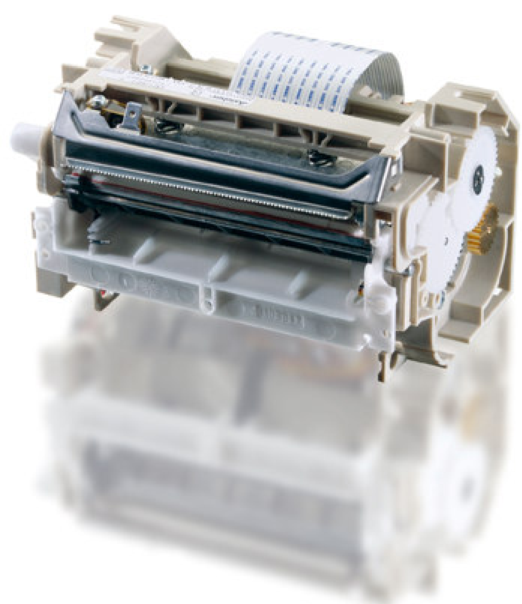
THERMAL PRINTER MECHANISM

80-82.5 Printer Mechanisms

XA / XB
PREMIUM VERSION

USER MANUAL

Reference 3107046
Issue A
May 2007



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EVOLUTIONS

Date	Issue	Modifications
01/2002	Preliminary	
02/2003	Z	Creation
05/2007	A	Suppression of Kits & Modification of Heating Time Table

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”.

CONTENTS

1 SUMMARY OF PRINTER SPECIFICATIONS

The following table provides the main specifications of the CA/XA and CB/XB mechanism series.

FEATURE	VALUE	UNIT
Printing method	Static thermal dot line printing	---
Paper loading	Front and bottom	---
Number of resistor dots	640	dots
Resolution	8	Dots/mm
Printing width	72 / 80	mm
Maximum Printing speed *	250	mm/s
Paper width	80 / 82.5	mm
Head temperature detection	By Thermistor	---
Number of steps / dot line	1	steps
Paper feed / dot line	0.125	mm
Out of paper detection	Standard : switch Option : optical-sensor	---
Operating voltage range Vcc (logic)	4.75 - 7	V DC
Operating voltage range Vch (dot)	22 - 26	V DC
Over all dimensions: Width Depth Height	139.5 78 85	mm
Weight (average)	600	g
Storage temperature range	- 20 to + 70	°C
Operating temperature range	0 to +50	°C
Relative humidity range (no condensing)	20 to 90 (up to 25°C) 20 to 80 (up to 50°C)	%
Safety certifications	UL recognized according to : - UL 60950 third edition - CSA 60950	

* The printing speed of the mechanism depends on three main parameters: the driving software of the mechanism, the paper sensitivity, and the temperature at which the mechanism is *used (see the chapter 6.3 "Heating time" for more details on this topic)*.
** Per Axiohm conditions (*see following page*)

Two options are available for paper path :

- rear paper path (with or without clamshell)
- straight paper path (without clamshell)

The following table provides the reliability features, according to the recommended paper reference.

RECOMMENDED PAPER / SUPPLIER	**Kanzan KLS 46**	**Unit**
Paper thickness	80	g / m^2
Print head electrical lifetime*	2×10^8	pulses
Print head mechanical lifetime due to abrasion	100	km
General mechanical lifetime (all components except for the print head) *	150	km
Cutter lifetime	1×10^6	cuts
Preheating required	Yes	

* The reliability of the head depends on the number of pulses applied to the dots. With the resolution of this print head (8 dots per mm), if the dots are used with 25% of duty and submitted to 2×10^8 pulses, the print head can reach 100 km. The number of pulses that can be applied to the head depends on the heating time. Thus for paper sensitivity, that is why this value varies according to the paper used, and why preheating may be required to achieve the print head lifetime.

Example: if the printing duty of dots is 20%.
The print head reliability is: $((2 \times 10^8) \times 5) / 8 = 1.25 \times 10^8$ mm = 125 km

The duty value for text printing can be estimated at about 25%.

Notes:

- These results are given with AXIOHM standard test conditions which are mainly: 24V, 25℃, and use of the recommended paper.
- For low temperature applications, preheating of the head may be implemented to improve print speed performance.
- Description of the preheating process:

Preheating of the thermal head is achieved by heating alternatively the even and odd points of the head with short pulses defined as follows:

TON = 80 µs (even and odd points)
TOFF = 1920 µs

This pulse time is defined for heating the head without marking the paper.

The temperature is regulated by a hysteresis control.
Low time = 30° C
High time = 35° C

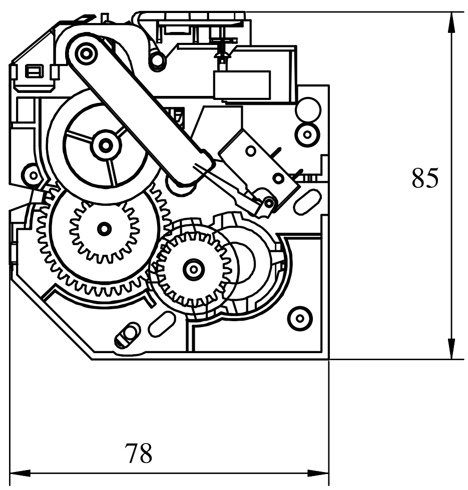
Preheating only when paper is present.

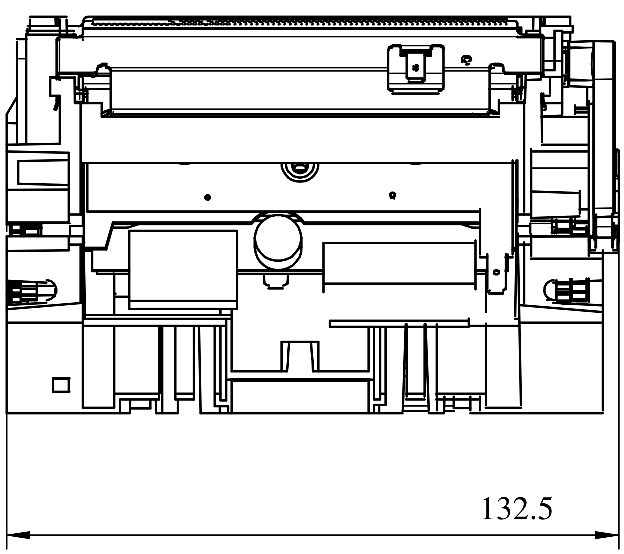
2 MECHANICAL DIMENSIONS

2.1 Overall Dimensions

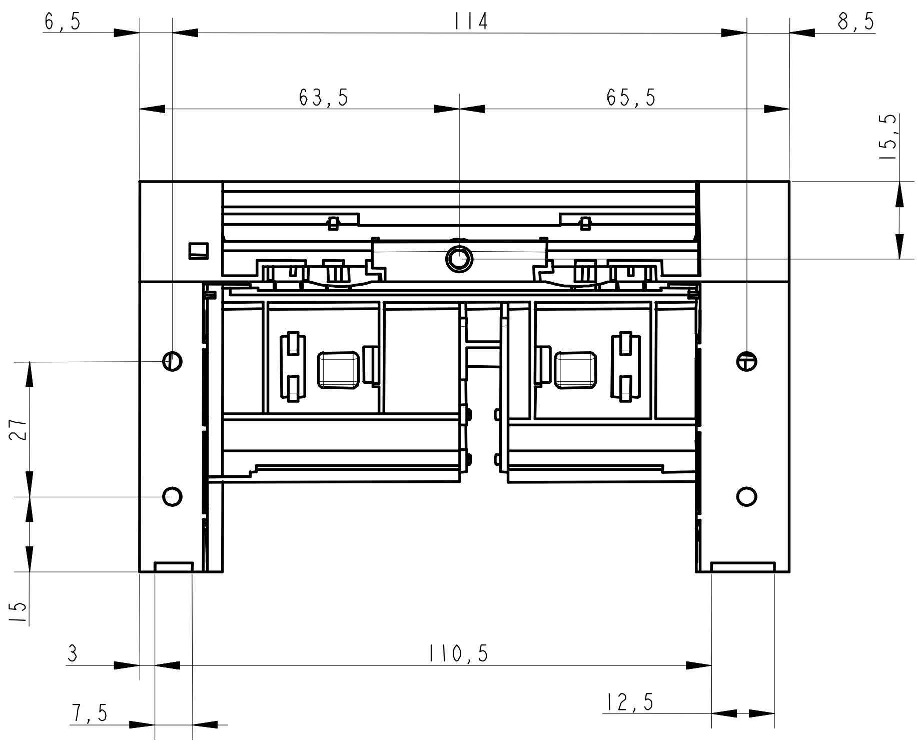
Dimensions without Axiohm's integrated cover

Height & Depth



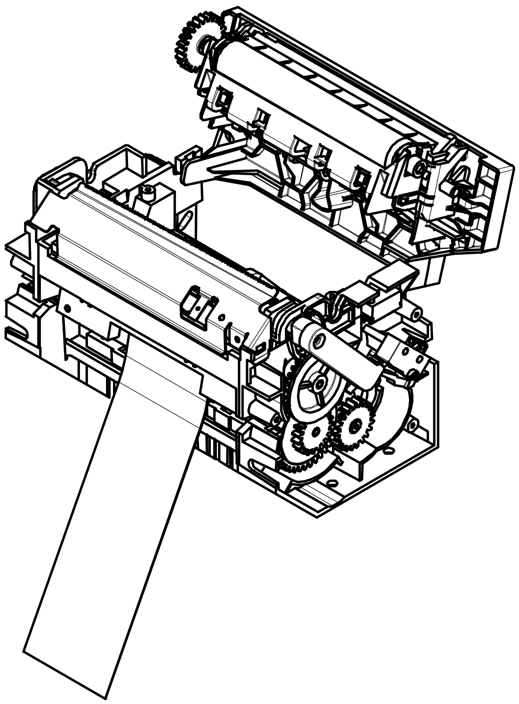


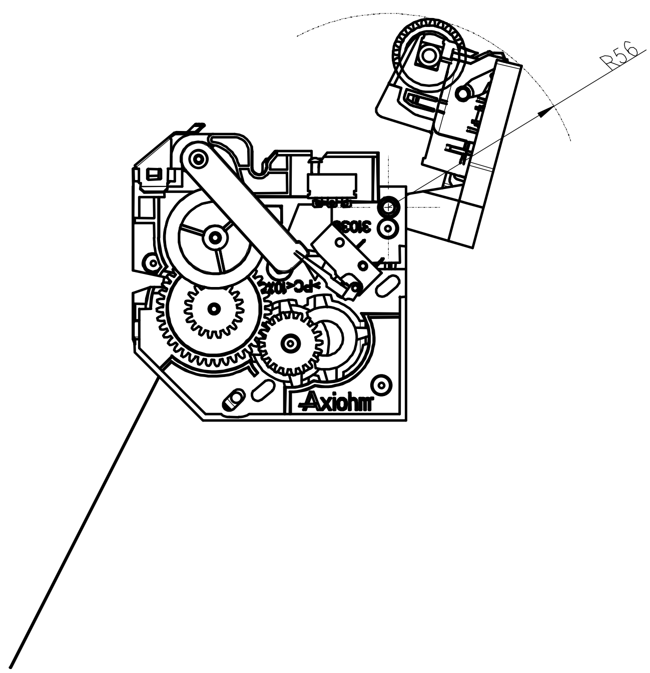
Width

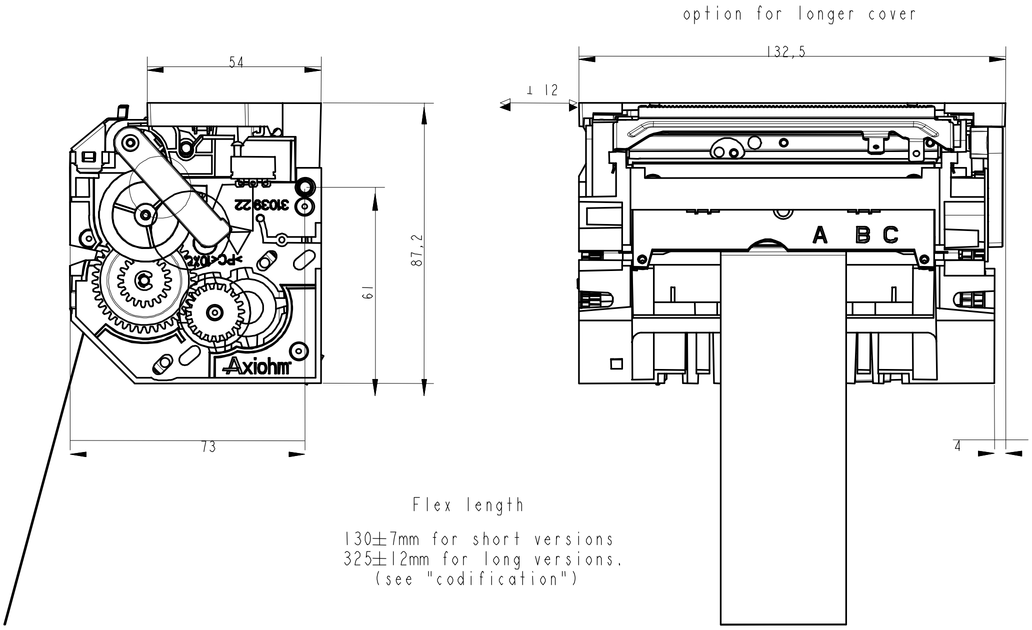


Fixing Elements

2.1.1 Dimensions with Axiohm's integrated cover



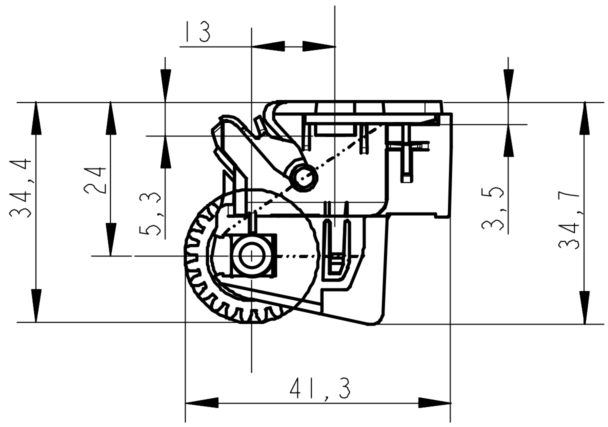


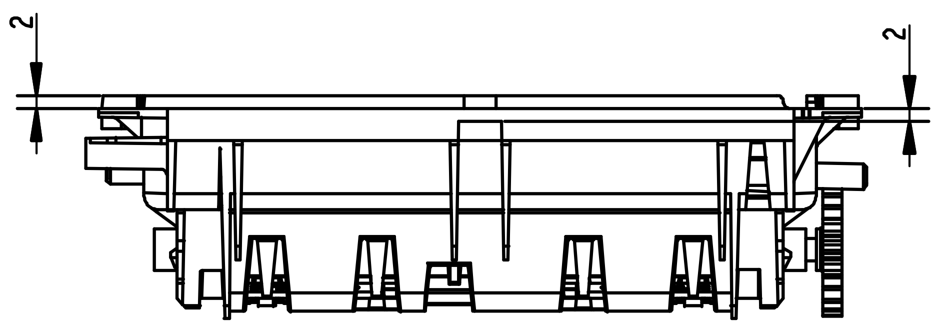


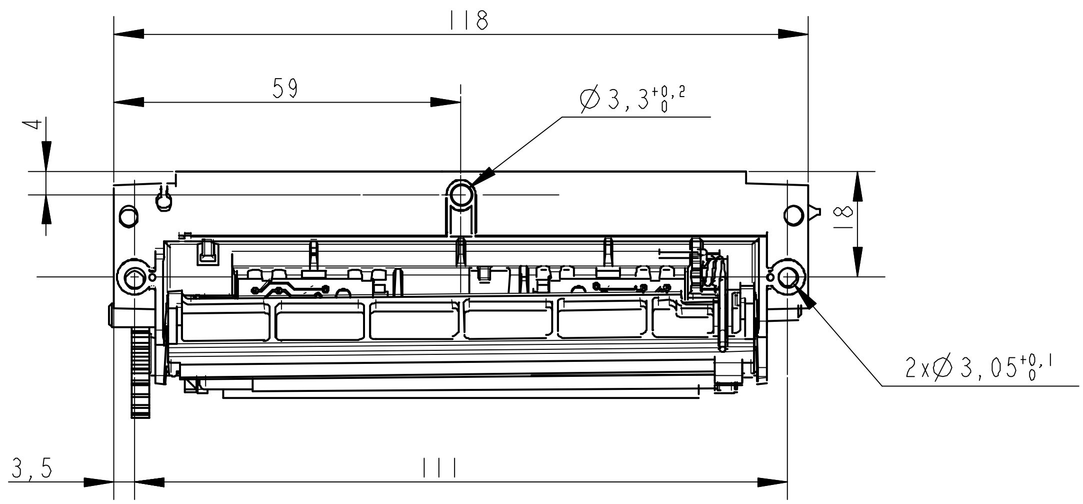
Notes:

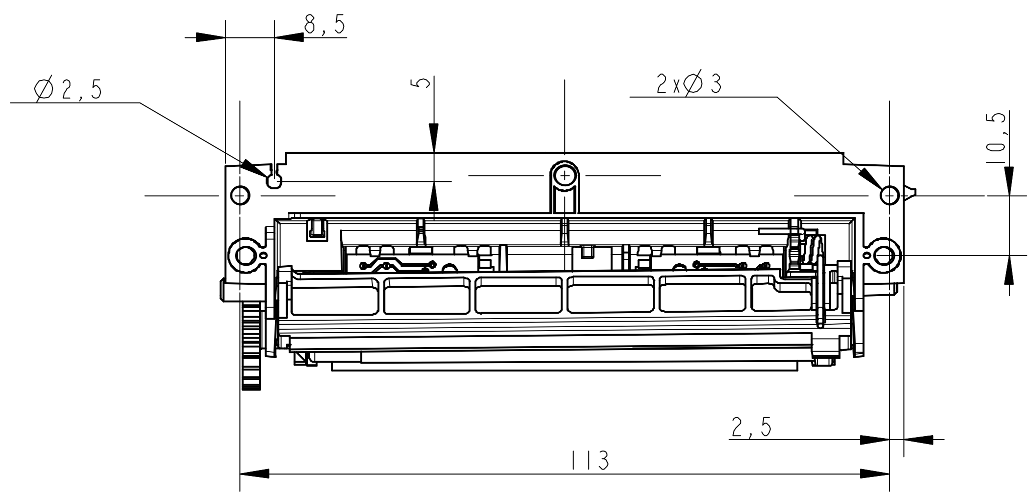
- The cover width is the same as the mechanism width (outside dimension).
- If no cutter is set on the mechanism (for CA/CB), the cover exceeds the rest of the mechanism by 4 mm as shown above.
- For easier opening, another cover is available; it exceeds by an extra 12 mm on one side of the mechanism.
- Other dimensions are the same with or without cover.

2.2 Platen Holder for Customized Cover



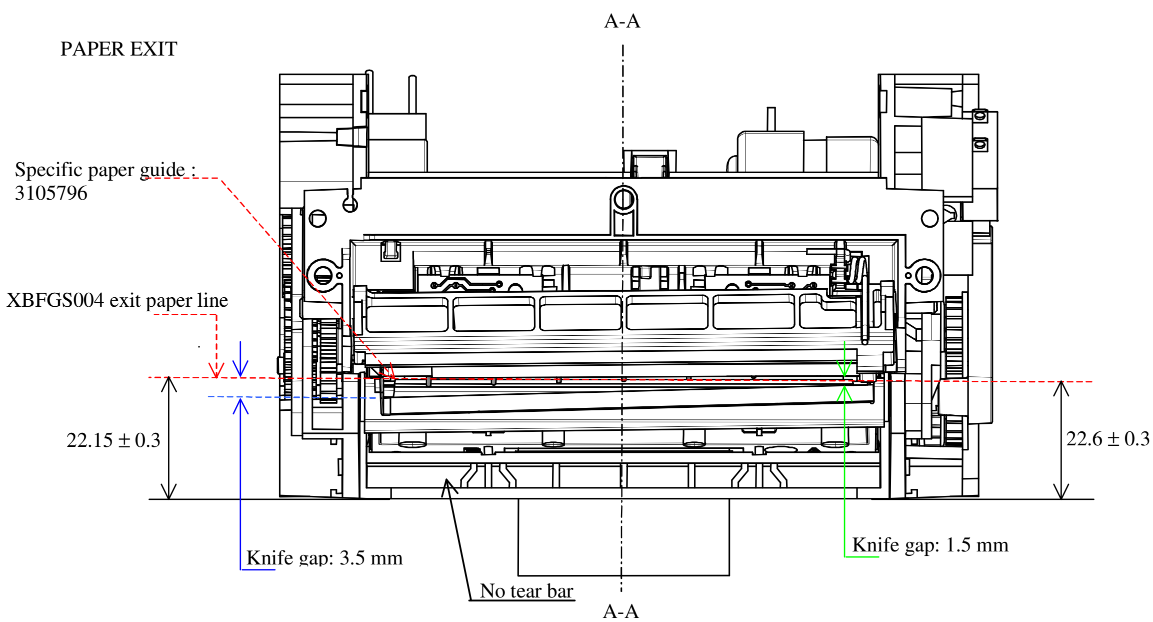



118
59
Ø3,3 +0,2 0
4
18
2xØ3,05 +0,1 0
3,5
111


8,5
Ø2,5
5
2xØ3
10,5
2,5
113

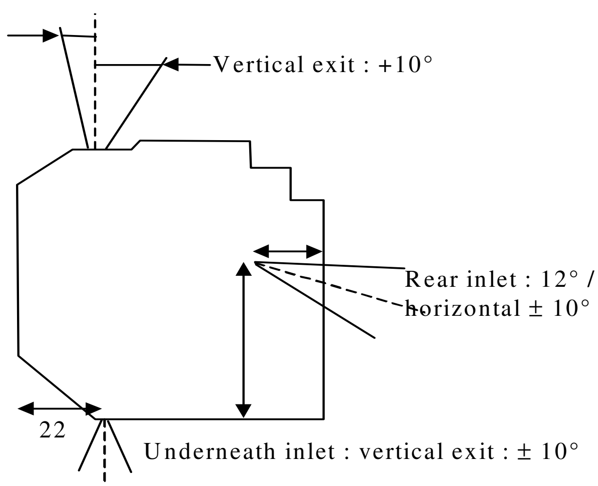
2.3 Paper Entry and Exit

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 not to bend the paper too much or this will create jam.
The design of the mechanism guide at the paper exit is optimized to avoid dust accumulation when cutting. 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.



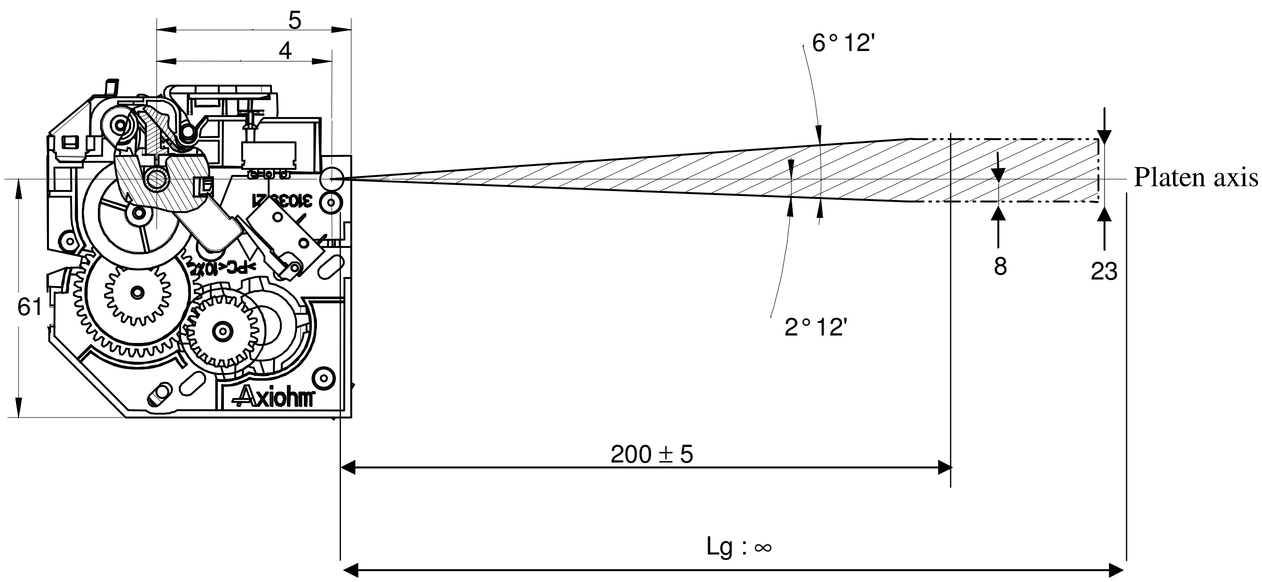
PAPER EXIT ANGLE

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



2.4 Axis Position for Customized Cover

The following drawing portrays the area in which it is possible to set the cover axis. The position is given in reference to the platen axis (when set in the mechanism) and to the cover axis when Axiohm's cover is used.
The cover axis has to be parallel to the platen axis.



Notes:

There must be clearance in the cover hinge so that the position of the platen holder is adjusted to the mechanism, with the help of the fixed blade support axle.

The cover cannot be opened or closed if the rotating blade is not in its "open" position (cutter switch closed).
Forcing to close the cover will damage the blades.

2.5 Optical Sensor Position

The position of the Optical sensor in relation to the paper path can be used for Paper out detection, Top of form or Hole detection management.

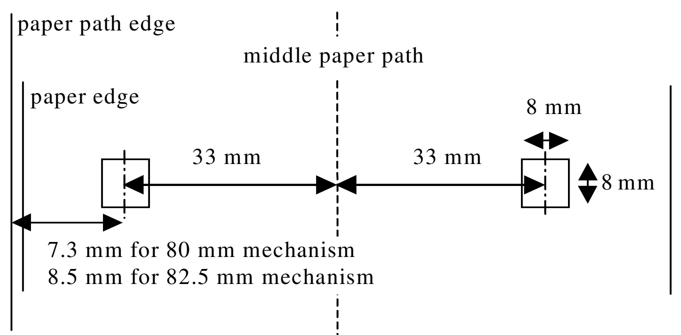
The following drawings give the position of the middle of the Optical sensor for left and right position.

On the mechanisms described in this manual, the optical sensors can be set either on the printed or non-printed side. This does not change the following distances as sensor-setting holes are "face to face".

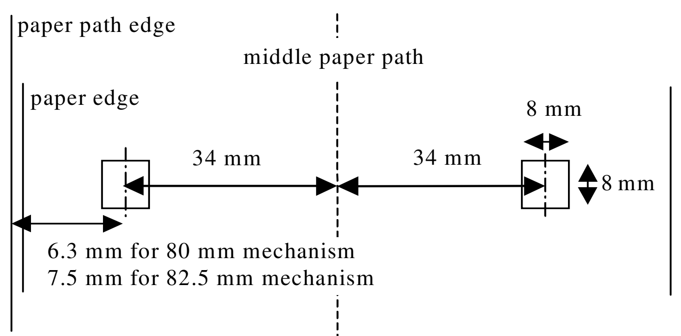
The size of the black mark should be 8x8 mm as indicated on the drawing (both sides and for both paper paths).

Measurements: 0.7 minimum Macbeth optical density (20% max. reflectance) to 900NM* infrared light
*measure with the D filter on the Macbeth PCM II.

With Rear/Clamshell paper path



With straight paper path



Useful distances for Top of form management

Distance from the optical sensor to the line of cut with rear paper path: 38.5 ± 1 mm
Distance from the optical sensor to the line of cut with underneath paper path: 61 ± 1 mm

Distance from the line of dots to the line of cut: 16.4 ± 1 mm

3 ELECTRICAL SPECIFICATION

3.1 General Print Head Characteristics

3.1.1 Class A

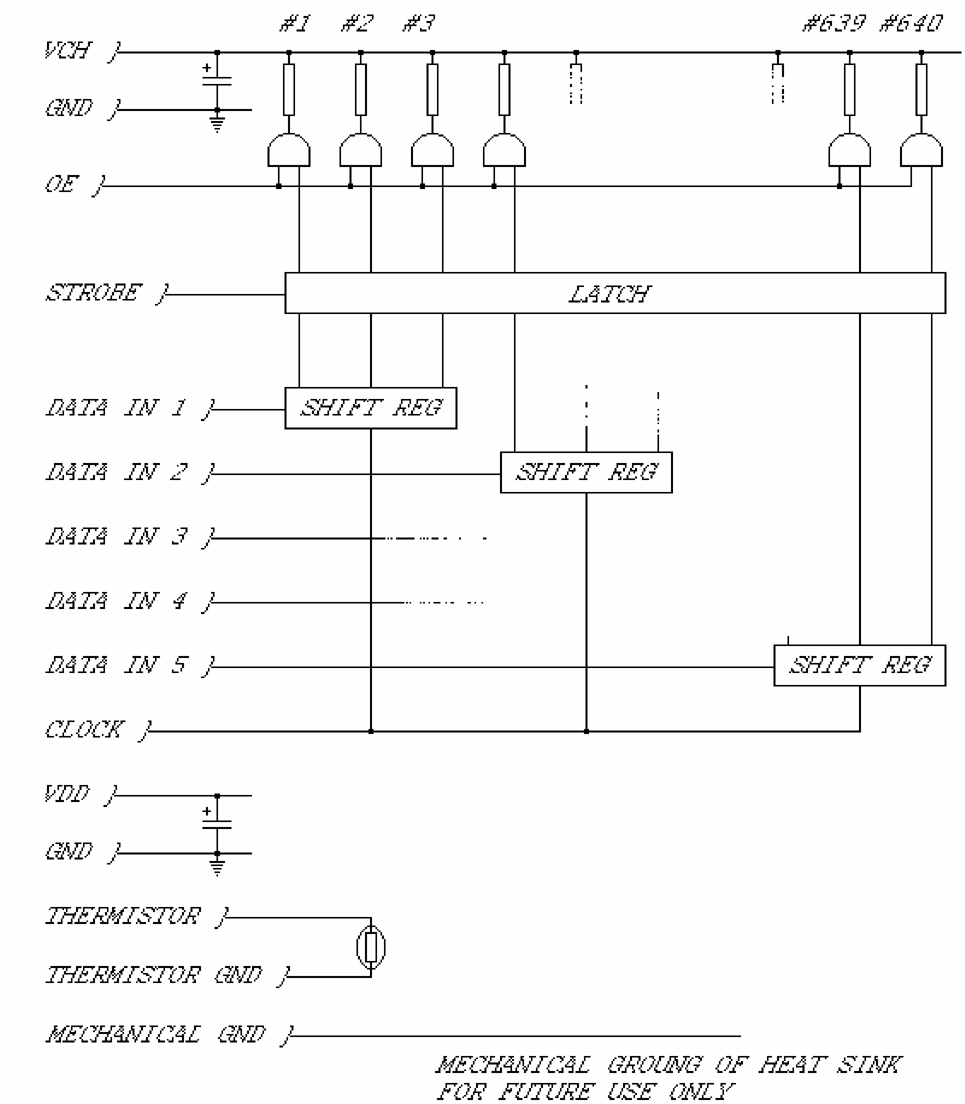
Number of dots	640
Number of driver ships	10 (64 dots per ships)
Dot resistance	533 ± 3 % Ω
Maximum current per dot line (at 24V)	16.2A

3.1.2 Class B

Number of dots	640
Number of driver ships	10 (64 dots per ships)
Dot resistance	567 ± 3 % Ω
Maximum current per dot line (at 24V)	19.8A

*For optimum print quality, the heating times should be adapted to each class.
See appendix 3.

3.1.3 Print head circuit diagram



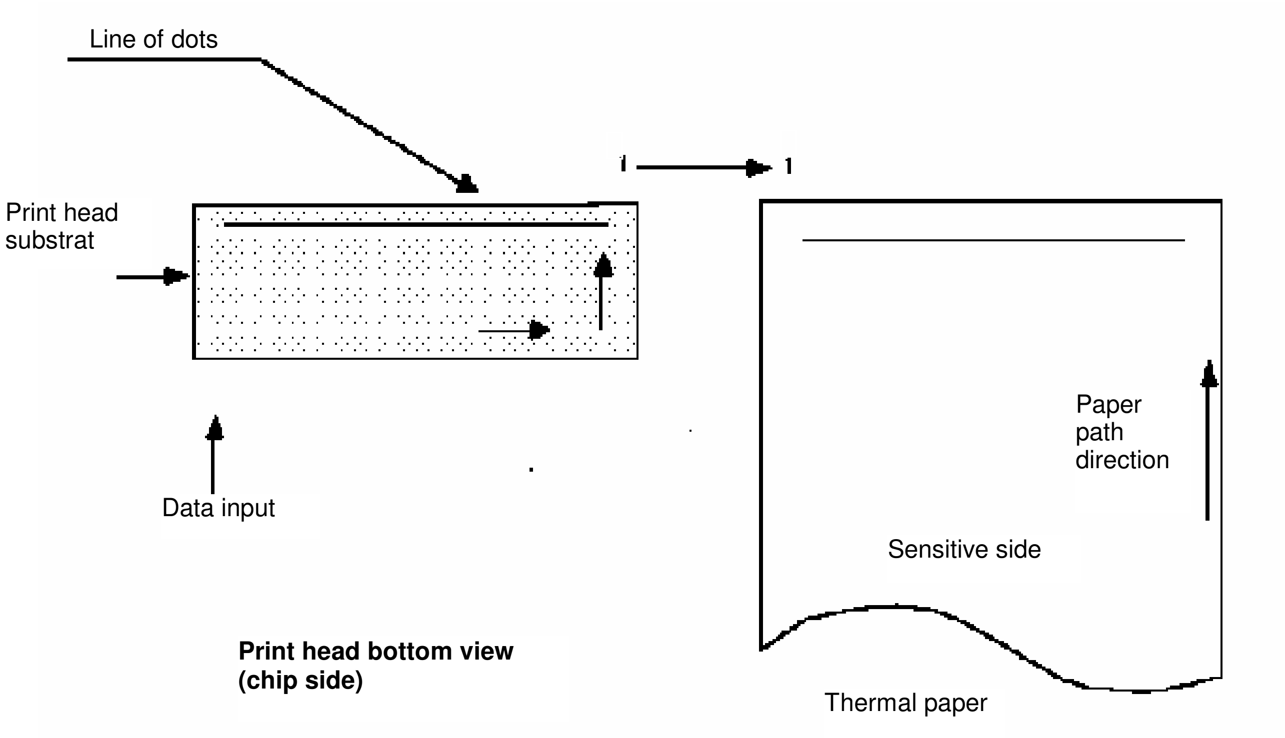
Driver IC schematic

The print head uses 10 LSI Drivers circuits	
These circuits are supplied by	5V +/- 5% 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)

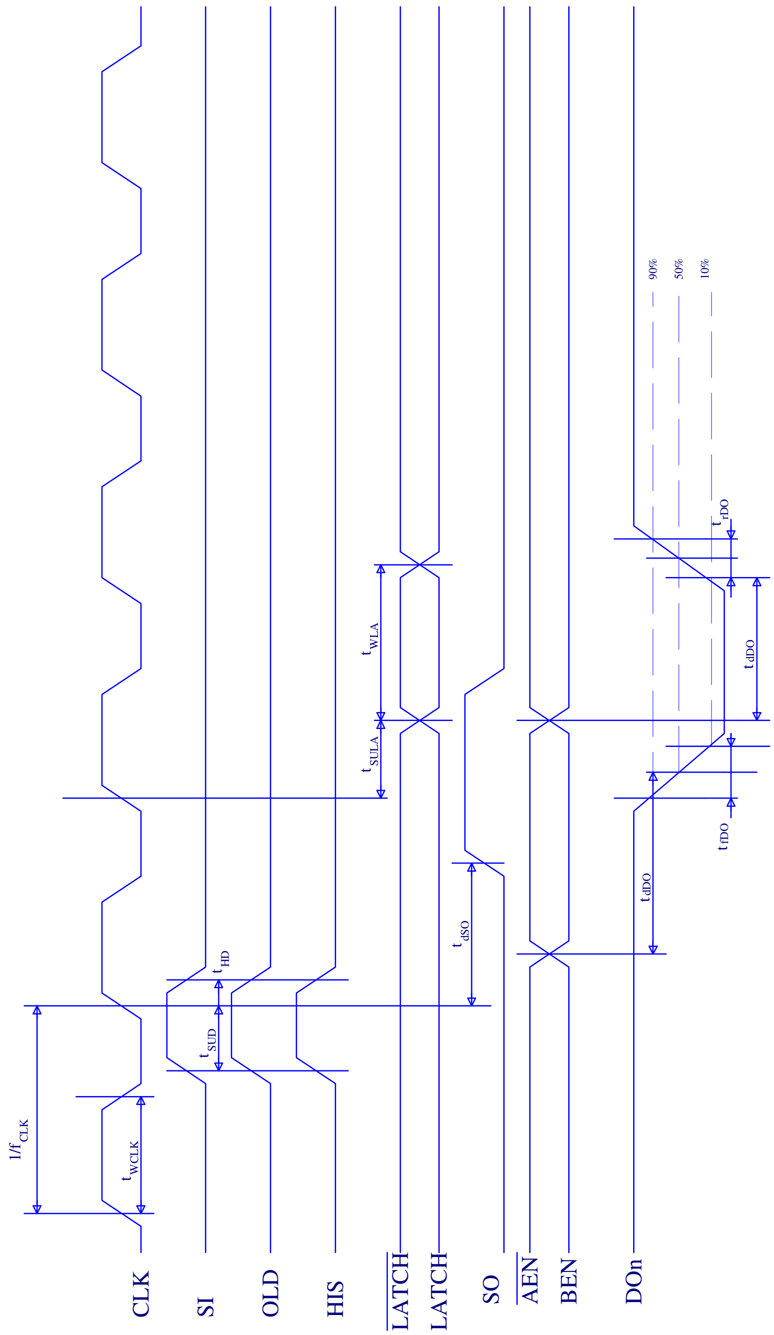
3.1.4 Routing of data to the thermistor dots



Dots print order

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

3.1.5 Clock diagram



3.1.6 AC Electrical characteristics

Unless otherwise specified: Vdd=5.0V ±10%, Ta=-0℃ to 50℃.

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
CLK pulse width	twclk		70	-	-	ns
Data setup time	tsud	Vih=Vdd, Vil=Vsso	40	-	-	ns
Data hold time	thd	Vih=Vdd, Vil=Vsso	40	-	-	ns
Latch pulse width	twla		100	-	-	ns
Latch setup time	tsula		100	-	-	ns
CLK-SO propagation delay time	tdso	Cl=3 pF	-	-	120	ns
EN-Don propagation delay time	tddo	Rl=1.0 kΩ, Vdoh=24V	-	-	10,5	µs
Don rise time	trdo	Rl=1.0 kΩ, Vdoh=24V	-	2	6	µs
Don fall time	tfdo	Rl=1.0 kΩ, Vdoh=24V	-	3,5	10	µs
Clock frequency	tclk	when cascade connection	-	-	6.25	MHz

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3.1.7 DC electrical characteristics

Unless otherwise specified: Vdd=5.0V ±10%, Ta=-10℃ to 80℃.

Parameter	Sybl	Conditions		Min	Typ	Max	Unit
Supply voltage	Vdd			4,5	5	5,5	V
High level input voltage	Vih	*1		0,7 x Vdd	-	Vdd	V
Low level input voltage	Vil			Vss	-	0,3 x Vdd	V
High level input current	Iih	Vdd=5,0V	BEN, CONT, OLD, HIS	-	-	55	µA
		Vih =5,0V					µA
		Ta=25℃		-	-	0,5	µA
Low level input current	Iil	Vdd=5,0V	AEN	-55	-	-	µA
		Vih =0V					µA
		Ta=25℃		-0,5	-	-	µA
High level output voltage	Voh	SO terminal, no load		4,45	-	-	V
Low level output voltage	Vol	SO terminal, no load		-	-	0,05	V
High level output current	Ioh	SO terminal, Voh=Vdd-0,4V		-	-	-0,05	mA
Low level output current	Iol	SO terminal, Vol=0,4V		0,5	-	-	mA
High level driver output voltage	Vdoh	Heat generator resistance: 500 Ω min.		-	24	26	V
Low level driver output voltage	Vdol		Idol=30mA	-	0,7	1,5	V
Driver leakage current	Ileak		Vdoh=26V Per 1-bit of driver output	-	-	1	µA
			Vdoh=26V Per 64-bit of driver output	-	-	10	µA
Current consumption	Idd	Ta=25℃	fclk=2Mhz, SI:fixed		0,2	0,6	mA
			fclk=5Mhz, SI:fixed		0,4	1,2	mA
			fclk=5Mhz, SI=1/2 fclk		1,6	5	mA
lower Vdd detection voltage	Vdet			0,8	-	4	V

*1: CLK : fclk=fmax duty 50%
SI, OLD, HIS = 1/2 fmax
Others : DC level

Tsud=THD=100 nsec
LATCH : Twla=100 nsec

Absolute maximum ratings

Parameter	Symbol	Ratings	Unit
Supply voltage	Vsso,1 - Vdd	-0,4 to +7,0	V
Driver output voltage	Vdoh	36	V
Driver output current	Idol	50	mA
Input voltage	Vin	Vsso-0,5 to Vdd+0,5	V
Output voltage	Vout	Vsso-0,5 to Vdd+0,5	V
Max. Junction temperature	Timax	125	℃
Operating temperature range	Topr	-10 to +80	℃
Storage temperature range	Tstg	-40 to +125	℃

3.1.8 Driver Signals Description

No	Name	Functions
1 to 64	DO1 to DO64 (DOn)	Driver output terminals (Nch open-drain)
65, 66, 73, 74, 82, 83	Vss1	GND for driver (0 V)
71, 80	Vdd	Positive power supply for logic (+5 V)
67, 75	Vsso	GND for logic (0 V)
77	CLK	Clock input terminal for 64-bit shift register
81	SI	Serial data input terminal for 64-bit shift register
68	SO	Serial data output terminal for 64-bit shift register
69	LATCH	Data Latch signal input terminal When CONT="L" or open LATCH="L" : Reads the data of the shift register LATCH="H" : Holds the preceding data When CONT="H" LATCH="L" : Holds the preceding data LATCH="H" : Reads the data of the shift register
72	CONT	DATA Latch signal control terminal : Select "H" or "L" for LATCH (A pull-down resistor is built in)
76	AEN	Driver enable terminal : Outputs the latch data to the driver when low (A pull-down resistor is built in)
70	BEN	Driver enable terminal : Outputs the latch data to the driver when high (A pull-down resistor is built in)
79	OLD	Former column serial data input terminal (A pull-down resistor is built in)
78	HIST	Former column serial data input control (A pull-down resistor is built in)
		HIST="H" : OLD terminal is active
		HIST="L" or open : input from OLD terminal is not allowed

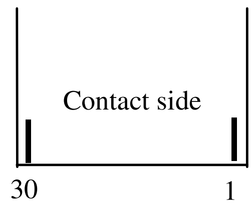
3.1.9 Print head Connection

Pinout diagram

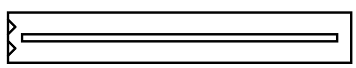
PIN NUMBER	SIGNAL
1	VCH
2	VCH
3	VCH
4	VCH
5	DATA IN 1
6	VDD
7	DATA IN 2
8	DATA IN 3
9	CLOCK
10	THERMISTOR
11	THERMISTOR GND
12	GND
13	GND
14	GND
15	GND
16	GND
17	GND
18	GND
19	GND
20	GND
21	LOGIC GND
22	MECHANICAL GND
23	DATA IN 4
24	DATA IN 5
25	STROBE
26	OUTPUT ENABLE (OE)
27	VCH
28	VCH
29	VCH
30	VCH

OUTPUT ENABLE	DOT NUMBER	DOTS PER OUTPUT ENABLE
OE	1 to 640	640

DATA IN NUMBER	DOT NUMBER	DOTS PER DATA IN
1	1 to 128	128
2	128 to 256	128
3	257 to 384	128
4	385 to 512	128
5	513 to 640	128



30 pin compatible connectors (to be fitted on the controller board) (Pitch : 1.25mm)



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

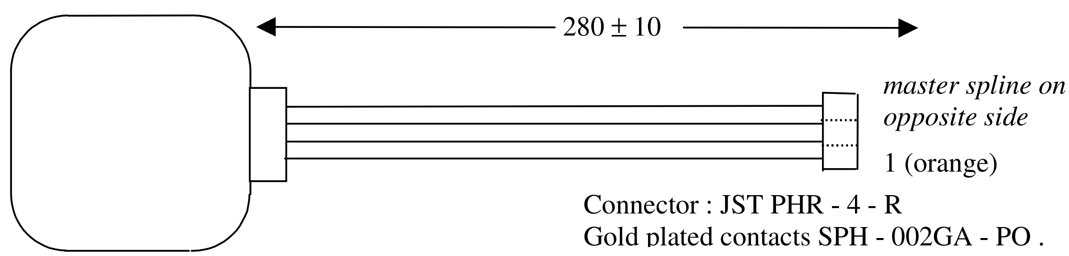
3.2 Paper Feed and Cutter Motor Characteristics

Hybrid motor

Recommended control voltage	24	VDC
Coil Resistance	6.5 ± 10%	Ω
Number of phases	2	
Step angle	3.75 (96 steps per revolution)	°
Recommended control current	830	mA/phase

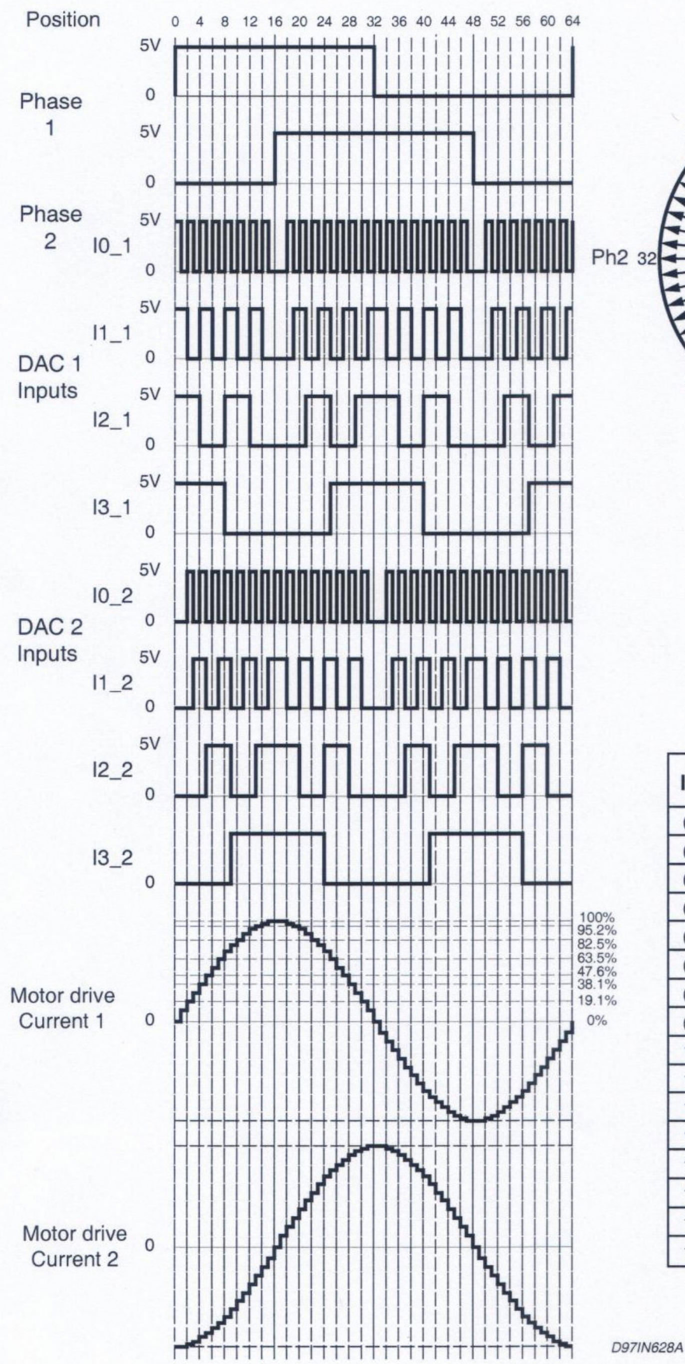
3.2.1 Motor connections

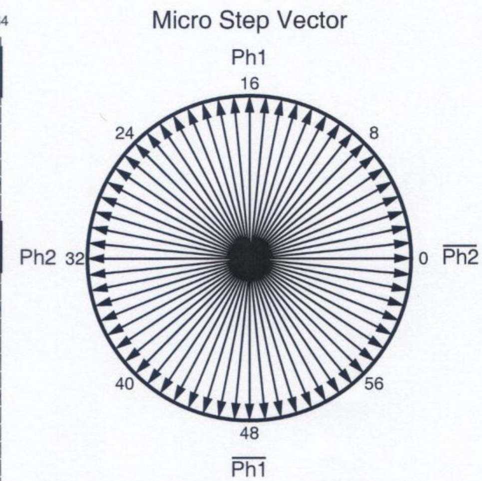
PIN n°	Wire color	Motor
1	Orange	$\overline{B}$
2	Blue	B
3	Yellow	$\overline{A}$
4	red	A



Corresponding contact to be set on the board:	gold plated	JST B4B-PH-K-G
	tin-plated	JST B4B-PH-K

3.2.2 4 bit Microstep operation mode timing diagram (Phase - DAC input and Motor Current)





I3	I2	I1	I0	Current level % of I_{MAX}
0	0	0	0	100
0	0	0	1	98.4
0	0	1	0	95.2
0	0	1	1	92.1
0	1	0	0	88.9
0	1	0	1	82.5
0	1	1	0	77.8
0	1	1	1	71.4
1	0	0	0	63.5
1	0	0	1	55.6
1	0	1	0	47.6
1	0	1	1	38.1
1	1	0	0	28.6
1	1	0	1	19.1
1	1	1	0	9.5
1	1	1	1	No Current

3.2.3 Acceleration curve for paper feed 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, without axis.

step number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
printing speed (mm/s)	20	23	26	29	31	34	37	40
motor speed (step/second)	160	183	206	228	251	274	297	320
step motor time (µs)	6250	5470	4864	4378	3981	3650	3369	3129

step number	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
printing speed (mm/s)	43	46	49	51	54	57	60	63
motor speed (step/second)	342	365	388	411	434	456	479	502
step motor time (µs)	2921	2738	2577	2434	2306	2191	2087	1992

step number	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
printing speed (mm/s)	66	68	71	74	77	80	83	86
motor speed (step/second)	525	548	570	593	616	639	662	684
step motor time (µs)	1905	1826	1753	1686	1623	1565	1511	1461

step number	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
printing speed (mm/s)	88	91	94	97	100	103	106	108
motor speed (step/second)	707	730	753	776	798	821	844	867
step motor time (µs)	1414	1370	1328	1289	1253	1218	1185	1154

step number	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
printing speed (mm/s)	111	114	117	120	123	125	128	131
motor speed (step/second)	890	912	935	958	981	1004	1026	1049
step motor time (µs)	1124	1096	1069	1044	1020	996	974	953

step number	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**
printing speed (mm/s)	134	137	140	143	145	148	151	154
motor speed (step/second)	1072	1095	1118	1140	1163	1186	1209	1232
step motor time (µs)	933	913	895	877	860	843	827	812

step number	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**
printing speed (mm/s)	157	160	163	165	168	171	174	177
motor speed (step/second)	1254	1277	1300	1323	1346	1368	1391	1414
step motor time (µs)	797	783	769	756	743	731	719	707

step number	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
printing speed (mm/s)	180	182	185	188	191	194	197	200
motor speed	1437	1460	1482	1505	1528	1551	1574	1596

(step/second)								
step motor time (µs)	696	685	675	664	654	645	635	626

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").

3.3 Full and Partial Cut Sequences

3.3.1 Cutter Motor Driving

The position of the cutter blade is obtained with the switch.

Ramp table

step number	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
motor speed (pps)	370	570	641	757	840	953	1136	1152

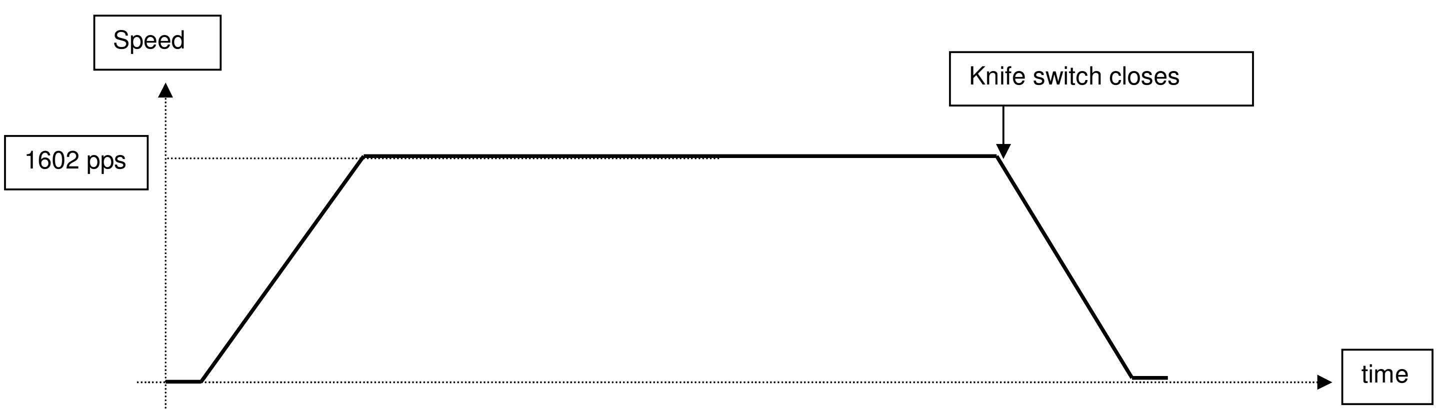
step number	**8**	**9**	**10**	**11**
motor speed (pps)	1315	1386	1526	1602

3.3.2 Full cut sequence

A full cut cycle requires 5 phases:

*1 : turn on current in motor and wait 20ms
*2 : accelerate following ramp table until speed = 1602 pps
*5 : maintain speed = 1602 pps until knife switch closes
*6 : decelerate following ramp table until knife motor fully stops
*7 : wait 20ms, then turn off current in motor

Total cycle time = **260 ms**,
Note however that the ticket is available before the end of the cycle, **200ms** after the start of the cycle.

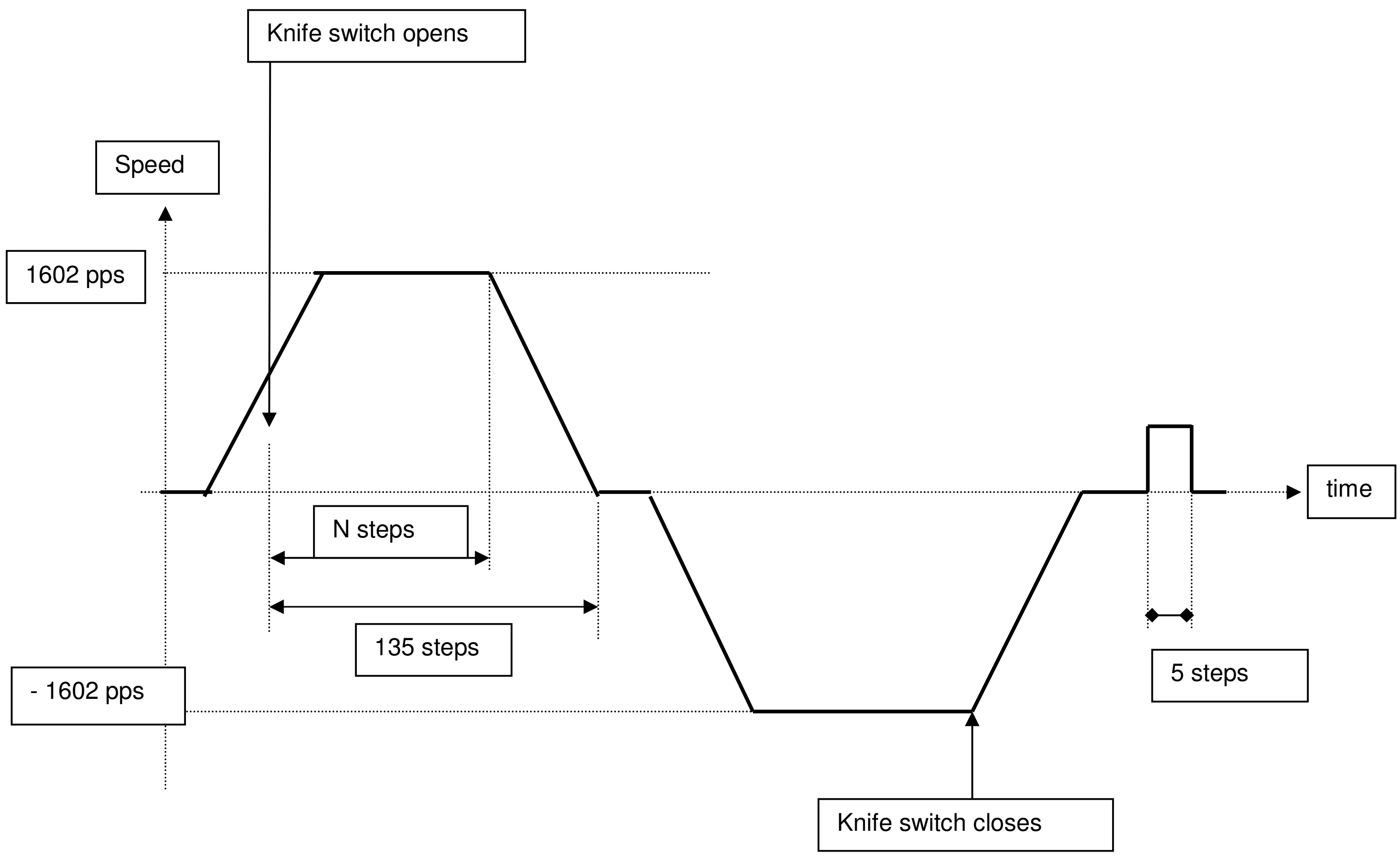


3.3.3 Partial cut sequence

A partial cut cycle requires 11 phases:

*1 : turn on current in motor and wait 20ms
*2 : accelerate following ramp table until speed = 1602 pps
*3 : maintain speed = 1602 pps for (135 – RampIndex) steps **after** knife switch opens
*4 : decelerate following ramp table until full stop
*5 : wait 40 ms
*6 : reverse motor direction and accelerate following ramp table until speed = - 1602 pps
*7 : maintain speed = -1602 pps until cover switch closes
*8 : decelerate following ramp table until full stop
*9 : wait 40 ms
*10 : run knife motor forward 5 steps at 714 pps
*11 : wait 20ms, then turn off current in motor

Total cycle time = **310 ms**



3.4 Stepping Motors Electric Control

3.4.1 Driving schematic

Axiohm recommends to use drivers L6258 from ST.

⁕ For other stepping motor control requirements, please contact Axiohm.

3.5 Sensors

On CA/CB / XA/XB sensors are used as follows :

End of Paper: switch or optical sensor.
The optical sensor is reflective (eight possible positions); it can be used for Top of form detection.

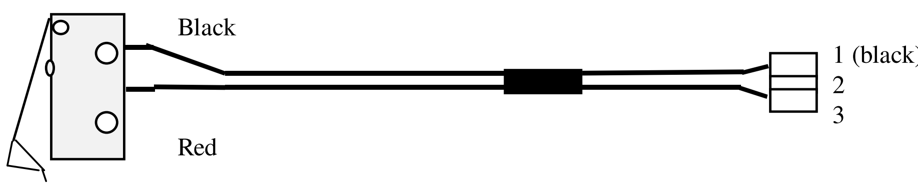
Cover Sensor: switch

Cutter Blade position: switch

3.5.1 End of paper switch characteristics

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

3.5.2 End of paper switch connection



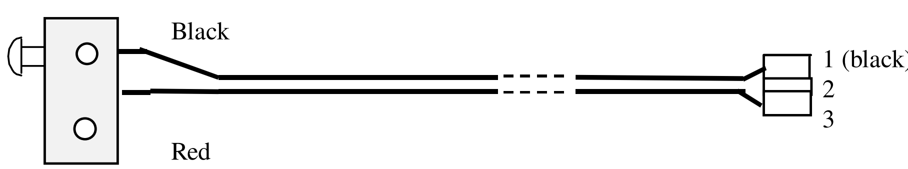
Leads length:	250 ±5 mm	
Connector:	JST PHR - 3 - Y (yellow)	1 : Black
	golden plated contacts	2 : Not Connected
	SPH - 002GA - P0 . 5S	3 : Red

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

3.5.3 Cover switch characteristics

- contact resistance :	<150 mΩ
- maximum rating :	10 mA/5 VDC
- operating temperature :	10 mA/5 VDC

3.5.4 Cover switch connection



Leads length:	260 ±5 mm	
Connector:	JST PHR - 3 - BL (blue)	1 : Black

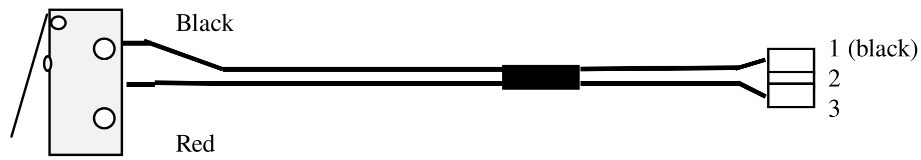
golden plated contacts	2 : Not Connected
SPH - 002GA - P0 . 5S	3 : Red

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

3.5.5 Cutter switch characteristics

- contact resistance :	30 mΩ
- maximum rating :	100 mA/250 V
- operating temperature :	-40° C +120° C

3.5.6 Cutter switch connection

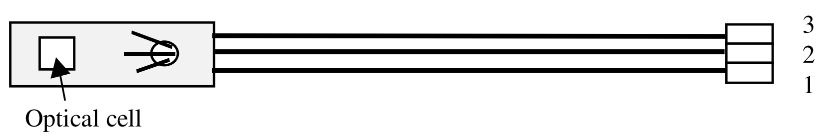


Leads length:	270 ±5 mm	
Connector:	JST PHR - 3 - BK (black)	1 : Black
	golden plated contacts	2 : Not Connected
	SPH - 002GA - P0 . 5S	3 : Red

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

3.5.7 Optical sensors characteristics

Reflective sensor is described below.



Leads length:	Different length will be available from 200 mm to 500 mm	
Connector:	JST PHR - 3 - BK (black)	1 : Black : Ground
	golden plated contacts	2 : Orange : Diode command
	SPH - 002GA - P0 . 5S	3 : Green : 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.

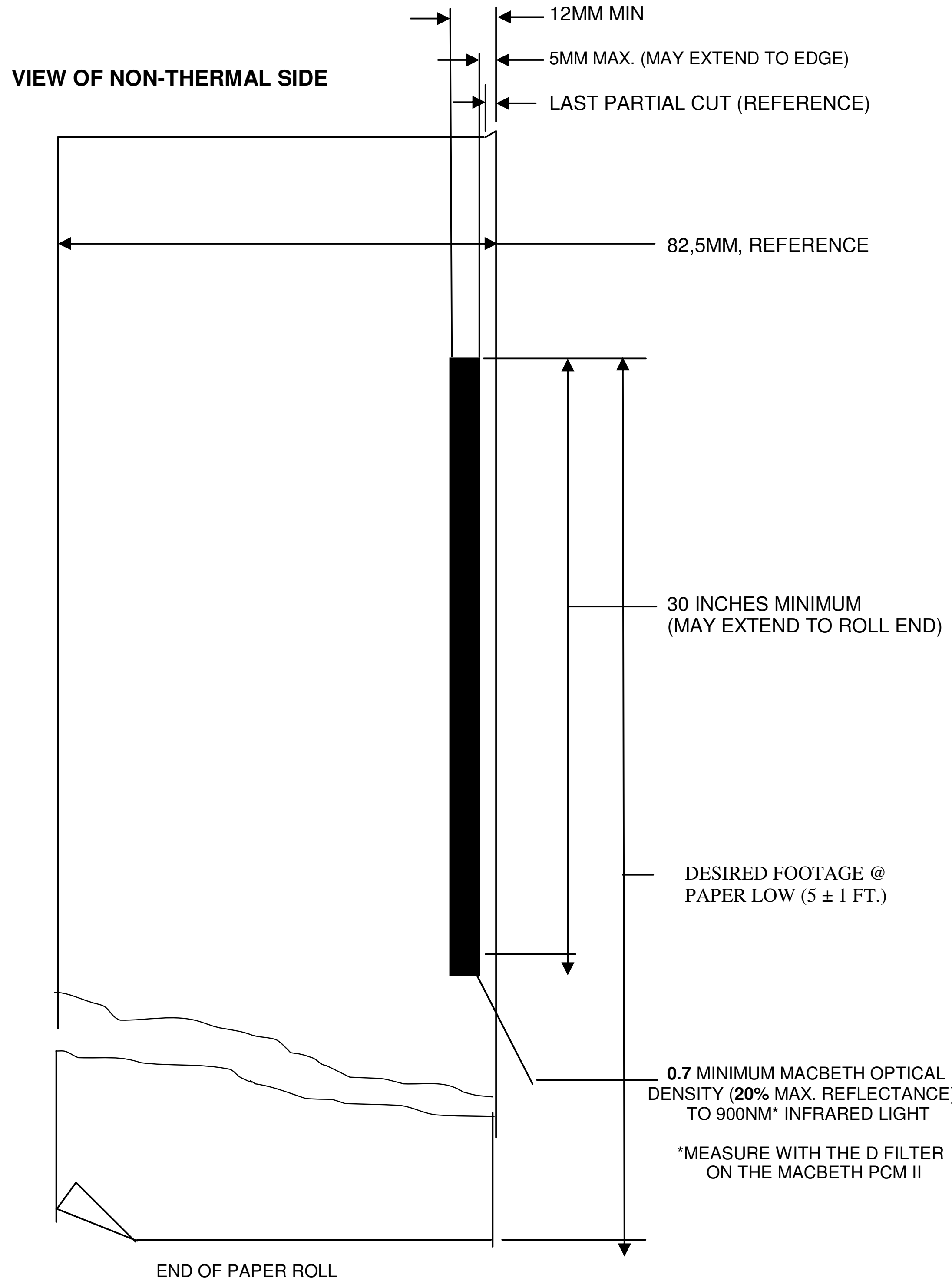
For Top of form detector:

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.

MACHINE READABLE END-OF-ROLL WARNING STRIPE



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**	**30**	**V**
Collector Dissipation at 25°C max	**PC**	**50**	**Mw**

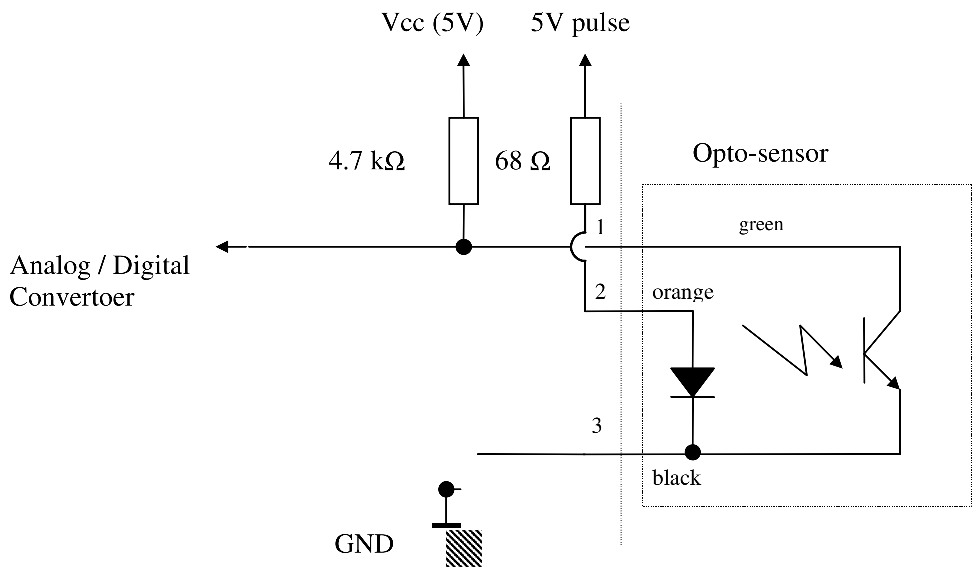
Note: Driving the sensor with pulse current allows to use higher current to improve paper detection.

*** (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)

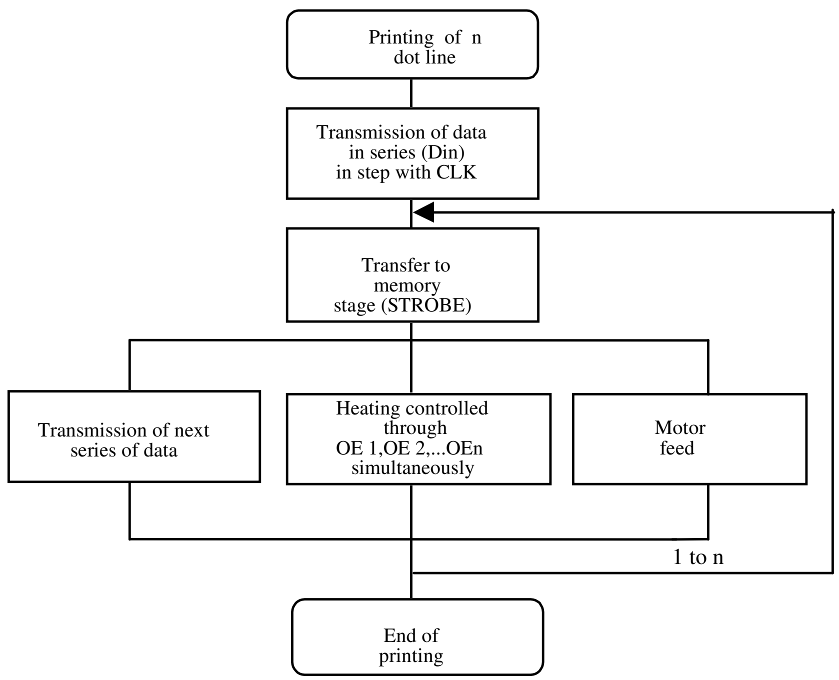

Vcc (5V)
5V pulse
4.7 kΩ
68 Ω
Opto-sensor
Analog / Digital
Convertoer
1
green
2
orange
3
black
GND

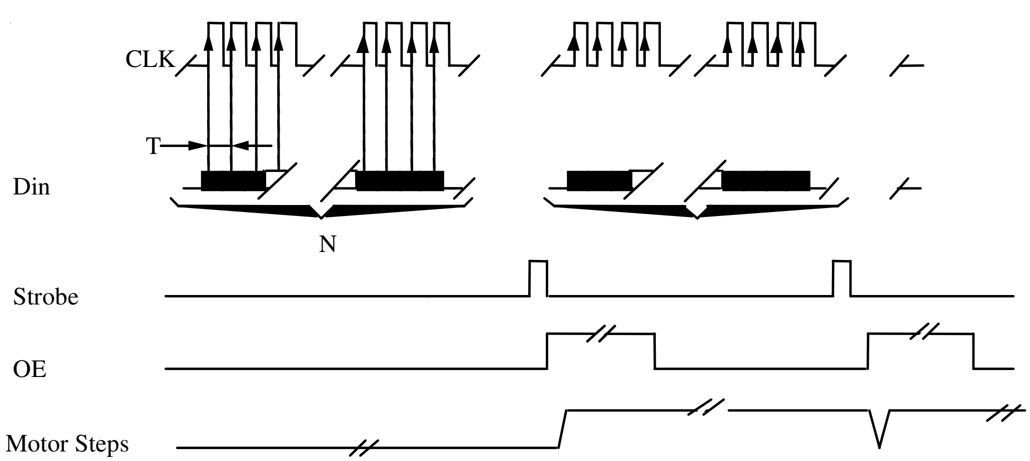
4 PRINTER CONTROL TECHNICS

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).





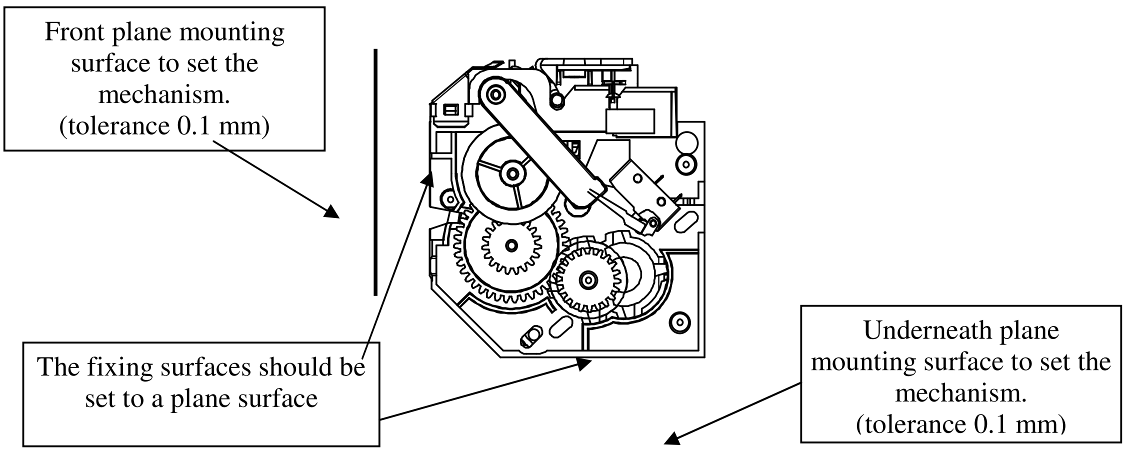
T : Clock frequency

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.
- Also this could change the angle between blades thus degrading cutting and cutter lifetime.

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

<u>IMPORTANT</u>:

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 paper rolls, (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 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.

5.4 Recommendations to Drive Cutter

Make sure your mechanism version is adapted to the required type of cut.
Depending on your mechanism (see chapter "Codification") the blades can achieve:

- total cut only,
- partial cut only,
- total and partial cut (in this case only, the software will determine the type of cut)

- **In case of paper jam** between the blades, the cutter motor must be stopped. It is possible to prevent this jam, by counting the number of steps achieved by the stepper motor and comparing it to the standard number of steps for a cut.

5.5 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, the mechanism integrator must make tests. The temperature should not exceed 80°C on the motor frame.
  In a typical application, the duty cycle will be 50% ON, 50 % OFF.
- In order to prevent thermal head damage, it is recommended to monitor the temperature
  provided by the head thermistor (Appendix 1).
  In case temperature exceeds 60°C, the printing should be stopped to allow the head to cool
  below this value.
- 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).

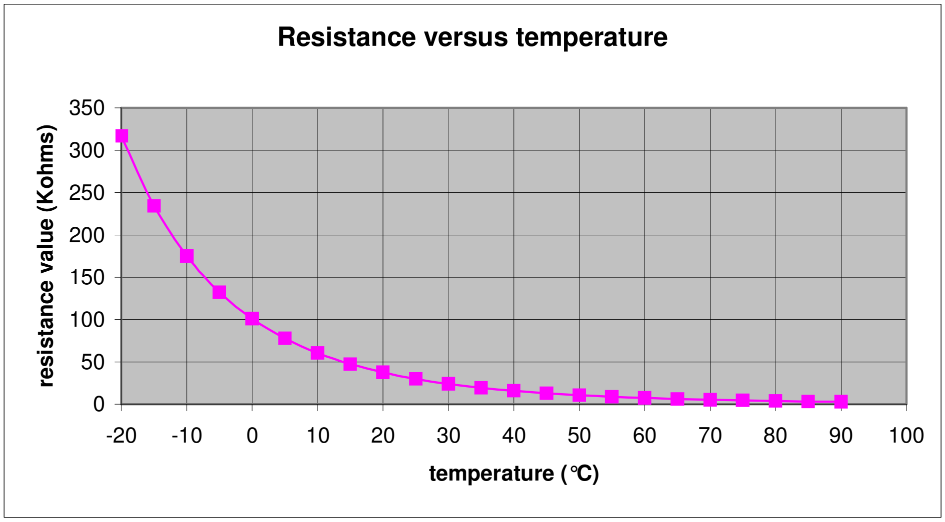
- Never open the mechanism while printing or when the cutter is operating.
- In order to prevent paper jam, it is recommended to advance the paper 1mm after the cut line when the printer is in stand by mode.

6 APPENDIX

6.1 Print Head Thermistor Characteristics

Electrical requirements

- Resistance R25 : 30 Kohms +/- 5 % at 25 °C (298 °K).
- B25/85 value : 3950 °K ± 3%.
- Resistance versus temperature : $R_x = R_{25} * e^{\left(B_x * (\frac{1}{T_x} - \frac{1}{T_{25}}) \right)}$



Rating

- Operating temperature : -40 °C to 100 °C.
- Dissipation constant : > 0.3 mW/°C (in the air).
- Time constant : < 1.5 s (in the air).

6.2 Paper Characteristics

Typical Properties of Kanzan KLS 46 (used to achieve the heating timetable given in this manual):

Properties :	Value	Units	Test method
Base weight	80 ± 5	g / m^2	ISO 536
Thickness	81 ± 5	µm	ISO 534
Brightness R457-	79.5	% min.	ISO 2470
Smoothness Bekk	1100	sec min.	ISO 5627
Image color	black	-	
Initial activation T°	75 ± 5	°C	O.D. = 0.2
Effective activation T°	85 ± 5	°C	O.D. = 1.2
Tensile strength	3.3 to 5.2	KN/m min.	ISO 1924/1
Tear strength	580	mN min.	ISO 1974
Moisture content	6.5 ± 1	%	ISO 287
Saturated density	1.35	- min.	

6.3 Heating Time Calculation

6.3.1 Real heating times

The heating times are calculated with the following formulas:

- **$t1 = (Rmean / V'^2) \times E_0$**

With $E_0 = 0.345$ mJ.

- **$t2 = t1 \times (a \times Log(tm) + b)$**

With tm = time for motor step (ms).
With a = 0.3817
With b = 1.1794

- **Heating time $t3 = g \times t2^2 + h \times t2 + i$**

With T = print head thermistor temperature (°K).
With g = 0.000138
With h = -0.022759
With i = 1.482759

- **V' = eV + f**

With V = print head voltage (V).
With e = 0.7440
With f = 6.1603

6.3.2 Heating times approximation

See the chart below for a heating time approximation by factor.

The software must know the rank of the head; switches on the user's circuits can do this, for example.

The values of V and T are measured.

Compute the position of tch in the table from V, T and Rmean.

Get the value of tch at this position, and apply the corresponding factor to find the required heating time.

Heating time = tch (obtained as described above) × factor

Rank	A	B
Resistance (Ω)	533 ± 3%	567 ± 3%
Factor	0.97	1.03

6.4 *Heating Time*

The heating timetable is presented on next page *(given for paper: Kanzan KLS 46)*
The print-head resistance to obtain this table was 567 Ω.
The top line of the table gives the printing speed (in mm/s).
The motor cycle time for one dot line is given in the second line of the table; it is the time for one motor step.
Column 3 (indicated with: speed <xxx mm/s and motor cycle time > xxx ms) 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: two areas are then defined in the table for uses with historical control.

Area 1 in "white": The maximum heating time (column 3) is shorter than the motor cycle time, thus can be applied within a motor step.

Area 2: “shaded”: The maximum heating time (column 3) is greater than the motor cycle time, thus cannot be applied within a motor cycle for one dot line.

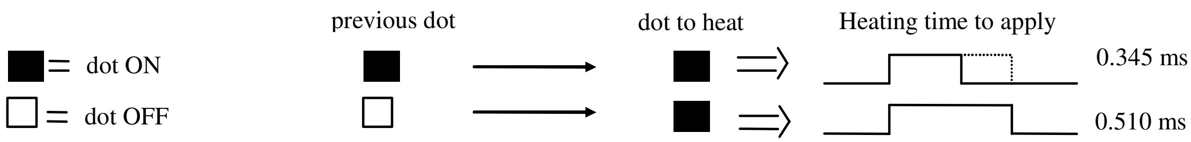
How to use the heating timetable?
The heating time can be controlled either with or without historical control as described here after.

- **Without historical control**: apply the indicated heating time given as a function of speed, voltage and temperature. At high speed, printing quality for isolated dots might be affected with this method.

  Example: at 80mm/s, 25°C and 24 volts, heating time = 0.345 ms.

- **With historical control in area 1**: apply the indicated heating time (function of speed, voltage and temperature) when the dot has been heated on the previous sub line, and the time from column 3 when it has not. This method gives the best printing quality.

  Example: at 80 mm/s, 25°C and 24 volts:



- **With historical control in area 2**: apply the indicated heating time (function of speed, voltage and temperature) when the dot has been heated on the previous sub line, and the motor cycle time when it has not. At high speed, printing quality for isolated dots might be slightly affected with this method.

Heating time table

Calculated Values For
T0GE 0015 with Kanzan KLS46

Voltage (V)	Temperature (°C)	Speed (mm/s)				R=	650 Ohms		
Real		< 20 mm/s	30 mm/s	80 mm/s	100 mm/s	130 mm/s	150 mm/s	180 mm/s	250 mm/s
Temps moteur pour un pas		6,250 ms	4,170 ms	1,560 ms	1,250 ms	0,960 ms	0,830 ms	0,690 ms	0,500 ms
Temps moteur pour une sous lig		6,250 ms	4,170 ms	1,560 ms	1,250 ms	0,960 ms	0,830 ms	0,690 ms	0,500 ms
20,00 Volts	0 °C	0,985 ms	0,892 ms	0,667 ms	0,616 ms	<None>	<None>	<None>	<None>
20,00 Volts	10 °C	0,843 ms	0,764 ms	0,570 ms	0,527 ms	0,475 ms	<None>	<None>	<None>
20,00 Volts	20 °C	0,719 ms	0,652 ms	0,487 ms	0,450 ms	0,405 ms	0,381 ms	<None>	<None>
20,00 Volts	25 °C	0,664 ms	0,602 ms	0,450 ms	0,415 ms	0,374 ms	0,352 ms	0,323 ms	<None>
20,00 Volts	30 °C	0,614 ms	0,556 ms	0,415 ms	0,384 ms	0,346 ms	0,325 ms	0,299 ms	<None>
20,00 Volts	40 °C	0,527 ms	0,477 ms	0,357 ms	0,329 ms	0,297 ms	0,279 ms	0,256 ms	<None>
20,00 Volts	50 °C	0,458 ms	0,415 ms	0,310 ms	0,286 ms	0,258 ms	0,243 ms	0,223 ms	0,189 ms
22,00 Volts	0 °C	0,859 ms	0,778 ms	0,581 ms	0,537 ms	0,484 ms	<None>	<None>	<None>
22,00 Volts	10 °C	0,735 ms	0,666 ms	0,498 ms	0,460 ms	0,414 ms	0,389 ms	<None>	<None>
22,00 Volts	20 °C	0,627 ms	0,568 ms	0,425 ms	0,392 ms	0,354 ms	0,332 ms	0,305 ms	<None>
22,00 Volts	25 °C	0,579 ms	0,525 ms	0,392 ms	0,362 ms	0,327 ms	0,307 ms	0,282 ms	<None>
22,00 Volts	30 °C	0,536 ms	0,485 ms	0,362 ms	0,335 ms	0,302 ms	0,284 ms	0,261 ms	<None>
22,00 Volts	40 °C	0,460 ms	0,416 ms	0,311 ms	0,287 ms	0,259 ms	0,243 ms	0,224 ms	0,189 ms
22,00 Volts	50 °C	0,400 ms	0,362 ms	0,270 ms	0,250 ms	0,225 ms	0,212 ms	0,194 ms	0,164 ms
24,00 Volts	0 °C	0,756 ms	0,685 ms	0,512 ms	0,473 ms	0,426 ms	0,400 ms	<None>	<None>
24,00 Volts	10 °C	0,647 ms	0,586 ms	0,438 ms	0,404 ms	0,365 ms	0,343 ms	0,315 ms	<None>
24,00 Volts	20 °C	0,552 ms	0,500 ms	0,374 ms	0,345 ms	0,311 ms	0,292 ms	0,269 ms	<None>
24,00 Volts	25 °C	0,510 ms	0,462 ms	0,345 ms	0,319 ms	0,287 ms	0,270 ms	0,248 ms	<None>
24,00 Volts	35 °C	0,436 ms	0,395 ms	0,295 ms	0,273 ms	0,246 ms	0,231 ms	0,212 ms	0,179 ms
24,00 Volts	40 °C	0,404 ms	0,366 ms	0,274 ms	0,253 ms	0,228 ms	0,214 ms	0,197 ms	0,166 ms
24,00 Volts	50 °C	0,352 ms	0,319 ms	0,238 ms	0,220 ms	0,198 ms	0,186 ms	0,171 ms	0,145 ms
26,00 Volts	0 °C	0,670 ms	0,607 ms	0,454 ms	0,419 ms	0,378 ms	0,355 ms	0,326 ms	<None>
26,00 Volts	10 °C	0,574 ms	0,520 ms	0,388 ms	0,359 ms	0,323 ms	0,304 ms	0,279 ms	<None>
26,00 Volts	20 °C	0,490 ms	0,443 ms	0,331 ms	0,306 ms	0,276 ms	0,259 ms	0,238 ms	0,202 ms
26,00 Volts	25 °C	0,452 ms	0,410 ms	0,306 ms	0,283 ms	0,255 ms	0,239 ms	0,220 ms	0,186 ms
26,00 Volts	30 °C	0,418 ms	0,378 ms	0,283 ms	0,261 ms	0,235 ms	0,221 ms	0,203 ms	0,172 ms
26,00 Volts	40 °C	0,359 ms	0,325 ms	0,243 ms	0,224 ms	0,202 ms	0,190 ms	0,175 ms	0,148 ms
26,00 Volts	50 °C	0,312 ms	0,282 ms	0,211 ms	0,195 ms	0,176 ms	0,165 ms	0,152 ms	0,128 ms
28,00 Volts	0 °C	0,599 ms	0,542 ms	0,405 ms	0,374 ms	0,337 ms	0,317 ms	0,291 ms	<None>
28,00 Volts	10 °C	0,512 ms	0,464 ms	0,347 ms	0,320 ms	0,289 ms	0,271 ms	0,249 ms	<None>
28,00 Volts	20 °C	0,437 ms	0,396 ms	0,296 ms	0,273 ms	0,246 ms	0,232 ms	0,213 ms	0,180 ms
28,00 Volts	25 °C	0,404 ms	0,366 ms	0,273 ms	0,252 ms	0,227 ms	0,214 ms	0,196 ms	0,166 ms
28,00 Volts	30 °C	0,373 ms	0,338 ms	0,252 ms	0,233 ms	0,210 ms	0,198 ms	0,182 ms	0,154 ms
28,00 Volts	40 °C	0,320 ms	0,290 ms	0,217 ms	0,200 ms	0,180 ms	0,170 ms	0,156 ms	0,132 ms
28,00 Volts	50 °C	0,278 ms	0,252 ms	0,188 ms	0,174 ms	0,157 ms	0,147 ms	0,135 ms	0,115 ms

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

Base heating time