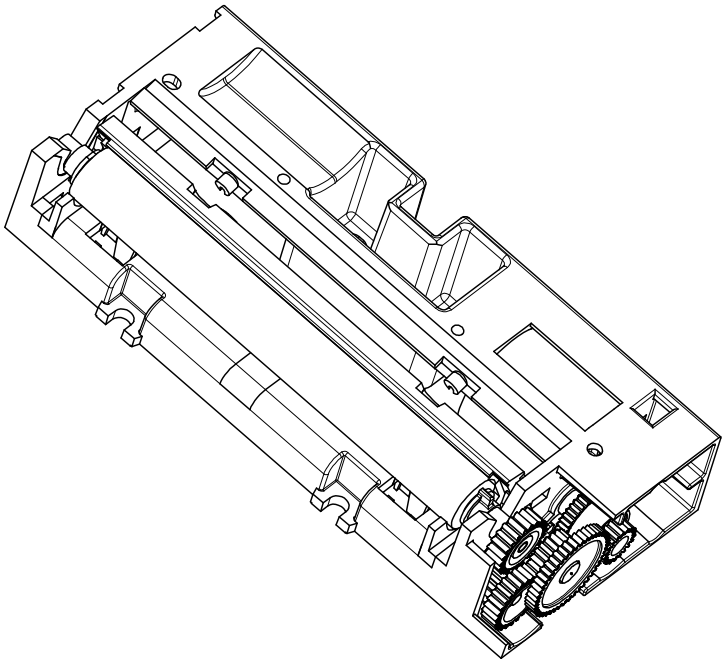
THERMAL PRINTER MECHANISM

MC/MHTP SERIES & MC/MHTA SERIES PRINTER MECHANISM

USER MANUAL

Reference 3106657
Issue D
July 2007



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EVOLUTIONS

Date	Issue	Modifications
06/2001	Z	Creation
02/2002	A	Update for UL certification
02/2003	B	General update to include MCTP version
07/2005	Preliminary C	Upgrade to include 12V versions and new high speed motor
12/2005	C	Upgrade to include advanced version : MHTA/MCTA
07/2007	D	Duty Cycle modification; Add of ROHS and UL certifications, add of external view with tear bar option, modification of PINOUT in chapter 8.3 Connections.

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IMPORTANT

This manual contains the basic operations for running your printer.

Read it carefully before using your printer.

Pay special attention to the chapter “Recommendations”.

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CONTENTS

1. UNPACKING YOUR PRINTER MECHANISM

Each printer mechanism is packaged in an anti-static bag. Cautions must be taken when handling in electrostatic protected areas.

2. OVERVIEW

Based on static thermal printing technology, the MC/MHTP series is a family of user-friendly, highly reliable devices, which have been especially designed with 24V dot line and in a very small size, to suit independent terminal applications.
MC/MHTA is the 'advanced' version that allows greater maximum printing speed as shown below.
The printer can be used either with or without a clamshell cover, an optional tear bar is available, and the mechanism can tolerate a latch if required.
Important Note: the 12V version is only available without cutter.

3. SUMMARY OF TECHNICAL SPECIFICATIONS

ITEM	VALUE		UNIT
	24V versions	12V versions	
Printing method	Static thermal dot line printing		-
Paper loading	Front and bottom		-
Number of resistor dots	640		-
Resolution	8		dots/mm
Printing width	80		mm
MCTP/MHTP Printing speed	120	100	mm/s
MCTA/MHTA Printing speed	180 See recommendation		
Paper width	80 max or 82.5 max or 2 x 38 (*with double printing station*)		mm
Head temperature detection	thermistor		-
Paper feed pitch	1		motor steps
	0.125		mm
Paper empty detection	opto-sensor		-
Operating voltage range Vcc (logic)	5 ± 5%		V DC
Operating voltage range Vch (dot)	20 – 26.4	12 ± 10%	V DC
Current consumption: Vch (*at nominal value* : 24V or 12V)	30	31.5	mA per resistor dot «On»
Current consumption for MCTP/MHTP: Vcc (*at nominal value* : 5V)	70	50	mA
Current consumption for MCTA/MHTA: Vcc (*at nominal value* : 5V)	50	NA	mA
Maximum number of dots energized simultaneously *	384		-

SUMMARY OF TECHNICAL SPECIFICATIONS (*continued*)

ITEM		VALUE		UNIT
		24V	12V	
Current consumption: Paper feed stepping motor (*at nominal value*)		420		mA per activated phase
Current consumption: Cutter stepping motor (*at nominal value*)		900		mA per activated phase
Supply voltage : Vch		24	12	volts
Supply power : Po		630	300	MW/dot
Supply energy at 25°C (On time)		0.17 to 0.28 (0.27 to 0.45)	0.17 to 0.28 (0.57 to 0.93)	MJ/dot (ms)
Supply current : Io		11.5	10.8	A
Duty cycle MCTP/MHTP** (up to 25°C)	printer	25		%
	cutter	16		
for t° = 50°c	printer	17		%
	cutter	8.3		%
Duty cycle MCTA/MHTA	printer	15		%
(24V) (up to 25° C)	cutter	16		%
for t° = 50°C (**	printer	8.5		%
bis)	cutter	8.3		%
Storage		-20 to +60		°C
Relative humidity		15 to 85		%
Operating range		-10 to +50		°C
Printer electrical lifetime ***		10^8		pulses
Printer mechanical lifetime ***		100		km
Cutter mechanical lifetime ****		500000		cuts
		Without Cutter	With Cutter	
Over all dimension:	Height	49.5	53.3	mm
	Width	108.6	122.3	
	Depth	20.8	38.5	
Weight		120	210	g
Recommended paper		Kanzaki P310		-
Maximum paper thickness		60 to 80 g/m2 with front paper path.	60 g	-
		If thicker paper is needed, contact our Technical Support Team.		
Maximum paper roll diameter		100 *If larger paper roll is needed, contact our Technical Support Team.*		mm
Specified standards		UL60950 ; CSA 22.2-60950 (cUL) ; ROHS		-

* The maximum current allowed in the print head is 12A; but the printing density variation may become significant when the number of dots energized simultaneously becomes greater than 64 (*384 dots "On" corresponds to 11.5A when applying 24V*).
** Time ON printing max : 1 minute at 25°C (30 sec at 50°C)

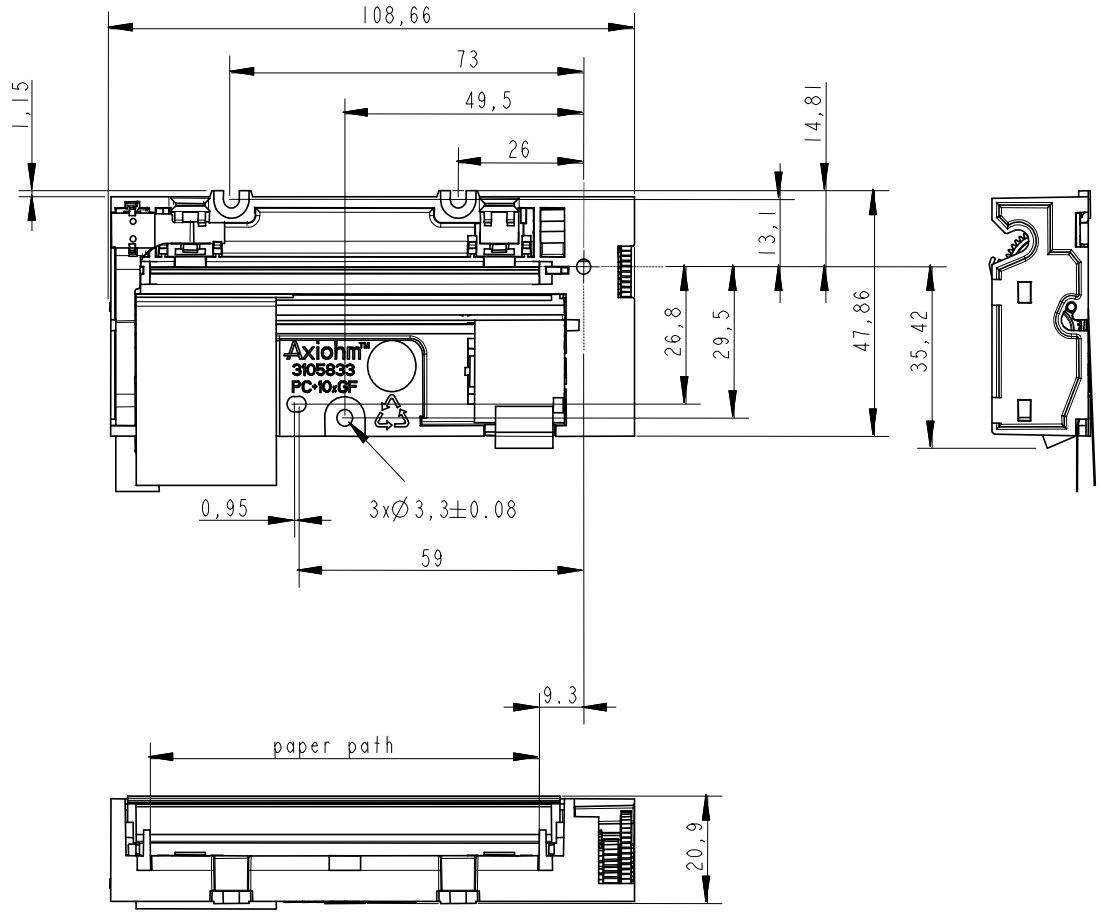
** bis Time ON printing max (MCTA/MHTA) : 30 sec at 25°C (15 sec at 50°C). Please, once your mechanism is integrated, check your duty cycle.
*** Per AXIOHM standard test conditions (*which are mainly 24V, ● 25°C, dot printing = 25%*)
**** with P310 paper

4. MECHANICAL SPECIFICATIONS FOR MHTP / MHTA

***Note**:* general tolerances ± 0.1 *(when no other is specified)*

4.1 External dimensions and fixing elements

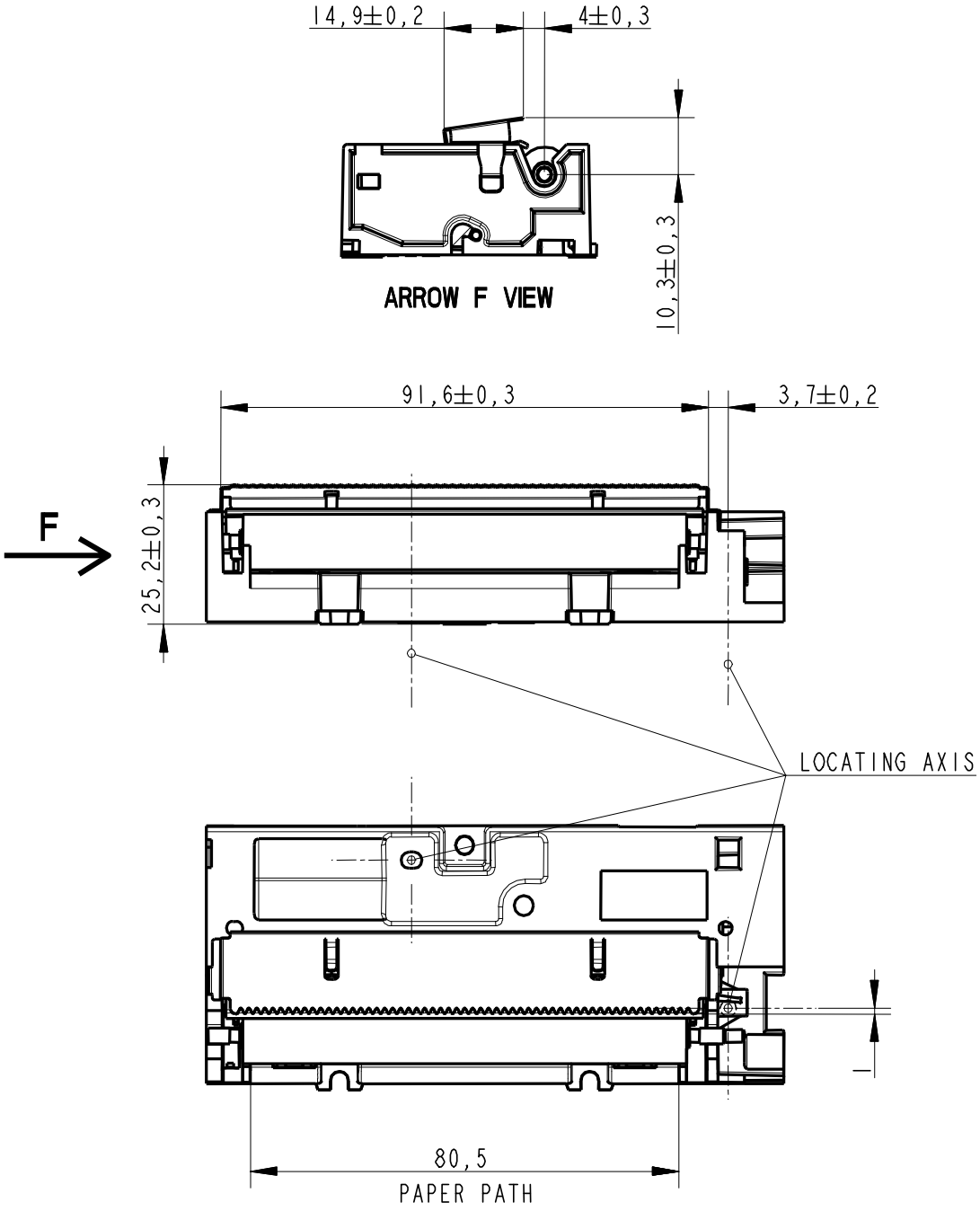
4.1.1 Without tear bar:



***Caution*: The paper roller bucket location must be aligned properly in front of the printer paper path.**

Note: paper path is according to paper width, see the chart page 7

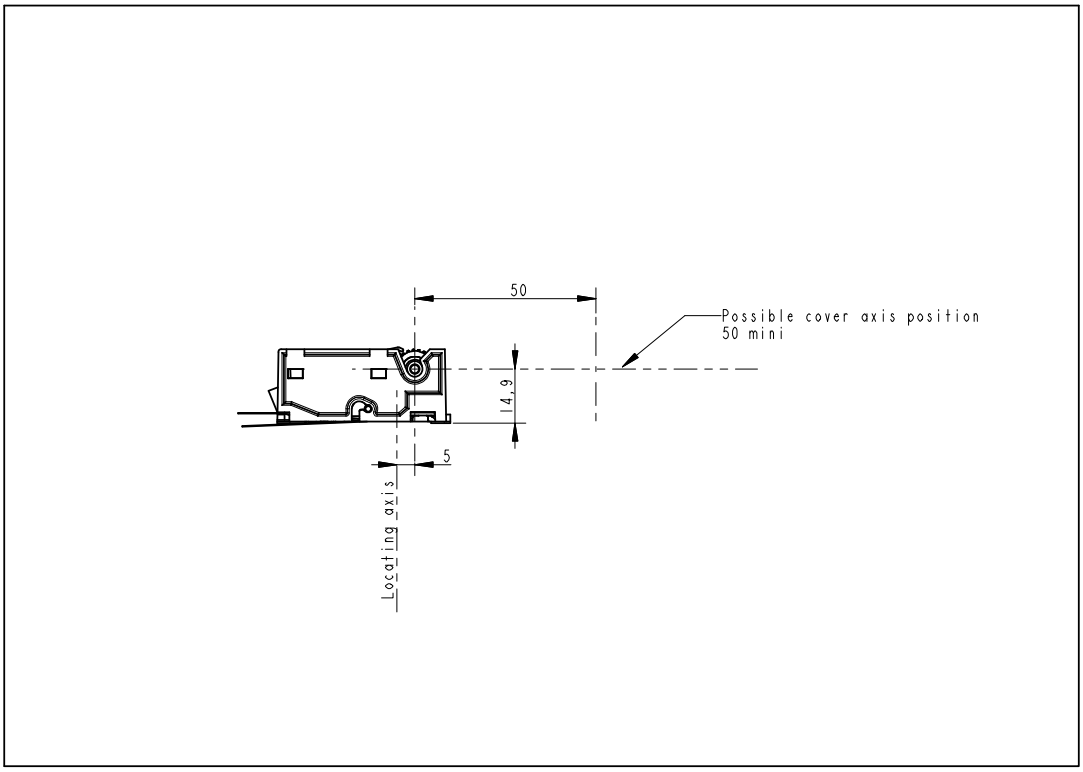
4.1.2 With tear bar option:



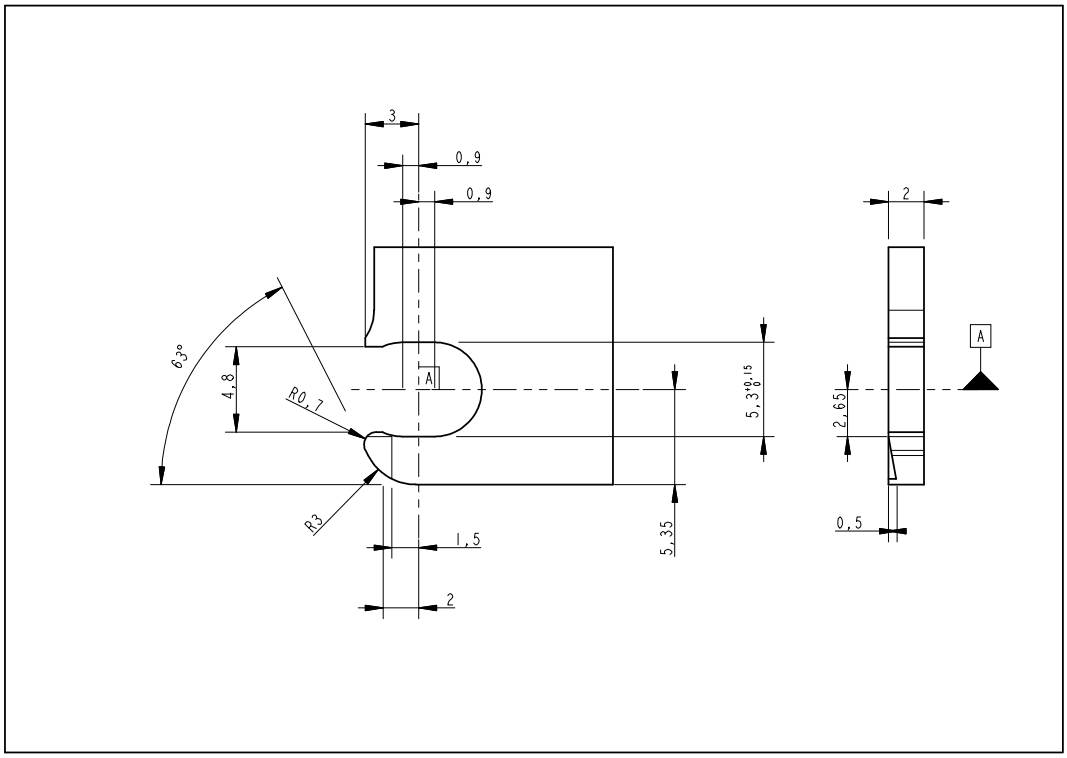
TEAR-BAR INFORMATIONS

Precaution : with the tear bar option, you can't use an axle for paper roll.

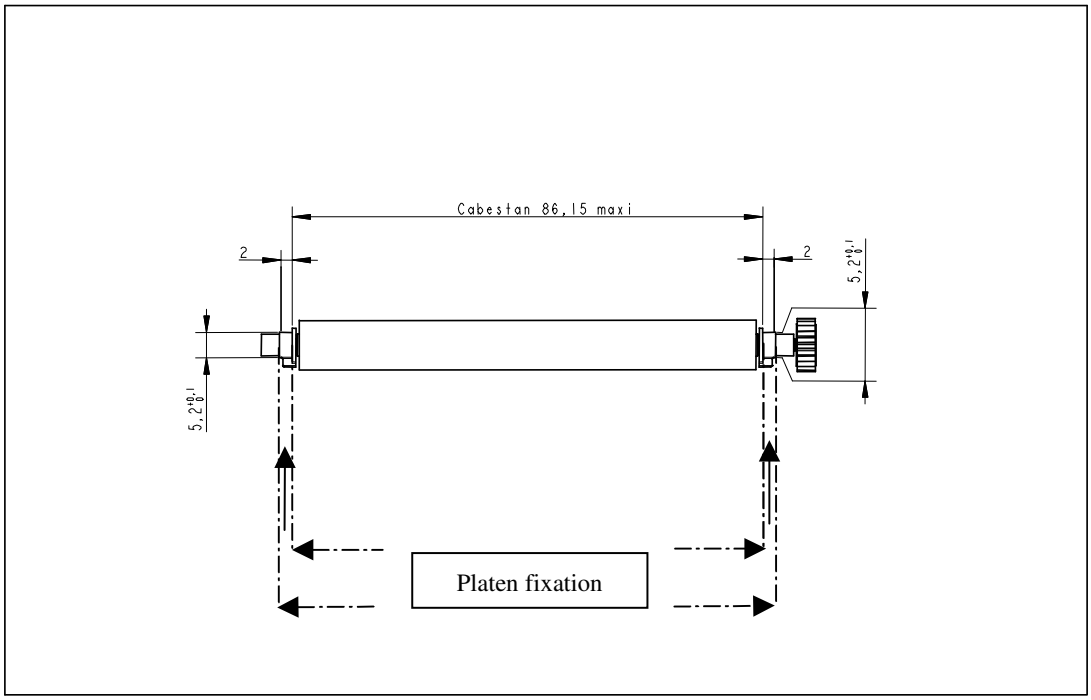
4.2 Recommended cover axis position



4.3 Recommended platen fixation on cover

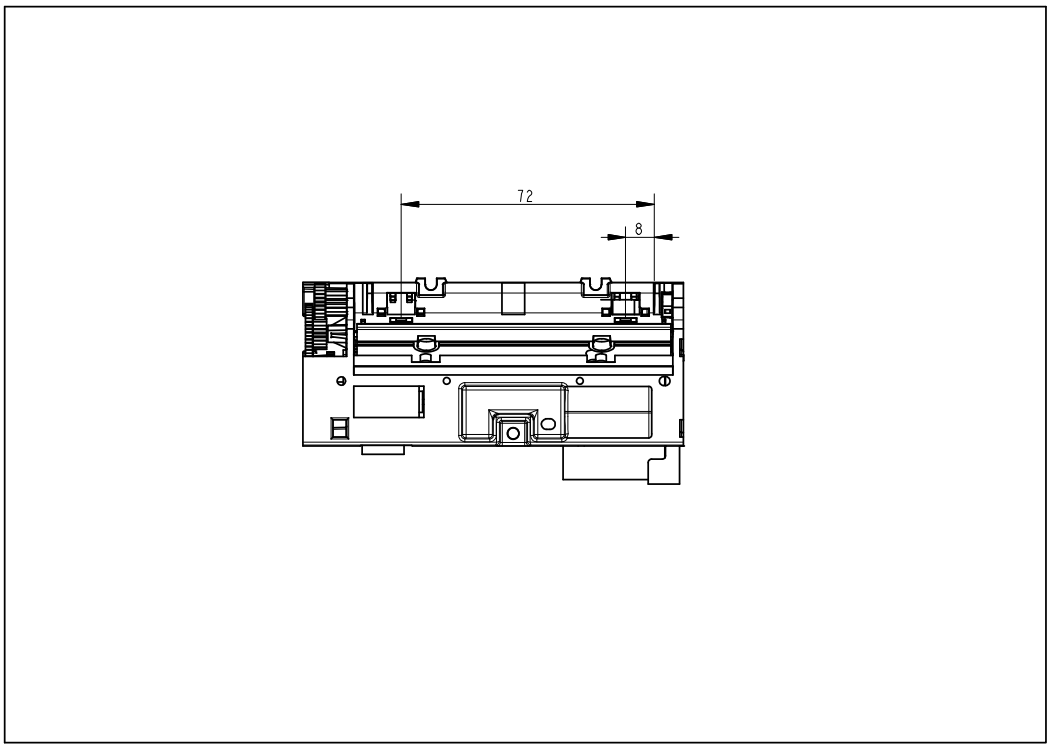


4.4 Lateral position for platen fixation on cover

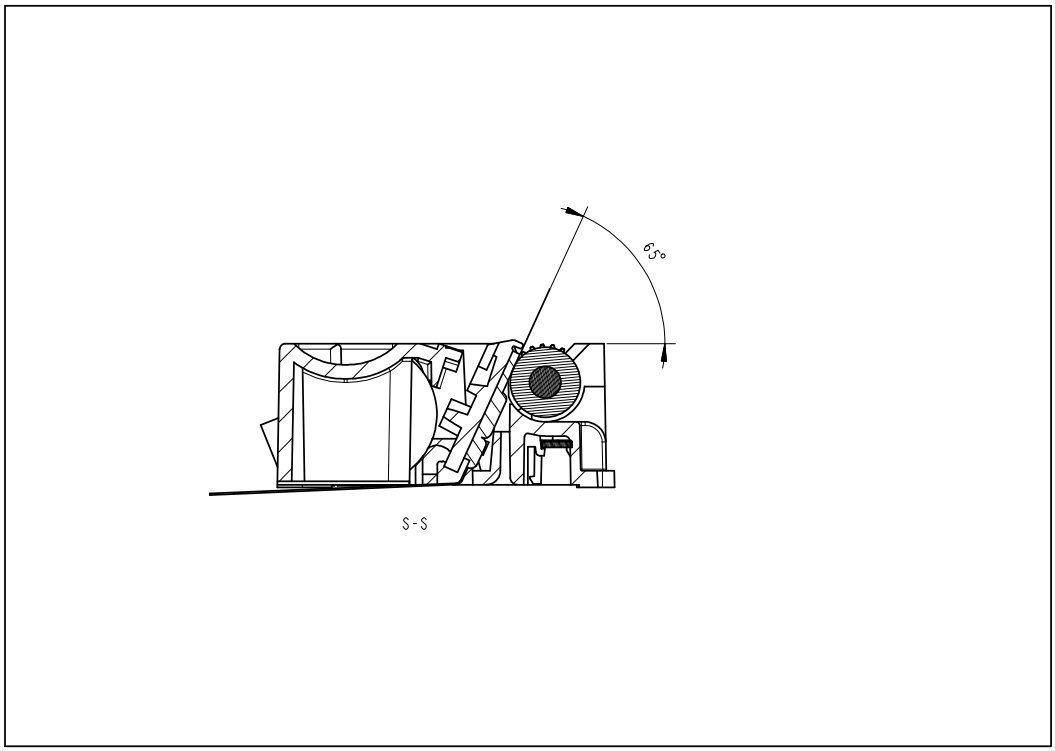


4.5 Opto-sensor position

Distance between opto-sensor and line of dots: 12.5mm



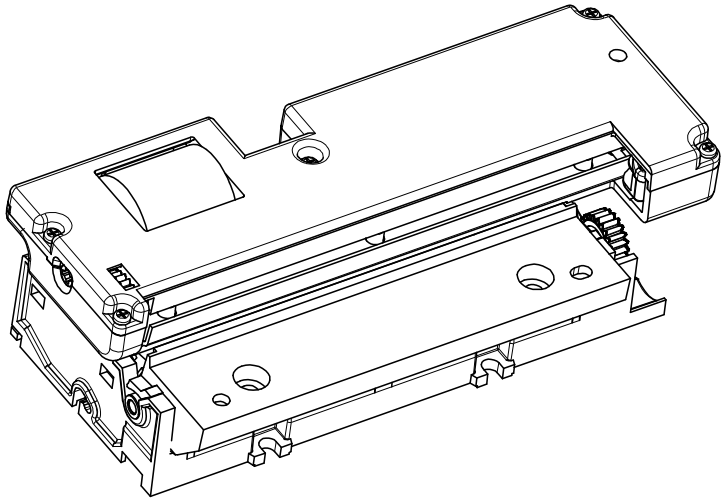
4.6 Paper exit angle

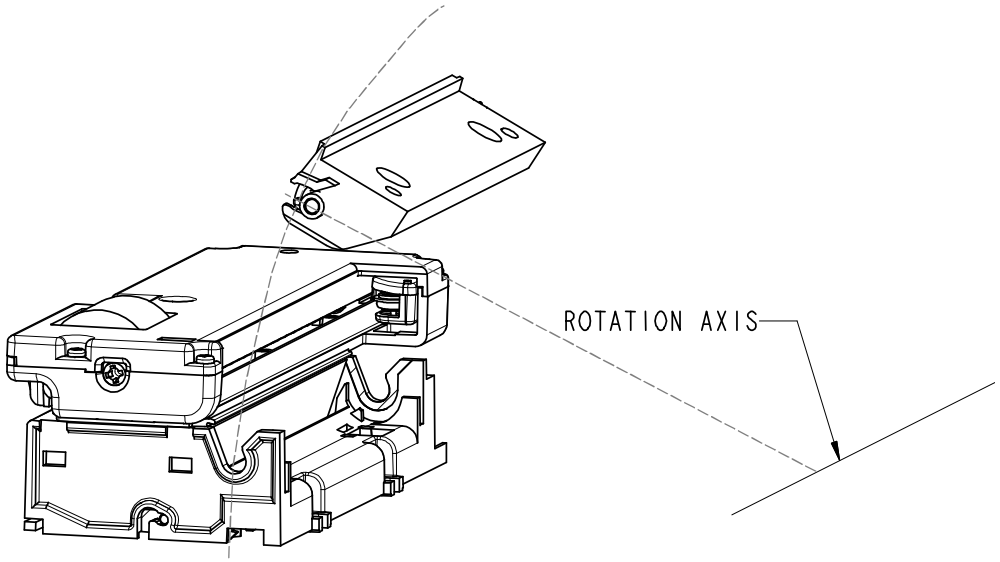


5. MECHANICAL SPECIFICATIONS FOR MCTP / MCTA

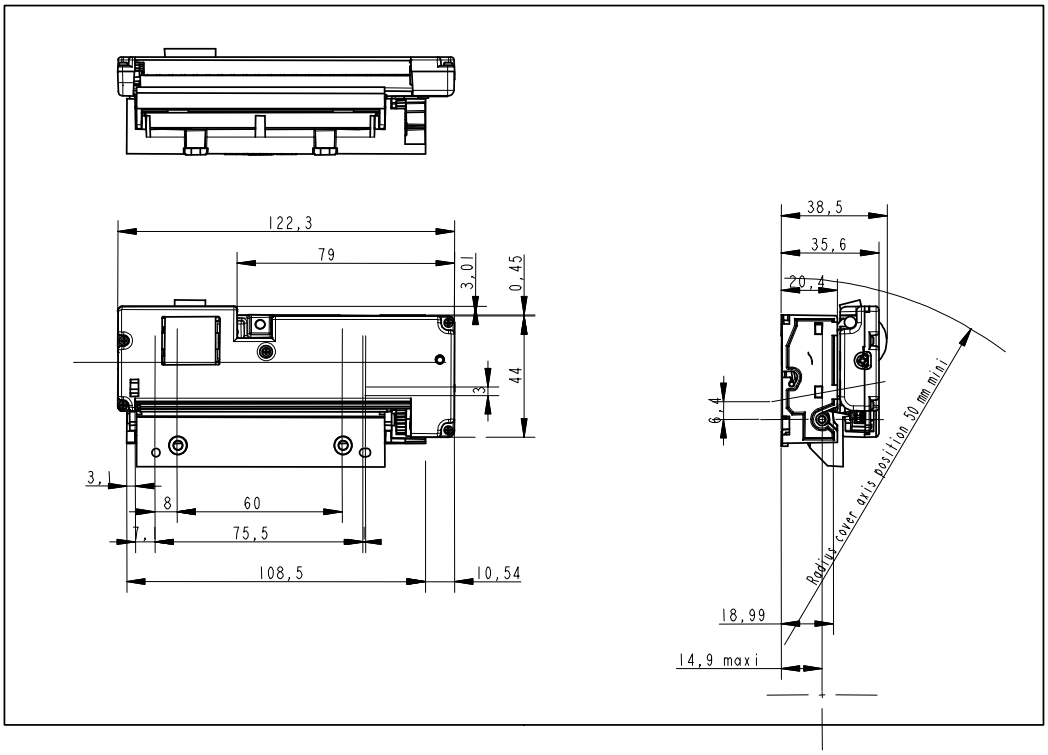
***Note**:* general tolerances ± 0.1 *(when no other is specified)*

5.1 General view

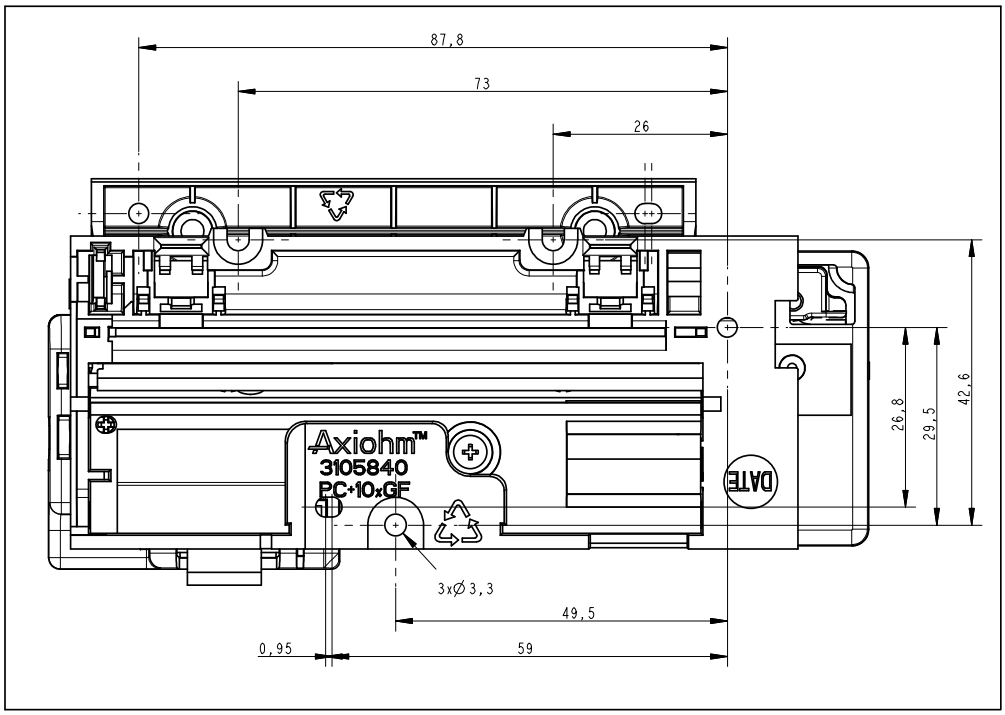




5.2 External dimensions and fixing elements



***Caution*: The paper roller bucket location must be aligned properly in front of the printer paper path.**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3105840
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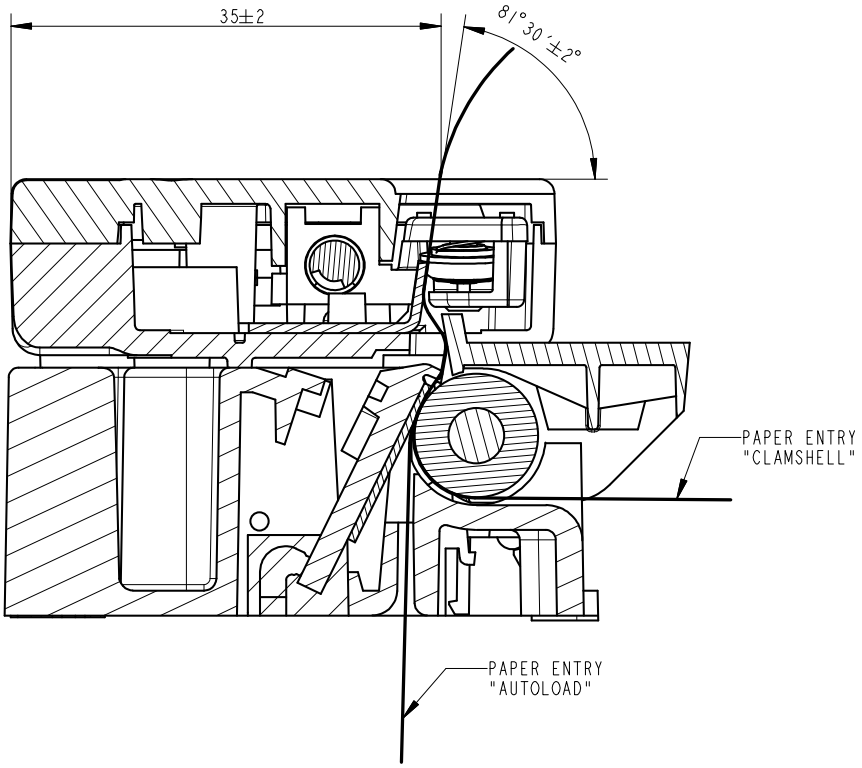
5.3 Paper exit angle



6. ELECTRICAL SPECIFICATIONS

6.1 Nominal Power supply

PRINT HEAD		
Logic (Vcc)	5	Volts
Dot line (Vch)	24 or 12	
Stepping Motor	24 or 12 (but usually driven with currant)	

6.2 Nominal consumption of printer

PRINTER		
Print-head : Heating current / dot (Vch)	30	mA
Logic current complete MCTP/MHTP Print-head	67 (24V versions) 50 (12V Versions)	
Logic current complete MCTA/MHTA Print-head	50	
Stepping motor current (2 activated phases)	840	

6.3 Description of print-head

PRINTER	24V	12V	
Driver chips	10		-
Operating range (Vcc)	5, ±5%		V DC
Mean dot resistance	800 ± 3%	380 ± 5%	Ω
Nominal dot supply voltage (Vch)	24 to 26,5 (max)	12 to 13.2 (max)	V DC
LSI supply voltage (± 5%)	5		V DC
Nominal Heating current per dot	30		mA
Max. number of dots to heat at once	384*		-

* **The purpose is to avoid current greater than 12A**
(*384 dots "On" give 11,5 A when applying 24V at nominal resistances on 24V versions, 384 dots "On" give 10.8 A when applying 12V at nominal resistances on 12V versions*).

6.3.1 Function of 64-BIT LSI drivers chart and operation

The LSI power and multiplexing circuit drivers located on the thermal print head provide power control from logic signals and the DC power supply voltage.

These circuits are supplied by **5 V ± 5%** logic voltage. Take care to filter transient and parasitic on all logic lines. Undetermined states can happen and can destroy the head. The power source should be disconnected from the logic source. The logic source must be connected to the same source as the electronic circuits in charge of controlling the printer.

Each circuit features 64 open collector transistors, a 64-bit shift register and a 64-bit memory register.
Each circuit controls 64 resistor dots on the print head.

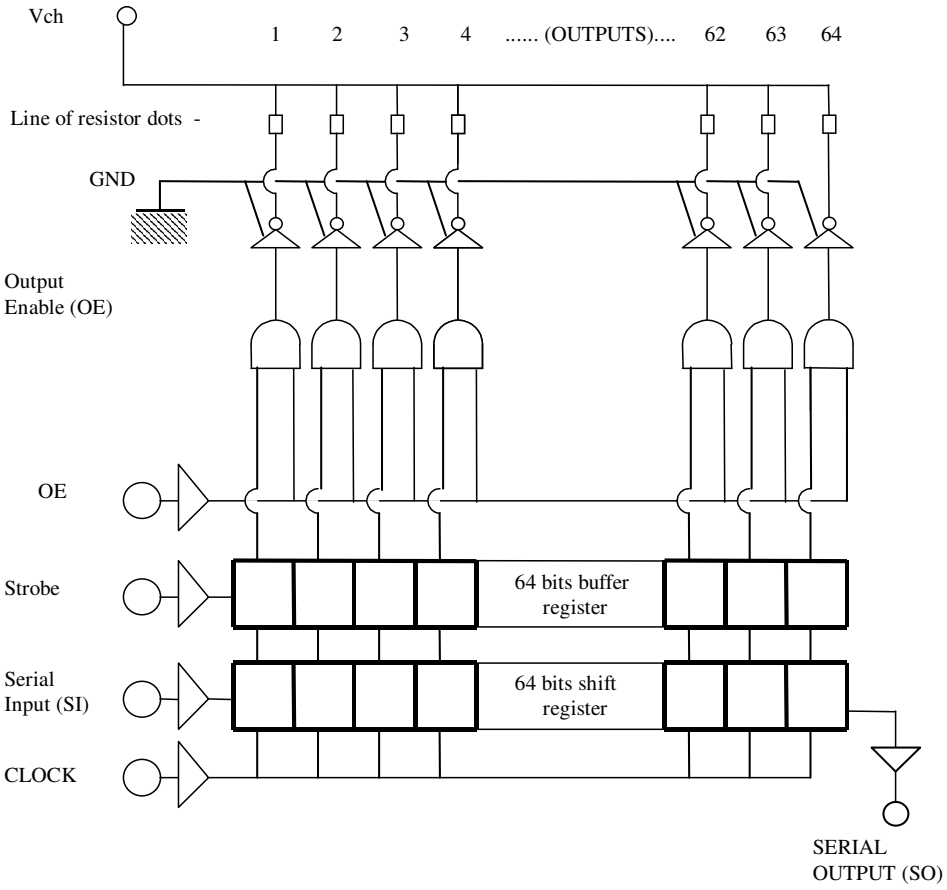


Figure 1 driver chart

Note: See the following pages for available signals on the printer connection.

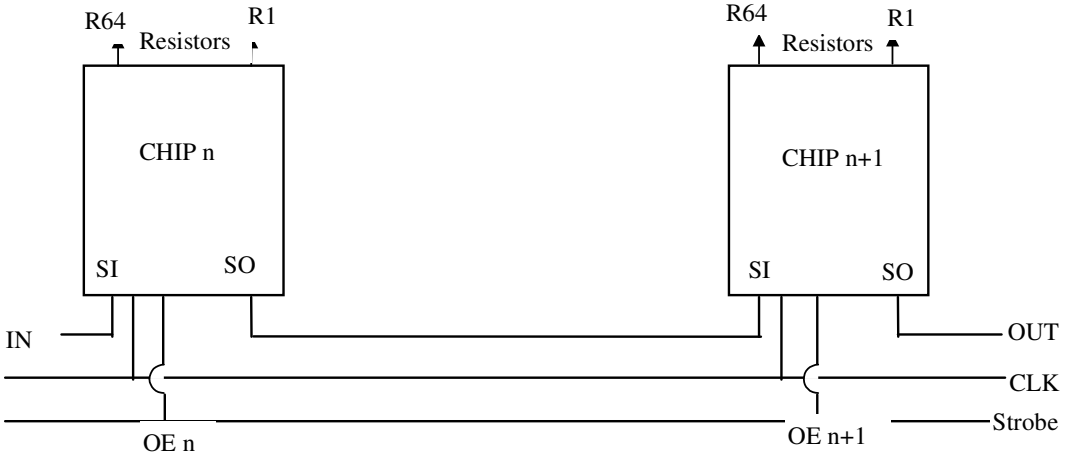


Figure 2 Routing of data to the thermistor dots

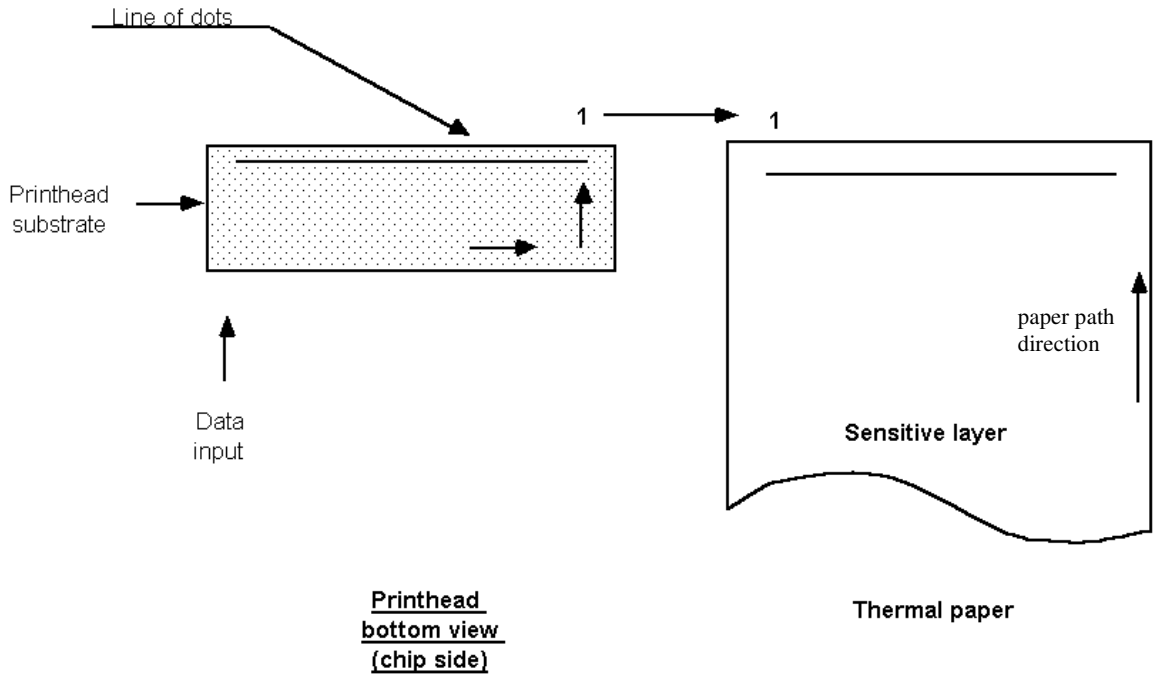


Figure 3 Dots print order

The first bit of data entered will be the first bit of data printed (FIFO).

6.3.2 Electrical specifications of 64-bits LSI driver

6.3.2.1 General electrical description of drivers

DESCRIPTION	Min	Maxi	Unit
Max. voltage at outputs 1 to 64		26,4	Volt
Max. voltage any other pin		5,25	Volt
Max. output current		31	mA
Total max. output current (384 dots "On")		11.9	A

6.3.2.2 Other

The specifications given below are given for the following conditions:

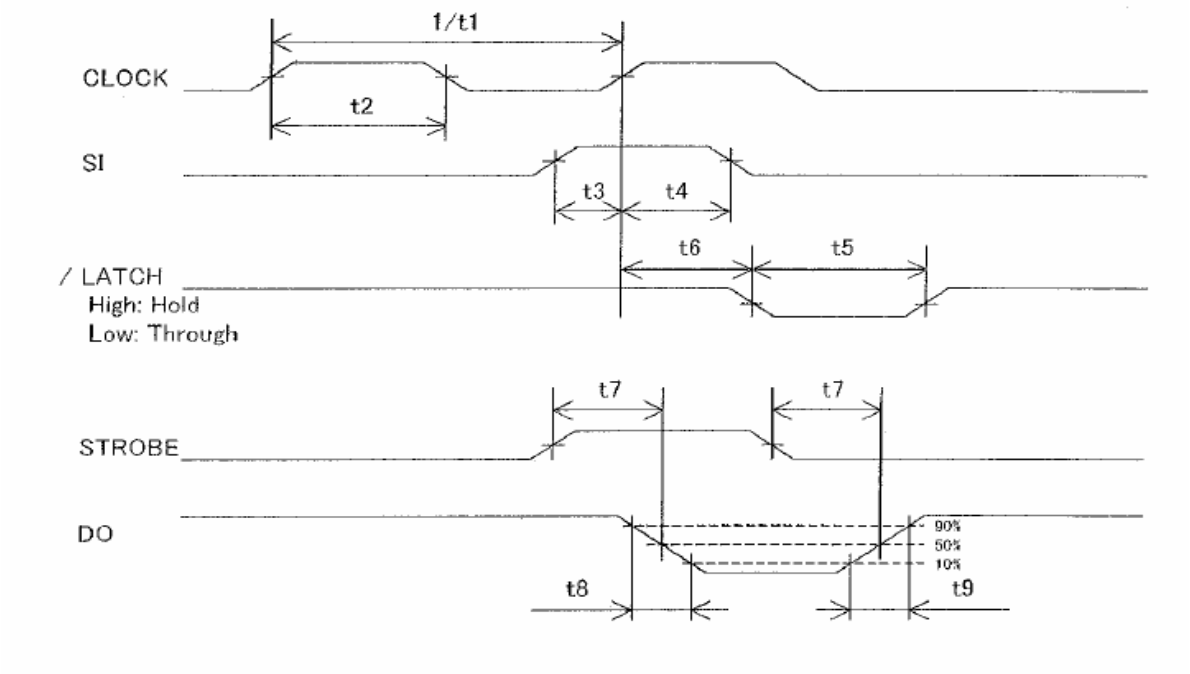
Logic voltage on chip: 4.75V < Vcc < 5.25V (*care should be taken to filter any transient signal or parasitic in order to keep the driver in a known state: failure to observe this may result in head destruction*).

Clock frequency (*max.*): 5 MHz

	CONDITIONS	VALUES	SYMBOL
Vcc supply current Complete print-head	All inputs High Level	70mA	Idd
Min. high-level input voltage	Vcc ≤ 5 Volts	0,7 × Vcc	Vih
Max. high-level input voltage	Vcc ≥ 5 Volts	Vcc	Vih
Min. low-level input voltage		0	Vil
Max. low-level input voltage		0,3 × Vcc	Vil
Max. high-level input current		0,5 µA	Iih
Max. low-level input current		0,5 µA	Iil

6.3.2.3 Timing

6.3.2.3.1 Advanced version (MC / MHTA):



1 LSI driver symbols

SYMBOL	DESCRIPTION	Min	Typ	Maxi	Unit
Rave	Average Resistance Value	776	800	824	Ω
Vset	Output Supply Voltage	-	-	26,4	V
VDD	Supply Voltage	4.75	5.00	5.25	V
IDD	Supply Current	-	-	50	mA
V_{IH}	Hich Level Input Voltage	0.7 x VDD	-	VDD	V
V_{IL}	Low Level Inptu Voltage	0	-	0.3 x VDD	V
I_{IH}	Hich Level Input Current	-	-	0.5	µA
I_{IL}	Low Level Inptu Current	-0.5	-	-	µA
I_{LEAK}	DO Leakage Current	-	-	0.08	mA
t1	CLOCK Frequency	-	-	8	MHz
t2	CLOCK Pulse Width	50	-	-	ns
t3	CLOCK-SI Setup Time	20	-	-	ns
t4	CLOCK-SI Hold Time	10	-	-	ns
t5	LATCH Pulse Width	100	-	-	ns
t6	CLOCK-LATCH Setup Time	100	-	-	ns
t7	STROBE-DO Delay Time	-	-	10.5	ns
t8	DO Fall Time	-	3.5	10.0	µs
t9	DO Rise Time	-	2.0	6.0	µs

6.3.2.3.2 Standard version (MC / MHTP):

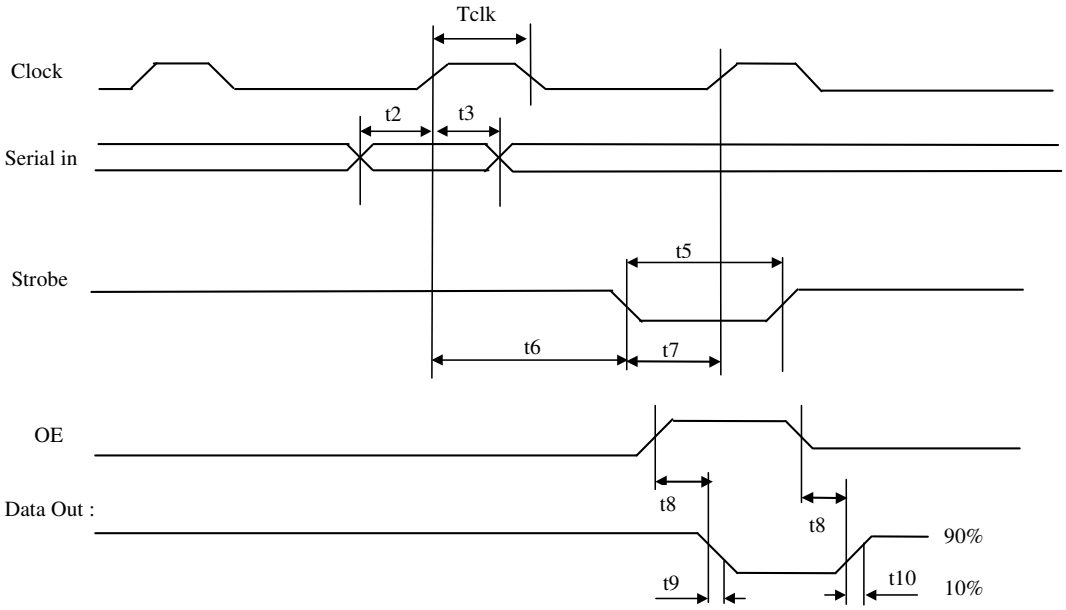


Figure 4 LSI driver timing chart

Serial in	:	Serial input for data to be printed.
Clock	:	Serial/parallel shift register clock, activated on leading edge of pulse (rest level = logic 0) Maximum clock frequency is 5MHz.
STROBE	:	Signal for putting data into memory, active on logic level 0 (rest level = logic 1).
OE	:	Output Enable (OE1 to OE5) power activation signals active at logic level 1.
Data Out n	:	Internal data out to heating points (not available on connector).

***Note*: All of these inputs are CMOS compatible.**

1 LSI driver symbols

SYMBOL	DESCRIPTION	Min	Typ	Maxi	Unit
Tclk	clock pulse width	70	-	-	ns
t2	data in to clock set-up time	50	-	-	ns
t3	data in from clock hold time	10	-	-	ns
t5	Strobe pulse width	100	-	-	ns
t6	Clock to strobe setup time	100	-	-	ns
t7	Clock to strobe hold time	50	-	-	ns
t8	OE to data out delay time	-	0.5	2.0	µs
t9	Data out fall time	-	0.2	0.5	µs
t10	Data out rise time	-	1.0	2.0	µs

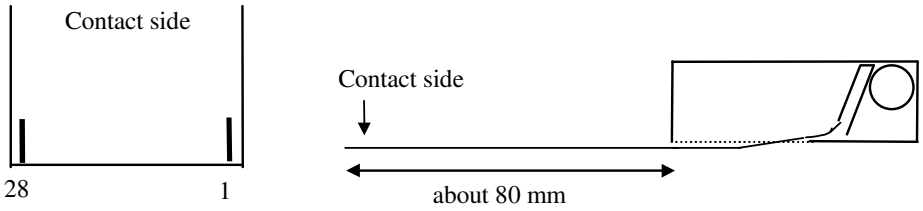
Vcc = 5V, Temp = 25 °C with resistive load.

6.3.3 Print-head connection

Table 1 Pin out of the printer flex cable

PIN NUMBER	SIGNAL	COMMENT
1	Vch	
2	Vch	
3	Serial In	Serial input for data to be printed
4	GND	
5	TM	Thermistor
6	TM	Thermistor
7	OE2	OE for driver 3 and for driver 4
8	OE1	OE for driver 1 and for driver 2
9	Vcc	Supply voltage 5volts +/- 5%
10	Strobe	Strobe signal for line print
11	GND	
12	Clock	Clock signal for serializing data to the line
13	OE5	OE for driver 9 and for driver 10
14	GND	
15	GND	
16	OE4	OE for driver 7 and for driver 8
17	OE3	OE for driver 5 and for driver 6
18	GND	
19	GND	
20	GND	
21	GND	
22	GND	
23	Vch	
24	Vch	
25	Vch	
26	Vch	
27	Vch	
28	Vch	

***Caution*:** All GND pins should be connected to Mother Board's GND (GND Signal). It is necessary to connect a capacitor (2,2µF - 10V) between Vcc and GND and another (10 µF - 35V mini) between Vch and GND.



For the connection of the mechanism, Axiohm recommends the following 28 pin connectors (from print head flex to board): - Molex series 52610 reference 52610-2890 (straight connector).

7. PAPER FEED BIPOLAR STEPPING MOTOR

This bipolar stepping motor is used to drive the platen for paper feed; its characteristics are described bellow.

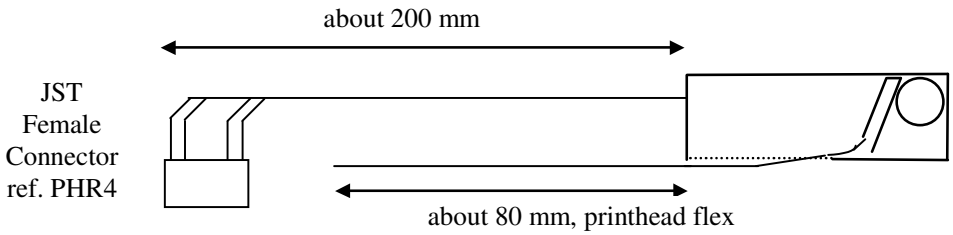
7.1 Characteristics

MOTOR SPECIFICATIONS		
Recommended control voltage*	24 +/-5% or 12 +/-10%	VDC
Coil Resistance	18	Ω
Coil Resistance on high speed version	14	Ω
Number of phases	2 (bipolar)	
Pitch angle	18°	
Number of steps per revolution	20	
Paper feed for 1 motor step	0.125	mm
Recommended control current	420	mA / phase
Maximum starting speed **	200	step / s

* Usual steeper motor control for 12 and 24V is done with current control, not with voltage control. Motor driver should be chosen accordingly.

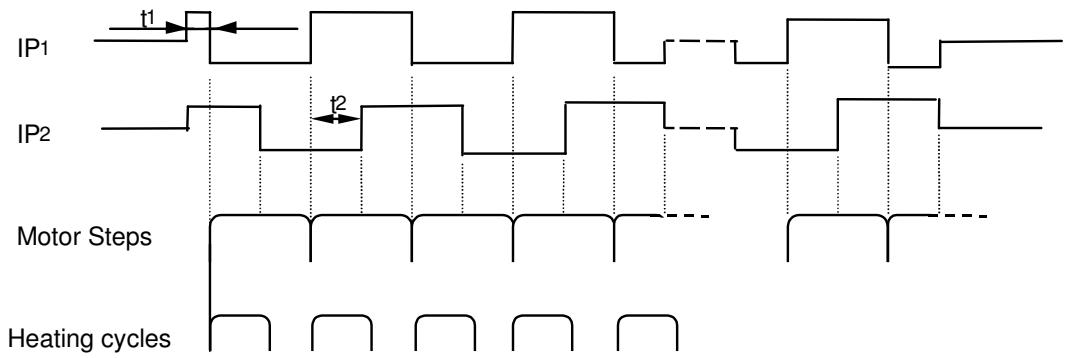
** for MC/MHTP An acceleration ramp up must be achieved to reach 100 mm/s (800pps). For motor driving, see the following page and the chapter "Recommendations".
for MC/MHTA an acceleration ramp up must be achieved to reach 170 mm/s (735 pps). For motor driving, see the following page and the chapter "Recommendations".

7.2 Motor connection



7.3 Induction sequence and timing (paper feed)

Motor feed timing diagram



Note that each time the motor has been stopped for more than 8 minutes, the next step should be longer by 1 minute, in order to restart the motor in the appropriate position.

Motor initialization:

This operation is necessary to place the motor in a good position when the printer electronic is powered on or reset. Both phases must be powered with the same current during t1=1 ms. It must be followed by 16 motor steps in order to compensate the play in the gears.

7.4 Printing mode :

There are 4 different positions for the motor phases.

The circulation is:

P1 = A0B0 ; P2 = A1B1

P1P2 => $\bar{P}$1P2 => $\overline{P1P2}$ => P1$\bar{P}$2 => P1P2

The position of the phases must be kept in memory while the phase currents are switched to zero, in order to restart the motor in a good position.

IP = ± 420mA
t2 > 1.3 ms

During printing, the motor phases should be maintained, otherwise a paper motion can occur and induce unevenly spaced sub-lines. A good way to achieve this, without over heating the motor, is to keep the motor phases "on" when the buffer contains data, and to release them when the buffer is empty.

7.5 Acceleration ramp up:

Step number	Speed (mm/s)	Motor Phase Time (µs)	Step number	Speed (mm/s)	Motor Phase Time (µs)
0	30	4167	16	102	1225
1	35	3571	17	107	1168
2	39	3205	18	111	1126
3	44	2841	19	116	1078
4	48	2604	20	120	1042
5	53	2358	21	125	1000
6	57	2193	22	129	969
7	62	2016	23	134	933
8	66	1894	24	138	906
9	71	1761	25	143	874
10	75	1667	26	147	850
11	80	1563	27	152	822
12	84	1488	28	157	796
13	89	1404	29	161	776
14	93	1344	30	166	753
15	98	1276	31	170	735

8. SENSORS SPECIFICATIONS

8.1 Cover detection micro-switch

Contact resistance : < 1 Ωinitial (< 2 Ω after life-time).
Maximum rating : 0.1 A -30 V DC.

8.2 End of paper opto-sensor

This opto-sensor detects the end of paper.
(*When in a double-printing station configuration, there are two opto sensors*.)

***Note*:** Two sensors are provided with double station (*two paper rolls*).

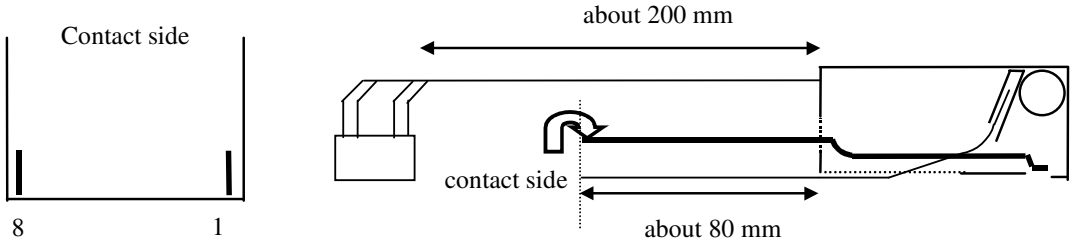
ELECTRICAL CHARACTERISTICS			
Reverse voltage : Vr Reverse current : Ir		5 0,01 (< 0,1)	Volts µA
Continuous collector-emitter voltage : Vce		16	Volts
Collector-emitter voltage	Vce Vcesat*	30 0,15 (< 0,6)	Volts
Collector-emitter current : Ice *		0.4 < ….< 1.25 0.7 Typ	mA
Forward current : If Forward voltage : Vf		50 1,25 (< 1,65)	mA Volts
Collector-emitter leakage current : Iceo (Vce = 20V)		3 (< 200)	nA
Total power dissipation : Ptot		100	mW
Thermal resistance : Rthja		400	K/W
Ambient temperature range : Ta		- 40 to + 85	°C

* ***With*: If = 10mA; Vce = 5V; 90% reflection and d = 1mm**

The user should be aware that the opto-sensor characteristics have very wide tolerances.
Thus, we recommend the use of one of the schematics on the following page.

8.3 Connections

A second flex is used (*pitch = 1mm*).

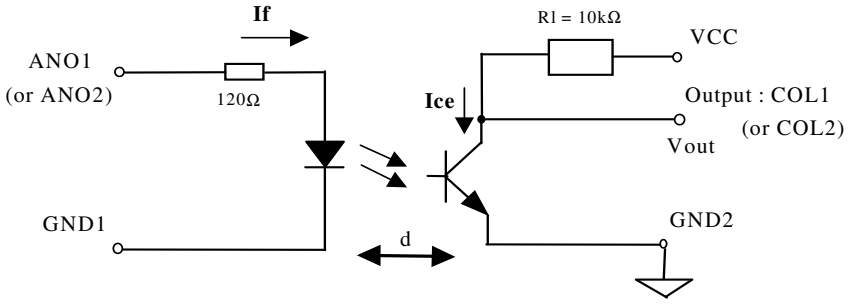


PIN NUMBER	SIGNAL	COMMENT
1	SW1	Switch
2	GND1	
3	ANO1	Photodiode's anode
4	GND2	
5	COL1	Transistor-collector
6	N.C or ANO2 *	Photodiode's anode
7	N.C or GND	
8	N.C or COL2 *	Transistor-collector

* Double station

8.4 Recommended use for Opto-sensor

Reflective Interrupter: Sample of schematic used



Vout (Volts)

Paper	0.275 V ⊏ 10%
No paper	AA 2.5 V

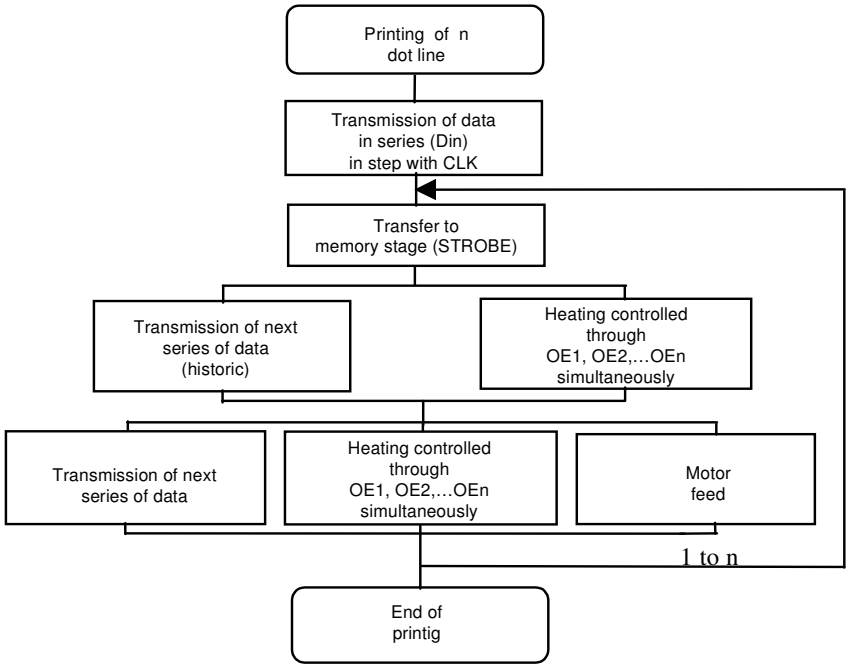
***Condition*: Ta = 25°C; Vcc = 5 volts; d = 1mm.**
Note that Ice is as a function of the forward current of the emitting diode; the degree of reflection and the distance between reflector and component (d).

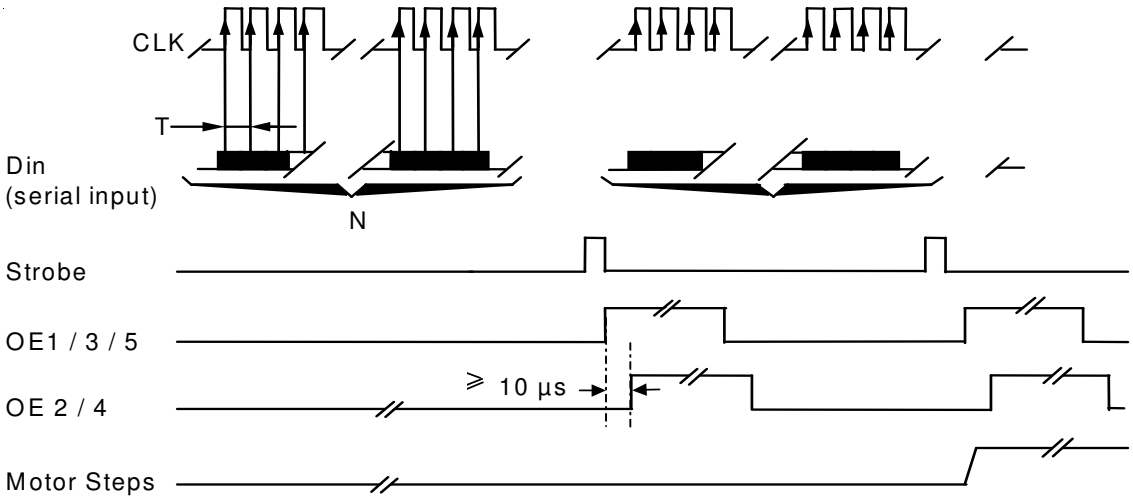
9. PRINTER CONTROL TECHNICAL

Printer control techniques in order to operate the printer. We depict hereafter three possible modes.

9.1 Mode 1

The paper feeds itself automatically during the heating cycle, thereby permitting to achieve high speed. (In this mode, it is recommended to use historical control, see chapter: "Heating Time")

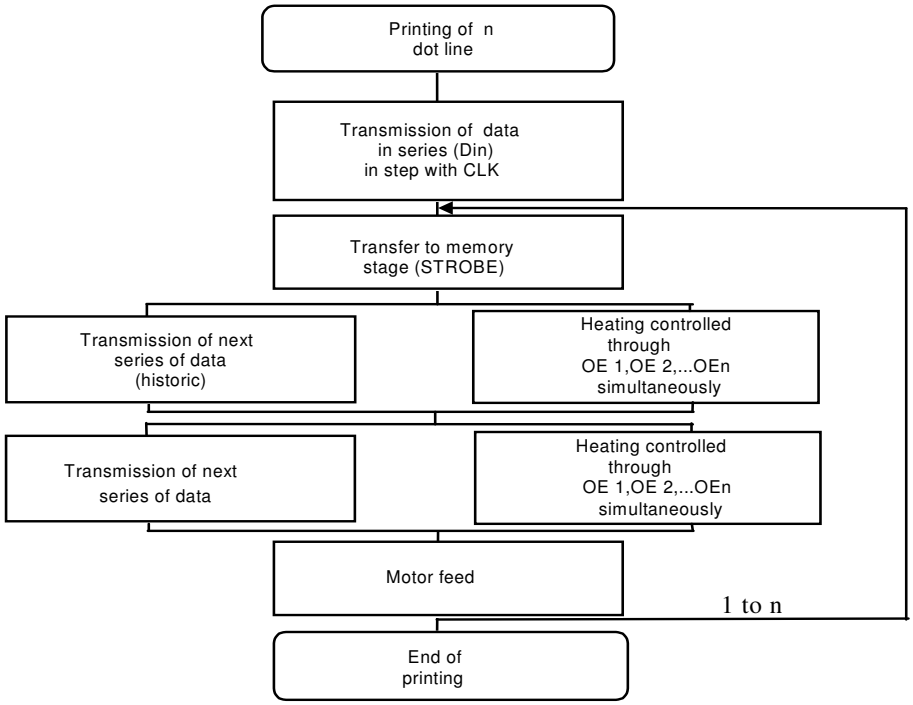


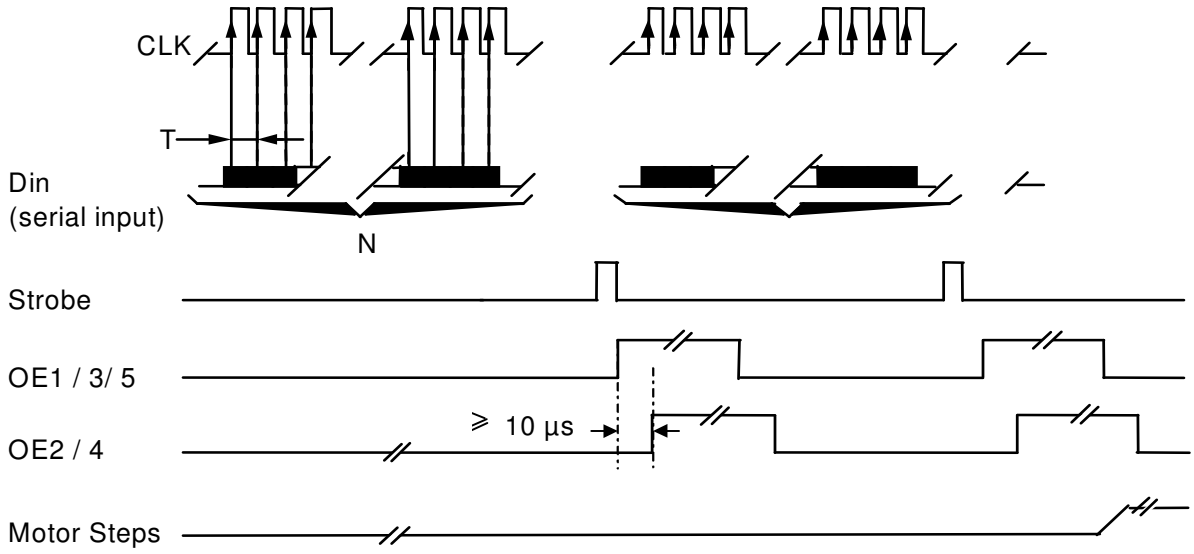


T : Clock frequency 5 MHz maximum 0 Ωn Ω5

9.2 Mode 2

The paper feed occurs after the heating cycle, giving high quality printing.

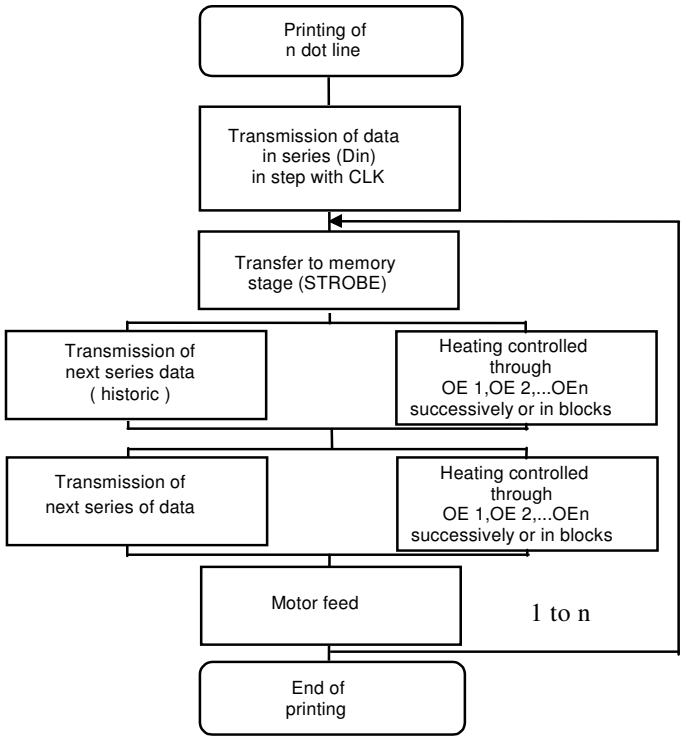


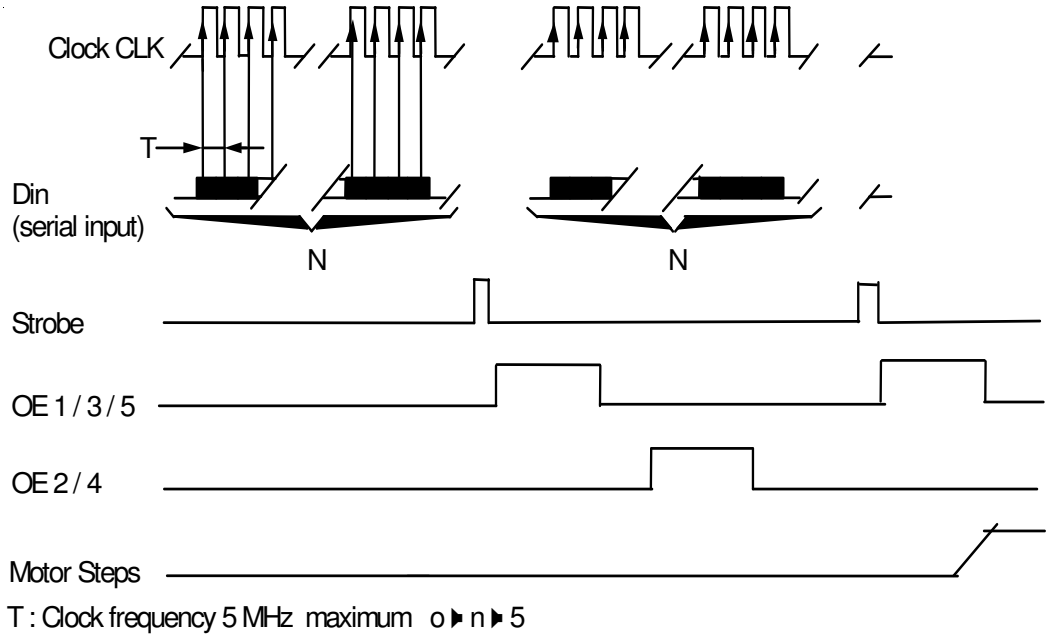


T : Clock frequency 5 MHz maximum 0 === n = 5

9.3 Mode 3

This mode is used in conditions where there is limited electrical current. The dot line is printed in stages, heating only a portion of the line at a time and effectively reducing consumption.





T : Clock frequency 5 MHz maximum o ▸ n ▸ 5

10. RECOMMENDATIONS

10.1 Mechanical Recommendations

Never apply mechanical stress to the printer, as this could result in misalignment and thus degradation of the print quality.
The thermal print head must have 1 degree of freedom. Never prevent the print head from pivoting on its axis.
Refer to the drawings in chapters "Cover switch position" & "Cover axis position" to design an easy loading Clamshell cover.
Avoid any direct contact between the printer motor and surrounding components.

10.2 Electrical Recommendations

When energizing the thermal print head (Vcc, 5 V) it is important to apply all the logic signals within 10 ms (*particularly to de-energize all the OEs*).
If the line of dots is supplied before the control logic, resistor dots may be destroyed. Because the control logic has a random state, resistors might be heated for a longer period than the specified maximum, burning out the heated resistor.
To avoid this, we recommend applying the heating voltage (Vch) after the logic supply voltage (Vcc, 5V).
The same precaution should be taken when shutting off. The supply voltage Vch must be switched off before the logic supply voltage Vcc. Care should be taken to allow enough time for residual capacitate charge to dissipate.

10.3 Motor Driving Recommendations

*Motor driving can be achieved with voltage control or regulated current control.

- If the motor is connected to the heating source power, it is recommended to control it under regulated current.
- **When the control voltage is greater than 26 V, or the current is greater than 420mA per phase, it is necessary to determine a duty cycle time to avoid the motor temperature from rising.** This has to be achieved with the customer host chassis as the cooling depends on air volume and circulation around the motor.

The duty cycle and Time ON max must be respected.
See table page 8, this table was made for a mechanism not integrated.

10.3.1 Printing speed :

The motor phase timing is described in chapter'paper feed motor'; this timing determeins the printing speed.
The MHTA/MCTA mechanism can reach 180mm/s however the paper roll diameter can impact that speed when it is big enough. Please see the following examples to give idea of the possible speeds compatible with roll daimeters.

- With a max speed set at 180mm/s the maximun diameter for the roll on an axle is 185mm
- With a max speed set at 180mm/s the maximun diameter for the roll in a bucket is 150mm
- With a max speed set at 170mm/s the maximun diameter for the roll on an axle is 200mm

- With a max speed set at 170mm/s the maximun diameter for the roll in a bucketis 165mm

Please contact Axiohm tech support.to determine your maximum speed in case of bigger rolls.

10.4 Cutter Driving Recommendations

Integration of the platen roller:

The pin on the bearing must be visible in order to correctly integrate the platen roller into the paper guide.
The paper guide has a life span of 3000 open/shut cycles.
The paper exit must be free for the cutter function to work properly.
The minimum ticket length to use in order to guarantee proper functioning is 50mm.
Avoid sticking anything on the cutter motor; leave "air space".
Do not forget to leave room for the "paper jam" screw.

11. HEATING TIME

11.1 Historical Control

The heating timetable is given on next page.

The motor cycle time for one dot line is given in the second the top lines of table, it is the time for two motor steps.

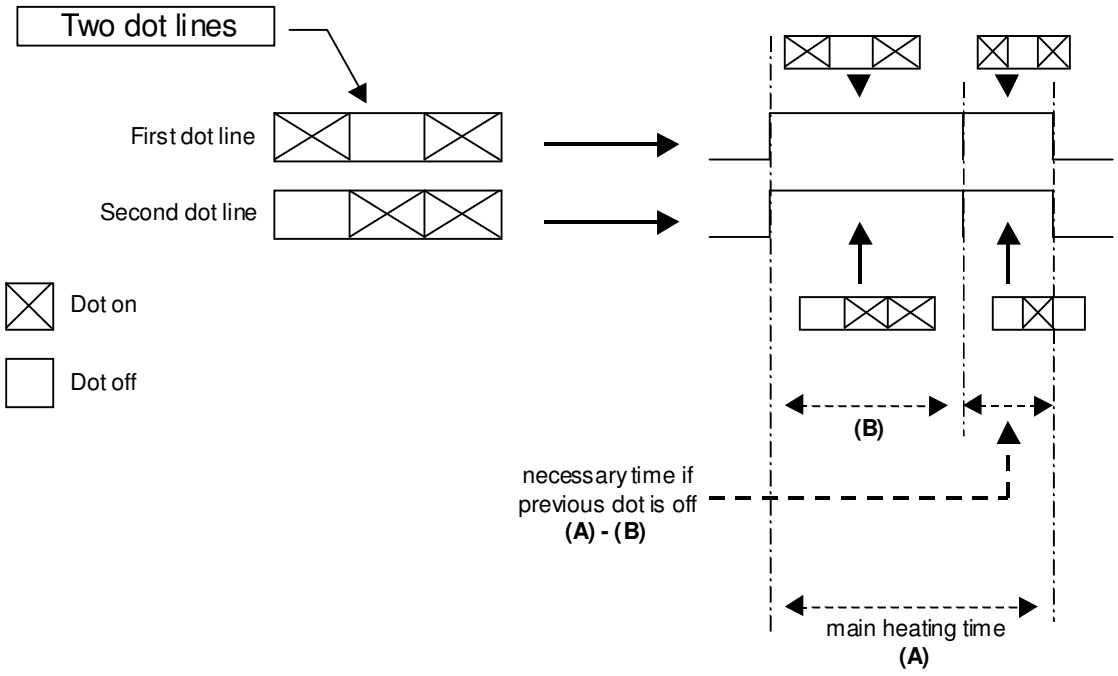
The column **(A)** (*indicated with: speed <10 mm/s and motor cycle time > 12.5 ms*) gives the required heating time, giving the necessary energy to obtain an optical density of 1,2.

With historical control: The column **(B)** gives the required heating time, if the previous dot is on.

If not, the heating time is given by the column **(A)**.

Without historical control: Heating time is given by all the column **(B)**. At high speed, printing quality for isolated dots might be affected with this method.

Example: at 100mm/s, 25°C and 24 Volts: heating time = 0,3ms



11.2 Heating Table for 24Vstandard versions

CALCULATED VALUES for MHTP 24 V with P310 PAPER									
Voltage (V)		Temperature (°C)	Speed (mm/s)				R=800 Ohms		
Real			< 10 mm/s	20 mm/s	40 mm/s	60 mm/s	80 mm/s	100 mm/s	120 mm/s
Time for one motor step			12,500 ms	6,250 ms	3,130 ms	2,080 ms	1,560 ms	1,250 ms	1,040
			(A)	(B)					
22,00 V		**0 °C**	1,100 ms	0,910	0,720	0,610	0,530	0,470	---
22,00 V		**10 °C**	1,010 ms	0,840	0,660	0,560	0,490	0,430	0,380
22,00 V		**20 °C**	0,920 ms	0,760	0,600	0,510	0,440	0,390	0,350
22,00 V		**25 °C**	0,880 ms	0,730	0,570	0,480	0,420	0,370	0,330
22,00 V		**30 °C**	0,840 ms	0,690	0,550	0,460	0,400	0,350	0,320
22,00 V		**40 °C**	0,750 ms	0,620	0,490	0,410	0,360	0,320	0,280
22,00 V		**50 °C**	0,660 ms	0,540	0,430	0,360	0,310	0,280	0,250
24,00 V		**0 °C**	0,880 ms	0,720	0,570	0,480	0,420	0,370	0,330
24,00 V		**10 °C**	0,800 ms	0,670	0,530	0,440	0,390	0,340	0,300
24,00 V		**20 °C**	0,730 ms	0,610	0,480	0,400	0,350	0,310	0,280
24,00 V		**25 °C**	0,700 ms	0,580	0,460	0,390	0,330	0,300	0,260
24,00 V		**30 °C**	0,660 ms	0,550	0,430	0,370	0,320	0,280	0,250
24,00 V		**40 °C**	0,590 ms	0,490	0,390	0,330	0,280	0,250	0,220
24,00 V		**50 °C**	0,520 ms	0,430	0,340	0,290	0,250	0,220	0,200
26,00 V		**0 °C**	0,710 ms	0,590	0,470	0,390	0,340	0,300	0,270
26,00 V		**10 °C**	0,650 ms	0,540	0,430	0,360	0,310	0,280	0,250
26,00 V		**20 °C**	0,600 ms	0,490	0,390	0,330	0,290	0,250	0,230
26,00 V		**25 °C**	0,570 ms	0,470	0,370	0,310	0,270	0,240	0,210
26,00 V		**30 °C**	0,540 ms	0,450	0,350	0,300	0,260	0,230	0,200
26,00 V		**40 °C**	0,480 ms	0,400	0,320	0,270	0,230	0,200	0,180
26,00 V		**50 °C**	0,420 ms	0,350	0,280	0,230	0,200	0,180	0,160

11.3 Heating Table for 24Vadvanced versions

CALCULATED VALUES for MHTA with KLS46 PAPER									
Voltage (V) Real	**Temperature (°C)**	**Speed (mm/s)**							
		< 30 mm/s	**80 mm/s**	**100 mm/s**	**120 mm/s**	**140 mm/s**	**150 mm/s**	**160 mm/s**	**180 mm/s**
Motor step time		4,170 ms	1,560 ms	1,250 ms	1,040 ms	0,890 ms	0,830 ms	0,780 ms	0,690 ms
Cycle time		4,170 ms	1,560 ms	1,250 ms	1,040 ms	0,890 ms	0,830 ms	0,780 ms	0,690 ms
19,00 V	**0 °C**	1,253	0,964	---	---	---	---	---	---
19,00 V	**10 °C**	1,054	0,811	0,756	---	---	---	---	---
19,00 V	**20 °C**	0,931	0,716	0,668	0,628	---	---	---	---
19,00 V	**25 °C**	0,890	0,685	0,639	0,600	0,568	---	---	**---**
19,00 V	**30 °C**	0,859	0,661	0,616	0,579	0,548	---	---	---
19,00 V	**40 °C**	0,810	0,623	0,581	0,546	0,517	0,503	---	---
19,00 V	**50 °C**	0,759	0,584	0,545	0,512	0,484	0,472	0,461	---
21,00 V	**0 °C**	1,061	0,816	0,761	---	---	---	---	---
21,00 V	**10 °C**	0,893	0,687	0,640	0,602	---	---	---	---
21,00 V	**20 °C**	0,789	0,607	0,566	0,532	0,503	0,490	---	---
21,00 V	**25 °C**	0,754	0,580	0,541	0,508	0,481	0,469	0,458	---
21,00 V	**30 °C**	0,727	0,560	0,522	0,490	0,464	0,452	0,441	---
21,00 V	**40 °C**	0,686	0,528	0,492	0,463	0,438	0,426	0,416	0,397
21,00 V	**50 °C**	0,643	0,495	0,461	0,433	0,410	0,399	0,390	0,372
24,00 V	**0 °C**	0,847	0,651	0,607	0,571	0,540	---	---	**---**
24,00 V	**10 °C**	0,712	0,548	0,511	0,480	0,454	0,443	0,432	---
24,00 V	**20 °C**	0,629	0,484	0,451	0,424	0,401	0,391	0,382	0,364
24,00 V	**25 °C**	**0,602**	**0,463**	**0,432**	**0,406**	**0,384**	**0,374**	**0,365**	**0,348**
24,00 V	**30 °C**	0,580	0,446	0,416	0,391	0,370	0,361	0,352	0,335
24,00 V	**40 °C**	0,547	0,421	0,393	0,369	0,349	0,340	0,332	0,316
24,00 V	**50 °C**	0,513	0,395	0,368	0,346	0,327	0,319	0,311	**0,297**
26,00 V	**0 °C**	0,738	0,568	0,529	0,498	0,471	0,459	0,448	---
26,00 V	**10 °C**	0,621	0,478	0,445	0,419	0,396	0,386	0,377	0,359
26,00 V	**20 °C**	0,548	0,422	0,393	0,370	0,350	0,341	0,333	0,317
26,00 V	**25 °C**	0,524	0,403	0,376	0,354	0,334	0,326	0,318	0,303
26,00 V	**30 °C**	0,506	0,389	0,363	0,341	0,323	0,314	0,307	0,292
26,00 V	**40 °C**	0,477	0,367	0,342	0,322	0,304	0,296	0,290	0,276
26,00 V	**50 °C**	0,447	0,344	0,321	0,301	0,285	0,278	0,271	0,258

11.4 Heating Table for 12V standard versions

CALCULATED VALUES for MHTP 12 V with P350 PAPER

Voltage (V)	Temperature (°C)	Speed (mm/s)				R=	379 Oh		
		< 20 mm/s	30 mm/s	50 mm/s	60 mm/s	70 mm/s	80 mm/s	90 mm/s	100 mm/s
Real Motor step time		6,250 ms	4,170 ms	2,500 ms	2,080 ms	1,790 ms	1,560 ms	1,390 ms	1,250 ms
Cycle time		6,250 ms	4,170 ms	2,500 ms	2,080 ms	1,790 ms	1,560 ms	1,390 ms	1,250 ms
10,00 Volts	**0 °C**	1,955	1,714	1,411	1,301	---	---	---	---
10,00 Volts	**10 °C**	1,829	1,604	1,320	1,217	---	---	---	---
10,00 Volts	**20 °C**	1,714	1,503	1,237	1,141	1,063	---	---	---
10,00 Volts	**25 °C**	**1,656**	1,453	1,195	1,103	**1,027**	---	---	**---**
10,00 Volts	**30 °C**	1,596	1,400	1,152	1,062	0,990	---	---	---
10,00 Volts	**40 °C**	1,460	1,280	1,053	0,972	0,905	0,844	---	---
10,00 Volts	**50 °C**	1,291	1,132	0,931	0,859	0,800	0,747	0,701	---
11,00 Volts	**0 °C**	1,649	1,446	1,190	1,098	1,023	---	---	---
11,00 Volts	**10 °C**	1,543	1,353	1,113	1,027	0,957	0,892	---	---
11,00 Volts	**20 °C**	1,446	1,268	1,043	0,963	0,897	0,836	---	---
11,00 Volts	**25 °C**	1,397	1,225	1,008	0,930	0,866	0,808	---	---
11,00 Volts	**30 °C**	1,346	1,181	0,972	0,896	0,835	0,779	0,731	---
11,00 Volts	**40 °C**	1,231	1,080	0,889	0,820	0,764	0,712	0,669	0,629
11,00 Volts	**50 °C**	1,089	0,955	0,786	0,725	0,675	0,630	0,592	0,556
12,00 Volts	**0 °C**	1,410	1,236	1,017	0,938	0,874	0,815	---	---
12,00 Volts	**10 °C**	1,319	1,157	0,952	0,878	0,818	0,763	0,717	---
12,00 Volts	**20 °C**	1,236	1,084	0,892	0,823	0,767	0,715	0,672	0,632
12,00 Volts	**25 °C**	**1,194**	1,048	0,862	0,795	**0,741**	0,691	0,649	**0,610**
12,00 Volts	**30 °C**	1,151	1,009	0,831	0,766	0,714	0,666	0,625	0,588
12,00 Volts	**40 °C**	1,053	0,923	0,760	0,701	0,653	0,609	0,572	0,538
12,00 Volts	**50 °C**	0,931	0,816	0,672	0,620	0,577	0,538	0,506	0,476
13,00 Volts	**0 °C**	1,219	1,069	0,880	0,811	0,756	0,705	0,662	0,623
13,00 Volts	**10 °C**	1,140	1,000	0,823	0,759	0,707	0,660	0,620	0,583
13,00 Volts	**20 °C**	1,069	0,937	0,771	0,712	0,663	0,618	0,581	0,546
13,00 Volts	**25 °C**	1,033	0,906	0,745	0,688	0,641	0,597	0,561	0,528
13,00 Volts	**30 °C**	0,995	0,873	0,718	0,663	0,617	0,576	0,541	0,509
13,00 Volts	**40 °C**	0,910	0,798	0,657	0,606	0,565	0,526	0,495	0,465
13,00 Volts	**50 °C**	0,805	0,706	0,581	0,536	0,499	0,466	0,437	0,411
14,00 Volts	**0 °C**	1,064	0,934	0,768	0,709	0,660	0,616	0,578	0,544
14,00 Volts	**10 °C**	0,996	0,873	0,719	0,663	0,618	0,576	0,541	0,509
14,00 Volts	**20 °C**	0,933	0,819	0,674	0,621	0,579	0,540	0,507	0,477
14,00 Volts	**25 °C**	**0,902**	0,791	0,651	0,600	**0,559**	0,522	0,490	**0,461**
14,00 Volts	**30 °C**	0,869	0,762	0,627	0,579	0,539	0,503	0,472	0,444
14,00 Volts	**40 °C**	0,795	0,697	0,574	0,529	0,493	0,460	0,432	0,406
14,00 Volts	**50 °C**	0,703	0,616	0,507	0,468	0,436	0,407	0,382	0,359

n,nnn *Warning base heating time > line time for this speed*

11.5 Thermistor specifications

Resistance value : R25	30 kΩ +/-5%
Operating temperature	- 40°C to 125°C
Time constant	5 seconds
Max. Power	400mW at 25°C

Correlation between Thermistor resistance and Temperature :

$R = R_{25} * \exp. (B * (1/T - 1/T_{25}))$.
B = 3950 K +/-2%.
T_{25} = 25°C

T (°C)	R (kΩ)	T (°C)	R (kΩ)	T (°C)	R (kΩ)
-40	1205.579	25	30.000	90	2.801
-35	844.731	30	24.111	95	2.416
-30	600.612	35	19.517	100	2.093
-25	432.951	40	15.904	105	1.819
-20	316.154	45	13.044	110	1.587
-15	233.694	50	10.765	115	1.390
-10	174.737	55	8.935	120	1.221
-5	132.078	60	7.458	125	1.077
0	100.862	65	6.259	130	0.952
5	77.774	70	5.280	135	0.844
10	60.524	75	4.475	140	0.751
15	47.511	80	3.811	145	0.670
20	37.606	85	3.260	150	0.599

12. ELECTRICAL SPECIFICATIONS FOR CUTTER

12.1 Bipolar motor

This bipolar motor is used to drive the cutting blade; its characteristics are described bellow.
Please note that the cutter is not available with 12V versions.

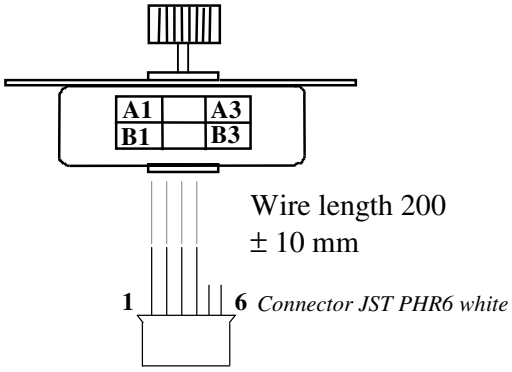
12.1.1 Characteristics

Stepping motor specifications:

SPECIFICATIONS		
Recommended control voltage	24 +/- 5%	VDC
Coil resistance	4	Ω
Number of phases	2 (bipolar)	
Pitch angle	18°	
Number of steps per revolution	40	steps
Recommended control current	900	mA / phase
Maximum starting speed *	500	step / s

12.1.2 Motor connections

PIN n°	Wire color	Motor
1	black	A1
2	brown	A3
3	yellow	B3
4	orange	B1
5	white	switch
6	white	switch



Switching sequence and timing

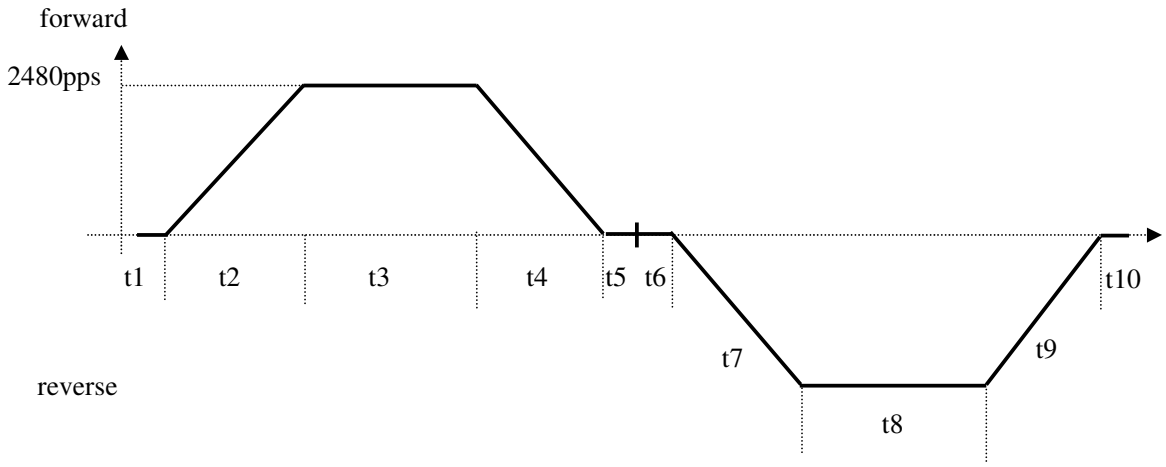
	BLACK	ORANGE	BROWN	YELLOW
STEP 1	—	+	+	—
STEP 2	—	—	+	+
STEP 3	+	—	—	+
STEP 4	+	+	—	—

CW ↓ ↑ CWW

Voltage on cable is negative where shown as "-".
Voltage on cable is positive where shown as "+".

12.1.3 Cutting mode

To obtain a cut, the first motor phase must be set "On" 40ms to avoid blade oscillation. Another 40ms "On" should be set in the motor phase at the end of the cut, before switching off the current.



t1 = t5 = t6 = t10 = 40ms

t2 = t4 = t7 = t9 = 30 steps (acceleration ramp, see chart below)

t3 = t8 = for total cut = 1296 steps

for partial cut = 1224 steps (80mm paper)

= 1240 steps (82.5mm paper)

Acceleration ramp for MCTP/MCTA (24V only):

step number	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
motor speed (pps)	500	566	632	698	764	830	896	962

step number	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
motor speed (pps)	1028	1094	1160	1226	1292	1358	1424	1490

step number	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
motor speed (pps)	1556	1622	1688	1754	1820	1886	1952	2018

step number	**24**	**25**	**26**	**27**	**28**	**29**	**30**
motor speed (pps)	2084	2150	2216	2282	2348	2414	2480

12.2 Disc position Micro-switch detector

This sensor detects the cutter's entry position (or initial position).

12.2.1 Electrical characteristics

- contact resistance :	<150 mΩ
- maximum rating :	10 mA/5 VDC
- operating temperature :	- 10 to + 50 °C

12.2.2 Connection

See "Motor connection" chapter.