BIXOLON®

福跃电子 Fosvos Electronic
嵌入式系统设计领导品牌与元器件供应商

Revised at December 3, 2008

SPECIFICATIONS FOR APPROVAL

CUSTOMER :

NOMENCLATURE : 2 inch Thermal Printer

MODEL : SMP640UKC

SIGNATURE OF APPROVAL

The Designs or Specifications are subject to change without notice.

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REVISION SHEET

The table below indicates which pages in this specification have been revised.
Before reading this specification, be sure you have the correct version of each page.

Revisions			Design section			Sheet revision NO.					
REV.	Document	Date	WRT	CHK	APL	Sheet	REV.	Sheet	REV	Sheet	REV
A						I	A	16	A		
						II	A	17	A		
								18	A		
								19	A		
								20	A		
						1	A	21	A		
						2	A	22	A		
						3	A	23	A		
						4	A	24	A		
						5	A				
						6	A				
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						12	A				
						13	A				
						14	A				
						15	A				

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REVISION SHEET

REV.	Sheet	Changed contents
A		
Title SMP640UKC Specification (Standard)		

TABLE OF CONTENTS

1. DESIGN PRECAUTIONS

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

◆ If too much energy is applied to the thermal head, it may overheat and become damaged. Always use the printer with the specified amount of energy.

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

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

◆ Keep the Vp power off when not printing to prevent the thermal head from becoming electrically corroded.

◆ When turning the power on or off, perform the Vp and Vcc simultaneously or in the order of 1) and 2) as follows:

At power ON: 1) Vcc (5 V) On → 2) Vp On
At power OFF: 1) Vp Off → 2) Vcc (5 V) Off

◆ Always monitor the output of the platen position sensor and paper detector. Incorrect activation of the thermal head may damage and reduce the longevity of the thermal head and the platen.
Design the outer case so that the paper detector is not affected by light from outside. Since a reflection type photo interrupter is used in the paper detector, the detector may be affected by light from outside.

◆ Allow for movement of the FPC when designing the outer case because the FPC will shift 2 to 4 mm from the thermal head moving. Also, design the outer case so that it prevents the paper feed out from being caught in the platen.

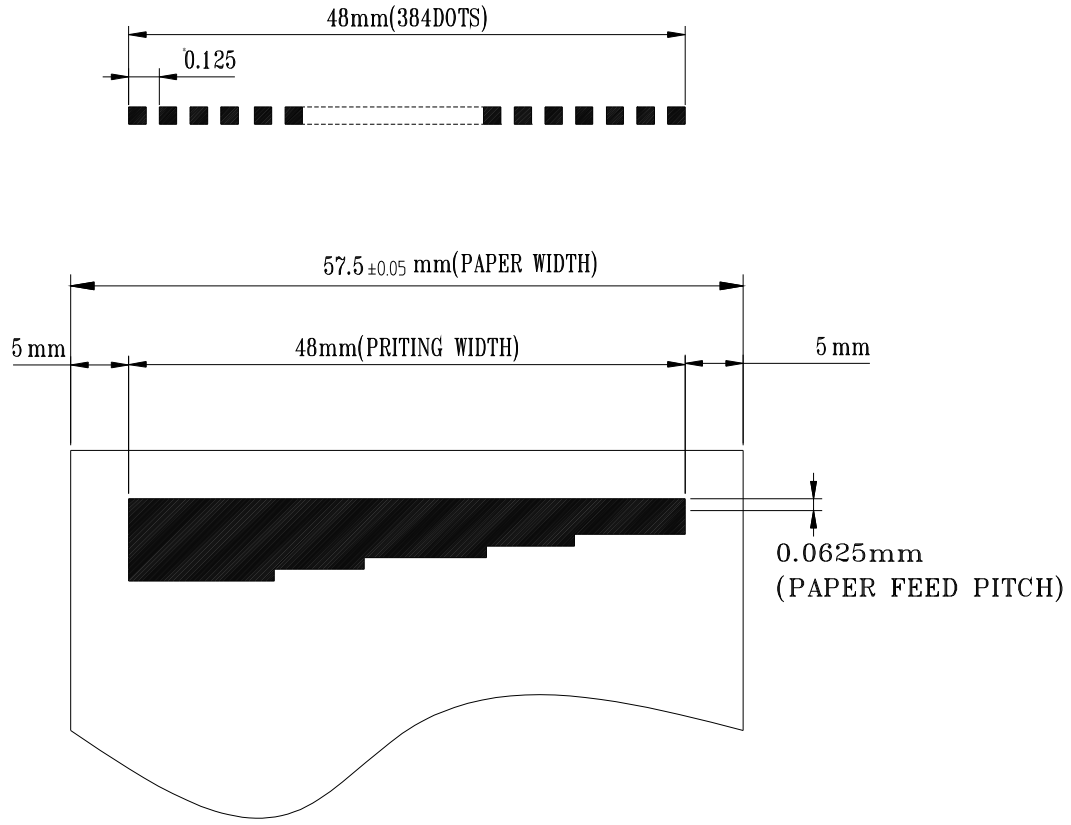
2. GENERAL SPECIFICATIONS

2-1. General Specifications

Item	Specifications
Printing method	Thermal Dot Line Printing
Resolution	8dots/mm
Dots per line	384dots
Printing width	48mm
Maximum Printing Speed	70mm/s at 8.5V
Paper feed pitch	0.0625mm
Head temperature detection	Via thermistor
Out of paper detection	Via photo interrupter
Operation voltage	4.0~8.5 DCV (for head and motor drive) 3.0 ~ 5.5DCV (for logic)
Current consumption (at 7.2V, 64dots on)	For driving the Head : 2.8A max For driving the motor : 0.5A
Paper width	57.5 ± 0.5 mm
Paper feeding force	50gf or more
Paper holder force	80gf or more
Printer Life (at 25° and rated energy)	Activation pulse resistance : 100million Abrasion resistance : 50Km
Temperature range	Operating : 0˚C to 50˚C Storage : -40˚C to 80˚C (no condensation)
Humidity range	Operating : 10 to 90% RH Storage :10 to 90% RH (no condensation)
Impact resistance	Package BIXOLON standard package Height : 75cm Directions - 1 corner, 3edges and 6 surfaces
Recommended paper	HANSOL PAPER 65GSM
Dimension (W × D × H)	66.7mm × 30.3mm × 30.6mm
Weight	38g

2-2.Heat Element Dimensions

The printer contains a thermal head with 384 heat elements



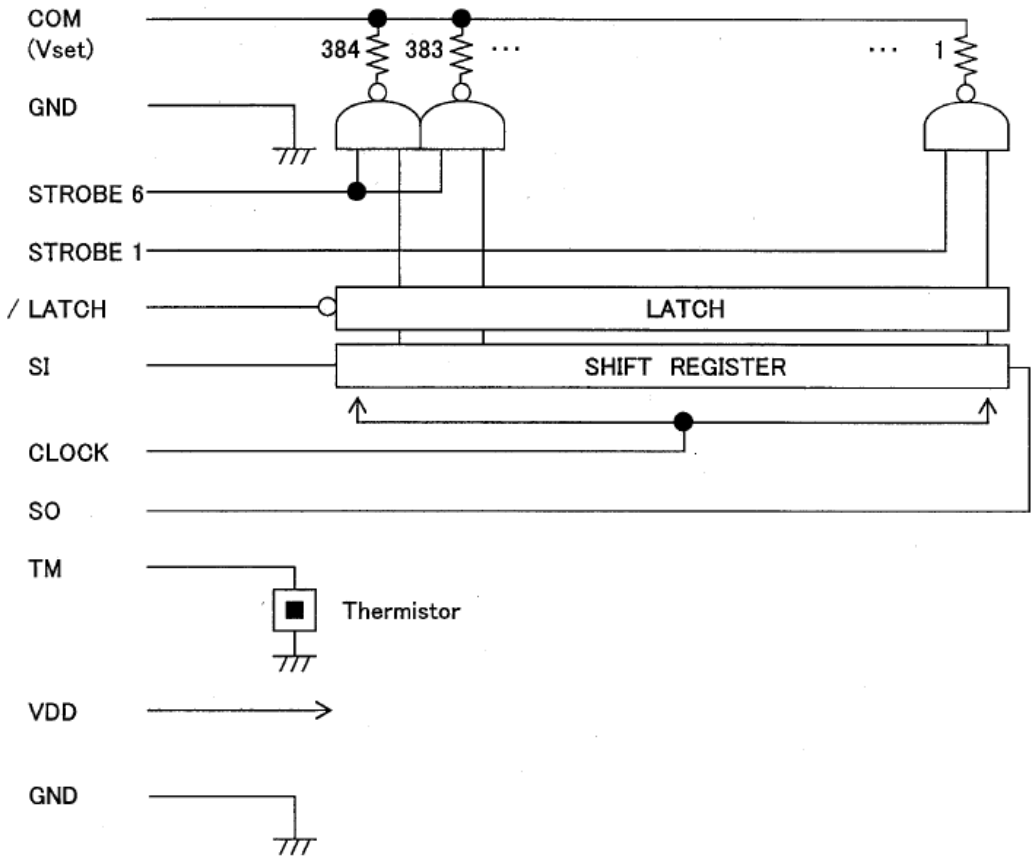
Paper Roll Printable Area

3. THERMAL HEAD

3-1. General Specifications

Item	Specifications
Printing Width	48mm± 0.2 mm
Total Number of Dots	384Dots / Line
Dot Density	8 Dots/mm (Dot Size 0.125 X 0.125)
Dot Pitch	0.125mm
Average Resistance	R_{ave} = 176 Ω ± 7Ω

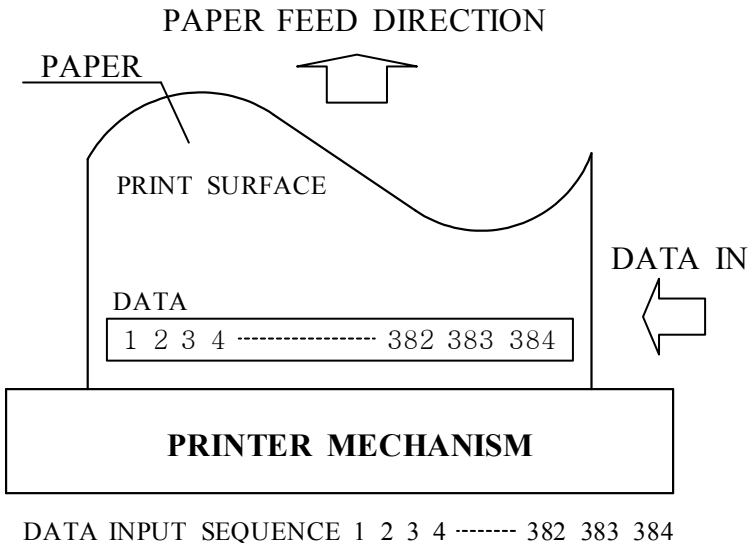
3-2. Thermal head Block Diagram



3-3. Block and Activated Heat Elements

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

3-4. Printed Position of the data



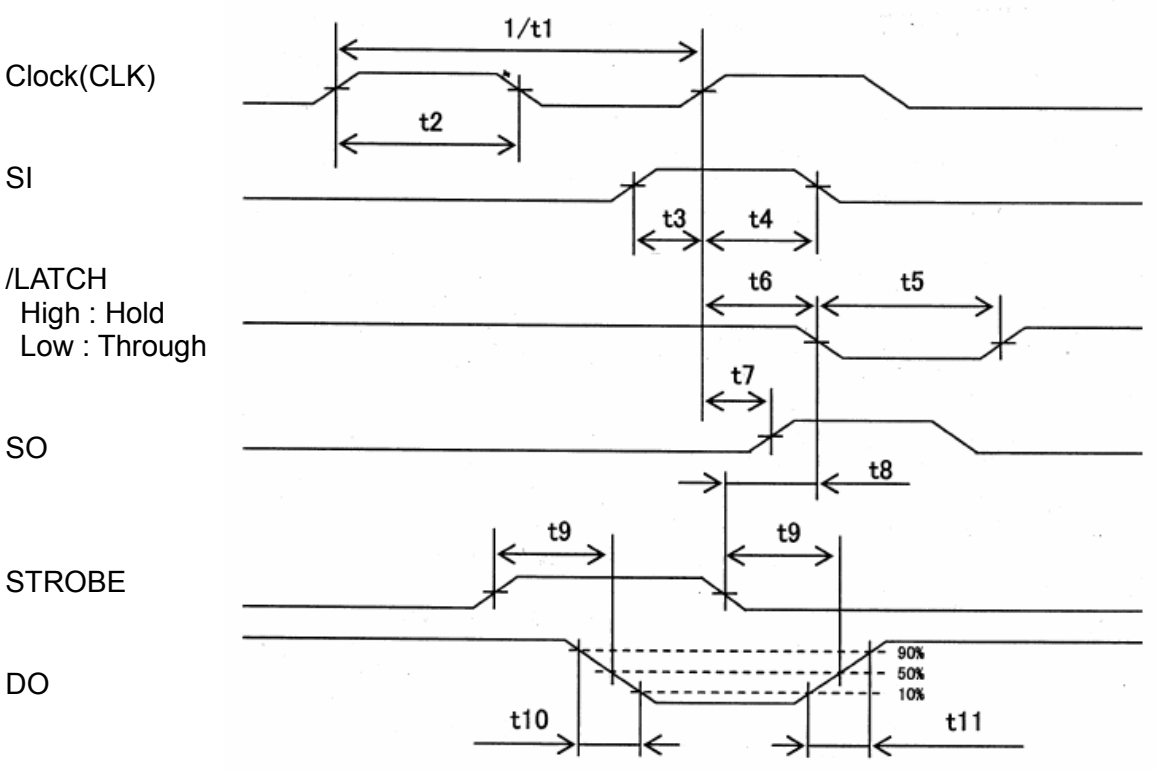
DATA INPUT SEQUENCE 1 2 3 4 -------- 382 383 384

3-5. Electrical Characteristics

T = 25℃

Item		Symbol	MIN.	TYP.	MAX.	Unit	Remark
Print Voltage		V_H	-	-	8.5	V	
Logic Voltage		V_{DD}	3.0	5 or 3.3	5.5	V	
Logic Current		I_{DD}	-	-	42	mA	All-high
Input Voltage	H	V_{IH}	0.8Vdd	-	Vdd	V	
	L	V_{IL}	0	-	0.2Vdd	V	
Input Current (DI)	H	I_{IH}	-	-	1.0	μA	SI,CLOCK,/LATCH
			-	-	55	μA	STROBE (VDD=5V)
			-	-	22	μA	STROBE (VDD=3.3V)
	L	I_{IL}	-	-	-0.5	μA	
Output Voltage	H	V_{OH}	4.1	-	-	V	VDD=5V
			2.3	-	-	V	VDD=3V
	L	V_{OL}	-	-	0.4	V	
Output Current	H	I_{OH}	-	-	0.5	mA	
	L	I_{OL}	-	-	0.5	mA	
DO Leakage Current		I_{LEAK}	-	-	0.04	mA	ALL-low
CLOCK Frequency		t1	-	-	8	MHz	VDD=5V(See 3-6)
			-	-	5	MHz	VDD=3V(See 3-6)
CLOCK Pulse Width		t2	50	-	-	ns	See 3-6
SI-CLOCK Setup Time		t3	40	-	-	ns	See 3-6
CLOCK-SI Hold Time		t4	40	-	-	ns	See 3-6
LATCH Pulse Width		t5	100	-	-	ns	See 3-6
CLOCK-LATCH Setup Time		t6	100	-	-	ns	See 3-6
CLOCK-SO Delay Time		t7	-	-	70	ns	VDD=5V(See 3-6)
			-	-	130	ns	VDD=3V(See 3-6)
STROBE-LATCH Removal Time		t8	12.3	-	-	μs	VDD=5V(See 3-6)
			24.5	-	-	μs	VDD=3V(See 3-6)
STROBE-DO Delay Time		t9	-	1.0	10.0	μs	VDD=5V(See 3-6)
			-	-	20.0	μs	VDD=3V(See 3-6)
DO Fall Time		t10	-	1.0	4.0	μs	VDD=5V(See 3-6)
			-	2.0	8.0	μs	VDD=3V(See 3-6)
DO Rise Time		t11	-	1.0	4.5	μs	VDD=5V(See 3-6)
			-	2.0	9.0	μs	VDD=3V(See 3-6)

3-6. Timing Chart



3-7. Maximum Conditions at 25℃

Item	Maximum Conditions	Conditions
Supply Energy	0.23 mJ/dot	S.L.T.=1.25msec
Supply Voltage	8.5 V	Just after battery charge. 7.2V at all time
Substrate Temperature	70 ℃	Thermistor Temperature

3-8. Head supply Voltage

The input voltage to TPH is as below.

Item		Voltage Range
Head Drive Voltage	V_P	4.0 to 8.5V
Head Logic Voltage	V_{DD}	3.0 to 5.5V

3-9. Peak Current

The Peak Current at running Head can be calculated as following formula in most cases. Specially pay attention to a Voltage dropping at circuit.

$$I_P = \frac{N \times V_P}{R_{AVE}}$$

I_P : Peak current (A)
N : Number of dots that are driven simultaneous
V_P : Head drive voltage

3-10. Control of a Pulse width of Head

3-10-1. Pulse width on Voltage

To secure the stable print quality, apply a control of Pulse width according to Head running Voltage. Head Pulse width can be gained as below

$$T_o = E_o \times \frac{(R_{COM} \times N + R_{AVE} + R_{IC} + R_{LEAD})^2}{V_H^2 \times R_{ave}}$$

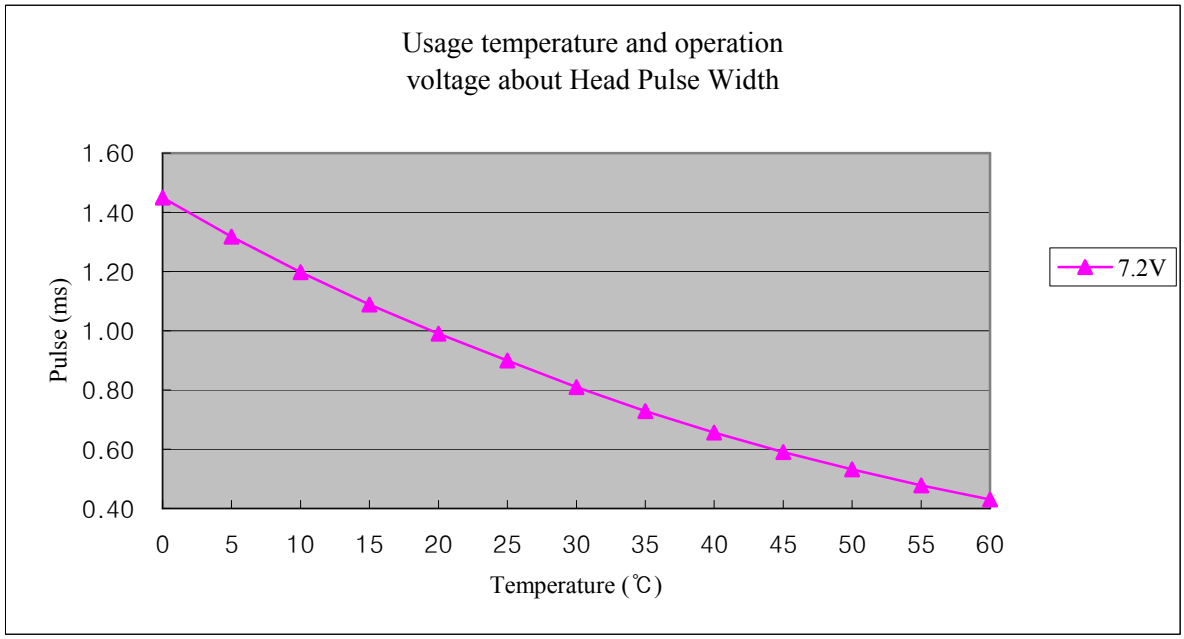
T_O : Pulse per width
E_O : Nominal Energy (0.23mJ)
R_{COM} : Common Resistance (0.05Ω)
R_{IC} : Driver saturated resistance (10Ω)
R_{LEAD} : Lead resistance (10Ω)

3-10-2. Pulse width calibration on temperature change

It detects a temperature change by reading a Thermistor Resistance value built in thermal Head. It is recommended to control energy and calibrate the Pulse width into thermal Head based on the installation environmental temperature and a temperature change of thermal Head. When it detects the temperature higher than 60℃, stop the printing process. Pulse per width is calculated the following formula.

$$T_{on} = T_{25} \times \{ 1 + \frac{(25-T_X) \times C}{100} \}$$

T_{on} : Pulse width on working temperature(T_X) (ms)
T_{25} : Pulse width on working temperature 25℃
T_X : Working temperature
C : Temperature calibration constant
(When Hansol 65 GSM paper used, apply C = 1)



3-11. Thermistor Specifications

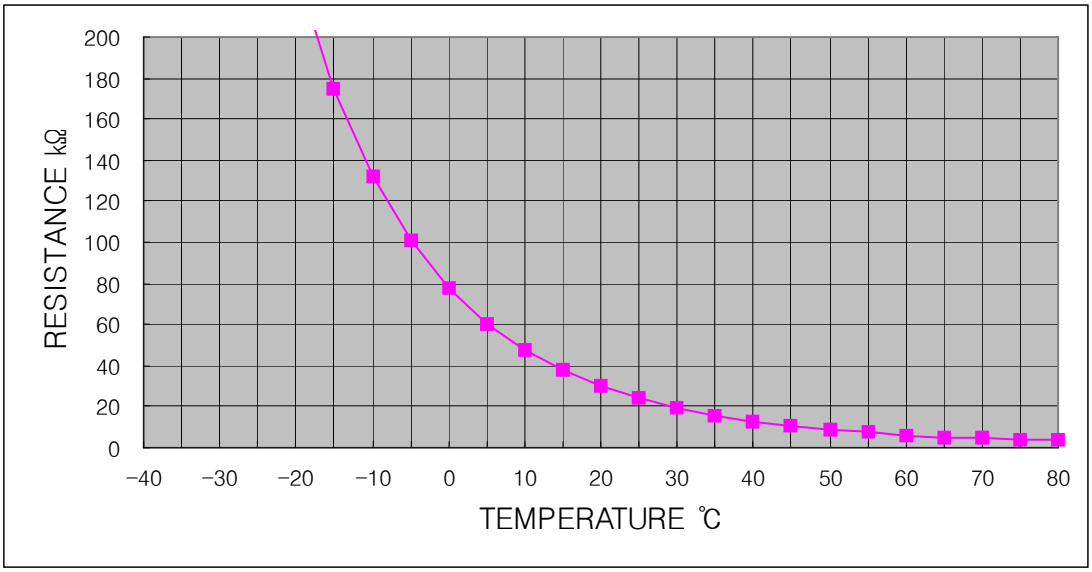
▷ Rating

1) Operating temperature : 0 ~ 50 ℃
2) Storage temperature : -40 ~ 80 ℃
3) Time Constant : Max. 30 sec (in the air)

▷ Electrical Requirements

1) Resistance R_{25} : 30 kΩ ± 5% (at 25℃)
2) B Value : 3950 K ± 2%

$$R_X = R_{25} \times EXP\{B \times (1/T_X - 1/T_{25})\}$$
(T: Absolute Temperature)



Temperature	R std (kΩ)	Temperature	R std (kΩ)
-40	1205.5	25	30
-35	844.7	30	24.11
-30	600.6	35	19.51
-25	432.95	40	15.91
-20	316.15	45	13.04
-15	233.69	50	10.76
-10	174.73	55	8.93
-5	132.07	60	7.45
0	100.86	65	6.26
5	77.77	70	5.28
10	60.52	75	4.47
15	47.51	80	3.81
0	37.6	85	3.26

3-12. 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(TM) detects a temperature 60°C or higher and reactivate the heat elements when a temperature of 50°C or lower is detected. If the thermal head continues to be activated at a temperature higher than 60°C, the life of the thermal head may be shortened significantly.

■ Detecting abnormal temperatures by hardware

If the Control unit malfunctions, the software for detecting abnormal temperatures may not function properly, resulting in overheating of the thermal head.

Overheating of the thermal head may cause damage to the thermal head or injury. Always use hardware in conjunction with software for detecting abnormal temperatures to ensure personal safety. (If the Control unit malfunctions, it may be impossible to prevent damage to the thermal head even if a detection of abnormal temperature is detected by hardware.)

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

1) Overheating of the thermal head (approximately 100°C or higher).
2) Faulty thermistor connection (the thermistor may be open or short-circuited).

If (1) and (2) are detected, immediately deactivate the heat elements. Reactivate the heat elements after the temperature of the thermal head has returned to normal.

4. PAPER FEED MOTOR

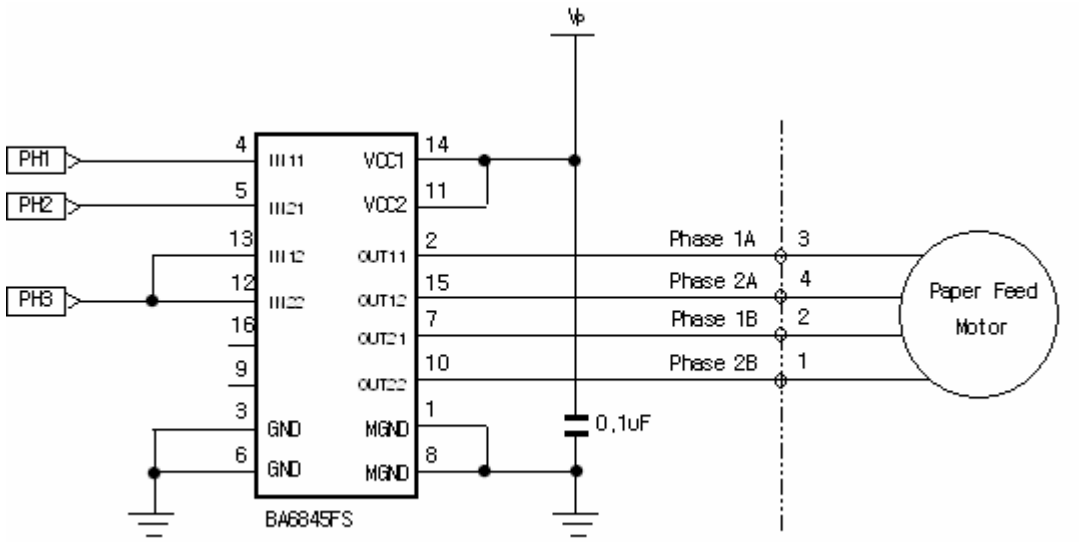
4-1. Basic Specifications

Item	Specification
Type	PM 20 Steps type stepping motor
Drive method	2-2 PHASE excitation Bipolar method
Rated voltage	Max 8.5VDC (for drive)
Amount of paper feed	0.0625mm per 1 step
Resistance	12 Ω

4-2. Example of Driving Circuit

Motor driver : **ROHM BA6845FS**

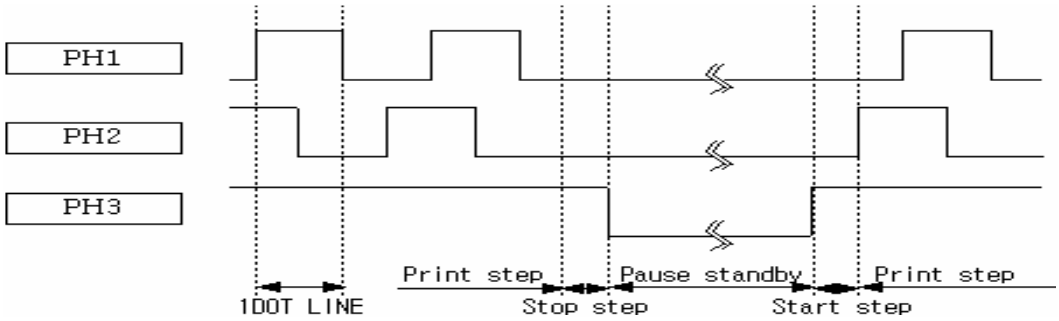
(User Side) (Printer Side)



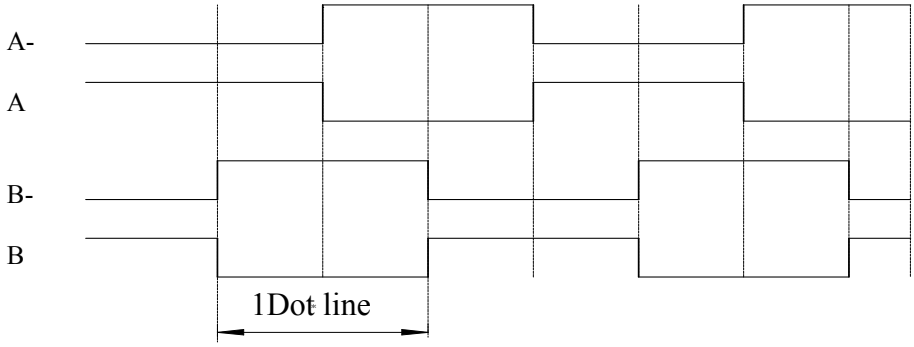
4-3. Excitation Sequence

▷ Paper is fed in a forward direction when the motor shaft is rotating in the CCW (Counter Clock Wise) when seen from the motor gear side

Signal Name	Sequence			
	Step 1	Step 2	Step 3	Step4
In Signal –1	L	H	H	L
In Signal –2	L	L	H	H



Signal Name	Sequence → CCW			
	Step 1	Step 2	Step 3	Step 4
A-	L	H	H	L
A	H	L	L	H
B	H	H	L	L
B-	L	L	H	H



※ Precautions for Designing the Motor Control Circuit and Software

▷ To stop the motor, excite for a single step period with a phase that is the same as the final one the printing step

▷ In the pause state, do not excite the step motor to prevent the motor from overheating

4-4. Sample For Drive Frequency

The following chart gives the maximum paper feed speed vs the step motor Voltage(at 25℃)

Operation Voltage	Drive Frequency(Paper Feed)	Duty Cycle(%)
5.0V	500 PPS	60
7.5V	1050 PPS	30
8.5V	1120 PPS	15

In order to avoid stepper motor overheat, it is strongly advised to respect the maximum ON/OFF duty cycle as indicated above. Note that the maximum period for the ON time is 45 seconds (when the duty cycle is not 100%).

5. PAPER DETECTOR

The printer has a built-in paper detector (reflection type photo interrupter) to detect whether paper is present or not.
An external circuit should be designed so that it detects output from the paper detector and does not activate the thermal head and motor when there is no paper. Doing not so may cause damage to the thermal head or platen roller or shorten the life of the head significantly. If the motor is drove when it is out-of paper, a load is put on the reduction gear and the life of the gear may be shortened

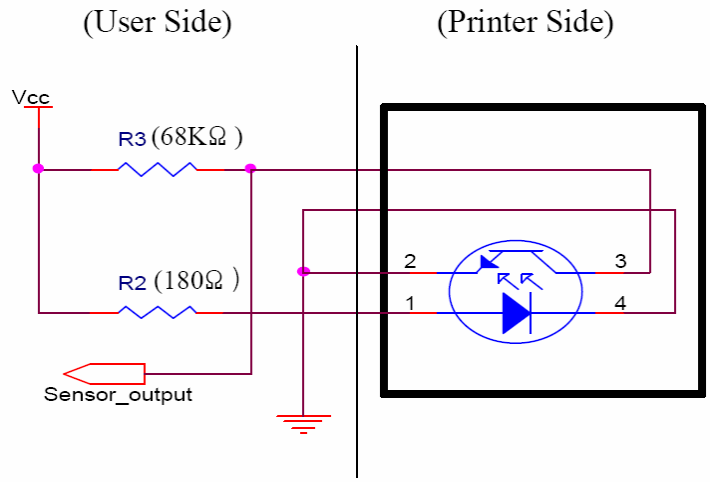
5-1. Absolute Maximum Ratings (T_A = 25℃)

Parameter		Symbol	Rating	Unit
Input Diode	Forward Current	I_F	50	mA
	Reserve Voltage	V_R	5	V
	Power Dissipation	P_D	75	mA
Output Photo Transistor	Collector-Emitter Voltage	V_{CEO}	30	V
	Emitter-Collector Voltage	V_{ECO}	3	V
	Collector Current	I_C	20	mA
	Power Dissipation	P_C	50	mW
Operation Temperature		T_{opr}	-20 to +85	℃
Storage Temperature		T_{stg}	-30 to +100	℃

5-2. Photo electrical Characteristics (Ta = 25℃)

Parameter		Sym.	Condition	Min	Type	Max	Unit
Input Diode	Forward Voltage	V_F	I_F = 10mA	-	-	1.3	V
	Reverse Current	I_R	V_R = 5V	-	-	10	μA
Output Transistor	Dark Current	I_{CEO}	V_{CE}=10V , I_F=0	-	-	0.2	μA
Coupied	Collector Output Current	IC	I_F=10mA V_{CE}=5V	180	-	440	μA
	Leakaged Current	I_{LEAK}	I_F=10mA, V_{CE}=5V	-	-	0.2	μA
	Fall Time Rise Time	t_f /t_r	VCC=2V, IC=0.1mA RL=1 kΩ	-	25/30	-	μs

5-3. Sample External Circuit

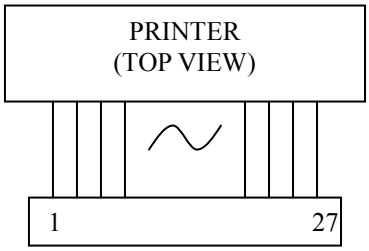


Paper end sensor Detection	PE_SENSOR Output signal level
In case of paper exist	Low
In case of no paper	High

6. PIN LAYOUT FOR CONNECTOR

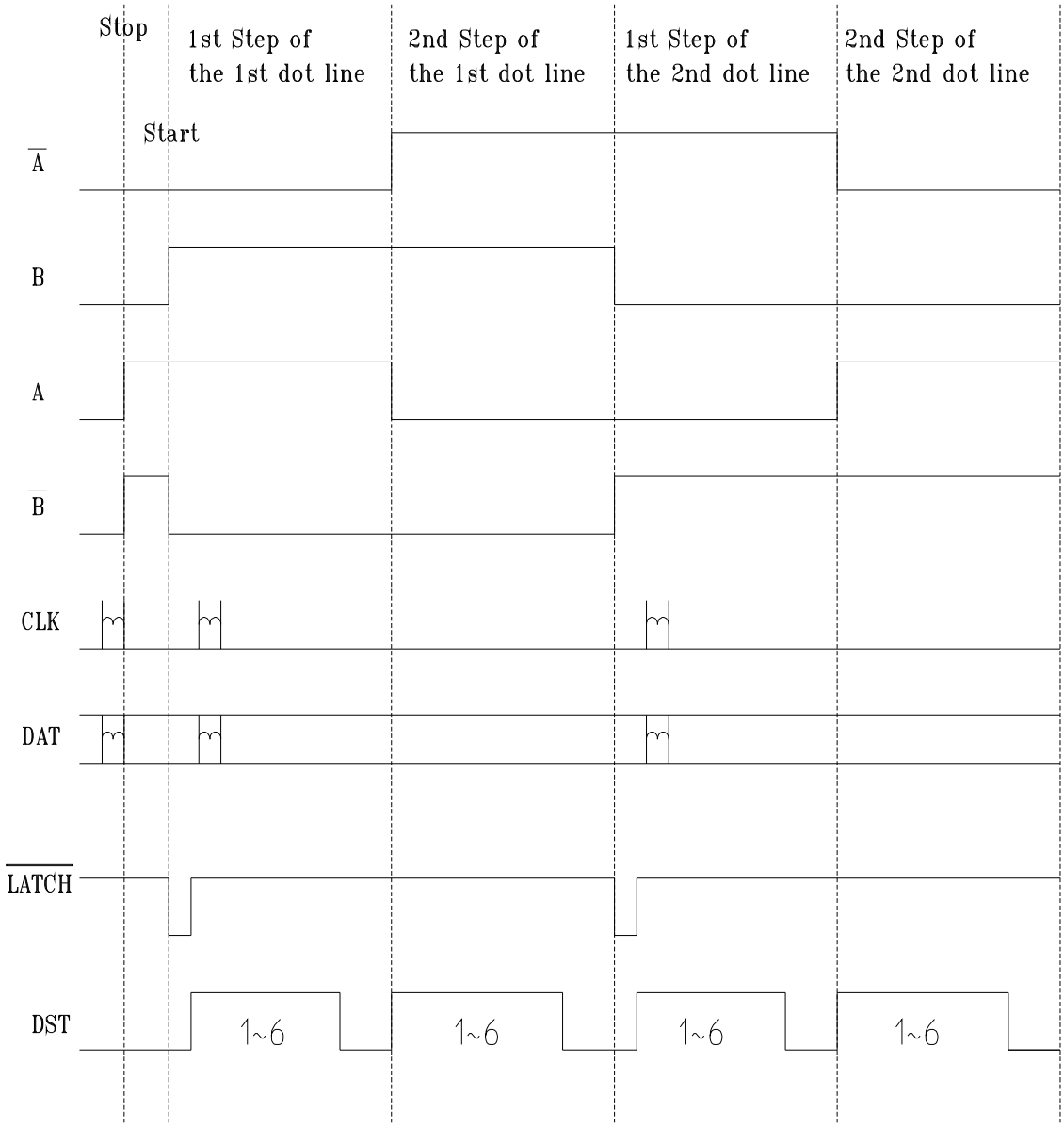
FPC Connector (Sensor / Motor / Head)

Pin No.	Signal	Description
1	A	Motor drive signal
2	B	Motor drive signal
3	A-	Motor drive signal
4	B-	Motor drive signal
5	VH	Head drive voltage
6	VH	Head drive voltage
7	SO	Print data output
8	LAT	Print data latch
9	CLK	Synchronizing signal for print data transfer
10	Vdd	Logic power supply
11	STB1	Strobe
12	STB2	Strobe
13	STB3	Strobe
14	TM	Thermistor
15	P-GND	GND for Head drive
16	P-GND	GND for Head drive
17	P-GND	GND for Head drive
18	P-GND	GND for logic
19	STB4	Strobe
20	STB5	Strobe
21	STB6	Strobe
22	SI	Print data input
23	VH	Head drive voltage
24	VH	Head drive voltage
25	L-GND	GND FOR LOGIC
26	VF	ANODE OF PHOTO SENSOR
27	CO	COLLECTOR OF PHOTO SENSOR



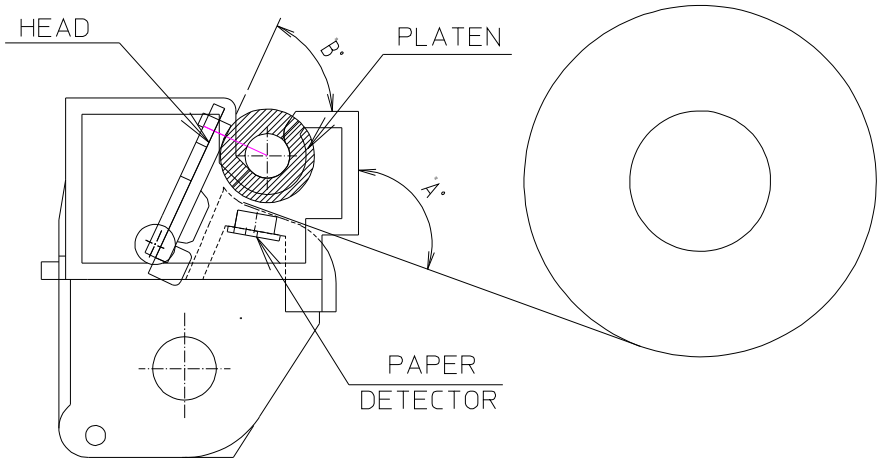
▷ FPC Connector (27P) :
-1mm pitch FFC/FPC connector 27pin

7. OPERATION SEQUENCE

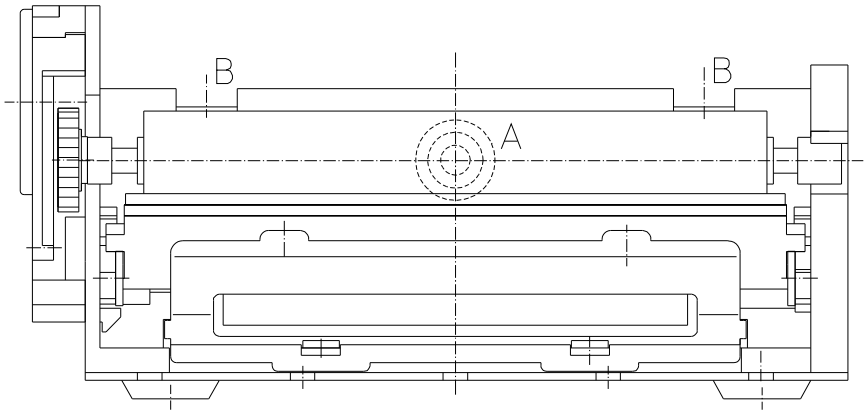


8. LAYOUT OF PRINTER AND PAPER

8-1. SMP640UKC Printer Mechanism



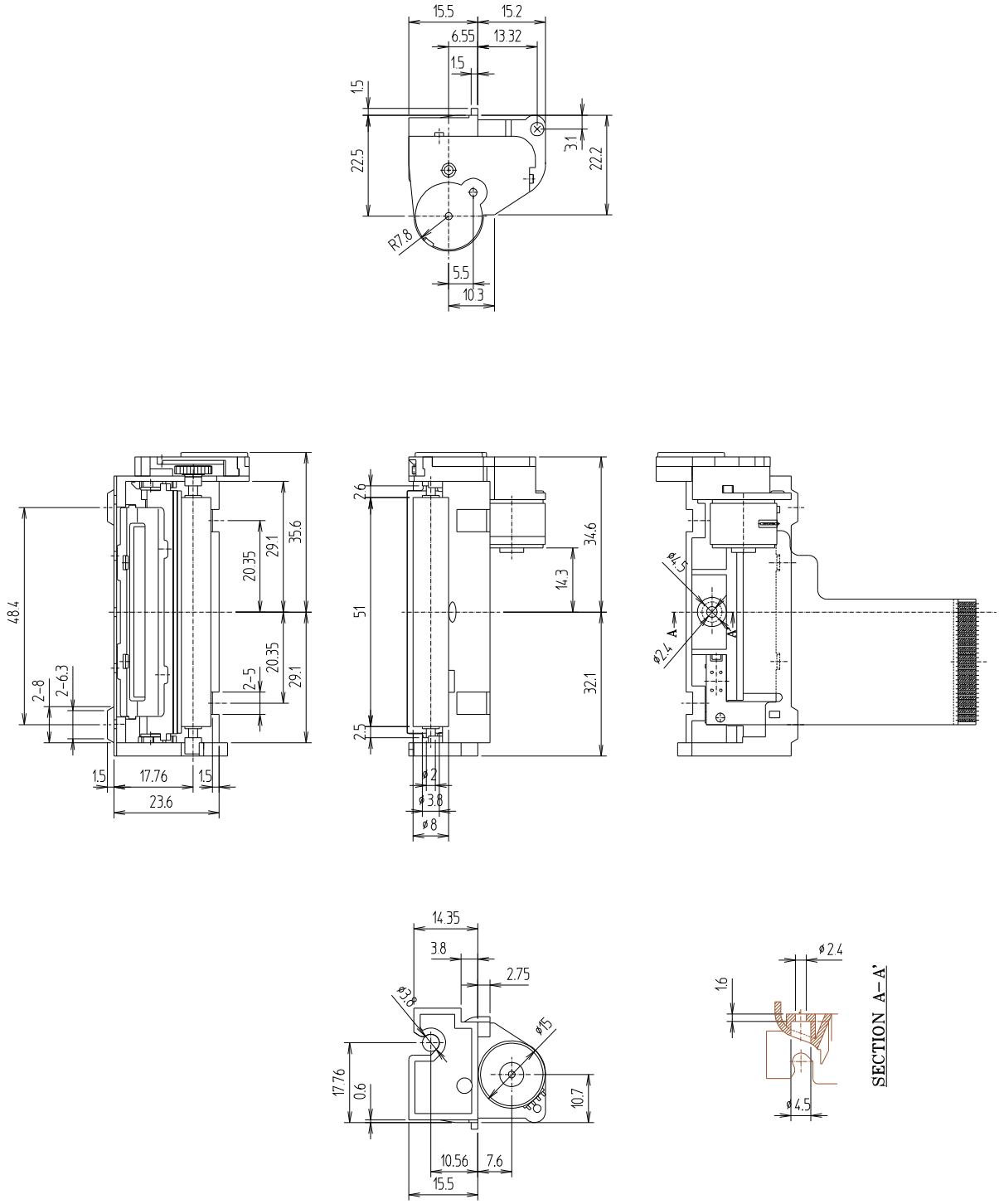
- Paper inlet angle (A) : A ≥ 110 °
- Paper outlet angle (B) : 65 ° ≤ B ≤90 °
- The distance between the paper detector and the heat element is approximately 6mm



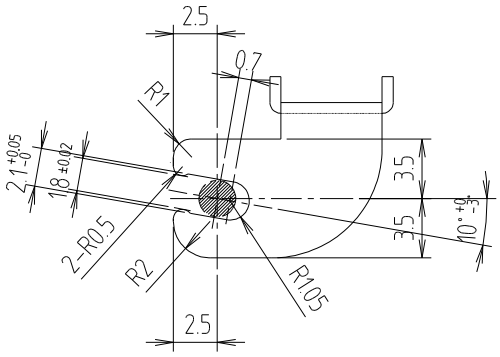
- Fix mechanism by using the mounting positions A,B and C(2points)

9. MECHANICAL DIMENSIONS (ASSEMBLY VIEW)

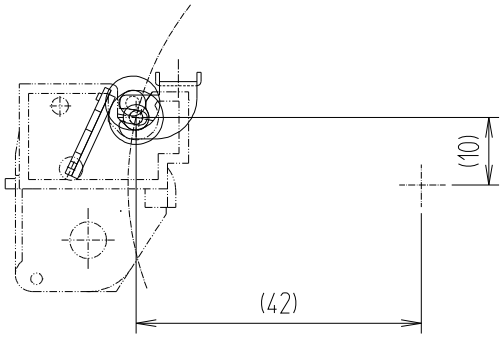
9-1 MECANICAL DIMENSIONS



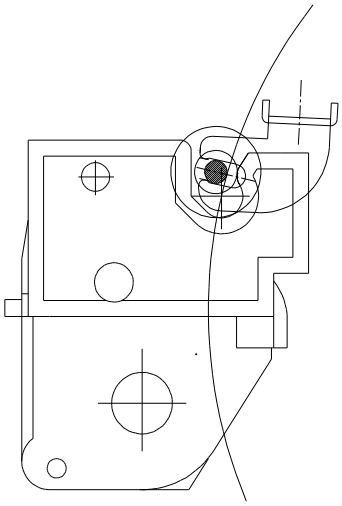
9-2. SUGGEST FIXTURE & SET PROFILE



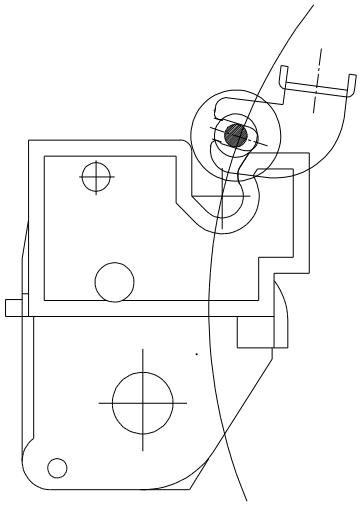
PLATEN ROLLER FIXTURE



OPERATION CENTER



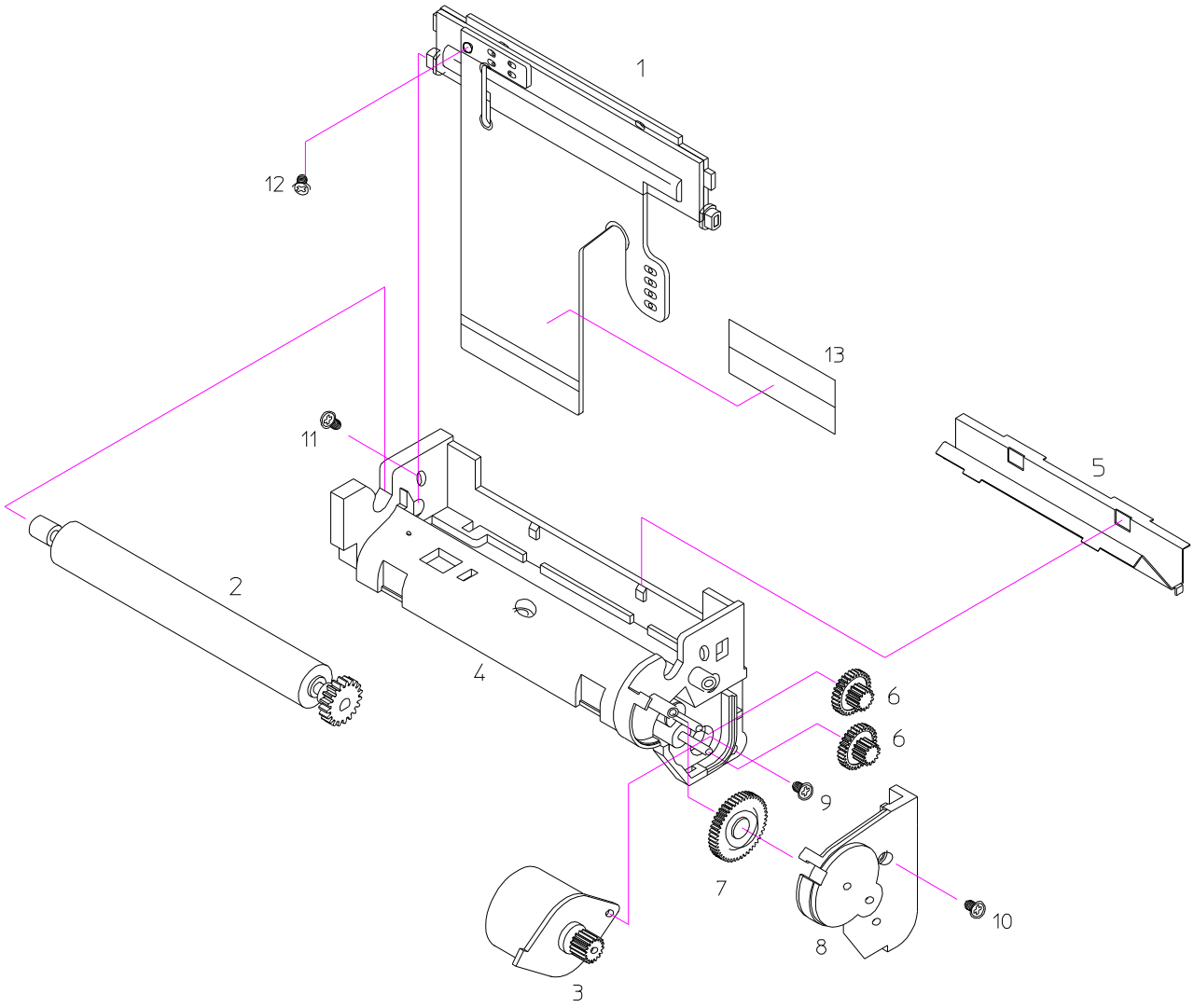
[Platen roller midway locking]



[Platen roller initial locking]

OPERATION FLOW

10. EXPLODED VIEW



11. PART LISTS

No	Code No	Descriptions	Specifications	Q'ty	Service
1	AE05-00025A	ASS' Y BRACKET TPH	TPH/FPC/Bracket/Photo-sensor/Bush	1	Y
2	AR05-00010A	ASS'Y PLATEN ROLLER	Roller/Shaft	1	Y
3	K105-00016A	MOTOR-STEP	5V,25G.CM,BIPOLAR	1	N
4	JE72-00223B	FRAME-MAIN	SMP640,LUCELN109,BLACK,W64.5	1	N
5	JE70-00300A	PLATE-PRESSURE	SMP640UL,SUS304CSP,0.25T	1	Y
6	JE72-00001D	GEAR DECELERATION B 2.0	LUCELN109LD,POM,natural,SAC210,3.8,*8	2	Y
7	JE72-00222B	GEAR-DECELERATION C	SMP640UL,LUCEL H1510	1	Y
8	JE72-00223A	FRAME-COVER	SMP640UL,LUCELN109,BLACK,W25.6	1	Y
9	6001-000805	SCREW-MACHINE,M1.7*4	CH,+<M1.7,L5,NIPLT,SWRCH10	1	Y
10	6002-001140	SCREW-TAPPING,M2*4	PH,2,M2.0,L4.0,NIPLT	1	Y
11	KC05-00017A	SCREW-TAPPING,M2*5	M2*L5	1	Y
12	6002-001124	SCREW-TAPPING,M1.7*2	CH,+,2,M1.7(0.45),L2,BLK	1	Y
13	KA05-00011A	LABEL STICKER	ART PAPER T0.1	1	N