SS205-V4-HS

Technical Manual

Preface

- This manual provides complete technical information about SS205-V4-HS thermal printer mechanism.
- For customized printers, A.P.S. supplies documentation in addition to the present specification.
- The present specification is valid also for customized types, where the different condition has no effects on common data (eg. different length of elec. cables)
- More information is available upon request such as high speed printing applications and reliability figures.
- A.P.S. reserves the right to make changes to the product, without notice, to improve reliability, functions or design.
- A.P.S. does not assume any liability of the application or the use of the product or circuits.
- The warranty terms of the product are described in a separate document, please contact A.P.S. for further information.

Revision History

Rev.Index	Date	Page/Sec.	Description	Author
Pre	27-Oct.-2010	-	Preliminary Version	YK
Pre	25-Nov-2011	Page 1 Page 5 Page 6 Page 7 Page 8 Page 12 Page 13 Page 18	Cover picture updated, add LV version, add ordering code.	BZ
Pre	19-Jun-2012	--	Divided into -HS/-LV two versions. Updated TPH、Sensor parameters.	JAKIE

Table of Contents

1. INTRODUCTION……...…4
1.1 SS205-V4-HS Features…….…… 4

2. GENERAL CHARACTERISTICS…….……...……..5

3. THERMAL HEAD AND PRINTING CONFIGURATION……6
3.1 Outlines……..6
3.2 Thermal Head Electrical Characteristics…….……...…6
3.3 Timing Chart…….…...……..7
3.4 Maximum Conditions at 25°C……...……7
3.5 Typical Printing Condition……8
3.6 Heating Time Calculation……..……...…….8
3.7 Thermistor…….……...…..9
3.8 Print Position of the Data……...……....9
3.9 Operating Precautions…….…..…10

4. STEPPER MOTOR DRIVING METHODS…….…….12
4.1 Paper Feed Speed in Voltage Control Driving Method……12

5. END OF PAPER SENSOR……..……..13

6. PIN OUT ASSIGNMENT……..14

7. MECHANICAL AND HOUSING……..……15
7.1 Designing the Door……....…15
7.2 The Easy Opening System……...……..15
7.3 Overall Dimensions and Fixing Points .. ……...…….16
7.4 The Drawing of Manufacturing……...…..16

8. ORDERING CODE……..……...…….……17

1. INTRODUCTION

The **SS205-V4-HS** (Super small 205, version 4, high speed) is a new version of latest **SS205-V3** optimized for low cost application. It is compatible with current SS205-V3.

The **SS205-V4-HS** printer has been designed to be the smallest, wide voltage range (from 3.0V to 9.5V), and high efficiency easy loading printer on its market. The unique easy loading APS concept makes the **SS205** an ultra compact, reliable and cost-effective mechanism. The rubber roller can be separated from the mechanism and fixed to the customer's door allowing for very easy integration.

The patented locking system of the rubber roller onto the chassis and easy opening lever makes the door position and rotation axe independent of the cover position, giving the customer a total freedom when designing his housing. The ergonomic centered paper path allows uniform and aesthetic housing design. Thus, no access to cover sides is required to open the door.

1.1 SS205-V4-HS Features

- Patented Easy loading and Easy Door Opening System
- Ultra compact design (width is 68mm, depth 15mm)
- Up to 95mm/s printing speed
- Ultra light (26g)
- Starting operating voltage as low as 3V for logic and 5.5V for the dots
- High resolution printing (8 dots/mm)
- Life of 100 million pulses, 100 km
- Low consumption
- Low noise due to its technology (thermal)

2. GENERAL CHARACTERISTICS

Item	Specification	
Printing method	Thermal dot line printing	
Number of dots/line	384	
Main scanning density (dot/mm)	8	
Subsequent scanning density (line/mm)	8	
Printing width (mm)	48	
Paper width (mm)	58 +0/-1	
Paper feed pitch (mm) Paper pitch (mm)	0.0625(every 1 step of the motor drive signal) 0.125(every 2 step of the motor drive signal)	
Paper feed tension (gf)	50 or more	
Paper hold tension (gf)	80 or more	
Dimension W*D*H (mm)	68 × 24 × 26	
Weight (g)	Approx 26	
Head temperature detection	Thermistor	
Paper end detection	Photo-interrupter	
Operating voltage range	Logic: 3-5.25V / Dots : 5.5-9.5V	
Current consumption	At printing(7.2V): (64 dots ON)	2.79A (Head power)
		60mA (Head logic 5V)
		0.76A (Motor in voltage control mode
	At paper feeding (7.2V):	0.76A (Motor in voltage control mode
		<100uA (Head logic 5V)
Recommended Paper (Equivalent types can be used)	PD160R OJI PAPER MILL Co.LTD.	
Operating temperature range (°C)	-30 ~ 65	
Operating humidity (RH%)	10 ~ 90 (no condensation)	
Storage temperature range (°C)	-40 ~ 80	
Storage humidity (RH%)	5 ~ 90 (no condensation)	

Printer life

	Durability	Basic conditions	Maximum variations
Thermal head pulse resistance	100 million pulse	-Room temp:20/50°C -Head Temp:70°C Max -Rated energy	Max 10% average dots Resistance value (Ohms) from initial value
Abrasion/wear resistance	100 km of paper		

3. THERMAL HEAD AND PRINTING CONFIGURATION

3.1 Outlines

Number of heat elements	384 dots
Heat element pitch	0.125 mm
Print width	48 mm (centered on paper)
Average resistance	176 Ohms ±3%

3.2 Thermal Head Electrical Characteristics

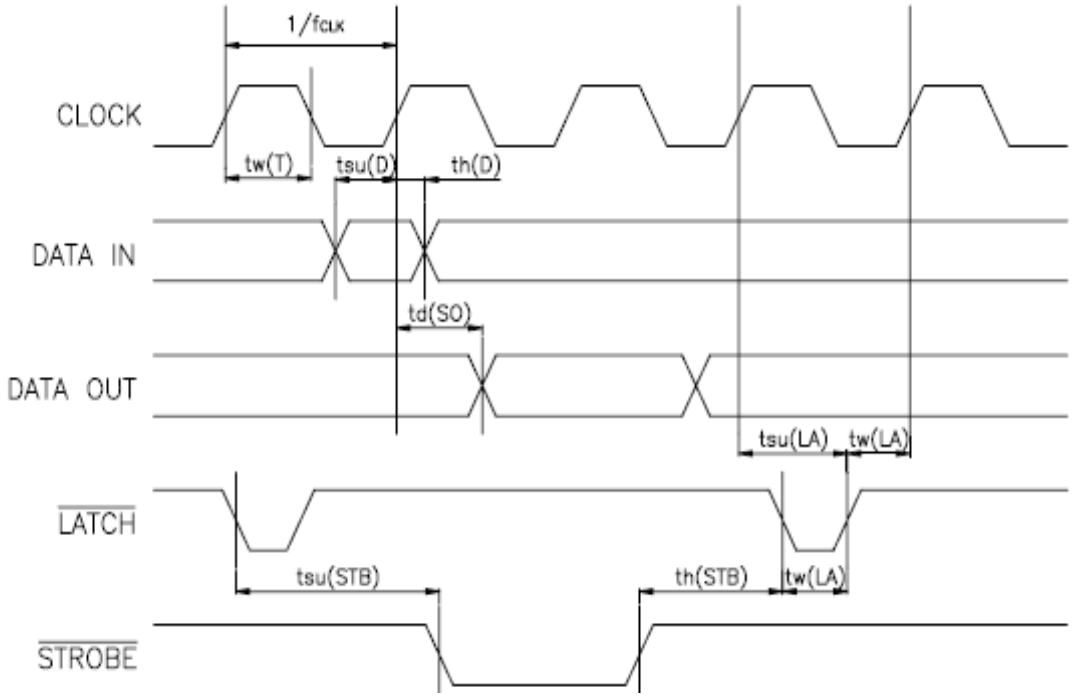
Parameter	Symbol	Test conditions	Recommendations			Unit
			Min.	Typ.	Max.	
Supply voltage	V_{DD}		3	5.0	5.25	V
	V_H		-	-	8.5	V
Inout voltage for logic	V_{IH}		0.8XVDD	-	VDD	V
	V_{IL}		0		0.2XVDD	V
Clock frequency	f_{CLK}	duty 50%	-	-	10	MHz

Parameter		Symbol	Test conditions	Ratings			Unit
				Min.	Typ.	Max.	
Input current for logic	$\overline{LATCH}$	I_{IH}	V_{IH} = VDD			3	uA
	$\overline{STROBE}$					1	uA
	CLOCK					3	uA
	DATA IN					0.5	uA
	$\overline{LATCH}$	I_{IL}	V_{IL} = GND	-330			uA
	$\overline{STROBE}$			-110			uA
	CLOCK			-3			uA
	DATA IN			-0.5			uA
"L" Output voltage of drivers		V_{DOL}	VDD=3V I_{DOL}=60mA		0.7	0.9	V
Leak current of drivers		I_{LEAK}	V_{DOH} = 8V			1	uA/dot
Logic supply current		Idd	f_{CLK}=8MHz DI=1/2f_{CLK}		21	60	mA
Logic supply current (Non-Operation)		Is	DATA IN/CLOCK = GND Other logic signal open			150	uA

Parameter	Symbol	Test conditions	Ratings			Unit
			Min.	Typ.	Max.	
Clock frequency	fCLK	cascade			10	MHz
Clock pulse width	tw(T)		40			ns
Data setup time	tsu(D)		40			ns
Data hold time	th(D)		40			ns
Latch setup time	tsu(LA)		100			ns
Latch pulse time	tw(LA)		100			ns
Latch to Strobe setup time	tsu(STB)		100			ns
Strobe to Latch setup time	th(STB)		100			ns

3.3 Timing Chart

The following chart gives the timing for driving the print head:



3.4 Maximum Conditions

Item	Symbol	Maximum Specification		Note
Heater energy consumption	Eo Max	2.5ms/line	1.25ms/line	Ta = 25℃
		0.45mJ/dot	0.24mJ/dot	
Head print voltage	VH max	9.5V		Between Connector
Logic voltage	VDD max	5.25V		
Number of heating dots simultaneously ON	Ndot max	192 dots		

Operating temperature	Ta	-30℃~+65℃	
Storage temperature		-40℃~+80℃	Non-operating
Operating humidity		10~90%RH	
Storage Humidity		5~90%RH	
Maximum operating temperature	Ts	65℃ 30min MAX Detected temperature of Thermistor shall not exceed 65° C	Head temperature shall not exceed 70℃

Notes:

- If energy above maximum ratings is applied to one dot, the print quality of this dot may be affected (usually by making a "light" print-out).
- The print quality will not be guaranteed if the operation temperature is out of range of 5℃~+50℃
- If the print cycle is less than that the one indicated above, then the maximum supply energy value is decreased. For these applications, please contact APS for further information.
- When using low energy paper, please contact A.P.S. for more information.

3.5 Typical Printing Conditions

Item		Symbol	Recommended conditions		Unit	Note
Print Speed			2.5	1.25	ms/line	
Heater power consumption		Po	0.238	0.336	W/dot	$\overline{R}$ =176Ω
Heat voltage			7.2	8.5	V	Between Connectors
Heater energy consumption	5℃	Eo(ts)	0.20(0.84)	0.17(0.51)	mJ/dot(ms)	$\overline{R}$ =176Ω
	25℃		0.18(0.76)	0.14(0.42)		
	40℃		0.16(0.67)	0.13(0.39)		
Supply current		Io	36.8	43.7	mA/dot	

3.6 Heating Time Calculation

The following formula allows calculating the heating time Ton depending on driving voltage VH:

$$T_{on} = \frac{E_0}{P_0} = E_0 * \frac{(N * R_{com} + R_{av} + R_{ic} + R_l)^2}{V_H^2 * R_{av}}$$

Where:

E_0 is the nominal energy

V_H is the driving voltage

R_{av}	is the average resistance
N	is the number of dots energized simultaneously
R_{com}	is the common resistance (0.05 Ohms)
R_{ic}	is the driver saturated resistance (11.7 Ohms)
R_l	is the lead resistance (10 Ohms) (or resistance of TPH contacts)

3.7 Thermistor

When performing continuous printing, it is recommended that the supply energy be reduced so that the substrate temperature monitored through the thermistor will remain below 70°C. The thermistor specification is the following:

- R25, resistance at 25°C: 10 KOhms +/- 10%
- B value: 3550 KOhms +/- 3%
- Operating temperature: -20°C to +80°C
- Time constant: Max.30 s (in the air)

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

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

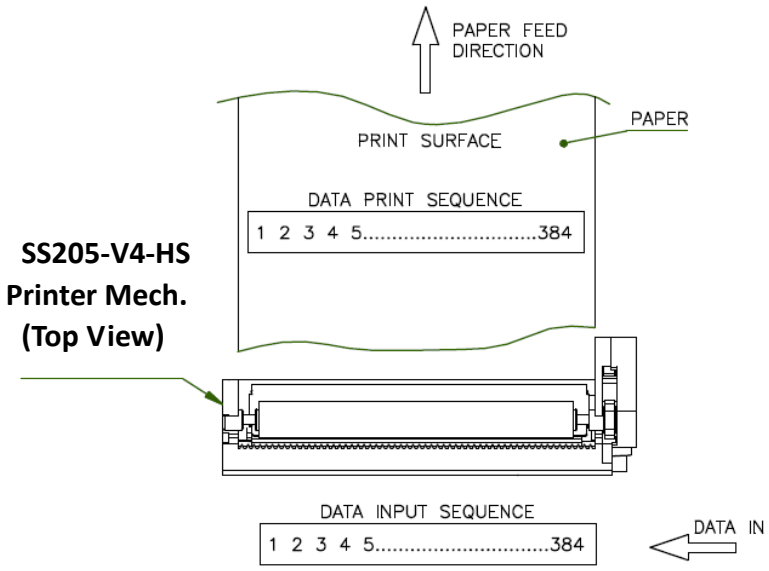
The dot activation compensation time (1% per degree) is defined as follows:

$$T_{on} = T_{on(25°C)} * (1 - (\frac{T-25}{100}))$$

T_{on}(25 ℃) is given in section 3.5

3.8 Print Position of the Data

The first bit of data (dot 1) entered is the first bit of data printed (FIFO), left side of TPH, top view (opposite side of the printer gear box).



3.9 Operating Precautions

1. When performing continuous printing, the supply energy should be reduced so that the substrate temperature, monitored through the thermistor, will remain below 65°C.

2. All strobes signals must be disabled during the power and logic voltage on/off sequence.

3. Do not touch the connector pins with naked hands.

4. The print-head substrate surface is coated with glass, for this reason, mechanical stresses, shocks, dust and scratches should be avoided to prevent damage.

5. When the print-head operation is completed, print supply voltage (including the charged voltage with capacitor) should be reduced to the ground level and maintained until next print-head operation.

6. Avoid condensation or water projection, if this occurs, do not switch on the print-head power, until condensation or water drops have disappeared.

7. When plugging in and out of the FPC, avoid using excess force as damage may result (Plug in-out cycle for this FPC should not exceeded 20 times). Do not pick up the mechanism by the FPC.

8. Always turn printer off before connection or disconnection of FPC.

9. Print quality would become degraded if paper or ink residue were stuck on the heat element area. In this case, clean the print-head with a soft applicator and alcohol. Do not use sandpaper as this will destroy the heating elements. For same reasons, avoid using printer in dusty environment.

10. If abnormal “sticking sound” is heard while printing, please check and adjust the printing mode to eliminate this sound (printing speed and heating time).

11. Make sure the paper does not have high abrasion factor, low sensitivity or abnormal chemicals.

12. To avoid current surges and voltage losses, VH and GND cable length should be less than 100mm and 47 µF aluminum capacitor between VH and GND is advised on customer’s controller board side.

13. FPC minimum bending radius of 0.5 mm

14. Usually, head cleaning is not required, if necessary: remove the platen roller first, then clean the head using dampened cotton with alcohol or isopropyl. Ensure to the alcohol has completely dried before insertion of the platen..Do not clean the head just after a printout; the head temperature could be high. Do not use metal tools or sandpaper, sharp objects or cutter, etc. to clean the head; they could damage the thermal head.

Important Precautions

To prevent any dot element damage:

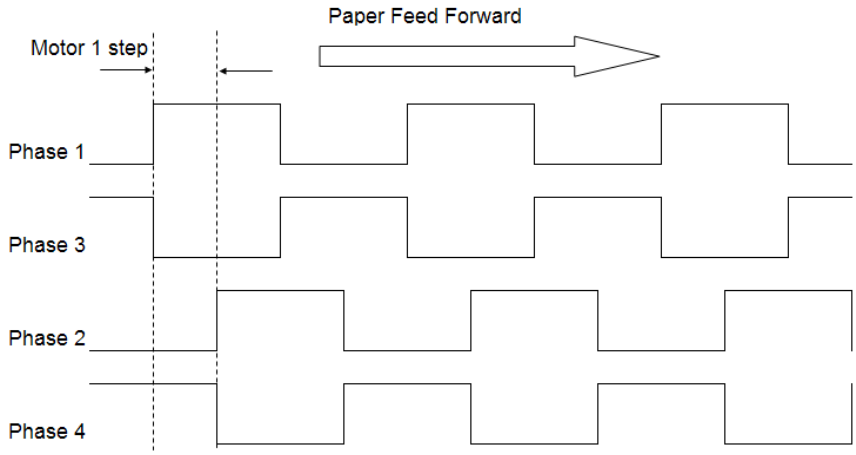
At power up make sure that logic voltage (Vdd) is present simultaneously or before VH.

At power down make sure that VH is at 0 V before removing logic voltage.

4. STEPPER MOTOR DRIVING METHODS

The paper feed pitch for stepper motor is 2 steps 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 timing diagram is then as follows:



There are four different positions for the stepper motor. The driving is bipolar and can be achieved with circuits like: the Rohm BA6845FS, the Sanyo LB1846, LB1848, or LB11948T which offer a PWM current control. Please refer to the IC's data sheet for further information. It is recommended not to exceed 0.2V like voltage drop in the stepper motor driver circuit.
Coil resistance: 19Ω±10%

4.1 Paper Feed Speed in Voltage Control Driving Method

The following chart gives the maximum paper feed speed versus the voltage at stepper motor phases (voltage drop in driver circuit not included)

Voltage (V)	Paper feed mm/s	Duty cycle (%)
5.5	52	75
6.0	57	60
6.5	64	50
7.0	73	45
7.5	83	40
8.0	86	35
8.5	90	30

In order to avoid stepper motor overheat, it is strongly advised to respect the maximum ON/OFF duty cycle s indicated above. This is given for ambient room temperature (25°C) and may have to be confirmed by test depending customer integration and application conditions (motor overheating is affecting its power and torque performances). Note that the maximum period for the ON time is 30 seconds (when the duty cycle is ot 100%).

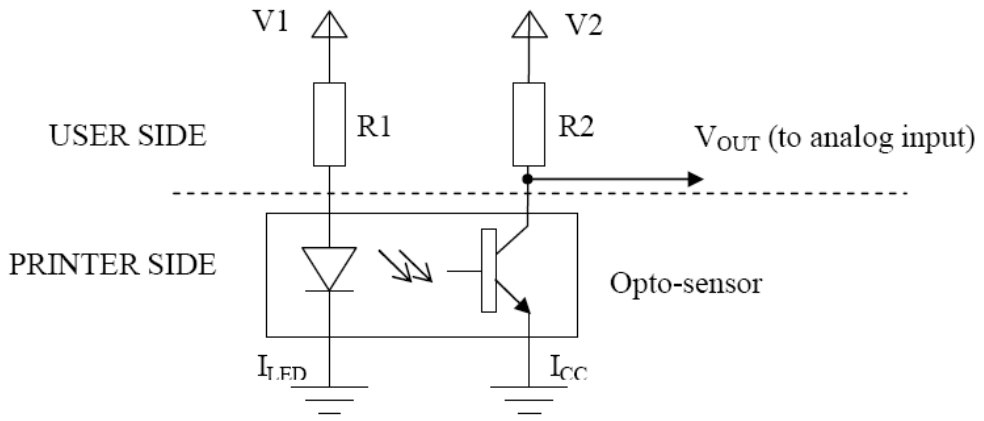
Example: since ***Toff = Ton*100 / Duty Cycle – Ton*** and maximum permissible Ton is 30s, at a voltage f 7V, we obtain from the table a duty cycle of 45%.
Inserting these values into the formula we obtain: Toff = 30*100/45 – 30 ・・37s.
So the maximum ticket length at maximum speed is: 57*30 ・1.7m. Then the printer must rest for 37 seconds.
There is no duty cycle limitation when using the current control. With current control, the max speed is 100mm/s or more when the current is 250mA.

5. END OF PAPER SENSOR

SS205-V4-HS has an end of paper sensor achieved by a photo-transistor. Arrange the circuitry so that no energy is applied to the head when there is no paper. If the head is energized when there is no paper and the head is in the down position, then both roller and head may be strongly damaged.
The table below contains opto sensor specification.

Parameter			Symbol	Conditions	Min.	TYP.	Max.	Unit
Input	Forward Voltage		V_F	I_F=20mA	1.0	1.2	1.5	V
	Reverse Current		I_R	V_R=6V	-	-	10	μA
Output	Collector Dark Current		I_{CEO}	V_{CE}=20V	-	-	0.1	μA
Transfer characteristics	Collector Current		I_C	V_{CE}=2V I_F=4mA	100	-	250	μA
	Response time	Rise time	tr	VCE=2V IC=100μA RL=1KΩ,d=1mm	-	20	100	μsec
		Fall time	tf		-	20	100	μsec

One possible interfacing of the opto-sensor circuit is shown in the figure below:



Where:

V1 = 5V
R1 = 380 Ohms (for ILED = 10mA) or R1 = 180 Ohms (for ILED =21mA)
V2 = 3.3V
R2 = 4700 Ohms
VOUT = V2 - R2·ICC

6. PIN OUT ASSIGNMENT

One Flexible Printed Circuit (FPC) is gathering all signals.
Contacts pitch is 0.5 mm and the number of contacts is 20.
User side FPC connector could be: JST 20FHSY-RSM or Molex 52746-2071 or any other equivalent.

Pin number	Signal name	Function
1	VH	Dotline voltage
2	VH	Dotline voltage
3	VH	Dotline voltage
4	VH	Dotline voltage
5	DATA_OUT	Data output signal
6	VDD	Logic Voltage
7	/STB5-6	Strobe signal (dots 1 to 128)
8	GND	Gnd (dotline and logic)
9	GND	Gnd (dotline and logic)
10	GND	Gnd (dotline and logic)
11	/STB4	Strobe signal (dots 129 to 192)
12	CLK	Serial clock signal
13	/STB2-3	Strobe signal (dots 193 to 320)
14	GND	Gnd (dotline and logic)

15	GND	Gnd (dotline and logic)
16	CO	Collector of photo-transistor
17	GND	Gnd (dotline and logic)
18	GND	Gnd (dotline and logic)
19	VF	Anode of photo-sensor
20	TM	Thermistor 1st terminal (2nd is Gnd)
21	/STB1	Strobe signal (dots 321 to 384)
22	VDD	Logic Voltage
23	CLK	Serial clock signal
24	/LATCH	Latch signal
25	DATA_IN	Data input signal
26	VH	Dotline voltage
27	VH	Dotline voltage
28	VH	Dotline voltage
29	PHI1	First phase of stepper motor
30	PHI2	Second phase of stepper motor
31	PHI3	Third phase of stepper motor
32	PHI4	Fourth phase of stepper motor

7. MECHANICAL AND HOUSING

7.1 Designing the Door

The function of the door is to bring the rubber roller to the chassis' window entrance and to make it follow the external path of the chassis' window.

Given the shape of the chassis and the example in the mechanical drawing section (end of the specification), the cover is fairly easy to design.

In order to keep a good alignment, it is strongly advised to keep the rubber roller fully floating inside the cover to compensate any tolerance problem inside the cover.

Moreover this play must be present in order to allow the rubber roller to follow the shape of the chassis.

However, the cover must ensure a fairly good lateral alignment of the roller gear and chassis' window entrance in order to avoid damage of roller teeth that might cause abnormal friction inside gear box.

7.2 The Easy Opening System

Because the rubber roller is only referenced to the chassis and has no dependence on the cover, the mechanism is very reliable. To achieve this reliability, the rubber roller must be strongly locked inside the chassis.
To avoid any twist, and mechanical stress on the cover and more generally on the customer plastic, so increasing the reliability and quality, A.P.S developed a unique and patented feature to ease the opening of the door, that makes the mechanism very easy to open, and does not require any access to the cover's sides, giving more flexi- ability and ergonomics to the customer design.

This is achieved by clipping an internal lever inside the cover that pushes symmetrically on both sides of the mechanism. So the mechanism's shape has been optimized to concentrate the effort locally and always refer this effort to the chassis.

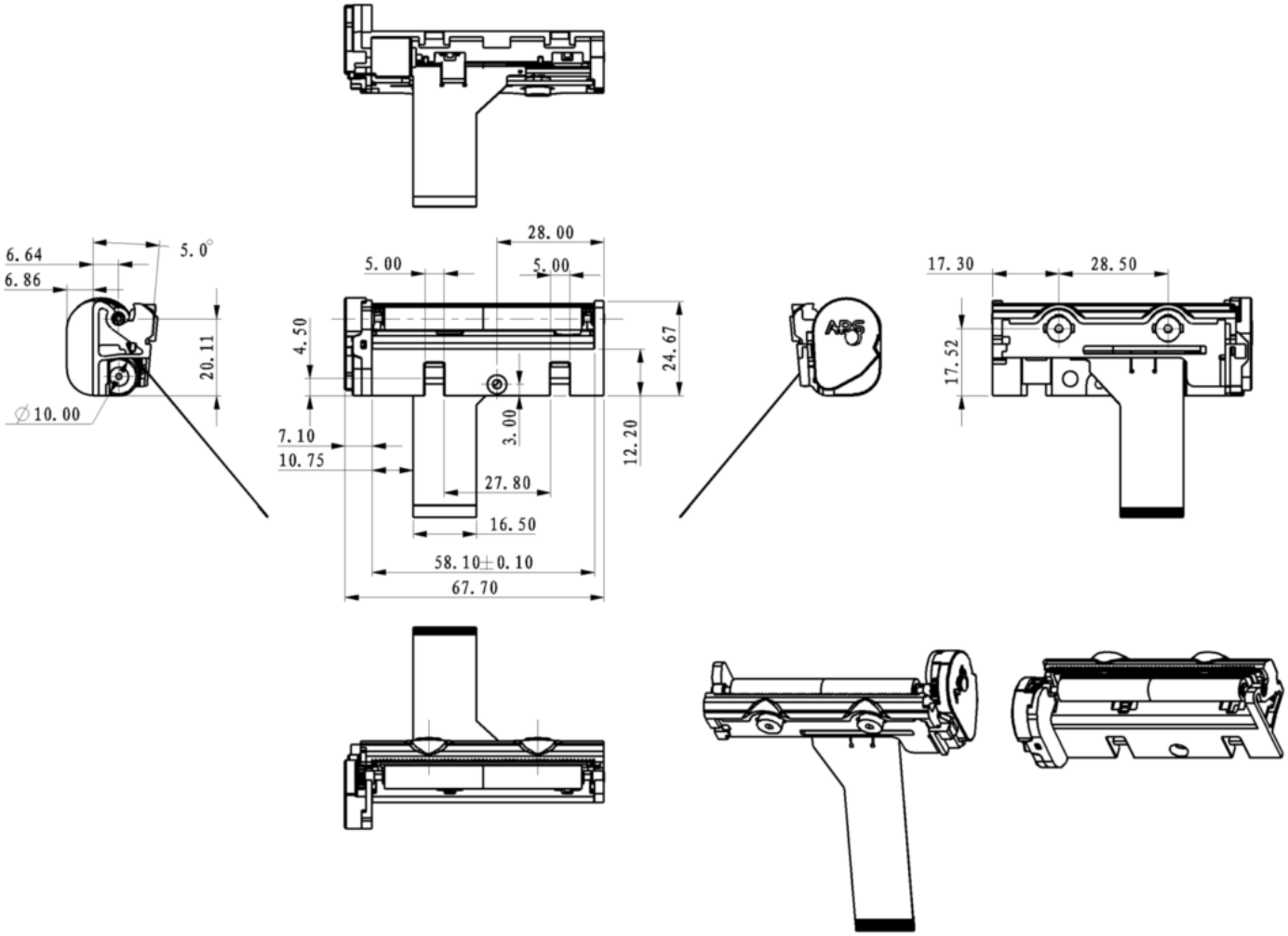
Doing so there is no need to have access to the cover side, giving more freedom to design the cover, and allowing reducing the width of the unit.
Please contact A.P.S for any assistance in designing this lever.

7.3. Overall Dimensions and Fixing Points

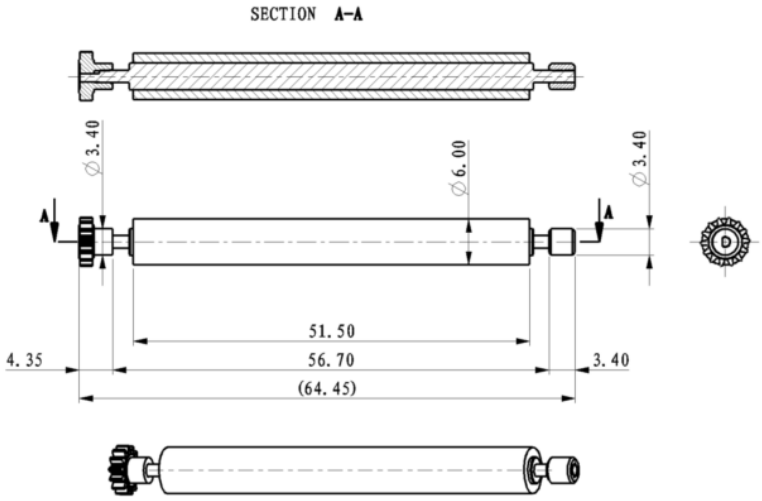
See attached drawing or ask A.P.S. for additional mechanical details.
The printer has to be fixed using its own points as described on the overall dimensions drawing, avoid any kind of deformation or torsion, if not, printing quality and printer's life will be drastically reduced.

7.4. The Drawing of Manufacturing

7.4.1 The drawing of printer (without roller unit)



7.4.2 The drawing of roller unit



8. ORDERING CODE

Type	Model Name	Ordering Code
SS205-V4-HS High Speed	SS205-V4-HS	90 200 814