” state.

3-7-1) General Standards

(1) Type: Microswitch
(2) Rating: DC5V 0.1mA
(3) Maximum Rating: DC16V 0.1A (Resistance Load)
(4) Ambient Temperature Range: -10 to +70°C
(5) Chattering and Bound: Chattering and bound occur when switching the sensor for ON to OFF and OFF to ON. Detect the sensor considering the chattering and bound phenomena.



3-7-2) External Circuit Example



3-8) Connector

There are three types of connectors for the TMP500 series printers.
See Table 3.8 for details of each.
Table 3.8

Connector No.	Function and Model Number	Pin Count	Recommended Connector for Other Side
1 (A)	Thermal Head Control Pin Made by JST PHR-16	16	Made by JST Top type B16-PH-K-S Side type S16-PH-K-S
2 (B)	Thermal Head Control Pin Made by JST PHR-15	15	Made by JST Top type B15-PH-K-S Side type S15-PH-K-S
3	Motors (for feeding and cut-ting) and sensor control pin Made by JST PHR-14	14	Made by JST Top type B14-PH-K-S Side type S14-PH-K-S

3-8-1) Thermal Head Control Pins (Connector 1)

Pin Numbers	Signal Name	I/O	Function
1	COM	-	Printing power voltage
2	(N. C.)		
3	COM	-	Printing power voltage
4	(N. C.)		
5	(N. C.)		
6	/ LATCH	Input	Print data latch
7	CLOCK	Input	Synch signal for transfer of print data
8	VDD	-	Circuit Power Voltage
9	/ STROBE 1	Input	Strobe 1
10	/ STROBE 2	Input	Strobe 2
11	(N. C.)		
12	(N. C.)		
13	GND	-	GND
14	(N. C.)		
15	GND	-	GND
16	(N. C.)		

3-8-2) Thermal Head Control Pins (Connector 2)

Pin Numbers	Signal Name	I/O	Function
1	COM	-	Printing power voltage
2	(N. C.)		
3	COM	-	Printing power voltage
4	(N. C.)		
5	SI	Input	Print data input (Serial Input)
6	(N. C.)		
7	/ STROBE 4	Input	Strobe 4
8	/ STROBE 3	Input	Strobe 3
9	TM	Output	Thermistor
10	(N. C.)		
11	(N. C.)		
12	(N. C.)		
13	GND	-	GND
14	(N. C.)		
15	GND	-	GND

3-8-3) Motor and Sensor Control Pins (Connector 3)

Pin Numbers	Signal Name	Function
1		Paper Out Detector Anode/Collector
2		Paper Out Detector Emitter
3		Paper Out Detector Cathode
4		-
5		-
6	A	Motor Drive Signal
7	/A	Motor Drive Signal
8	B	Motor Drive Signal
9	/B	Motor Drive Signal
10		Platen Position Detector Signal
11	S-GND	Logic GND
12		Cutter Home Position Detector Signal
13		Cutter Motor (+)
14		Cutter Motor (-)

3-9) Heat Sensitive Recording Paper

3-9-1) Type

Single Roll Thermal Paper

3-9-2) Paper Width

45 ±0.5 mm to 82.5 ±0.5mm

3-9-3) External Dimensions

Roll Diameter: Max. 254mm (10 inches)
Width (Roll-up Dimensions): 45 ±0.5/-1 mm to 82.5 ±0.5/-1 mm

Note 1: The maximum diameter of wrapping diameter is a tolerance value for use of the option al shock absorber mechanism.

Note 2: To use roll paper that is comparatively larger in external diameter, a load is applied to the shock absorber when paper is conveyed. For that reason, the shock absorber mechanism is required to alleviate that load. Consider this when designing the system. Also, if the external diameter of the roll paper is small, the shock absorber is recom mended.

3-9-4) Paper Thickness

65 to 150 mm

3-9-5) Shaft Core Diameter (mm)/Outer Diameter (mm)

Note: The tolerance value of the roll paper shaft core (paper tube) varies according to the thick-ness of the paper that you use.

Refer to the following values to determine the shaft core diameter of the roll paper to use.

For 65 µm ≦ Paper Thicknesses ≦ 100 µm:
Shaft core inner diameter 25.4 ±1 mm or larger, shaft core outer diameter 31.4 ±1 mm or larger

For 100 µm ≦ Paper Thicknesses ≦ 150 µm:
Shaft core inner diameter 50.8 ±1 mm or larger, shaft core outer diameter 56.8 ±1 mm or larger

Note: When using paper that is outside of the above specification ranges, paper jams may occur.

3-9-6) Recommended Thermal Paper

Manufacturer	Product Name	Quality Characteristics and Use	Paper Thickness µm	Value n
Mitsubishi Paper Mills Limited	P220AG	Normal Type	65	3 (Default)
	HP220A	Long-storage Type	65	3 (Default)
	HP220AB-1	Long-storage Type	75	3 (Default)
	P220AGB	Normal Type (For Cards and ickets)	80	2
	P220AB	Normal Type (For Cards and ickets)	85	2
	P220AC-1	Normal Type (For Cards and ickets)	95	2
	P220AC	Normal Type (For Cards and ickets)	105	2
	P220AD	Normal Type (For Cards and ickets)	130	2
	P220AE-1	Normal Type (For Cards and ickets)	150	3 (Default)
	PB670/PB770	2-Color Type (Red/Black, Blue/lack)	75	3 (Default)
Oji Paper Company	PD450	Normal Type	60	2
	PD150R	Normal Type	75	3 (Default)
	PD160R	Long-storage Type	65/75	2
	PD750R/PD700R	2-Color Type (Red/Black, Blue/lack)	75	3 (Default)
KSP	P320RB/P320BB	2-Color Type (Red/Black, Blue/lack)	65	3 (Default)
Nippon Paper Industries	TF50KS-E2D	Normal Type	65	3 (Default)

Note 1: Print density settings must be changed according to the type and thickness of the pa per.

Note 2: • There is the possibility that adequate reading results of bar codes or characters may not be attained because of the scanner, paper type of print density. If so, evaluate your scanner in advance.

Note 3: To use 2-color type thermal paper, print in the dedicated 2-color print mode.

3-9-7) Head Adjustment Lever Position According to Recording Paper Used

The TMP500 Series printers require that the head position be adjusted according to the thickness of the paper to be used to ensure high quality printing.
The adjustment of the head position is performed by changing the position of the head adjustment lever.
See the table below to set to the optimum lever position.

Paper Thickness	Head Adjustment Lever Position
65 µm ≦ Paper Thickness ≦ 110 µm	Normal Position
110 µm ≦ Paper Thickness ≦ 150 µm	Position for Thick Paper

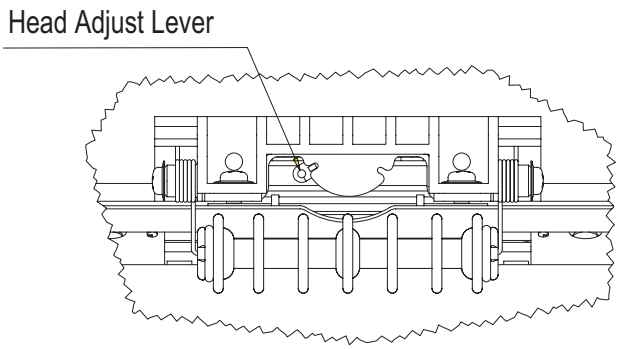


Fig. 3.3.1.6A Normal Position

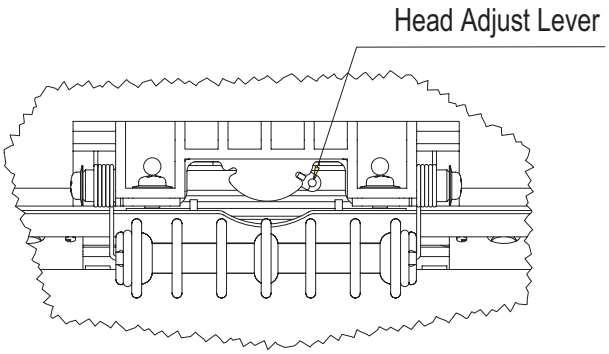
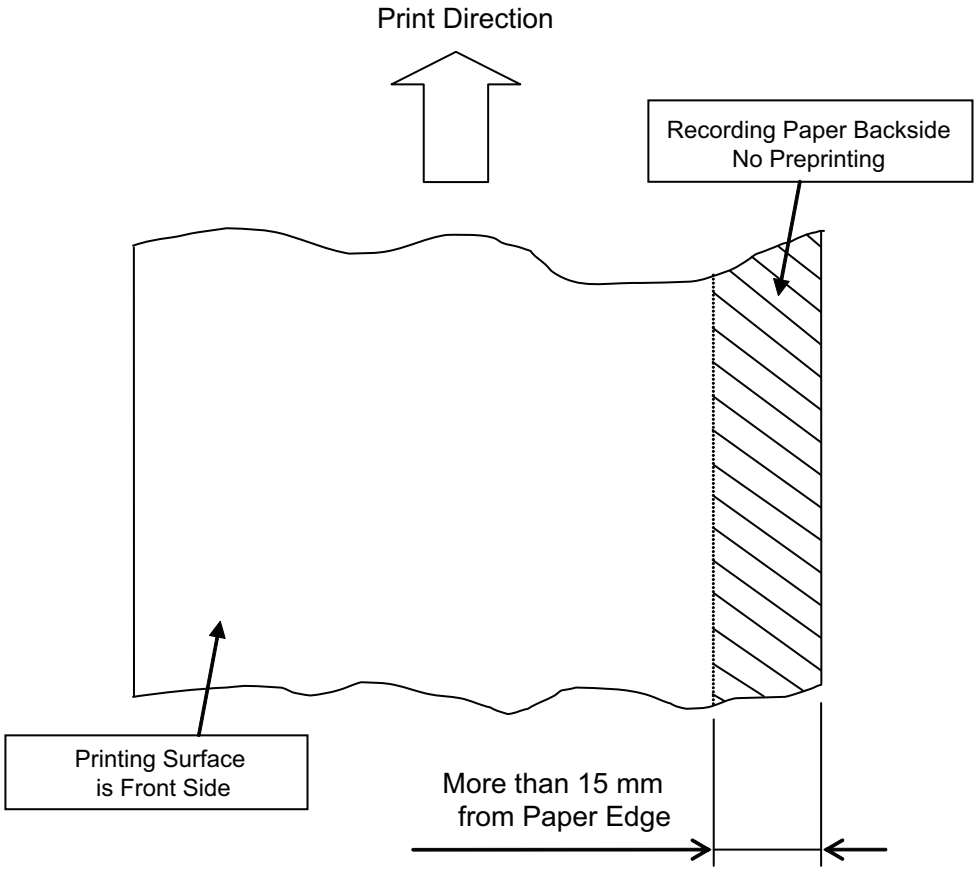


Fig. 3.3.1.6B Position for Thick Paper

Note 1: Depending on the type of paper used, the desired print quality may not be attained even if the head position is adjusted as described below. In such cases, try two head position settings and use with the position setting that gives you good results. Change the print density as required.

3-9-8) Pre-printing Range on the Backside of Recording Paper

When pre-printing to the backside of recording paper, it should meet the following specifications.

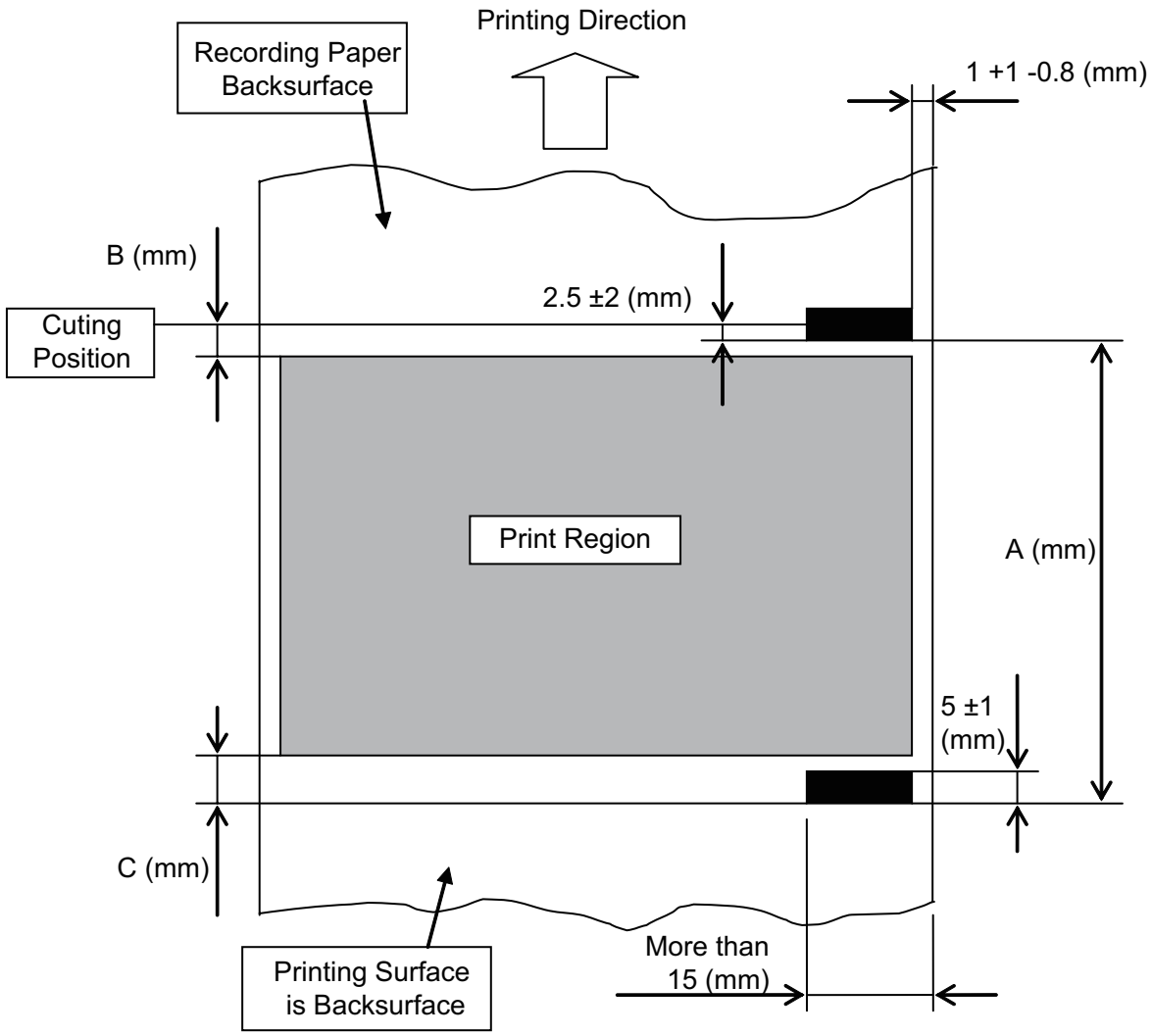


3-9-9) Others

- Coloring Side: Roll Outer Side
- Trailing Edge Processing: Do not glue to fasten to roll paper and shaft core. The trailing edge should not be folded.

3-10) Black Mark Specifications

The following describes the recommended black mark specifications for printers that use the paper out detector as the black mark detector.



3-10-1) Black Mark Pitch (Dimensions A)

Black mark pitch can be set to the following ranges.

(1) When not using the presenter: A = 45 to 300 mm
(2) When using the presenter: A = 75 to 300 mm

Note: Black mark pitch is recommended to be set to the above range, but to set to use pitches that are smaller than the aforementioned range, consult with Star.

3-10-2) Black Mark Dimensions

See the following drawings for the dimensions of black marks to be printed.

3-10-3) PCS Value

The PCS value of black marks to be printed should be under 0.9 mm.

Note: The PCS value of black marks can cause page skipping problems or improper page length detection if they do not meet the aforementioned specifications. For that reason, always ensure that the PCS value is met.

3-10-4) Top Margin (Dimension B)

Set the printing range, leaving plenty of top margin from the cutting position.
If not reverse feeding the recording paper, it is recommended that the top margin be a total of more than 17.25 mm including the distance of 11 mm from the thermal head heating elements to the cutting position and the amount of the acceleration step paper feed amount (in HS mode 100 steps = 6.25 mm) caused by the paper feed motor acceleration control after cutting the paper.
If you want a smaller top margin setting, reverse feed the recording paper. However, in such cases, it is recommended that the top margin be set to more than the paper feed motor acceleration step (more than 6.25 mm) after cutting the paper.

Note 1: If the top margin is not sufficiently taken, problems, such as the page being skipped, can occur.So, you must set for plenty of top margin.

2: The setting of the printing range should not exceed the black mark pitch.

3-10-5) Top Margin (Dimension C)

Set the printing range leaving plenty of bottom margin from the trailing edge of the printing range to the black mark. It is necessary to consider the printing precision of the black mark, the printing TOF accuracy (±##2 mm of the standard printing position), the setup ambient temperature of the printer mechanism, the variation in the forming accuracy of the parts and part wear-out to set the bottom margin. It is recommended that the following bottom margin be secured to set the printing range.
Bottom Margin (Dimension C) ≧ 3 mm + (Dimension A x 3%)

Note 1: If the bottom margin is not sufficiently taken, problems, such as the page being skipped, can occur. So, you must set for plenty of bottom margin.

2: The setting of the printing range should not exceed the black mark pitch.

3-10-6) Setting Example of the Printing Range

The following shows a printing range setting example when not reverse feeding recording paper.

• When Black Mark Pitch (Dimension A) is 100 mm:

The top margin is set to 20 mm.
The bottom margin is set to 3mm + (100 mm x 0.03) = 6 mm.
With the above, it is necessary that the printing region be less than 100 mm – 20 mm – 6 mm = 74 mm.

Note: If you have any questions regarding how to set the printing range for the black mark, consult with Star Micronics.

3-11) Roll Paper Supply Conditions

If the roll paper supply conditions are poor, there can be inconsistencies in the paper feed pitch or notable differences in the length of the print.For that reason, use the optimum roll paper supply conditions to maintain quality printing.

Specify to make the roll paper core parallel to the mechanism without shifting the left and right sides with regard to the mechanism paper insertion inlet.

Note 1: If the roll paper supply conditions are poor, print quality will be negatively affected and the paper feed motor will not drive normally.
Consult with us to use roll paper in a position other than what is recommended.

Note 2: Do not use with the damper roller removed. If not using the damper roller for the TMP500 series, you should install your own shock absorber mechanism (damper roller) and check operations.

3-11-1) When Using a Standard Damper Roll Unit

To use a standard damper roller, see Fig. 4.1.B (separate sheet) for the recommended roll paper layout.
However, the maximum roll paper diameter that can be used with the standard damper roller is Ø150 mm.

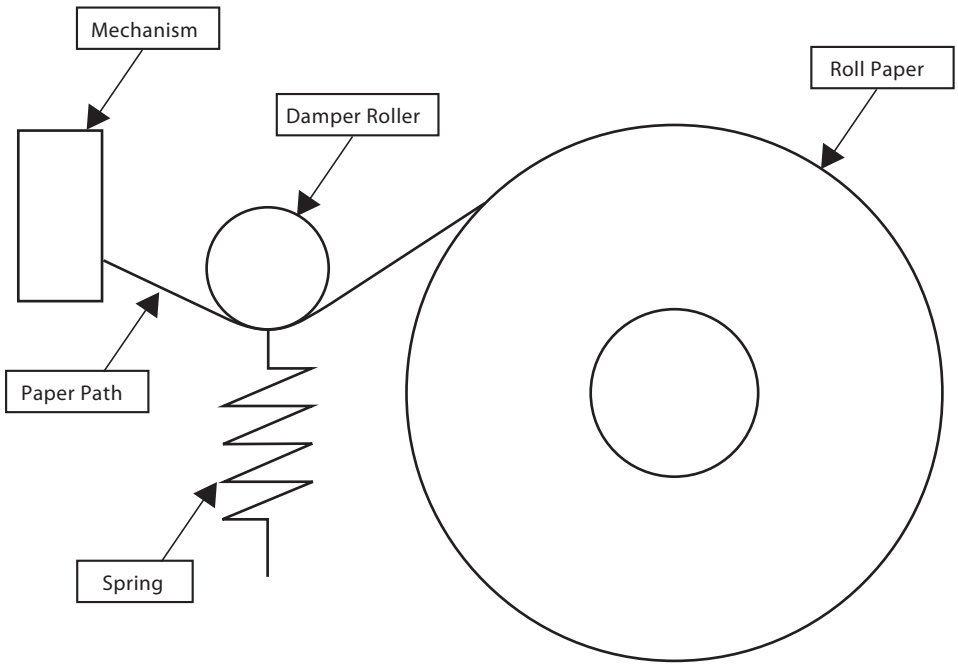
3-11-2) When Using the Optional Damper Roller B Unit

A damper roller B unit DRU-T500B (optional) is available for TMP500 as a shock absorber mechanism other than the standard damper roller. To use roll paper with an external diameter larger than Ø150 mm (less than Ø254 mm), replace the damper roller with the optional DRU-T500B and refer to the recommended layout in Fig. 4.1.B (separate sheet).

3-11-3) When Not Using a Standard TMP500 Series Damper Roll

To print, you should install your own shock absorber mechanism (damper roller) and check operations.

Shock Absorber Mechanism Example



The paper supply load on the printer should be less than 0.49 N (50 gf).

4. Designing the Outer Cover

4-1) Printer External Appearance and Dimensions

The accompanying Fig. 4.1A , Fig. 4.1B and Fig. 4.1C show the external appearance of the printer mechanism and the dimensions.

Refer to them to design the printer outer cover.

Note 1: If the positional relationship of the printer mechanism and the paper feed roll holder mounting is poor, recording paper can skew, the ends of the paper become creased or the paper to jam. For that reason, design so that center of the printer mechanism paper guide in the width direction and the center of the paper feed roll holder in the paper width direction match.

2: Set the insertion angle of the recording paper to the printer mechanism to be within the standard range.

3: Design so that paper transport is unobstructed at the recording paper discharge outlet.

4: Determine the layout of the cables from the printer mechanism so that no unnecessary loads are applied to them. Also, ensure that cable insulating covering is not damaged by the edges of the printer mechanism or the case.

5: Plated steel is used so rusting can occur on edges.

6: Design for gaps between the case and the printer mechanism for areas other than where attached.

4-2) Fastening the Printer

Use screws from the printer front side or backside to fasten the printer mechanism.

Note: Depending on the state of the surface to which the printer mechanism is fastened, the printer mechanism can become deformed making it difficult to attain quality prints. Avoid fastening to surfaces that have bumps or that are uneven.

4-2-1) Fastening from the Printer Front

Use the U-shaped grooves of a and b shown in Fig. 4.1.A on the separate sheet, and holes g, h, i, and j shown in Fig. 4.1.B to fasten the printer mechanism. Also, holes A and B are for positioning the printer mechanism.
When screwing into holes g, h, i, and j, use self-tapping screws. Control the tightening torque to avoid damaging the threads of the screws when tightening.

Note: If you are unsure of which self-tapping screws to select, contact Star Micronics.

4-2-2) Fastening from the Printer Back

Use the four holes c, d, e, and f shown in the accompanying Fig. 4.1.A on the separate sheet to fasten the printer mechanism. Also, holes A and B are for positioning the printer mechanism.
Use self-tapping screws to screw into the holes in the printer mechanism. Control the tightening torque to avoid damaging the threads of the screws when tightening.

Note: If you are unsure of which self-tapping screws to select, contact Star Micronics.

4-2-3) Fastening from the Printer Bottom Side

Use the four holes e, f, g, and h shown in the accompanying Fig. 4.1.A on the separate sheet to fasten the printer mechanism. Also, C and D are for positioning the printer mechanism.
Use self-tapping screws to screw into the holes in the printer mechanism. Control the tightening torque to avoid damaging the threads of the screws when tightening.

Note: If you are unsure of which self-tapping screws to select, contact Star Micronics.

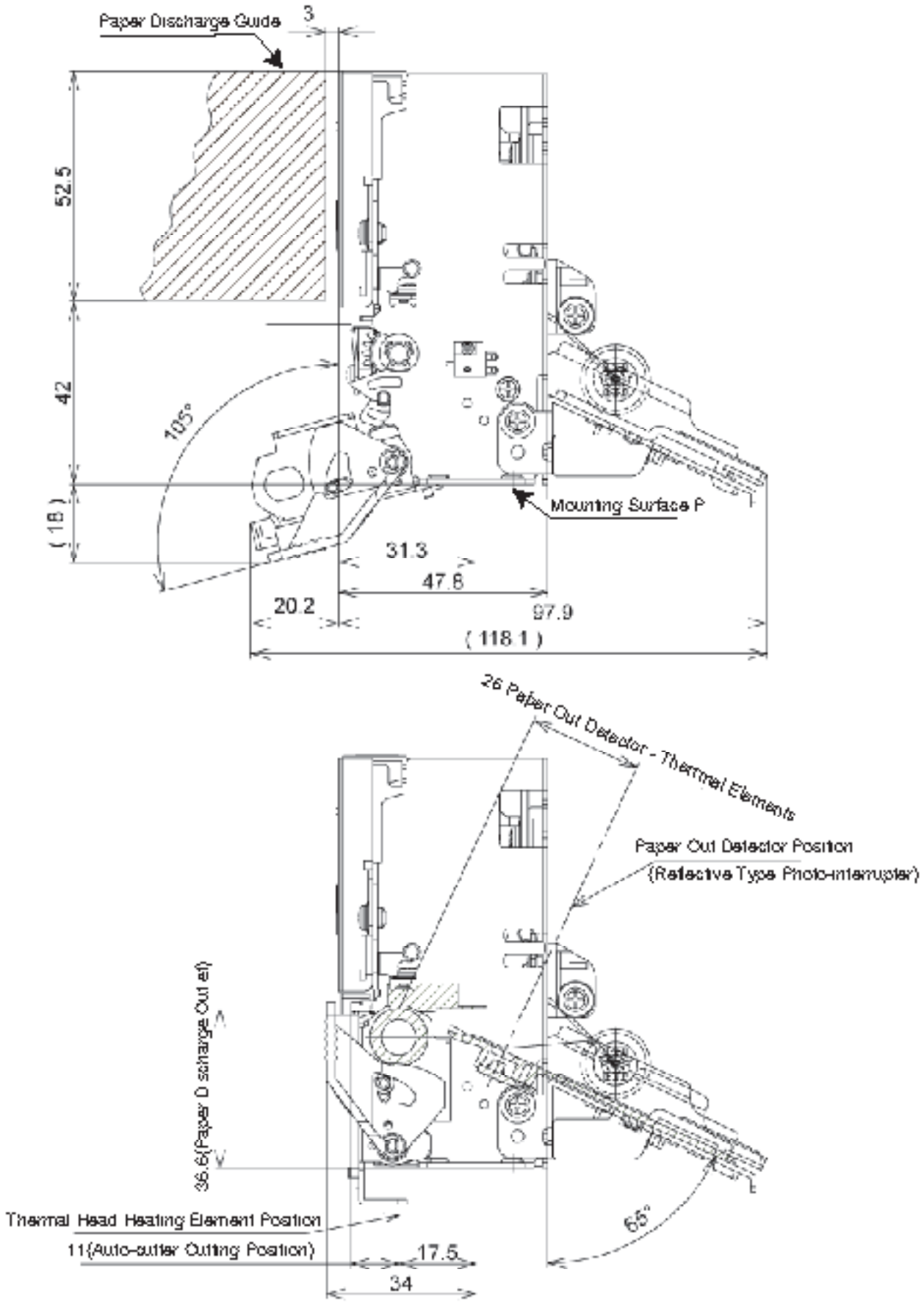

Paper Discharge Guide
3
52.5
42
(18)
105°
Mounting Surface P
31.3
47.6
20.2
97.9
(118.1)
26 Paper Out Detector - Thermal Elements
Paper Out Detector Position
(Reflective Type Photo-interrupter)
36.6(Paper Discharge Outlet)
Thermal Head Heating Element Position
11(Auto-cutter Cutting Position)
17.5
34
65°

Fig. 4.1.C

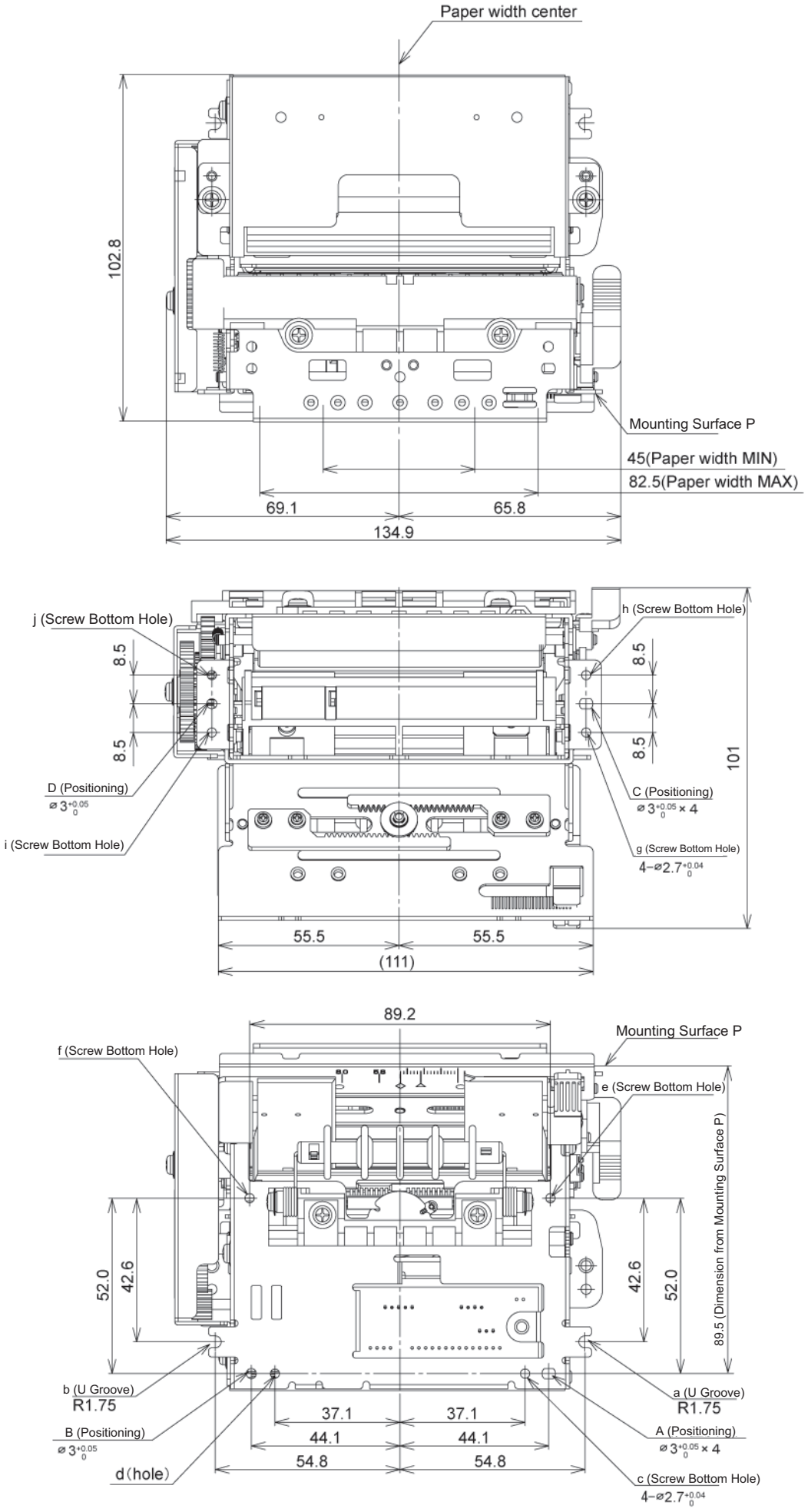
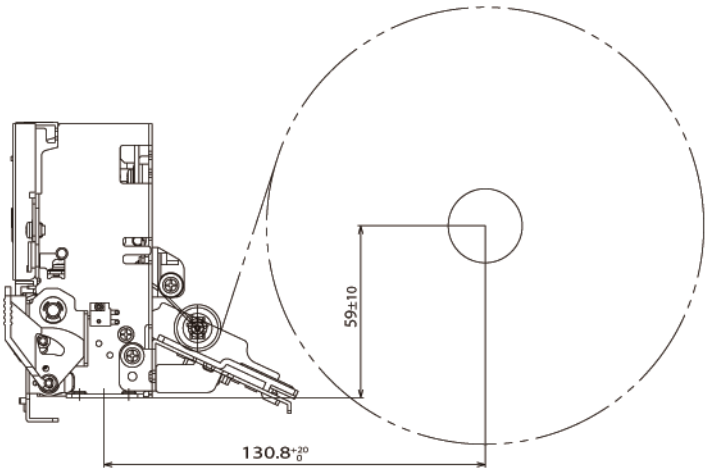
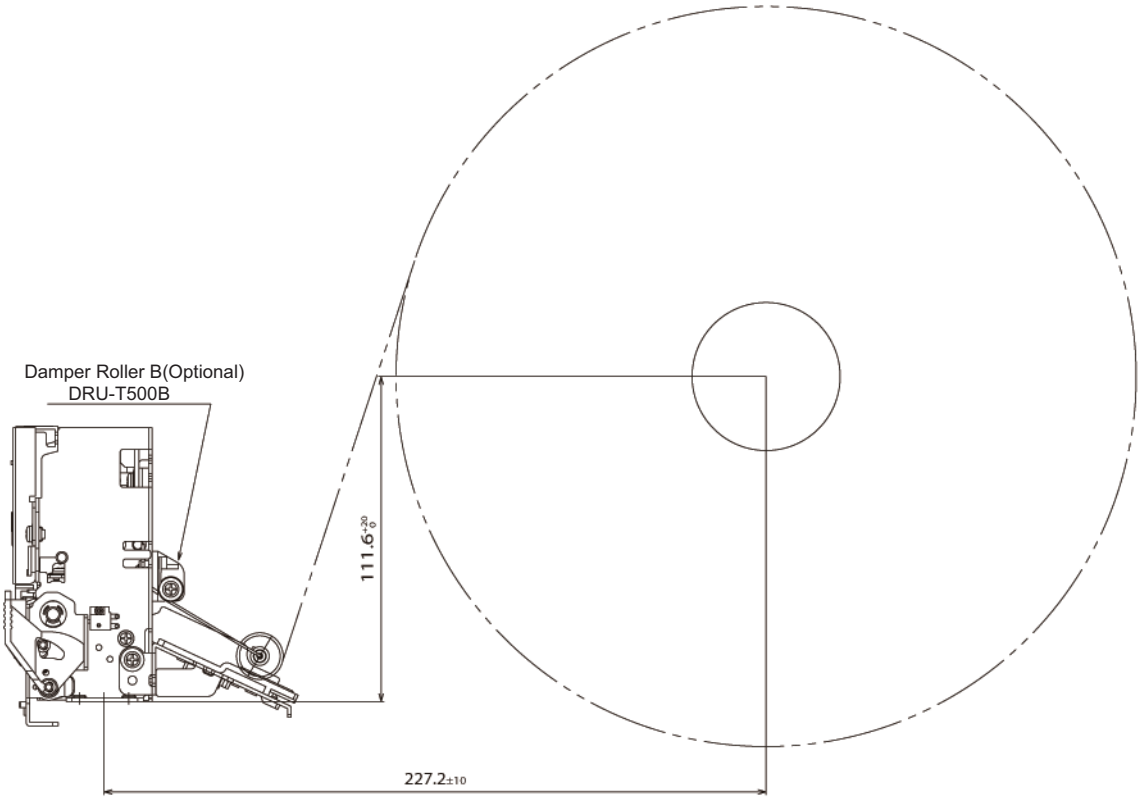


Fig. 4.1.A External View and Dimensions of the Printer Mechanism



When Using the Optional Damper Roller, Roll Paper External Diameter Max.Ø254



When Using the Optional Damper Roller, Roll Paper External Diameter Max.Ø254

Fig. 4. 1.B

5. HANDLING THE PRINTER

5-1) Precautions Regarding Designs

(1) See “3-4-10 Precautions Regarding Use of the Thermal Head” for details regarding the thermal head.

(2) To avoid damaging the thermal head heating elements that is generated by the ions on the recording paper and noise, design so that the VH charge is applied to the power circuit only when printing.

(3) Absolutely never energize the head when there is no recording paper, or when the platen is released.

(4) To issue short vouchers without using the optional presenter, it is necessary to equip a paper discharge guide to the mechanism paper discharge outlet. A setup example of the paper discharge guide is shown in Fig. 4.1.B. Always refer to that drawing to setup the paper discharge guide for printer operation.

(5) Consider measures to handle static electricity on the paper feed path. To cut and issue receipts, and the printer is used without measures for static electricity, the cut vouchers will stick to the guide in the paper feed path or the metal frame of the mechanism unit causing paper jams. Particularly, if the metal guide is setup in the paper feed path.
(6) Depending on the ambient environment, the cut surface of the metal plate may discolor or rust. Consider ways that this will not become a problem in appearance.
(7) Design an external cover so that the discharged recording paper does not get caught.
(8) If the printing or paper feed are temporarily terminated, paper feeding may be disrupted in several dot lines when starting printing, when data is input and printing is started. This particu larly affects printing bit images.
(9) Do not use with the damper roller removed. If not using the damper roller for the TMP500 se ries, you should install your own shock absorber mechanism (damper roller) and check operations.
Contact us for any unclear problems.

5-2) Precautions for Handling

(1) To prevent static electric damage to the thermal head’s heating elements and the IC, handle the printer only after preparing for anti-static and grounding yourself.
(2) Handle the thermal head carefully because applying mechanical stress or shocks to it (including wear out by micro-granules), it is possible to damage the PCB surface of the heating elements.
(3) Print quality and thermal head life cannot be guaranteed if you use recording paper other than what has been recommended.
(4) To prevent static electric damage to the thermal head’s heating elements and the IC, handle the printer only after preparing for anti-static and grounding yourself.
(5) Absolutely never directly touch the thermal head heating elements, the driver IC unit or the pins with your hands or a screwdriver.
Also, do not scrape or shock with sharp or hard objects. This can damage the thermal elements.
(6) Be careful not to allow condensation to form. If condensation does form, absolutely do no turn ON the power until it has evaporated.
(7) Absolutely never directly touch the thermal head heating elements, the driver IC unit or the pins with your hands or a screwdriver.
(8) Avoid leaving the printer without paper.
(9) Be careful not to allow foreign objects to adhere to the recording paper and the platen.
(10) Do not pull on the paper without opening the platen.
(11) When closing the platen from an open state, check that it has been correctly locked by the locking mechanism before operating the printer.
(12) Do not apply excessive force to the cable connectors. Limit the number of times to attach and detach the connectors to 10 times.

(13) There are cases of discoloring of the recording paper, degradation of the coloring layer or the recording paper and platen could fuse together if the printer is left unused for extended periods. So, when using the printer after having been unused for extended periods, it is recommended to install new recording paper.
(14) The platen rubber may deform making printing thinner in some places, if the printer is left unused for extended periods.
(15) Initial print may be thin when using the printer in a cold environment because the thermal head is cold.
(16) When using the printer in a high temperature environment, the print may run or characters may be distorted.
(17) Separate this printer an adequate distance from devices that emit wireless signals.
(18) Do not handle the printer with wet hands. To clean locations other than those described in section 9.2.1, always use a soft, dry cotton cloth or cotton swabs.
(19) When closing the platen unit, the leading edge of the platen drive gear and deceleration gear may hit making it difficult to assemble the platen unit. In such cases, open the platen unit and try closing it again.
(20) Do not open the platen unit while the printer is operating because this can damage the mechanism.
(21) Print quality and thermal head life cannot be guaranteed if you use recording paper other than what has been recommended.
[Ex. of Trouble]
(1) Decreased print quality caused by low-sensitivity recording paper
(2) Erroneous wear of the thermal head caused by rough paper surfaces
(3) Sticking of the heat-sensitive layer and thermal head and vibration sounds when printing
(4) Missing print caused by low-storage recording paper
(5) Electrolytic corrosion of the thermal head caused by bad quality heat-sensitive layer
(22) Do not print (empty printing) when there is no recording paper. Empty printing will damage the platen and thermal head.

5-3) Precautions Concerning Safety

(1) During or after printing, the area near the thermal head and the surface of the motor are extremely hot. Do not touch directly with your hands.

(2) Burning of the thermal head has the dangerous possibility of causing overheating or smoke. For that reason, see “3-4-10 Precautions Regarding Use of the Thermal Head” for details on dual use of the software and hardware for error detection of the control system.

(3) Do not touch the gears or rotating parts while the printer unit is operating.

(4) Be very careful because there is the possibility of injury by handling the edges of the printer mechanism (particularly the metal parts).

(5) Be careful to never directly touch the auto-cutter blade with your hands because it is extremely dangerous. The auto-cutter is also extremely dangerous when it is operating, so absolutely never put your fingers in or near the auto-cutter blades or paper discharge outlet.

(6) When performing maintenance on the printer mechanism, always check that the power has been turned OFF before starting your work.
(7) There is the possibility of injury by handling the edges of the printer. The cut portions of metal parts can be particularly dangerous. Create a structure that cannot be touched by hand, or provide adequate warnings.

5-4) Performing Maintenance

5-4-1) Cleaning the Thermal Head and Platen

To ensure long-term and stable printing, periodically clean the thermal head and the platen. It is recommended that you clean every 500,000 lines.
The thermal head and platen can be cleaned by opening the platen unit with the release lever.

- To clean the thermal head heating elements, wipe with a cotton swab dampened with an

alcohol based cleaner (such as ethanol or methanol).Also, do not apply excessive force when doing so. Wipe the heating elements gently. After cleaning, check that the alcohol has com pletely evaporated before closing the platen unit.

- To clean the platen, apply alcohol (ethanol or methanol) to a soft cloth and wipe away the dirt while rotating the platen.
  Use a soft, dry cotton swab to clean the platen. Wipe away the dirt while rotating the platen. Also, complete wipe away all of the paper dust on the rubber platen. If the cleaning is incom plete, there may be problems in paper feeds.

5-4-2) Handling Recording Paper Jams

If recording paper should become jammed, open the platen unit and remove the jammed paper.
Never pull on the jammed paper unnecessary while the printer unit is closed because this can damage the drive system parts.

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Rev. 0.00 2009.01.07
Printed in Japan, 80877265