



CP 290

Technical reference

1. Introduction

1.1. CP Series

The CP290 is part of the CP series. Specially designed for cash register, gaming , gas pumps, measuring instruments and analyzer, POS , or data terminal device. Within the same series is the CP 291 (High speed), CP295 and CP296 (5 volts) and CP2912 (12 volts). All these mechanisms can come with a divider for two stations application (28+28mm / CP295 and 32+32 / CP296) ,a complete winder and with 2 different paper width of 60 and 66 mm.

1.2. CP 290 features

- High speed 90 mm/s
- High resolution printing (8 dots/mm)
- Long life (100 millions pulses, 100 km minimum)
- Low noise due to its technology (thermal)
- Front and bottom paper loading

1.3. Revision history

Rev.	Date	Page	Revision item
A	10/09/98	-	First issue
B	30/03/99	-	Doubles opto / connectors revision
C	28/05/99	-	Paper Size adjustment

This manual provides complete information about CP290 thermal printer mechanism. Further information are available under request such as high speed printing applications and reliability figures.

A.P.S. reserves the right to make changes without notice to the product to improve reliability, functions or design. A.P.S. does nor assume any liability arising out of the application or use of the product or circuit described herein.

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2. General characteristics

ITEM	CP 290
Printing Method	Thermal dot line printing
Number of dots/line	432
Dots density (dot/mm)	8
Printing Width (mm)	54
Paper Width (mm)	60 or 66 +0/-0.5
Paper feed pitch (mm)	0.125
Paper Feed tension (g)	50 or more
Paper Hold tension (g)	80 or more
Dimension WxDxH (mm)	91 x 54.5 x 20
Weight (g)	115
Head temperature detection	Thermistor
Head-up detection	Switch
Paper end detection	photo-interrupter
Operation voltage range (V)	24V +/-10% Logic: 5V +/- 5%
Current consumption (A)	At printing: 24 V: 2.2 A (Head) 0,5A (Motor) 5V: 50 mA (Head) At paper feeding : 24V: 0,5A(Motor) 5V: <100uA (Head)
Recommended Paper	TSP-F50US (Fuji) or equivalent approved by APS
Operating temperature range (°C)	0/+50
Operating humidity (RH%)	20-90 (no condensation)
Storage temperature range (°C)	-40/+80
Storage humidity (RH%)	5-90 (no condensation)

3. Thermal Printhead and printing configuration

3.1. Outlines

Heat element structure	2 heaters/dot
Number of heat elements	432 dots
Heat element pitch	0.125 mm
Print width	54 mm (centered on paper)
Total width	60 mm
Average resistance	1500 Ohms +/- 10%

3.2. Maximum conditions at 25°C

ITEM	MAXIMUM CONDITIONS		UNIT
Supply energy (25°C)	0.314 (0.87)	0.509 (1.41)	mJ/dot (ms)
Print Cycle (25°C)	1.67	3.34	ms/line
Logic voltage	7		volts
Supply voltage	27		volts
Head Temperature	65		°C
Number of dots to be energized simultaneously ¹	144		dots

^{1/} In any case, if energy above 0.509 mJ is applied to one dot, the print quality of this dot will be effected (usually makes a “light” print-out).

3.3. Typical printing conditions

Item	Symbol	Electrical conditions		Unit	
Supply voltage	Vh	24		V	432 Dots fired at the
Print cycle	S.L.T	1.67	3.34	ms/line	
On time	Ton	0.83	1.34	ms	5°C 25°C 40°C Same Time
		0.69	1.12	ms	
		0.59	0.95	ms	
Optical Density (1)	OD	> 1.1			

¹ this the condition to satisfy the print density defined in section 3.3

- (1) This measurement is done at the full black pattern by Macbeth densitometer RD-914. Full black pattern means all dots printing pattern (100% black area) printed under correct paper speed.

3.4. General printing conditions

The following formula allows to calculate the heating time T_{on} depending on driving voltage V_H and R_{av}

$$T_{on} = (V_{24}^2 * R_{av}) / (R_{1500} * V_H^2) * T_{chart}$$

Where:

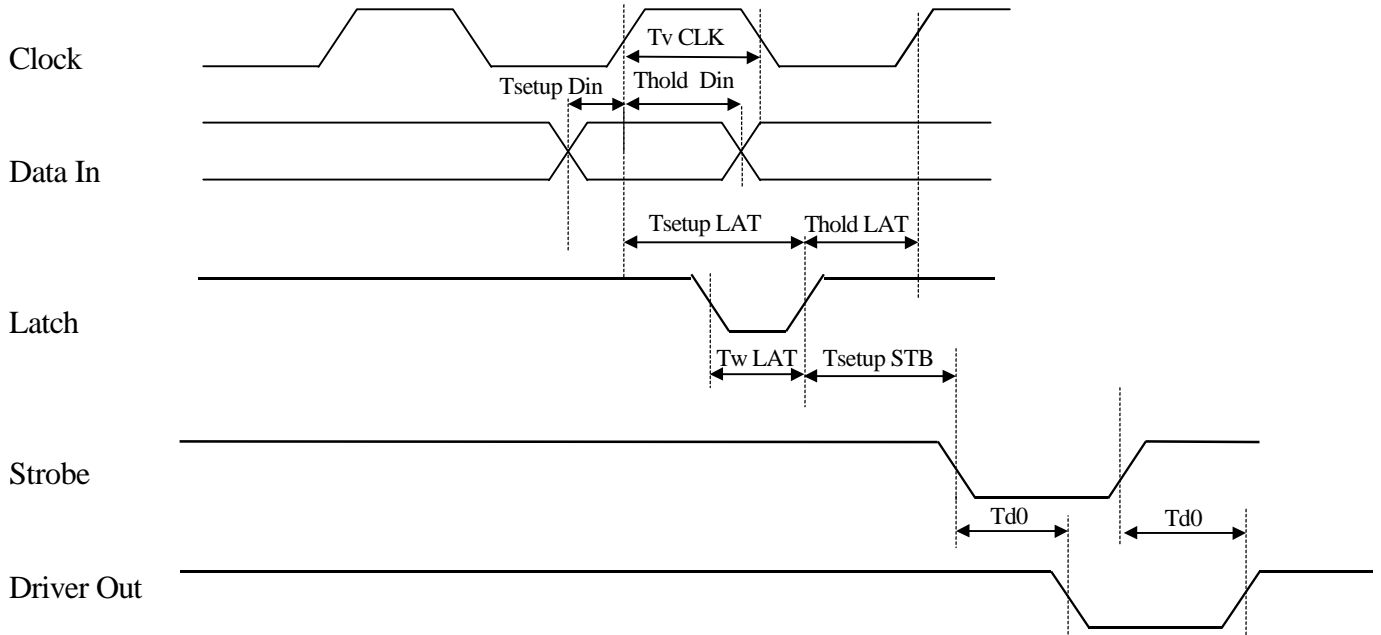
- V_{24} is the default driving voltage (24 v)
- R_{av} is the average resistance (see below ranking chart)
- V_H is the voltage
- R_{1500} is the default average resistance (1500 Ohms)
- T_{chart} is the activation time given in the section 3.3

3.5. Operation precautions

- 1- When continuous printing is performed, the supply energy should be reduced so that the substrate temperature monitored through the Thermistor will remain below the maximum temperature showed in Section 2. (Maximum Conditions at 25 degrees C).
- 2- All strobes signals must be disactivated during the Power and logic voltage ON/OFF sequence.
- 3- Do not touch the connector pins by naked hands.
- 4- The Printhead substrate surface is coated with glass and mechanical stress or shock (including dust scratch damage) should be avoided to prevent damage.
- 5- When the Printhead operation is finished, print supply voltage (including the charged voltage with capacitor) should be reduced to the ground level and remained until next Printhead operation.
- 6- Condensation should be avoided. If condensation occurred, do not switch on the Printhead power until condensation disappeared.
- 7- Please pay attention to the extra forces to get damages when the connector is plugged in or out. (Plug in-out cycle for this connector shall not be exceeded 20 time) Do not pick up connector to take Printhead.
- 8- Print quality would be degraded if paper or ink residue were stucked on the heat element area. For such a case, please use applicator with alcohol to clean up. Do not use the sandpaper destroying the heat elements.
- 9- If printing sound, for example sticking sound, occurred, please review and adjust the paper feed mechanism and the electrical pulse program to eliminate the sound.
- 10- Please pay attention that the paper used does not include bad factor to affect the Printhead life.
- 11- In order to avoid surge, V_H and GND cable length should be less than 100mm, and 47 uF Aluminum capacitor is required between V_H and GND at controller board side.
- 12- Precautions for attaching the mechanism .The printer has to be fixed on a flat surface to avoid any kind of deformation or torsion. If not, the print quality and printer's life will be drastically reduced.

3.6. Electrical Characteristics

The following chart gives the timing for driving the printhead:



ITEM	SYMBOL	MINI	TYP.	MAXI	UNIT
Print voltage	VH	-	24.0	26.5	V
Logic voltage	Vdd	4.75	5.00	5.25	V
Logic current	Idd	-	-	51	mA
Input voltage (High)	VIH	0.8vdd	-	vdd	V
Input voltage (Low)	VIL	0	-	0.2vdd	V
STB 1 to 2 input current (High)	IIHSTR	-	-	4	uA
STB 1 to 2 input current (Low)	IILSTR	-	-	-73	uA
input current (High) (clk/data/latch)	ILH	-	-	1	uA
input current (Low) (clk/data/latch)	ILL	-	-	-1	uA
Output voltage (driver out)	VOL	-	-	2	V
Clock frequency	fCLK	-	-	4	MHz
Clock width	twCLK	120	-	130	ns
Data setup time	tsetupDI	70	-	-	ns
Data hold time	tholdDI	30	-	-	ns
Latch width	twLAT	200	-	-	ns
Latch setup time	tsetup LAT	300	-	-	ns
STR setup time	tsetup STB	300	-	-	ns
Driver out delay time	tdo	-	-	2	us

Note: 1/The first bit of data (dot 1) entered is the first bit of data printed (FIFO), left side of TPH, top view (gearing & lever side of the printer).
 2/ STB 1 to STB 2 drive one third of the Printhead, starting from dot 1.

!!! ATTENTION !!!

At power up make sure that +5v logic is present simultaneously or before Vdot. At power down make sure that Vdot is at 0v before removing +5v logic voltage.

3.7. Thermistor

When performing continuous printing, the supply energy should be reduced so that the substrate temperature monitored through the Thermistor will remain below the maximum temperature shown in section 3.2. the Thermistor specification is the following:

- R25, resistance at 25°C: 30 Kohm +/- 5% at 25°C
- B value: 3950 Kohm +/- 2%
- operating temperature: -20°C to +80°C
- time constant: Max. 30 sec (in the air)

Then the resistance value, R , versus temperature, T (in °C), is given by the formula:

$$R(T) = R_{25} * e^{B * (\frac{1}{T+273} - \frac{1}{25+273})}$$

4. Stepper motor

The paper feed pitch for stepper motor is one step for one dot line (0,125 mm). For good print quality it is advised to keep the current into the windings between two successive dot lines.

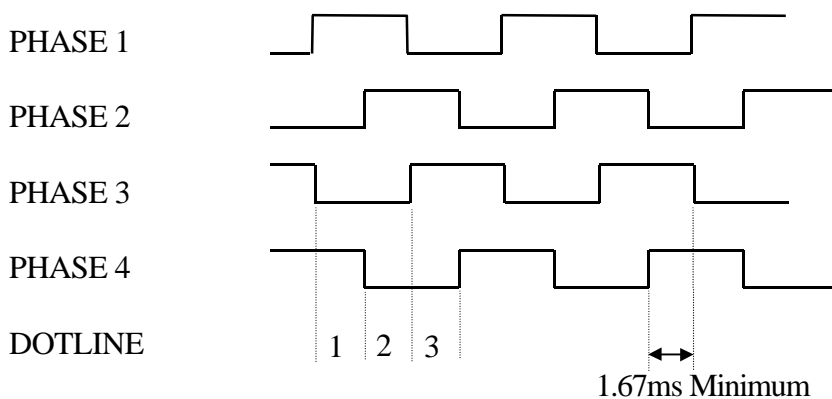
The coil resistance is 150 Ohms.

The driving is bipolar voltage mode and can be achieved by dual “H” bridges with clamp diodes (L293D, ST, TI,...). The maximum driving speed is then 600 pps. without acceleration is 75 mm/s.

Higher printing speed can be reached with acceleration. Contact APS for further information.

Coil resistance is 150 Ohms.

The timing diagram is then as follows:



5. Sensors

5.1. Head up and down detection

The CP290 has a head up and down function that separates the head from the rubber roller to prevent damage to the roller. The associated sensor is a switch driven by the lever. This switch is closed when the head goes down. So, in head-up state, the mechanical switch is turned off, disabling the current to flow into the thermal head.

The electrical characteristics of the switch are: 1A, DC 15 volts, contact resistance less than 200 mOhm. The easiest way for interfacing is to connect one end to Gnd and the others to I/O port of microcontroller with pull-up resistor.

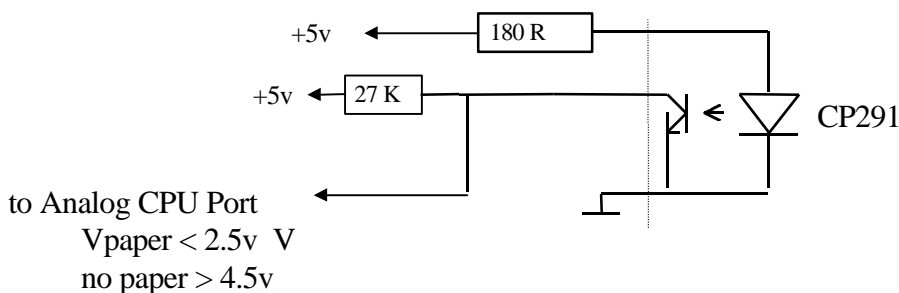
5.2. End of paper sensor

5.2.1. Single paper opto sensor

Opto sensor general specifications:

ITEM	Symbol	CONDITIONS	Min	Typ	Max	Unit
Forward current photodiode	I_F	$V_F = 5V \pm 5\%$	-	20	30	mA
Reverse current	I_R	$V_r = 5V$	-	-	10	μA
Output dark current	I_{CEO}	$V_{CE} = 10V$	-	-	0.2	μA
Light current	I_L	$V_{CE} = 5V$ $I_F = 20mA$	90	-	660	μA
time	T_R	$V_{CE} = 2V$ $I_C = 0.1 mA$ $R_L = 1K\Omega$	-	30	-	μs
Fall time	T_F		-	25	-	μs

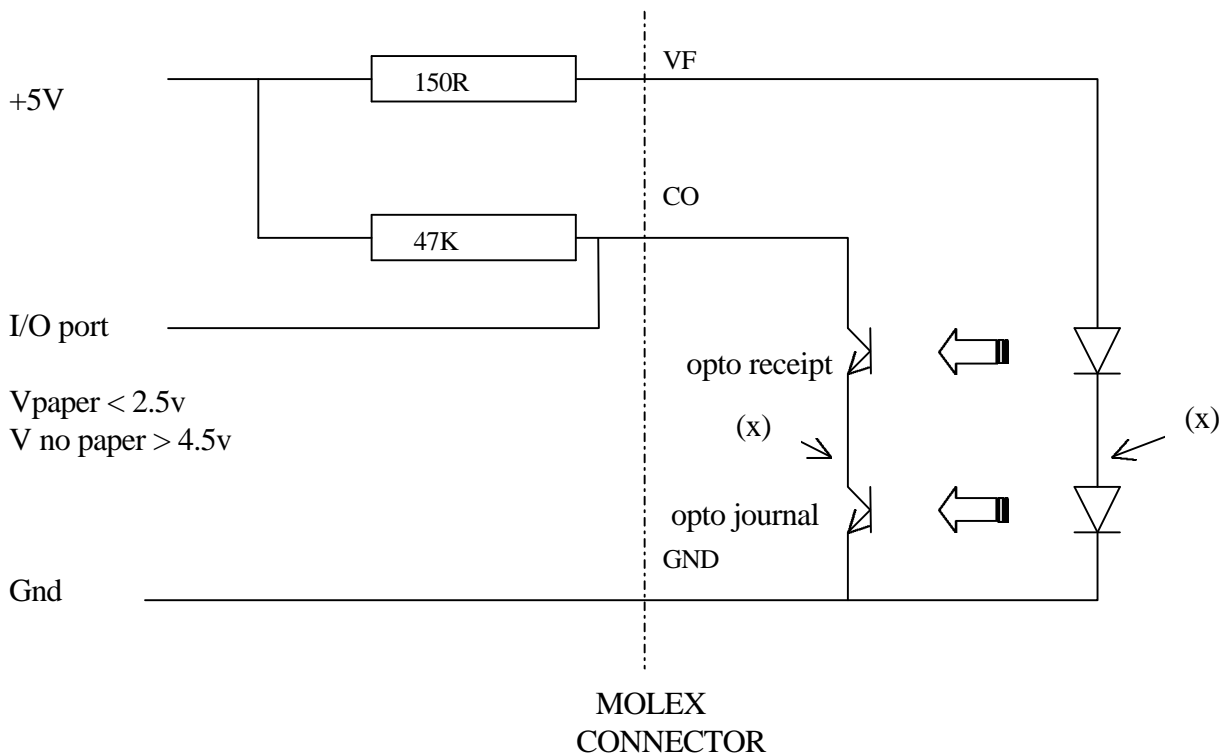
One possible interfacing is as follows:



5.2.2. Double paper opto sensor

This opto sensor is available when using the mechanism in two stations configuration. The two opto sensors are “anded” to provide an active end of paper signal as soon as one of the two sensors is running out of paper.

The schematics is as follows:



6. Pin out assignment

- 1/ Stepper motor connector: (P1) Molex 5264-04 (Male is 5267/5268)
- 2/ Head up/down and Paper out connector: (P2) Molex 5264-05 (Male is 5267/5268)
- 3/ Thermal Printhead connector: (P3) JST S16B-PH-K-S-1.2.

6.1. Stepper motor connector

Number	Signal name	Functions
1	$\Phi 1$	Drive signal for stepper motor
2	$\Phi 2$	
3	$\Phi 3$	
4	$\Phi 4$	

6.2. Head-up/down and Paper out connector

Pin number	Signal name	Function
1	VF	anode of photodiode
2	CO	collector of opto sensor
3	GND	GND
4	SW1	Switch first terminal
5	SW2	Switch second terminal

6.3. Thermal head connector

Pin Number	Signal name	Pin Number	Signal name
1	VH	9	GND
2	VH	10	Vdd
3	Thermistor 1st terminal	11	\STB1
4	Thermistor 2nd terminal	12	\LATCH
5	\STB2	13	CLOCK
6	GND	14	DATA IN
7	GND	15	VH
8	GND	16	VH

7. Life in standard printing conditions

Life is defined so that the average resistance value of the head changes more than 15% from its initial value. Head temperature shall not exceed the maximum 60°C with Thermistor reading.

Then:

- Pulse life : 10.10⁸ Pulses
- Abrasion life: 100 km guaranteed

8. Warranty

APS (“APS”) Warrants this product against defects in material or workmanship, as follows:

- For a period of twelve (12) months from the manufacturing date , APS will repair or replace any products return in fact, APS shall determine to be defective in material or workmanship upon inspection.
- The warranty shall be invalidated by any damage due to:
 - 1: Disasters such as fire, earthquake, flood, or robbery.
 - 2: Repair, modification, misuse, abuse or negligence.

APS shall not be liable for any incidental or consequential damages (defects of main units, parts replacement, parts transportation) for breach of any express or implied warranty production over.

9. Mechanical and housing

9.1. General dimensions

See attached drawings page 13.

9.2. Position of paper inlet or exit

Paper can be loaded from two inlet positions, bottom and front as mentioned on the attached drawing. The printer is delivered in standard with the opto sensor in front paper inlet detection. For bottom inlet use please remove the opto from its location and insert it in bottom position location for good paper detection

9.3. Fixation points

See attached drawings page 13 .

10. Ordering code

CP 290 – X – X – X

Paper width

- A = 60 mm
- B = 66 mm
- C = 2 x 29 mm
- D = 2 x 32 mm

Winder

- N= no winder
- X = paper 60 mm
- Y = paper 29 mm
- Z = paper 32 mm
- W= paper 66 mm

Single/Double opto-sensor

- 1 = One opto-sensor
- 2 = Two serial opto-sensors

1 2 3 4 5 6 7 8

A

B

C

D

E

F

A

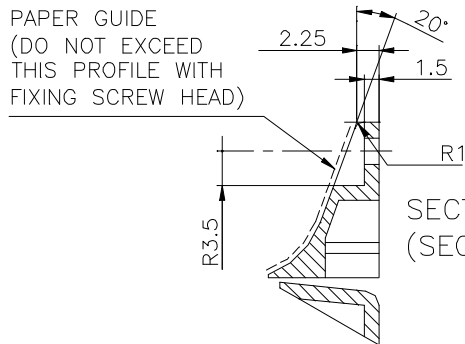
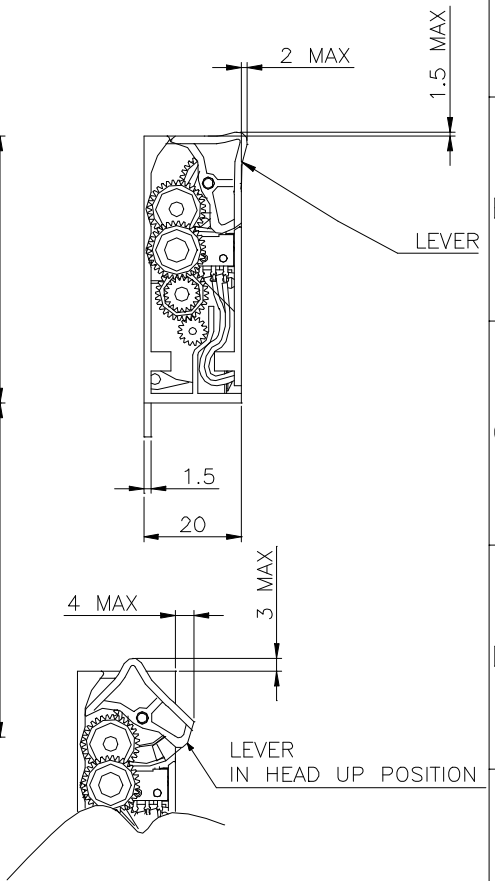
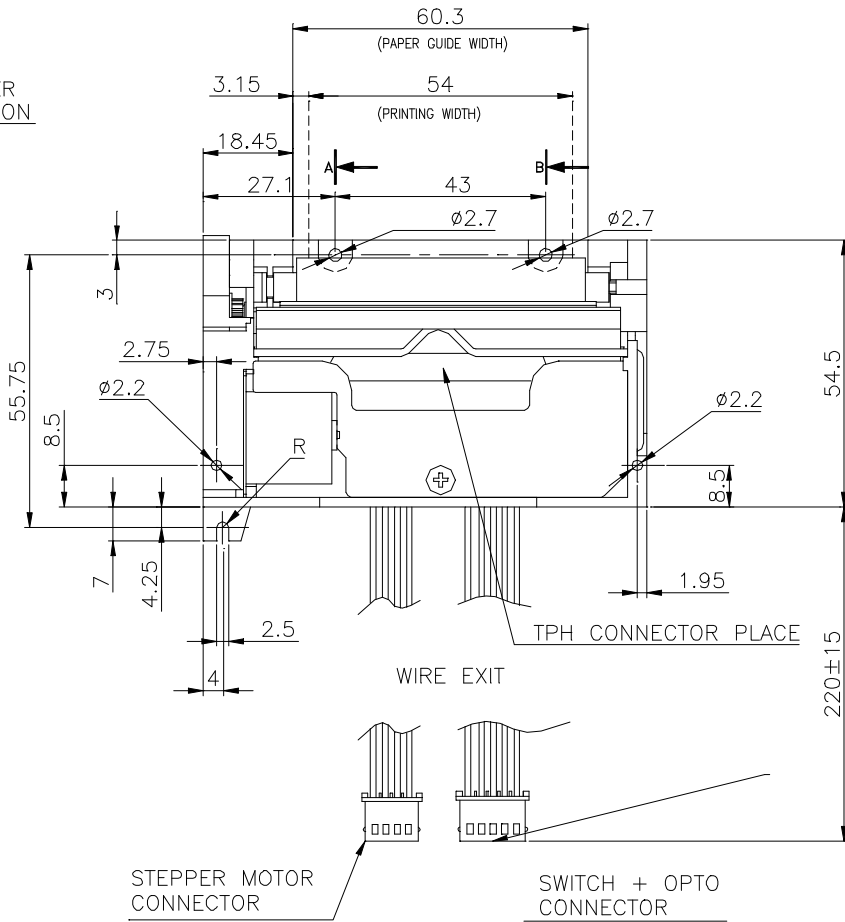
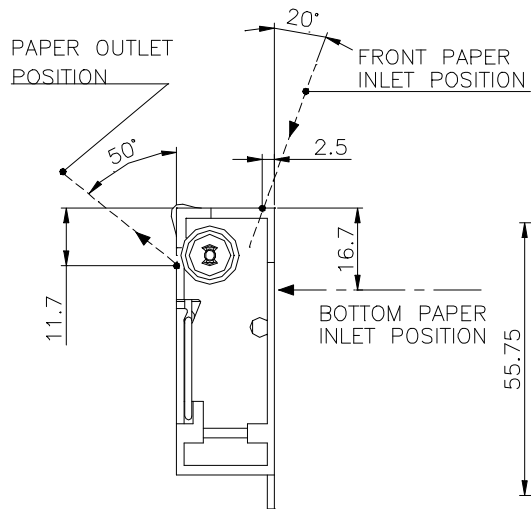
B

C

D


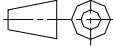
E

F



SECTION A (Scale 2:1)
(SECTION B = SEC. A)

LE DIMENSIONI SONO IN mm - Dimensions are in mm

DENOMINAZIONE Denomination	I	STAMPANTE	DISEGNATO DA Drawn By	F.C.	MASSA Mass	  FORMATO-Size A3	
	GB	PRINTER	VISTO DA Checked by		Kg.		
	F	IMPRIMANTE	DATA-Date	30-04-99	SCALA-Scale		1.1
	D	DRUCKER	NOME FILE - File Name	90290AN1-A...			
DISEGNO D'INGOMBRO OVERALL DIMENSIONS DRAWING			FOGLIO Sheet	1/1			
CATALOGO Catalog			N° DIS.-Draw.No		90290AN1	REV. A	

REVISIONI (Revisions) : A CREAZIONE(30-04-99 F.C.)

1 2 3 4 5 6 7 8