TURNKEY PRINTING SOLUTIONS

TA/TB – DA/DB PRINTER

USER MANUAL

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EVOLUTIONS

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INTRODUCTION

The TA/TB series are highly reliable printer mechanisms especially designed to print and cut very thick thermal paper. (DA/DB: version without cutter)

Those mechanisms come with standard features, such as top of form management, end of paper detection, possible reverse feeding.
The motor torque allows to handle big paper rolls or folded media to suit as many applications as possible.
The specific paper guiding added to a heavy duty guillotine blade give to this mechanisms the ability to cut the thickest thermal media available on the market.

The most common Axiohm PCBs available to drive those mechanisms are the 'Optiboard' series.

The following manual is designed to help the mechanical and electronic integration – Axiohm technical support can be contacted if necessary.

Axiohm

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1 TECHNICAL SPECIFICATIONS

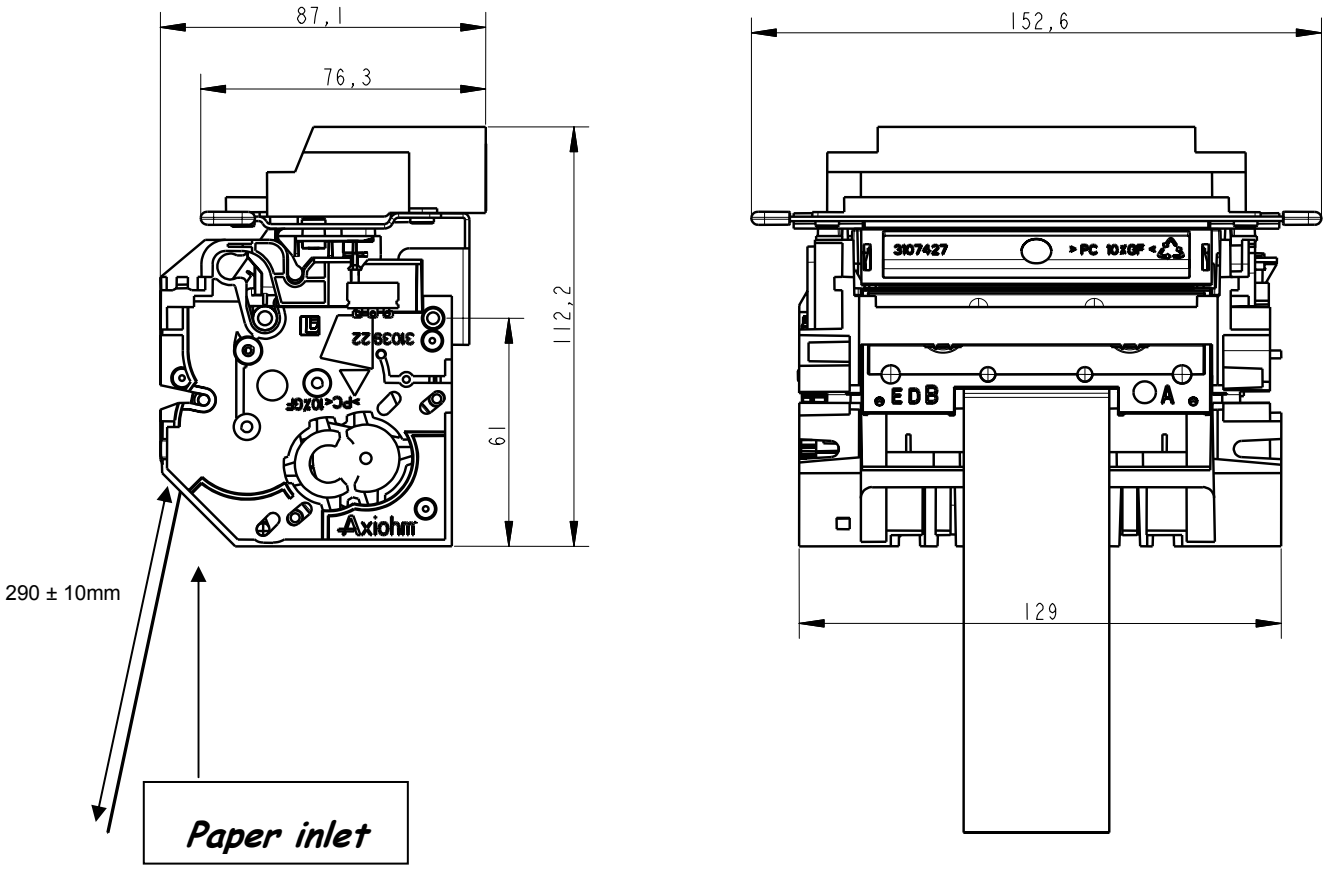
The following table gathers the main characteristics of the printing unit.

ITEM	VALUE	UNIT
Printing method	Static thermal dot line printing	--
Paper loading	Autoload/Automatic	--
Number of resistor dots	640	dots
Resolution	8 horizontal & vertical	Dots/mm
Printing width	72/80	mm
Max Printing speed	130	mm/s
Paper width (TAxx / TBxx)	80 / 82.5	mm
Head T° detection	By Thermistor	--
Paper feed pitch	0.125	mm
Paper empty detection	By switch	--
TOF	Option: optical-sensor	--
Operating voltage range Vcc (logic)	4.5 - 5.5 (5V±10%)	V DC
Vch (dot)	21.6 - 26.4 (24V±10%)	V DC
Current Consumption : Vch	26	mA per resistor dot "on" at 24V
Max Current Consumption: Vcc (all dots "on")	50	mA
Nominal dot energy (High sensitivity paper)	0.15	mJ
Current Consumption: Stepping motor	500	mA per activated phase at 24V
Peak print head current (all dots "on " at nominal value)	16.7	A
Over all dimensions: Width Depth Height	152.6 87.1 112.2	mm mm mm
Weight	838	g
Storage range*2	-40 to +80	°C
Relative humidity*2 no condensing	20 to 90 (up to 35°C) 20 to 80°C (up to 50°C)	%
Operating range*2	-10 to +50	°C
Electrical lifetime *3	2×10^8	pulses on OE signal
Mechanical lifetime *3	150	km
Cutter lifetime	Up to 500K	cuts

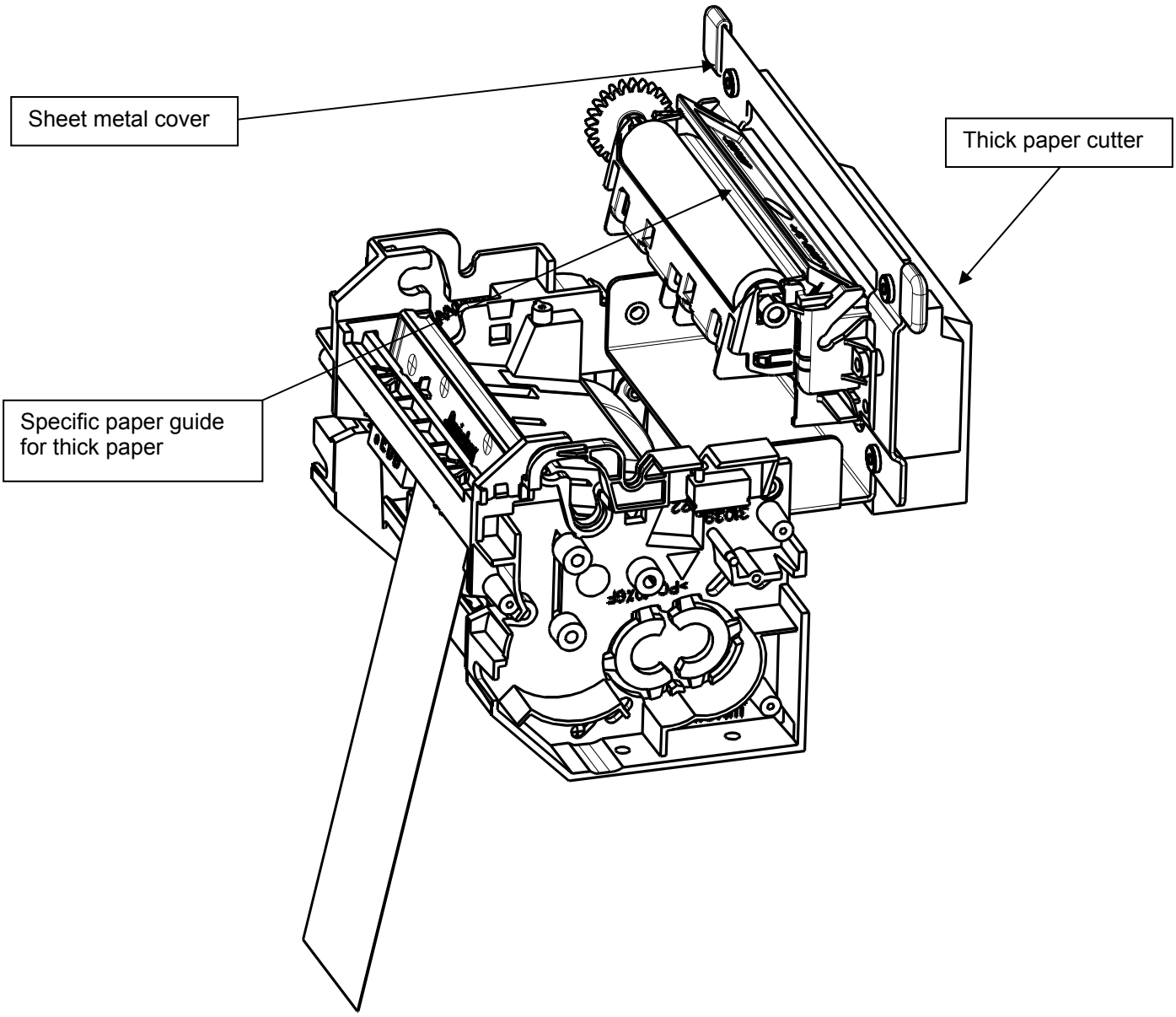
*1 In standard conditions: 24 Volts, 25°C, for a print head with a resistance of 950 Ω, at 1042 PPS
*2 Contact Axiohm for recommendations if extended conditions are required
*3 Per AXIOHM conditions

2 MECHANICAL FEATURES

2.1 External Dimensions



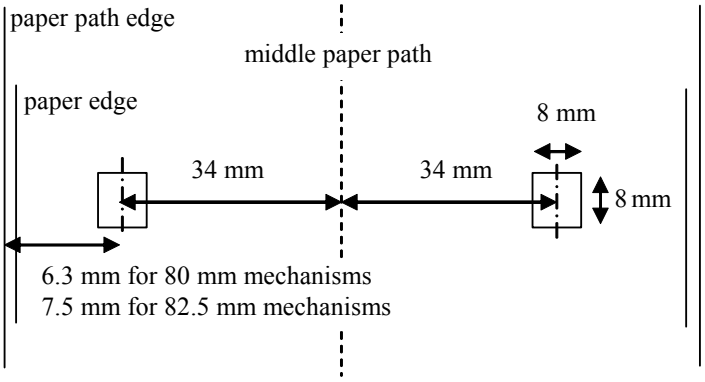
Only the straight paper path is available on these mechanism versions



Useful distances for Top of form management

Distance from the optical sensor to the line of cut :
79.5 ± 1 mm

Distance from the line of dots to the line of cut: 35 ± 1 mm



The optical sensors can be placed on both sides of the paper path. They can face the back side of the paper.

2.2 *Housing features for ticket access*

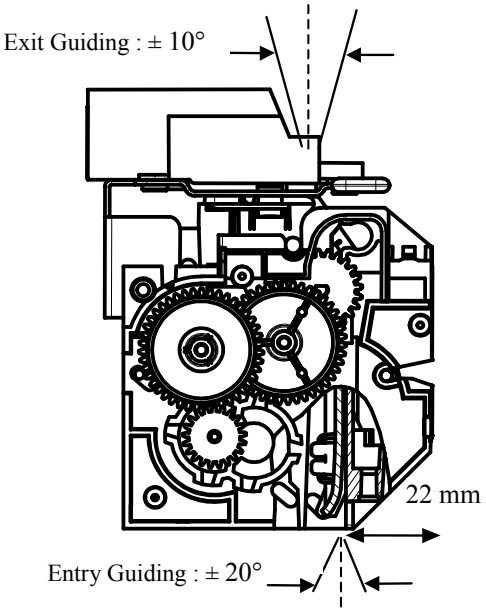
See section “Recommendations”.

2.3 *Paper entry and exit*

The paper must be guided to reach the mechanism paper inlet. The guide must be designed in such a way that it does not stop the paper or mark it, or create high friction.
If the application requires a paper guide at the mechanism paper exit, make sure the paper is not bent too much otherwise a jam will occur.
The design of the mechanism guide at the paper exit is optimized to cut thick paper. If an exit guide is added, leave enough space so that it does not obstruct the mechanism guide and prevent the internal paper guide from working properly.

PAPER ENTRY EXIT ANGLE

The paper should be guided as shown on the drawing here after.
Smooth curves are preferred to drive the paper (in or out).
In case of doubt when designing the guides, contact your Axiohm representative.



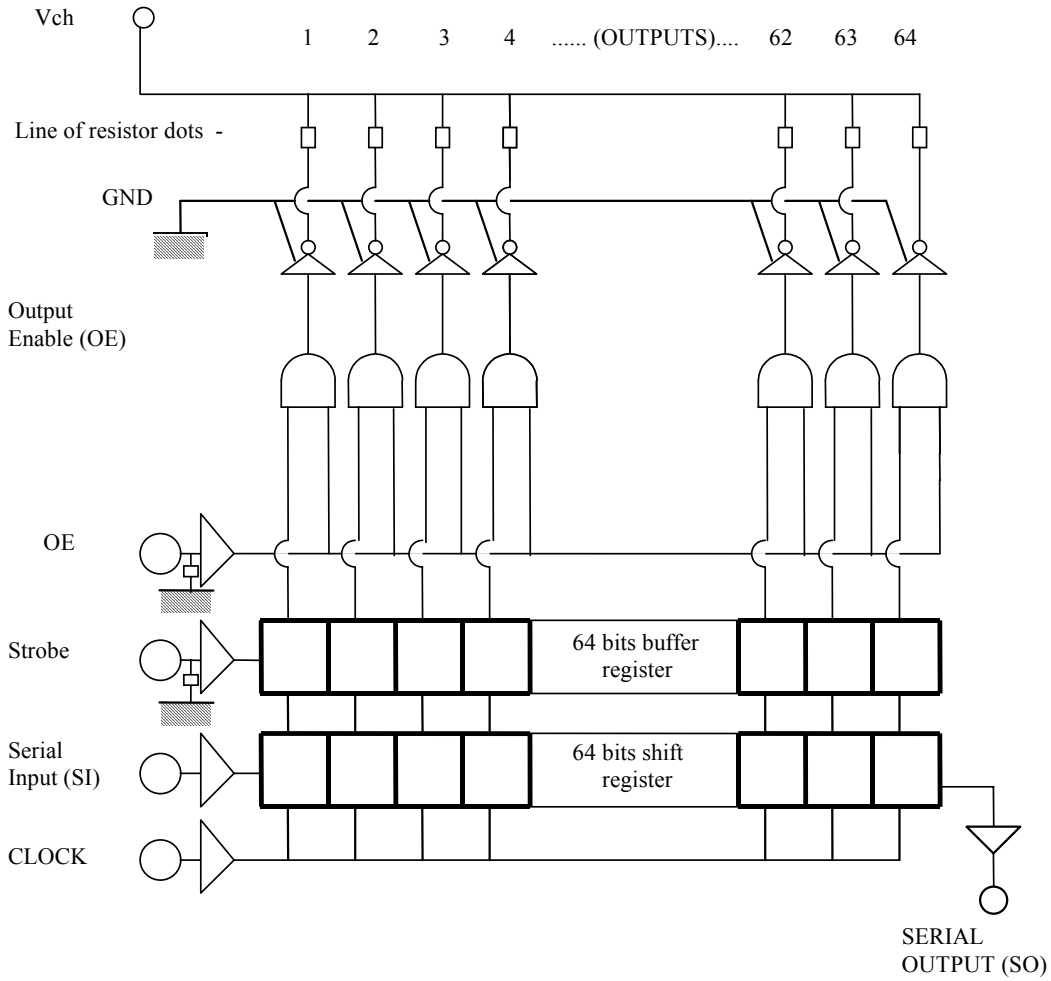
3 ELECTRIC INTERFACE

3.1 Overview:

3.2 General Print Head Characteristics

Number of dots	640
Number of driver ships	10 (64 dots per ships)
Dot resistance	950 ± 3 % Ω
Maximum current per dot line (at 24V)	16.2A

3.2.1 Fonction of each 64 bit IC (integrated circuit)

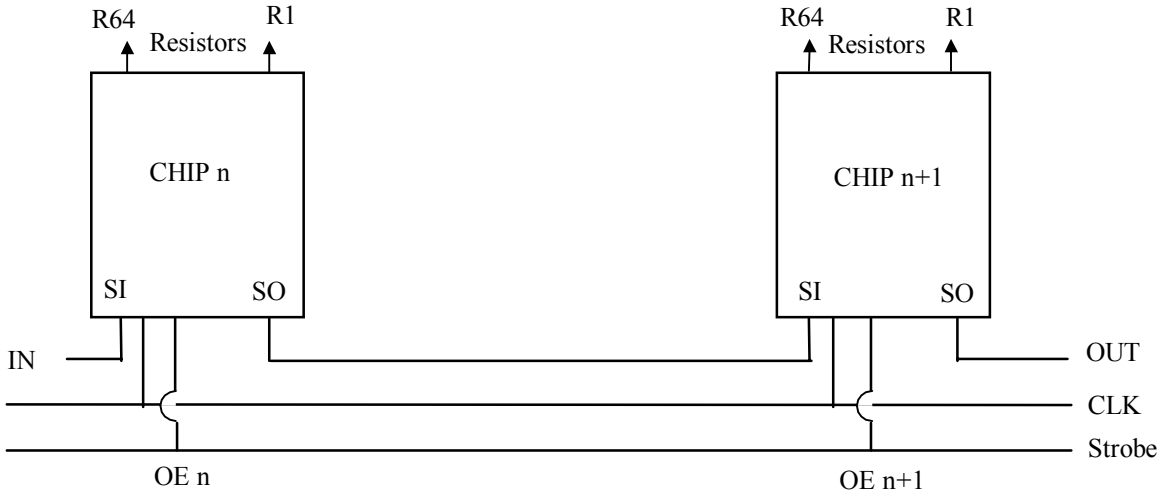


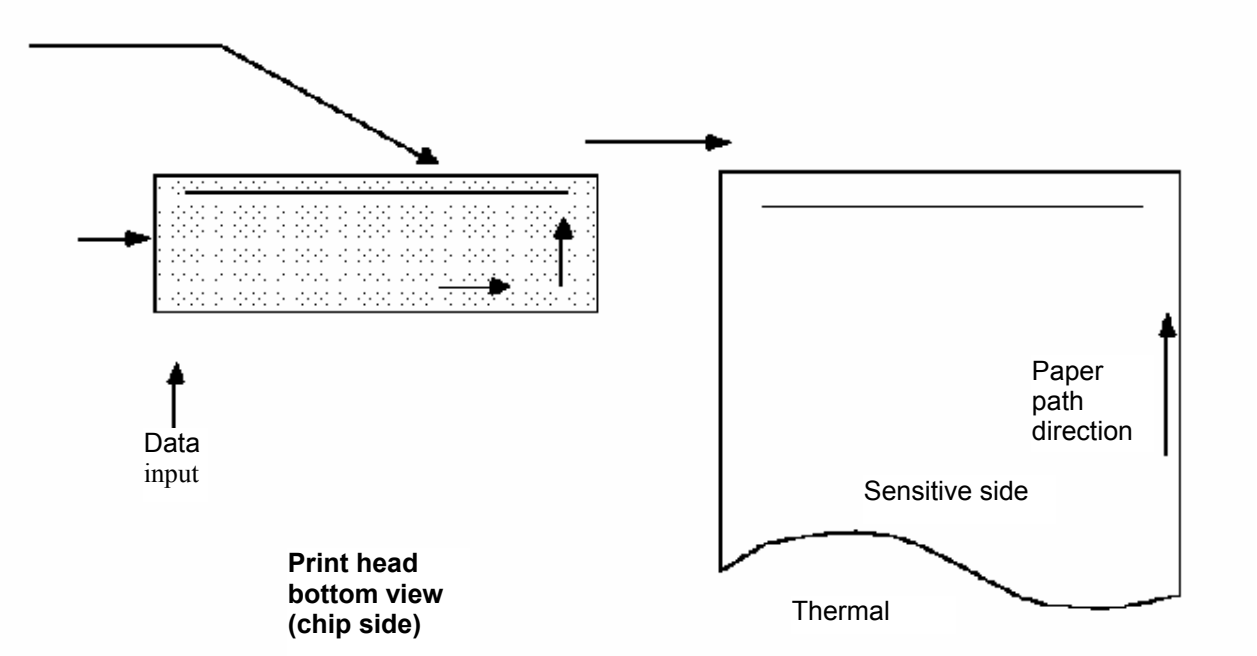
Driver IC schematic

These circuits are supplied by	4,5V to 5.5V logic voltage
Each circuit features	64 open collector transistors
	64-bit shift register
	64-bit memory register
Each circuit controls	64 resistor dots on the print head

The heating element power supply VCH is not connected to the Driver ICs but to the resistive line of dots itself. The driver ICs are connected via a pattern of high current gold interconnecting traces to the line of resistor dots. (Heat element structure: 2 heaters/dot)

3.2.2 Routing of data to the thermistor dots

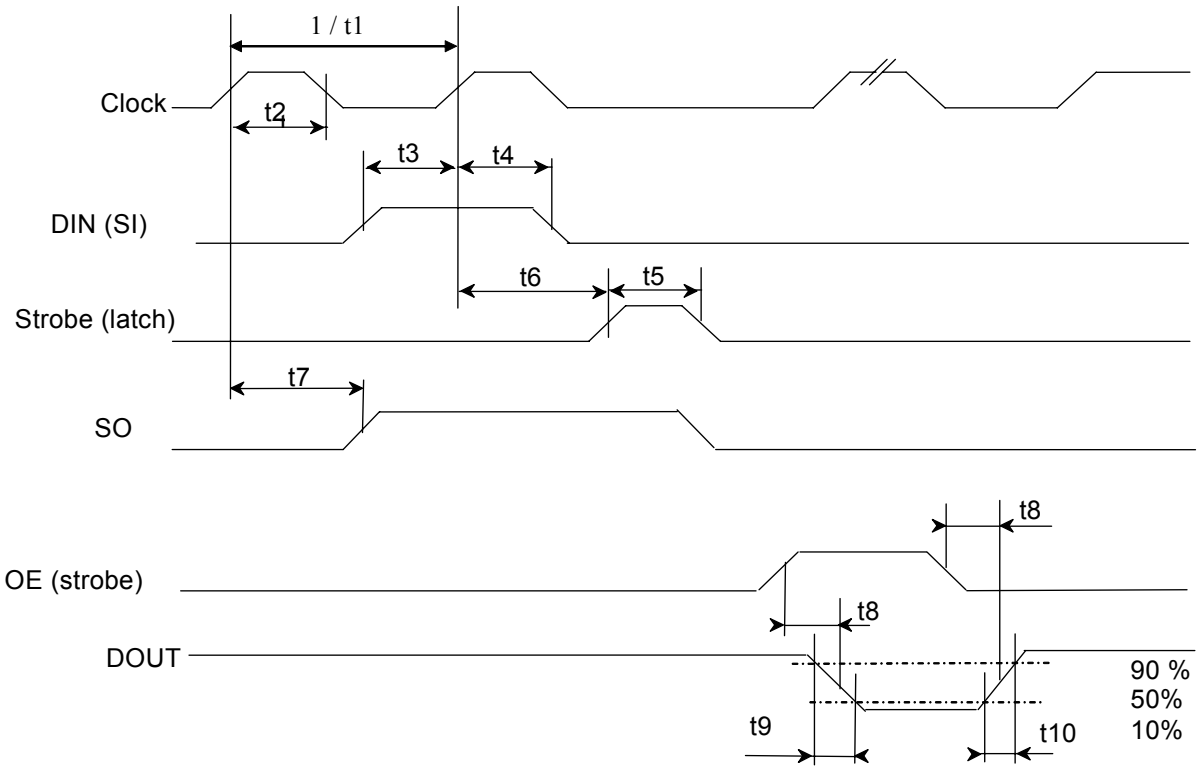




Dots print order

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

3.2.3 Timing Chart

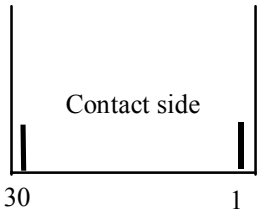


		Min	Typ	Max	
Clock frequency				6.25	Mhz
Clock pulse width	t2	70			ns
Clock SI set up time	t3	40			ns
Clock SI hold time	t4	40			ns
Latch pulse width	t5	100			ns
Clock latch setup time	t6	100			ns
SO Delay time	t7			120	ns
OE-DO delay time	t8			10.5	µs
DO fall time	t9		3.5	10	µs
DO rise time	t10		2.0	6.0	µs

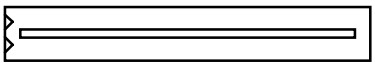
3.2.4 Print head connection

The following table provides the standard printing speed version.

Pin n°	Signal	Pin n°	Signal
1	Vch (heating)	2	Vch
3	Vch	4	Vch
5	Data - in	6	N C
7	OE 5	8	OE 4
9	Thermistor 1	10	Thermistor 2
11	GND	12	GND
13	GND	14	GND
15	GND	16	GND
17	GND	18	GND
19	GND	20	OE 3
21	OE 2	22	OE 1
23	Vcc (logic)	24	Clock
25	Strobe	26	Data - Out
27	Vch	28	Vch
29	Vch	30	Vch



30 pin compatible connectors (to be fitted on the controller board)


connector ZIF 30

Compatible connector suppliers and references: Molex 5597 3951 3304 straight connector
Molex 5597 3951 3303 bent connector
Stocko MZF 9390 60 3030 straight connector
Stocko MZF 8900 60 3030 bent connector

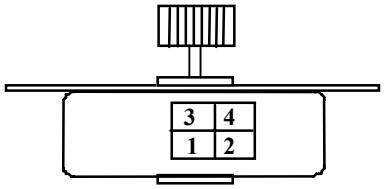
3.3 Paper Feed Motor Characteristics

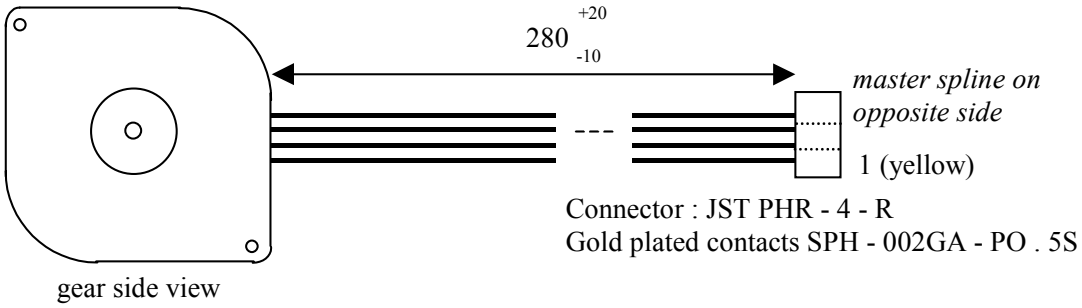
Motor for standard versions:

Recommended control voltage	24	VDC
Coil resistance	8	Ω
Number of phases	2 (Bipolar Chopper 2-2P)	
Paper feed for 1 motor step	0.125	mm
Step angle	7.5 (48 steps per revolution)	°
Recommended control current	500	mA/phase
Maximum starting frequency (with no load)	400	step/s
Maximum speed	1040	step/s
Maximum pull force	600	gr

3.3.1 Motor connections for standard versions (J15)

PIN n°	Wire color
1	yellow
2	orange
3	brown
4	black





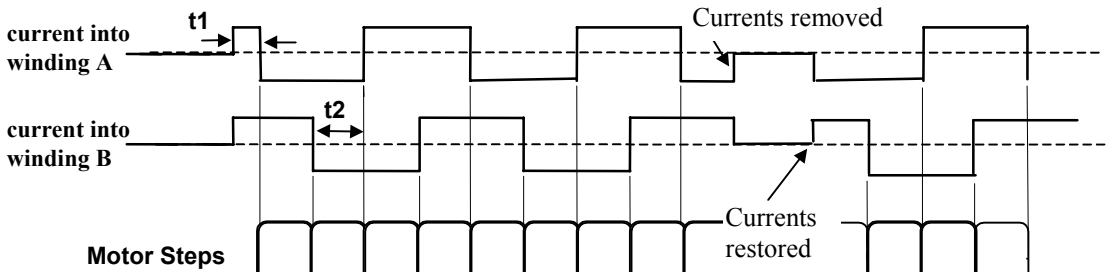
Connector : JST PHR - 4 - R
Gold plated contacts SPH - 002GA - PO . 5S

Corresponding contact to be set on the board:

gold plated	JST B4B-PH-K-G
tin plated	JST B4B-PH-K

3.3.2 Induction sequence and timing for standard motor

	Colour			
Step	**BLACK**	**ORANGE**	**BROWN**	**YELLOW**
1	+	+	-	-
2	-	+	+	-
3	-	-	+	+
4	+	-	-	+



3.3.3 Acceleration curve for standard motor

The following table is an **example** of an acceleration curve that can be used to increase from the maximum starting frequency of motor to 130 mm/s. The curve may need to be modified, depending on the paper roll size and the bucket resistance.

This curve has been designed for a paper roll of 90 mm diameter, not mounted to an axle.

step number	1	2	3	4	5	6	7	8
printing speed (mm/s)	31.25	52	62.5	69.3	71	72.6	89.25	91.9
motor speed (step/second)	250	416	500	555	568	581	714	735
step motor time (µs)	4000	2400	2000	1800	1760	1720	1400	1360

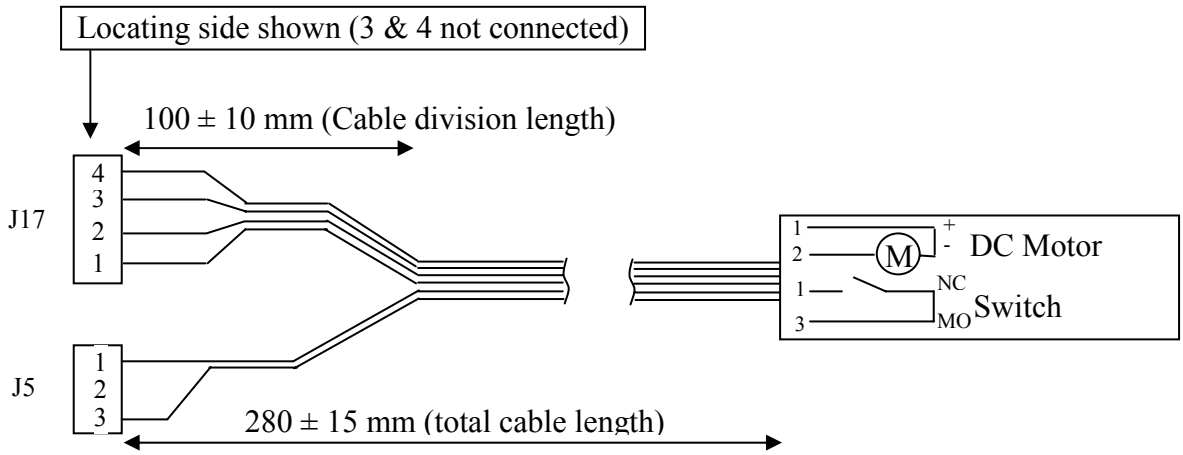
step number	9	10	11	12	13	14	15
printing speed (mm/s)	97.6	104.1	111.6	115.7	120.1	125	130
motor speed (step/second)	781	833	893	926	961	1000	1042
step motor time (µs)	1280	1200	1120	1080	1040	1000	960

It is also recommended to use this curve if lower speed is necessary or to re accelerate from medium speed.
This happens particularly when the dot line heating is divided into several dot groups (for consumption reasons or to avoid going over 60% of dots "on").

3.4 Cutter Motor Characteristics

This cutter is fitted with a DC motor, the blade position is detected by switch.

3.4.1 Motor & switch connections

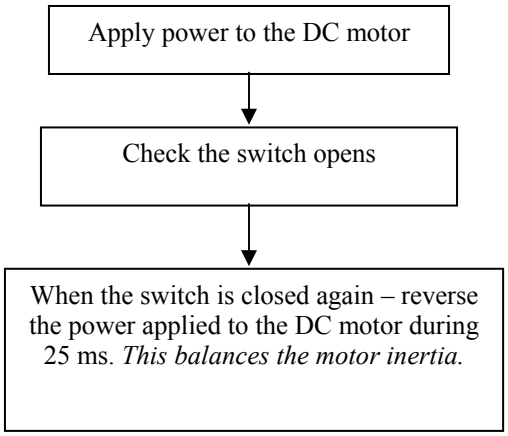


3.4.2 Motor driving

The home position of the cutter guillotine blade is detected by the switch.

It is necessary to test that the switch is closed when powering on, if it is not power the DC motor so that the blade is moved till it closes the switch.

CUT SEQUENCE



Note 1: Only the full cut is available with this mechanism series.
Notes 2: Depending on the application the 25ms can slightly vary – To tweak this timing in your development process, check the switch stays closed (meaning the blade stays in correct position).

3.5 Stepper Motors Electric Control (paper feed)

3.5.1 Used Driver

Even though different motor drivers can be used to apply the cycle described next, Axiohm recommends the use of **L6258EX** from ST.

3.5.2 Driving cycle

There are 4 different conditions for the motor windings:

The sequence is:

$$\mathbf{AB} \Longrightarrow \mathbf{\bar{A}B} \Longrightarrow \mathbf{\overline{AB}} \Longrightarrow \mathbf{A\bar{B}} \Longrightarrow \mathbf{AB}$$

Where

$\mathbf{\bar{A}B}$ **stands for : A = positive**

B = negative

This electrical sequence corresponds to a sequence of 4 consecutive mechanical positions.
The sequence is repeated 12 times for each revolution (24 for cutter motor).

If the phase currents are switched to zero, the position in the sequence must be memorized.
When the winding currents are re-applied, the polarities corresponding to the last known position should be used.
This ensures that the motor will re-start correctly.

Once the initial winding currents have been applied, they must be maintained for a time **t1** (t1 > 2 ms).
Once this time has passed, the motor can be operated if the winding currents are changed in the usual manner.

To take-up the backlash in the gears, please operate the motor for 16 steps before printing.

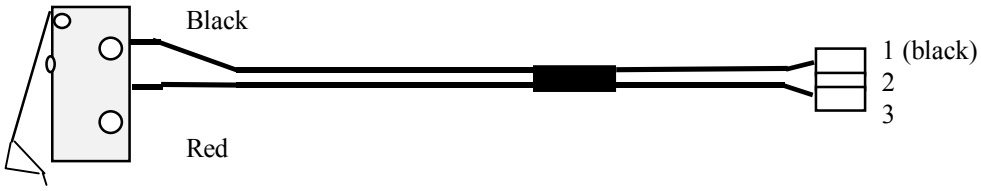
3.6 Sensors

- On DA/DB / TA/TB sensors are used as follows :
- End of Paper: switch (J7).
- Cover Sensor: switch (J6).
- Cutter Blade position: switch (J5).
- TOF opto sensor (only on certain version- J10)

3.6.1 End of paper switch characteristics

- contact resistance :	30 mΩ,
- maximum rating :	100 mA/250 V,
- operating temperature :	-40° C +85° C.

3.6.2 End of paper switch connection (J7)



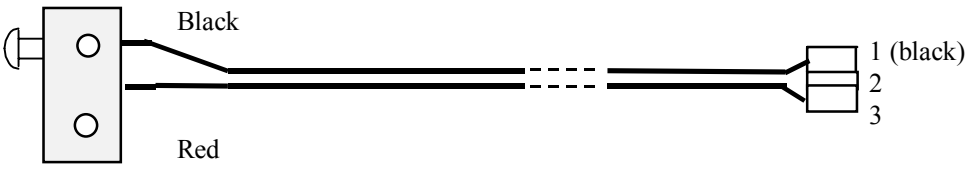
Leads length	: 250 ±5 mm	
Connector	: JST PHR - 3 - Y (yellow)	1 : Black
	golden plated contacts	2 : Not Connected
	SPH - 002GA - P0 . 5S	3 : Red

Corresponding contact to be set on the board:	gold plated	JST B3B-PH-K-G
	tin plated	JST B3B-PH-K

Cover switch characteristics

- contact resistance :	<150 mΩ,
- maximum rating :	10 mA/5 VDC,
- operating temperature :	-40° C +85° C.

3.6.3 Cover switch connection (J6)



Leads length	: 260 ±5 mm	
Connector	: JST PHR - 3 - BL (blue)	1 : Black
	golden plated contacts	2 : Not Connected
	SPH - 002GA - P0 . 5S	3 : Red

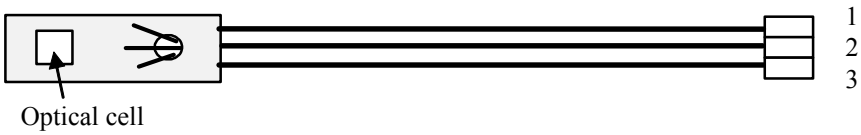
Corresponding contact to be set on the board: same as end of paper switch

3.6.4 Cutter switch characteristics (J5)

- contact resistance : 10 mΩ,
- maximum rating : 5 A/250 V,

3.6.5 Optical sensors characteristics (J10)

Reflective sensor is described below.



Leads length : 360mm ± 10
Connector : JST PHR - 3

1 : Black : Ground
2 : Purple : Diode command
3 : Brown : Transistor reception

Corresponding contact to be set on the board: same as end of paper switch

The optical cell is: Kodenshi SG105F
(see main characteristic on next page)

To use transmitive detection, two identical optical sensors can be placed face to face.
In this case the sensor cell will be the same as described but the connection has to be defined.

For Top of form detector :

It is recommended to have a 0.7 min. Macbeth optical density (20% max. reflectance) to 900NM* infrared light for the black mark on the paper.

* Use the D filter to measure with the Macbeth PCM II
See specifications in chapter 2.5 on Optical sensor position.

Absolute Maximum ratings

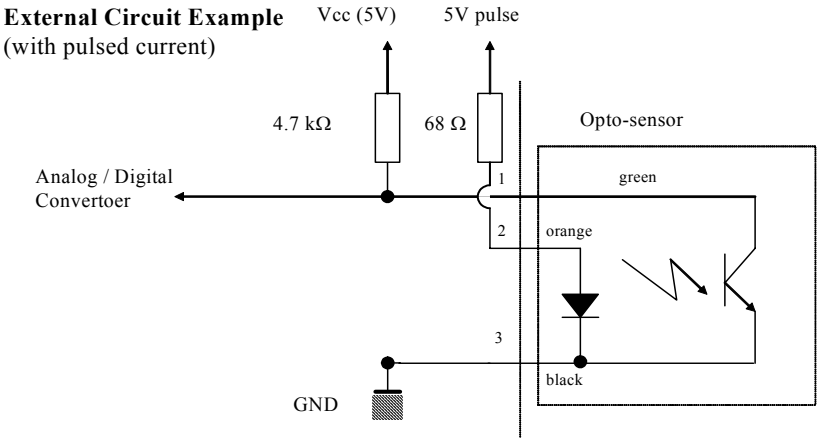
	SYMBOL	RATING	UNIT
LED			
Continuous Forward Current	**If**	**50**	**mA**
Pulsed forward current *	**IFP**	**1**	**A**
Reverse voltage	**VR**	**5**	**V**
Max. Power Dissipation at 25°C max	**P**	**75**	**mW**
PHOTO-TRANSISTOR			
Collector Emitter Voltage	**VCEO**	**30**	**V**
Collector Current	**IC**	**20**	**mA**
Collector Dissipation at 25°C max	**PC**	**50**	**Mw**

Note: Driving the sensor with pulse current allows to use higher current to improve paper detection.
*** (Time On, Time Off) T On = 100µs, T On + T Off = 10 ms**

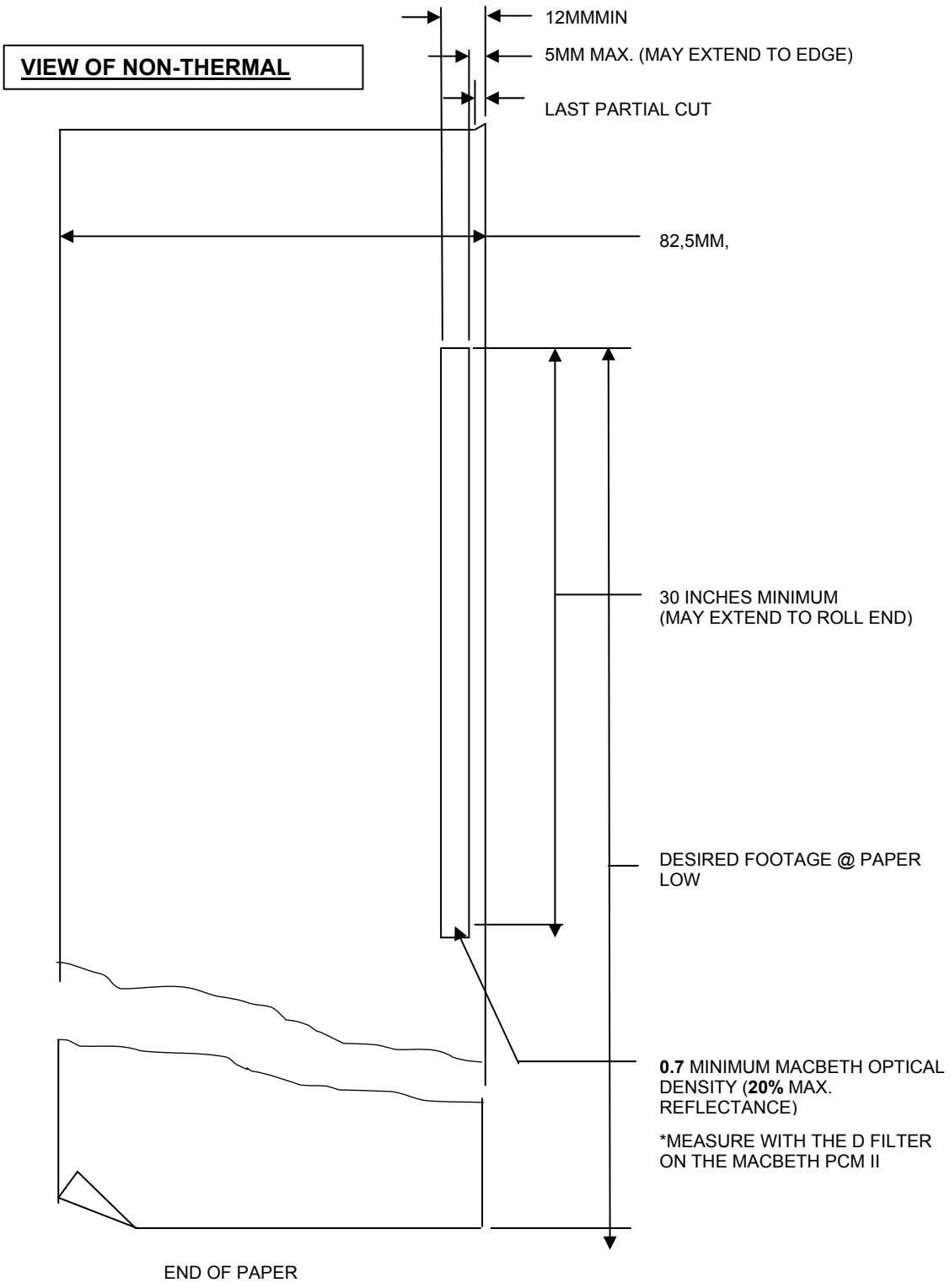
Input/Output Conditions

	SYMBOL	CONDITIONS	Min.	TYP.	Max.	UNIT
LED						
Forward voltage	**VF**	**IF=10 mA**			**1.3**	**V**
Reverse current	**IR**	**VR=5v**			**10**	**µA**
TRANSFER CHARAC.						
Collector dark current	**ICE0**	**VCE=10V**			**200**	**nA**
Light Current	**IL**	**VCE= 5V, IF=10mA**	**90**			**µA**
Leakage Current	**ICE0D**	**VCE= 5V, IF=10mA**			**200**	**nA**
Rise time	**tr**	**VCE= 2V, IC=100µA**		**30**		**µs**
Fall time	**tf**	**RL= 1kΩ**		**25**		**µs**
Peak wave length	**λp**			**940**		**nm**

External Circuit Example
(with pulsed current)



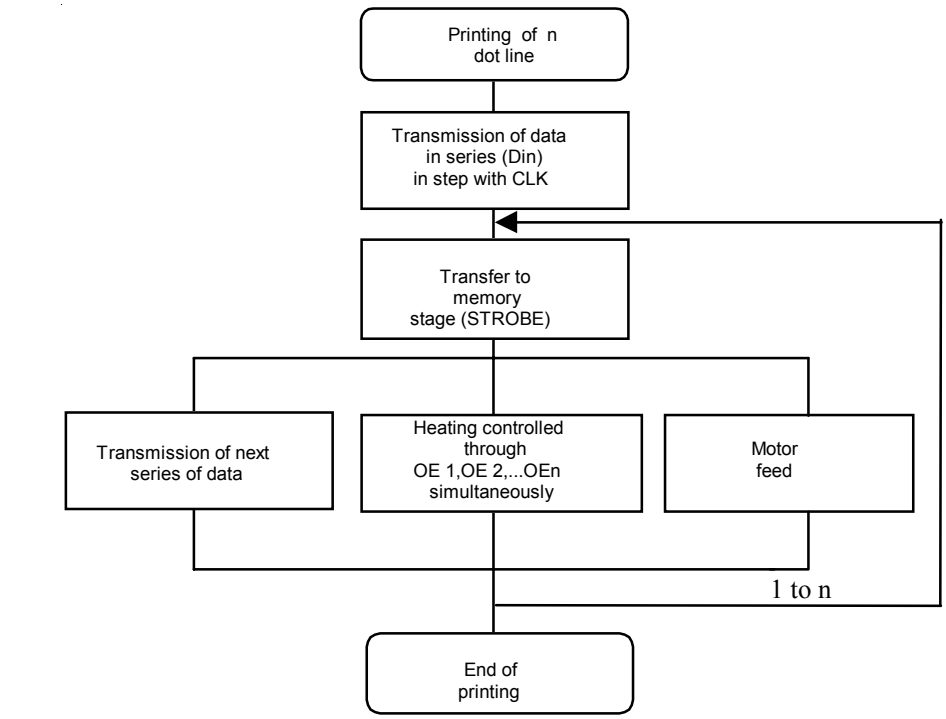
MACHINE READABLE END-OF-ROLL WARNING STRIPE

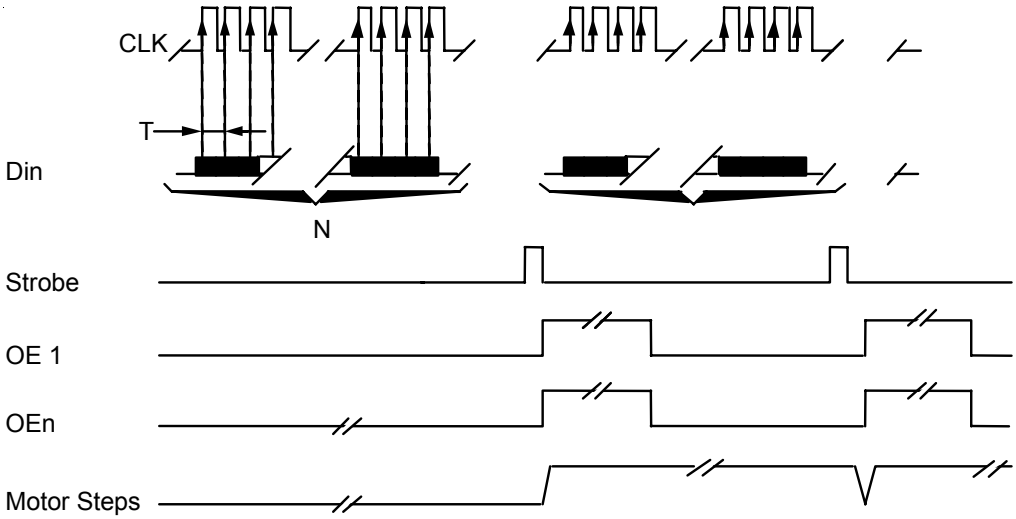


4 PRINTER CONTROL TECHNIC

In order to operate the printer, we depict hereafter the mode that will allow driving the printer with maximum speed.

Mode: 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). This is the most commonly used method with those mechanisms series.



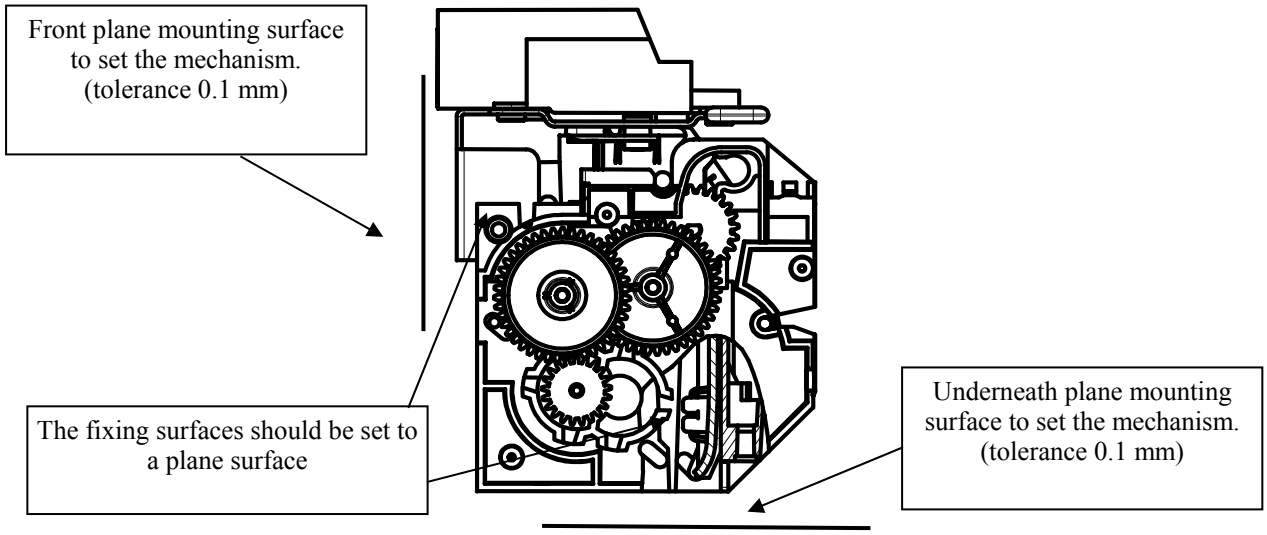


T : Clock frequency

5 RECOMMENDATIONS

5.1 Mechanical Recommendations

1 - Make sure the mechanism is fixed to a plane mounting surface as shown on next drawing.
This is necessary whether the mechanism is mounted to its front or underneath surface.



2 - Never apply mechanical stress to the mechanism (other than the necessary stress to fix the mechanism on a plane surface as described above).
This could result in print-head misalignment and thus degrading the print quality.
A good way to achieve this is to leave some freedom to some of the fixing points.

3 - The thermal print head must have 1 degree of freedom of movement. Never prevent the print head from pivoting on its axis.

5.2 Recommendations for Electronic

IMPORTANT: If the line of dots (Vch, 24 V) is supplied before the control logic (Vcc, 5V), 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, 24V) after the logic supply voltage (Vcc, 5V). When first applying Vch, make sure the OEs level is 0 in order to avoid the dot heating before sending data.

The same precaution should be taken when shutting down. The supply voltage Vch must be switched off before the logic supply voltage Vcc. Care should be taken to allow enough time for residual capacitive charge to dissipate.

To reduce the peak current drawn from the power supply, it is recommended to use a storage capacitor of 1000 to 1200 µF/35V.

5.3 Recommendations for paper

- Use a paper classified with an AXIOHM Part number (or approved by Axiohm).
- Make sure the paper stock spool is free to turn.
- With the acceleration curve of the paper feed motor given in this manual, the paper feed motor can pull with a maximum force (see chart in chapters 3.2 and 3.3) without affecting the printing quality. For common rolls of paper (and on common supports) this force corresponds to a roll diameter of 115mm sliding in its bucket. Above this value (or if the bucket and paper path friction are high), use an axle to set the roll (maximum diameter 200mm). If bigger rolls are required contact your Axiohm representative: a specific mechanical design and/or a specific acceleration curve may be required, and the printing speed may be affected.
- The roll of paper **must** be exactly "**on line**" (perpendicular to the printer mechanism) and parallel to the paper inlet in order to avoid paper tracking. Paper inlet path must be designed to avoid obstacles on paper edges.
- The printer should not operate without paper or this will damage the surface of the rubber roller.
- Note that the sensitivity of the paper has a direct impact on the mechanism's performance (in terms of speed). Make sure the chosen paper corresponds to your needs.

5.5 Cleaning your printer

The TA/TB DA/DB printer mechanism is a high reliability unit, which requires very little maintenance, but can benefit from cleaning as follows.

Depending on the environment in which the printer is used, the printer can accumulate dust.
Therefore it is necessary to clean it periodically in order to maintain good print quality.

The frequency of cleaning also depends on the environment and the use of the printer; but, the print head should be cleaned at least once a year, or up to one month in heavy duty applications.

The print head should always be cleaned immediately if the print becomes visibly fainter due to contamination of the print head.

Cleaning instructions:
Switch off printer. Never clean the head immediately after printing for the head may be hot.

Open the cover of the printer and remove the roll of paper roll.

Clean the heating dots of the head with a cotton stick containing a solvent alcohol (ethanol, methanol, or IPA), but do not touch the print head with your fingers.

Allow the solvent to dry.

Reload the paper and close the cover.

N.B.: AXIOHM can provide cleaning kits P/N: CK80000A

5.6 General Recommendations

- Ensure that there is adequate air circulation around the print head support/heat sink, for poor ventilation of the print head can degrade the print quality.
- Depending on the uses (high current set in the motor phases, integration of the mechanism in a very tight housing, high temperature), it may be necessary to set a duty cycle time to avoid overheating of the paper feed motor. In this case, tests must be made by the mechanism integrator. The temperature should not exceed 80°C on the motor frame.
- For Clamshell applications, the mechanism cannot be opened when the rotating blade is stopped in its cutting position. The rotating blade must be in such a position that the paper path is opened (cutter switch closed).
- Never open the mechanism while printing or when the cutter is operating.
- **Duty cycle restrictions :**

  There are restrictions on the duty cycle because of the heat generated by the receipt thermal print head, when printing solid blocks (regardless of the length of the block in relation to the print line). The restrictions are ambient temperature, the percentage of time (measured over one minute) of continuous solid printing, and the amount of coverage. Another cause for duty cycle restriction is paper feed motor temperature increase due to continuous printing.

Allowable Duty Cycle (measured over one minute of continuous printing)

Amount of Solid Coverage	Ambient Temperature		
	25°C	35° C	50° C
20%	100% during the first 3 minutes of continuous printing. 50% after 3 minutes.	50%	20%
40%	50%	25%	10%
100%	20%	10%	4%

For reference:

- A typical receipt with text (contains some blank spaces) is approximately 12% dot coverage.
- A full line of text characters (every cell on the line has a character in it) is approximately 25% dot coverage.
- Graphics are approximately 40% dot coverage.
- Barcodes are approximately 50% dot coverage.
- A solid black line is 100% dot coverage.

6 APPENDICES

6.1 APPENDIX 1 : PRINT-HEAD THERMISTOR

GENERAL CHARACTERISTICS	
Maximum operating temperatures	**-50° C to + 400° C**
Rated resistance at 25° C	**Rn = 30 kΩ**
Tolerance for Rn	**5 %**
Thermal dissipation constant	**> 0.3 mW/°C**
Thermistor time constant (in air)	**t = 1.5 sec**

This thermistor has a rated value of 30 kΩ. Its resistance variation can be expressed as follows:

$R = Rn \exp B \left(\frac{1}{T} - \frac{1}{Tn}\right)$ where T is in Kelvin degrees (°K)

B = 3950° K ± 3%

Rn = reference value at temperature Tn (298° K)

Note: that printing should be stopped if the thermistor value goes over 60°C.

6.2 APPENDIX 2 : PAPER CHARACTERISTICS

6.2.1 Paper width dimensions

Paper roll width dimensions should meet the following specifications to ensure correct operation of the printer mechanism.

Product	Paper width	Tolerance
DAxx / TAxx	80	± 0.3
DBxx / TBxx	82.5	+0 -0.4

6.2.2 Recommended paper characteristics

Kanzan KL415 SB+

Typical properties of KL415 SB+

Properties	Value	Units	Test method
Basis weight	182 ± 12	g / m^2	ISO 536 (JIS P8124)
Thickness	183 ± 12	µm	ISO 534 (JIS P8124)
Brightness	75 min.	%	ISO 2470 (JIS P8123)
Smoothness	500 min.	Sec	ISO 5627 (JIS P8119)
Image colour	black	-	
Initial activation T°	70 ± 5	°C	(D) = 0.2
Effective activation T°	80 ± 5	°C	(D) = 0.8
Tensile strength (MD/CD)	>6.8/>3.4	Kn/m	ISO 1924/1
Tearing strength (MD/CD)	>950/>950	mN	ISO 1974

Typical Properties of Appleton Optima T886-B

Topic	Value	Unit
Basis Weight	82.3 ± 4.1	g/m^2
Calliper	81.3 ± 7	Microns
Static temperature response for O.D. = 0.2	79.4 ± 5	°C
Static temperature response for O.D. = 1	93 ± 5	°C

(With this paper an average factor of 1.45 should be applied to the heating time given; this affects the printing speed as explained in the chapter 6.3 "Heating time calculations ")

Typical properties of Blumberg T49-32

Properties	Value	Units	Test method
Basis weight	88 ± 3.5	g / m^2	ISO 536 (JIS P8124)
Calliper	77 ± 3	µm	ISO 534 (JIS P8124)
Brightness	70 min.	%	ISO 2470 (JIS P8123)
Smoothness	>350	Sec	ISO 5627 (JIS P8119)
Image colour	black	-	
Initial activation T°	70 ± 5	°C	O.D.*) = 0.1
Effective activation T°	115 ± 5	°C	O.D.*) = 1.3
Tensile strength (CD)	> 2 min.	KN/m	ISO 1924 (JIS P8113)
Tear strength (CD)	> 300	mN	ISO 1924 (JIS P8116)
Head cleaning frequency	10 maxi.	km	

Typical properties of Mitsubishi TP 8065

Properties	Value	Units	Test method
Basis weight	82 ± 5	g / m^2	ISO 536
Calliper	87 ± 5	µm	ISO 534
Brightness (R457)	92 ± 4	%	ISO 2469
Smoothness (Bekk)	750 ± 250	Sec	ISO 5627
Image colour	Black	-	-
Initial activation T°	85	°C	-
Effective activation T°	100	°C	-
Tensile strength (CD)	80 ± 10	N/15mm	ISO 1924/1
Tear strength (CD)	40 ± 10	N/15mm	ISO 1924/1
Head cleaning frequency	*	-	-

Typical properties of Kanzaki Lotto 480

Properties	Value	Units	Test method
Basis weight	83.2	g / $m^{2\ avg}$	TAPPI T-410
Calliper	83.3	µm avg	TAPPI T-411
Brightness	89	% avg	TAPPI T-525
Smoothness	1500	Sec avg	TAPPI T-479
Image colour	Black	-	-
Initial activation T°	80 ± 5	°C	-
Effective activation T°	90 ± 5	°C	-
Head cleaning frequency	*	-	-

Typical properties of Sihl PrintTherm 80 P 7 CS

Properties	Value	Units	Test method
Basis weight	82 ± 8	g / m^2	ISO 536
Calliper	83 ± 8	µm	ISO 534
Brightness	> 75	%	ISO 2470
Smoothness	> 500	Sec	ISO 5627
Image colour	Black	-	-
Initial activation T°	78	°C	-
Effective activation T°	105	°C	-
Head cleaning frequency	*	-	-

* Refer to chapter "Cleaning your printer".

6.3 APPENDIX 3 : HEATING TIME CALCULATION

6.3.1 Real heating times

Heating time versus voltage and temperature:

Tch (saturation heating time)	0,440 ms
Température statique	100 °C

Heating Time vs Speed	
Voltage	24 Volts
Temperature	25 °C
Paper	KL415SB+
Coeff "a"	0,3826
Coeff "b"	1,0150

At Nominal Voltage & Nominal Temperature

$$t_2 = t_1 \times (a \times Log(tm) + b)$$

t_m = Time for motor step (ms)

Heating Time vs Temperature	
Voltage	24 Volts
Speed	130mm/s
Paper	KL415SB+
Coeff "c"	-0,0087
Coeff "d"	1,2175
Coeff "g"	-0,00000161
Coeff "h"	0,000173
Coeff "i"	-0,013690
Coeff "j"	1,259449

At Nominal Speed & Nominal Voltage

$$t_3 = t_2 \times (cT + d)$$

For polynomial modelisation *

$$t_3 = t_2 \times (g \times T^3 + hT^2 \times iT + J)$$

Heating Time vs Voltage	
Temperature	25 °C
Speed	130mm/s
Paper	KL415SB+
Coeff "e"	1,1192
Coeff "f"	-2,6037

At nominal Temperature & Speed

$$V' = eV + f$$

*: Recommended by Axiohm (more accurate)

6.3.2 History control

The history coefficient depends on the speed (explained below).
It gives the reduction (in %) of the TCH (nominal heating time), which has to be applied on a dot previously heated (on N-1 or N-2 dot line).

Paper feed motor control parameters:

Min Speed = 23 mm/sec
Max Speed = 130 mm/sec
Ramp Size = 32

Speed = MIN_SPEED + (MAX_SPEED - MIN_SPEED) x Index / (RAMP_SIZE-1)

History control :

Tb = (COEFA x ln(6.25) + COEFB)

Tb = 1,716

TbTmp = (COEFA x ln(StepTime/1000) + COEFB)
HistTmp = 110 x (Tb-TbTmp) / Tb

if (HistTmp < 0) HistCoef = 0 else HistCoef = HistTmp

Index	Step Time (µs)	Speed (mm/sec)	History Coef (%)
0	5435	23	3
1	4726	26	6
2	4180	30	8
3	3748	33	11
4	3396	37	13
5	3105	40	15
6	2860	44	17
7	2650	47	19
8	2470	51	20
9	2312	54	22
10	2173	58	23
11	2050	61	24
12	1940	64	26
13	1842	68	27
14	1753	71	28
15	1672	75	29
16	1598	78	30
17	1530	82	31
18	1468	85	32
19	1411	89	33
20	1358	92	34
21	1309	95	34
22	1263	99	35
23	1221	102	36
24	1181	106	37
25	1144	109	37
26	1109	113	38
27	1076	116	39
28	1045	120	39
29	1015	123	40
30	988	127	41
31	962	130	41

History control				
Raster (N)	1	1	1	1
Raster (N-1)	0	0	1	1
Raster (N-2)	0	1	0	1
HistoryEn	0	1	1	1

Actual heating time =

TCH x (1 - HistoryCoef x HistoryEn)

APPENDIX 4 : HEATING TIME

The heating timetable is presented on the following page *(given for paper: KL415SB+)*
The print-head resistance to obtain this table was 950 Ω.
The timetable gives the required heating time, giving the necessary energy to obtain an optical density of 1.2.

The heating time must always be shorter than the motor cycle time.

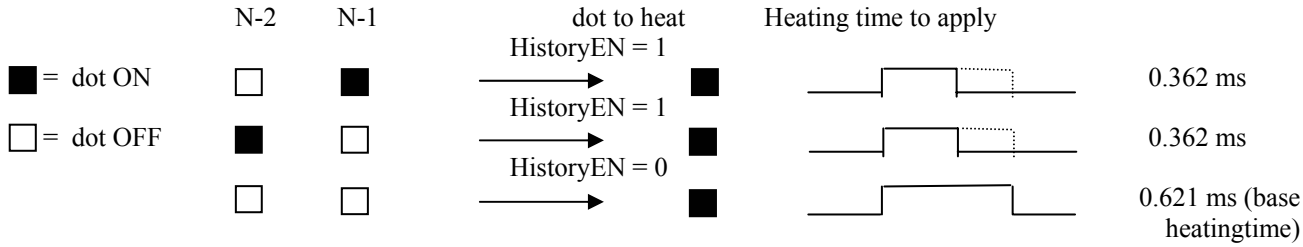
How to use the heating timetable?
The heating time can be controlled either with or without historical control as described here after.

Without historical control:
- Take the indicated heating time from the timetable (definition of voltage and temperature and speed)
- We do not take into account the history control (⇒ History EN always = 1).
- At high speed, printing quality for isolated dots might be affected with this method.

> ***Example***: at 130mm/s, 25°C and 24 volts
> TCH = 362 µs (from the table)
> In this mode only one serialisation of data is necessary for one dot line.

With historical control:
- In this mode, the actual heating time is different depending on if the dots have been previously heated or not. (History EN = 1 or 0)
- This method gives the best printing quality.
- With this mode, two serialisation data are necessary for one dot line.
- The first one will be all the data, and the second one will be only the dots not heated previously on lines (N-1) and (N-2).

> ***Example***: at 130 mm/s, 25°C and 24 volts:



Heating time table

Paper: KL 415 SB

Voltage (V) Real	Virtual	Temperature (°C)	Speed (mm/s) < 20 mm/s	50 mm/s	70 mm/s	80 mm/s	R= 942 Ohms 90 mm/s	100 mm/s	110 mm/s	130 mm/s
Temps moteur pour un pas			6,250 ms	2,500 ms	1,790 ms	2,500 ms	1,790 ms	1,560 ms	1,390 ms	1,250 ms
Temps moteur pour une sous ligne			6,250 ms	2,500 ms	1,790 ms	2,500 ms	1,790 ms	1,560 ms	1,390 ms	1,250 ms
20,00	**19,78**	**0 °C**	1,176 ms	0,936 ms	0,848 ms	0,812 ms	0,782 ms	0,754 ms	<None>	<None>
20,00	**19,78**	**10 °C**	1,063 ms	0,846 ms	0,767 ms	0,734 ms	0,707 ms	0,682 ms	0,660 ms	<None>
20,00	**19,78**	**20 °C**	0,973 ms	0,774 ms	0,702 ms	0,672 ms	0,647 ms	0,624 ms	0,604 ms	<None>
20,00	**19,78**	**25 °C**	0,934 ms	0,743 ms	0,674 ms	0,645 ms	0,621 ms	0,599 ms	0,580 ms	0,544 ms
20,00	**19,78**	**30 °C**	0,897 ms	0,714 ms	0,647 ms	0,620 ms	0,597 ms	0,575 ms	0,557 ms	0,523 ms
20,00	**19,78**	**40 °C**	0,827 ms	0,658 ms	0,596 ms	0,571 ms	0,550 ms	0,530 ms	0,513 ms	0,482 ms
20,00	**19,78**	**50 °C**	0,753 ms	0,599 ms	0,543 ms	0,520 ms	0,501 ms	0,483 ms	0,467 ms	0,438 ms
22,00	**22,02**	**0 °C**	0,949 ms	0,755 ms	0,685 ms	0,655 ms	0,631 ms	0,609 ms	0,589 ms	0,553 ms
22,00	**22,02**	**10 °C**	0,858 ms	0,683 ms	0,619 ms	0,592 ms	0,570 ms	0,550 ms	0,532 ms	0,500 ms
22,00	**22,02**	**20 °C**	0,785 ms	0,625 ms	0,566 ms	0,542 ms	0,522 ms	0,503 ms	0,487 ms	0,457 ms
22,00	**22,02**	**25 °C**	0,754 ms	0,600 ms	0,544 ms	0,521 ms	0,501 ms	0,483 ms	0,468 ms	0,439 ms
22,00	**22,02**	**30 °C**	0,724 ms	0,576 ms	0,522 ms	0,500 ms	0,481 ms	0,464 ms	0,449 ms	0,422 ms
22,00	**22,02**	**40 °C**	0,667 ms	0,531 ms	0,481 ms	0,461 ms	0,444 ms	0,428 ms	0,414 ms	0,389 ms
22,00	**22,02**	**50 °C**	0,608 ms	0,483 ms	0,438 ms	0,420 ms	0,404 ms	0,390 ms	0,377 ms	0,354 ms
24,00	**24,26**	**5 °C**	0,742 ms	0,591 ms	0,535 ms	0,512 ms	0,493 ms	0,476 ms	0,461 ms	0,432 ms
24,00	**24,26**	**10 °C**	0,707 ms	0,562 ms	0,510 ms	0,488 ms	0,470 ms	0,453 ms	0,439 ms	0,412 ms
24,00	**24,26**	**20 °C**	0,647 ms	0,515 ms	0,467 ms	0,447 ms	0,430 ms	0,415 ms	0,402 ms	0,377 ms
24,00	**24,26**	**25 °C**	0,621 ms	0,494 ms	0,448 ms	0,429 ms	0,413 ms	0,398 ms	0,385 ms	0,362 ms
24,00	**24,26**	**30 °C**	0,597 ms	0,475 ms	0,430 ms	0,412 ms	0,397 ms	0,383 ms	0,370 ms	0,347 ms
24,00	**24,26**	**40 °C**	0,550 ms	0,438 ms	0,397 ms	0,380 ms	0,366 ms	0,353 ms	0,341 ms	0,320 ms
24,00	**24,26**	**50 °C**	0,501 ms	0,398 ms	0,361 ms	0,346 ms	0,333 ms	0,321 ms	0,311 ms	0,292 ms
26,00	**26,49**	**0 °C**	0,655 ms	0,522 ms	0,473 ms	0,453 ms	0,436 ms	0,420 ms	0,407 ms	0,382 ms
26,00	**26,49**	**10 °C**	0,592 ms	0,471 ms	0,427 ms	0,409 ms	0,394 ms	0,380 ms	0,368 ms	0,345 ms
26,00	**26,49**	**20 °C**	0,542 ms	0,432 ms	0,391 ms	0,375 ms	0,361 ms	0,348 ms	0,337 ms	0,316 ms
26,00	**26,49**	**25 °C**	0,521 ms	0,414 ms	0,375 ms	0,359 ms	0,346 ms	0,334 ms	0,323 ms	0,303 ms
26,00	**26,49**	**30 °C**	0,500 ms	0,398 ms	0,361 ms	0,345 ms	0,333 ms	0,321 ms	0,310 ms	0,291 ms
26,00	**26,49**	**40 °C**	0,461 ms	0,367 ms	0,332 ms	0,318 ms	0,306 ms	0,296 ms	0,286 ms	0,268 ms
26,00	**26,49**	**50 °C**	0,334 ms	0,303 ms	0,290 ms	0,279 ms	0,269 ms	0,260 ms	0,244 ms	0,334 ms
28,00	**28,73**	**0 °C**	0,443 ms	0,402 ms	0,385 ms	0,371 ms	0,357 ms	0,346 ms	0,325 ms	0,443 ms
28,00	**28,73**	**10 °C**	0,401 ms	0,363 ms	0,348 ms	0,335 ms	0,323 ms	0,313 ms	0,293 ms	0,401 ms
28,00	**28,73**	**20 °C**	0,367 ms	0,333 ms	0,318 ms	0,307 ms	0,296 ms	0,286 ms	0,269 ms	0,367 ms
28,00	**28,73**	**25 °C**	0,352 ms	0,319 ms	0,306 ms	0,294 ms	0,284 ms	0,275 ms	0,258 ms	0,352 ms
28,00	**28,73**	**30 °C**	0,338 ms	0,307 ms	0,294 ms	0,283 ms	0,273 ms	0,264 ms	0,248 ms	0,338 ms
28,00	**28,73**	**40 °C**	0,312 ms	0,283 ms	0,271 ms	0,261 ms	0,251 ms	0,243 ms	0,228 ms	0,312 ms