

SC2

User's Guide Of Digital Close-loop Easy Servo Stepper Driver

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SC2

Digital Close-loop Easy Servo Stepper Driver

1. Products'introduce

1.1 General introduce

SC2 is a new low-voltage servo stepper product developed based on many years low-voltage servo system experience of our company.The product adopts the latest DSP digital processing chip and advanced variable current and frequency conversion control algorithm technology, which provides a cost-effective stepper servo drive solution for equipments manufacturers.SC2 has compact size,saving space, reducing the electromagnetic interference between lines.It use better vibration technology and low heat technology, effectively solve the motor and drive's heat, vibration, noise and other issues.Low heat, green environmental protection is this product's advantage.

1.2 Characteristic

- Operating voltage: 20~75Vac or 30~100Vdc
- Continuous output current maximum 6.0A(advanced step servo overload capability)
- Accepts differential and single-ended pulse / direction commands with three control modes: position / speed / torque
- FOC magnetic field positioning control technology and space vector pulse width modulation (SVPWM) closed-loop control technology
- Adopt advanced variable current technology and frequency conversion technology, effectively reducing the heating of the motor and drive
- The number of pulses per revolution can be set by debugging software or code (subdivision)
- with over-voltage, under-voltage, over-current and ultra-poor protection
- Single / double pulse mode, pulse valid edge optional
- Control instruction maximum pulse frequency is 200KHz (factory default is 200KHz)
- Pulse, direction and enable signal input interface level is 4.5-28V compatible
- RS232 serial debugging function, but need to use the company dedicated serial debugging cable
- Performance: Smooth speed, small overshoot, small tracking error, low heat of the motor and drive

1.3 Application

Suitable for a variety of small and medium-sized automation equipment and instruments, such as: laser machines, inkjet printers, small and medium engraving machines, electronic processing equipment, automatic grab equipment, special CNC machine tools, packaging equipment and robots. It use very well in the equipment that user expects small noise, and high speed.

2. Electrical, mechanical and environmental indicators

2.1 Electrical indicators

Parameter	SC2			
	Minimum	Typical	Maximum	Unit
Continuous output current	0.5	-	8	A
Supply voltage (AC)	20	60	75	VAC
Supply voltage (DC)	30	60	100	VDC
Logic input current	6	10	16	mA
Logic input voltage	4.5	5	28	Vdc

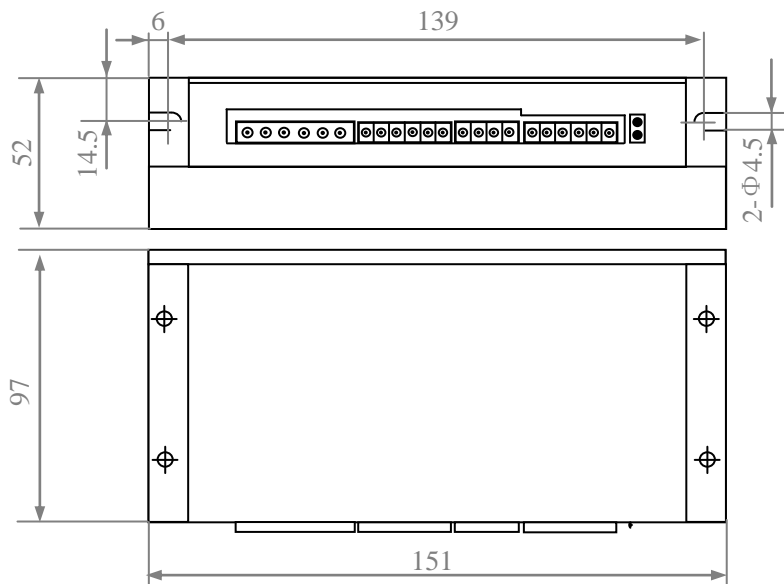
Pulse frequency	0	200	200	kHz
Pulse height width	1.5	-	-	uS
Position error control accuracy	-	±1	-	Pulse
Speed control accuracy	-	±2	-	rpm
Highest acceleration (empty)	-	100	-	rpm /ms
Overvoltage protection voltage	90			VAC
Insulation resistance	100	-	-	MΩ

2.2 Using environment and parameters

Cooling method		Natural cooling or forced air cooling
Using environment	occasion	Can not be placed next to other heating equipment, should avoid dust, oil mist, corrosive gas, too big humidity and strong vibration place, prohibit to have combustible gas and conductive dust
	temperature	-5°C ~ +45°C
	humidity	40 ~ 90%RH
	vibration	10 ~ 55Hz / 0.15mm
Storage temperature		-20°C ~ +65°C
Using altitude		≤1000m
Weight		About 0.6KG

2.3. Mechanical installation diagram

SC2 can match 60 series and 80 (86) series close-loop servo stepper motor, we recommended 3NM, 4.5NM, 8.5NM, 12,5NM close-loop servo stepper motor.



Drawing 1 Installation dimension diagram (mm)

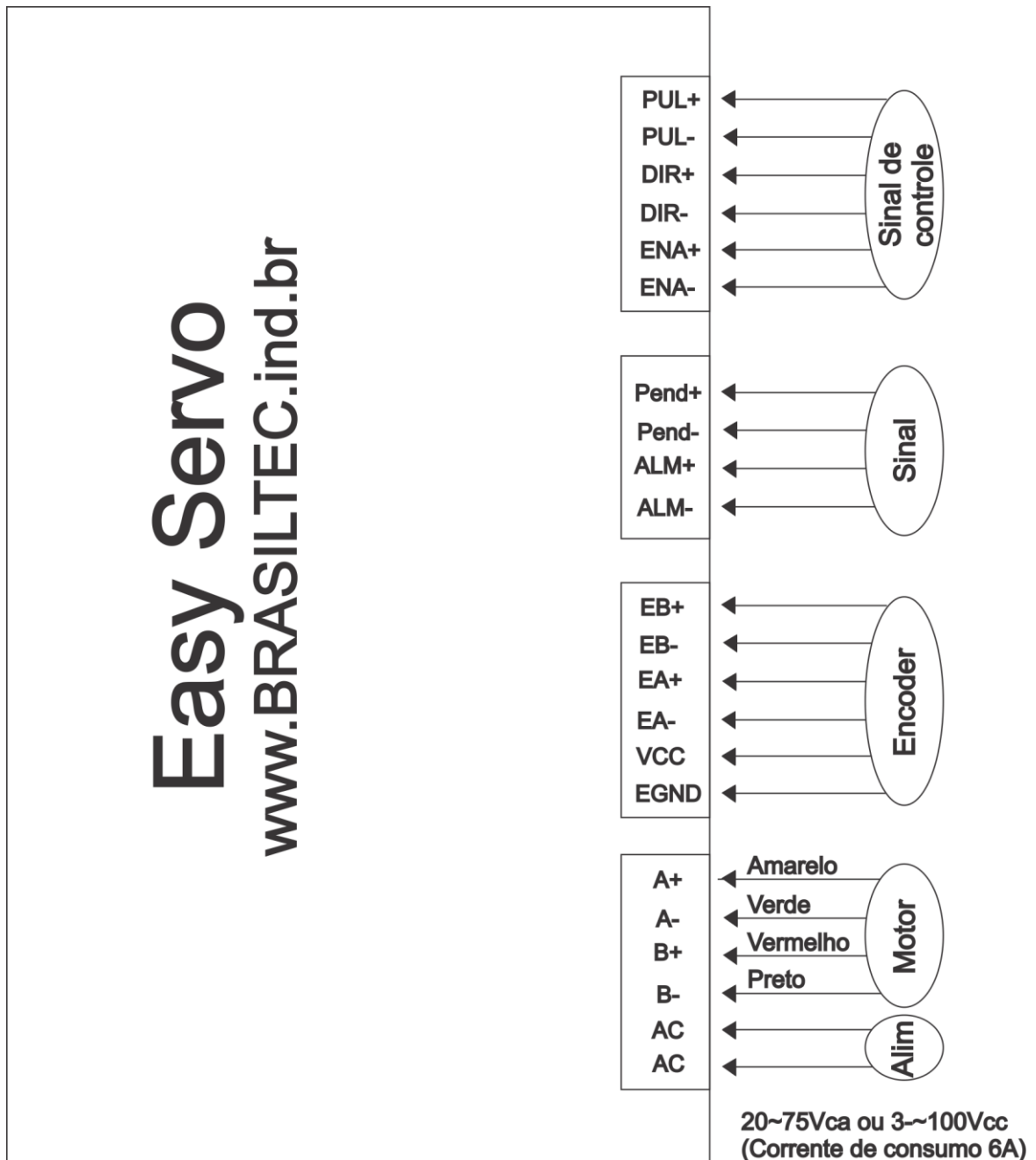
2.4 Enhanced heat dissipation

Reliable operating environment temperature of the driver is usually within -5°C to 45°C . And the driver's operation temperature limit in 60°C . When the motor is operating, the temperature is within 70°C . If necessary, install the fan near the driver to forcibly dissipate heat to ensure that the driver is working reliably within temperature range.

3. Drive Interface and Wiring Introduction

3.1 Interface description

3.1.1 Control signal and power input interface definition



Drawing 2 driver interface instruction

3.1.2 Control port

Using green 6+4 Pin 3.81mm Interval terminal

1	PUL+	Pulse positive input	Compatible with 4.5V~28V level signals
2	PUL-	Pulse negative input	
3	DIR+	Direction positive input	
4	DIR-	Direction negative input	
5	ENA+	Enable positive input	
6	ENA-	Enable negative input	
7	ALM+	Alarm signal positive output	Collect open circuit OC output, maximum pull-up level 24V, maximum output current 100mA
8	ALM-	Alarm signal negative output	
9	PEND+	In-position signal positive output	Collect open circuit OC output, maximum pull-up level 24V, maximum output current 100mA
10	PEND-	In-position signal negative output	

3.1.3 Motor and Power supply port

Use green 6 Pin 5mm spacing screw terminals (note the positive and negative of power supply, do not reverse them)

Pin number	Signal	Function	
1	A+	A phase motor wiring+	
2	A-	A phase motor wiring-	
3	B+	B phase motor wiring+	
4	B-	B phase motor wiring-	
5	AC	AC input	20V~ 75Vac or 30~100Vdc
6	AC	AC input	20V~ 75Vac or 30~100Vdc

3.1.4 Encoder port

Pin number	Signal	Function
1	EB+	Encoder signal B+ input
2	EB-	Encoder signal B- input
3	EA+	Encoder signal A+ input
4	EA-	Encoder signal A- input
5	VCC	Driver +5V output, supply power to encoder

6	EGND	DriverGND output, supply power to encoder
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3.1.5 Serial port RS232/ RS485 communication port

It can be connected to the PC through a serial port adapter (reset serial port adapter) and a dedicated serial cable(forbid charged plug). Through PC software, ProTuner, the subdivision and current value, effective edge and single double pulse all can be set, and can also be used for the elimination and adjustment of the resonance point.




Pin number	Signal	Name	Remark
1	+5V	5V positive of power supply	Only by external STU
2	TXD	RS232 sender	
3	RXD	RS232 receiver	
4	GND	5V power grounding	0V



Note: SC2 serial port cable(for tuning) must be special cable,please confirmwith us before use.

3.1.6 LED Status indication

Green LED is the power indicator, when the driver connect to the power supply, the LED is light; When the driver cuts off the power, the LED is off. The red LED is the fault indicator, and when there is a failure, the indicator will blink in a cycle of 5 seconds.Red LED is off when the fault is removed by the user.The red LED flashes at 2Hz, the LED is on for 200ms and off for 300ms. The flashing time of the red LED in 5 seconds represents different fault information, as shown in the following table:

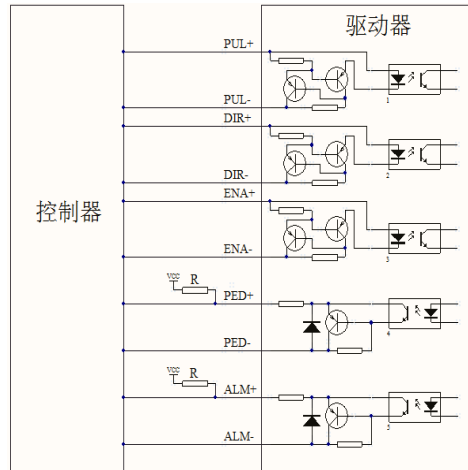
No.	Flashing times	Red LED flashes	Fault Description
1	1		Overcurrent fault ($I \geq 25A$)
2	2		Overvoltage fault ($V_{dc} \geq 90V$)
3	5		Tracking error over fault

When the driver has fault, it will shut down and advise the corresponding fault code. The fault can be cleared only when the user needs to power off and re-power on. When the drive fails, the driver will store the latest fault in the EEPROM of the driver in the form of a queue, and the driver will save up to 10 latest historical faults. The user can read the corresponding fault code via PC and text display.

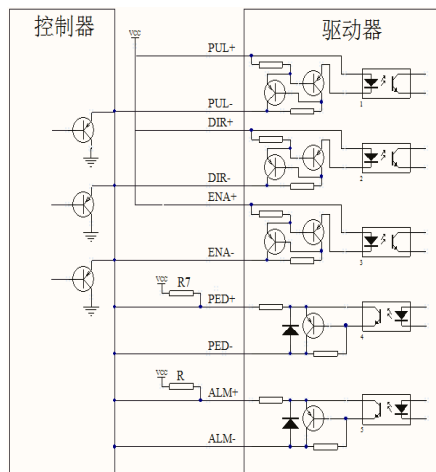
3.2 Control signal interface circuit

SC2 driver signal input interface can be differential signal input, common anode signal single-ended input and common cathode signal single-ended input. Built-in high-speed photoelectric isolation coupler; triode open collector OC output, the interface connection is as follows:

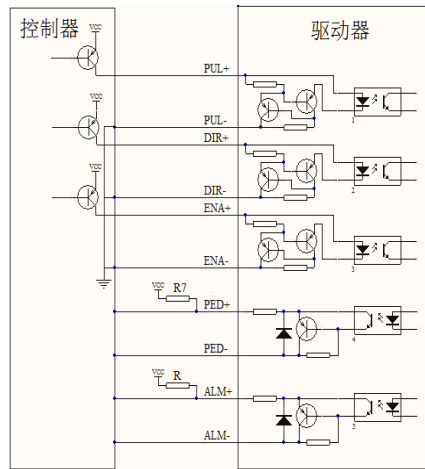
differential input signal connection



Input signal single-ended common anode connection



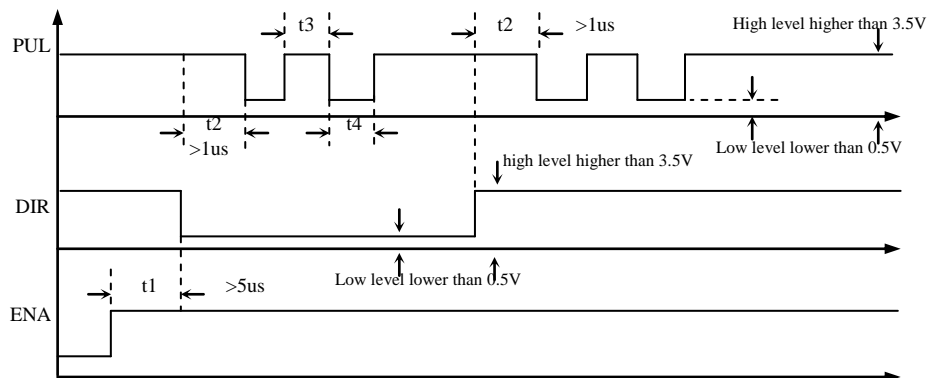
Input signal single-end common cathode connection



Note: The voltage range of signal input interface in the drawing is 4.5~28Vdc. No matter it is a single-ended connection or a differential connection, there's no need series current-limiting resistor. For the output interface external pull-up voltage is maximum 28Vdc, maximum output current is 100mA, according to the external pull-up voltage select the appropriate pull-up resistor. The basic parameter values: if the external pull-up voltage is 24Vdc, pull-up resistor selects 2K, if External pull-up voltage is 12Vdc, pull-up resistor selects 1K. If it is drive relay or motor brake coil, please consult to our engineer.

3.3 Control signal timing diagram

To avoid some missteps and errors, PUL-, DIR-, and ENA- should meet certain requirements:



Drawing 4 Control signal timing diagram

Remark:

- 1) t1: ENA (enable signal) should be ahead of DIR at least 5 μ s, identified as high. Under normal circumstances, we suggest vacant.
- 2) t2: DIR at least 1 μ s early than PUL falling edge to determine its status is high or low
- 3) t3: The pulse width is not less than 1.5 μ s
- 4) t4: Low-level width is no less than 1.5 μ s.

3.4 Control signal mode setting

Pulse trigger edge selection: Set the pulse rising edge or falling edge trigger by PC software.

Single and double pulse selection: Set single pulse or double pulse by PC software.

Direction selection: Set the initial running direction of the motor through the PC software.

3.5 Wiring requirements

1) In order to prevent the driver from being disturbed, it is recommended that use shielded cable for the control signal and the shielding layer should be connect to the ground. Unless otherwise specified, the shielding wire of the control signal is connected to the ground. One end of the shielded cable is grounded. One shielded cable end of the drive is vacant. The same machine only allows grounding at the same point, if it is not a true ground wire, the interference may be serious, then the shield is not connected.

2) The pulse and direction signal lines and the motor lines are not allowed to be tied together side by side, it is better to separate at least 10cm or more. Otherwise, the motor noise may easily disturb the pulse direction signal to cause the motor to be inaccurate and the system unstable.

3) If a power supply for multiple drives, parallel connection should be taken at the power supply, not allow one first to another chain-like connection.

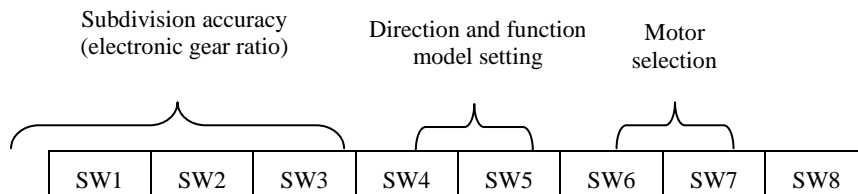
4) It is strictly forbidden to pull the plug of the driver with strong power P2 terminal. When the charged motor stops, a large current will flow through the windings. Plugging and inserting the P2 terminal will result in a huge inductive electromotive force that will burn the driver.

5) It is forbidden to connect the lead wire with tin to the access terminal. Otherwise, the terminal may be damaged due to overheated by the larger contact resistance.

6) The wiring terminals can not be exposed outside the terminals, in case of accidental short circuit and damage the driver

4. dial switch settings

The SC2 digital integrated low voltage servo stepper driver adopts 8-bit dial switch to set subdivision precision (electronic gear ratio), motor rotation initial direction, self-test and function mode selection. Detailed description is as follows:



Pulse/rev	S1	S2	S3	S4
Default	On	On	On	On
800	Off	On	On	On
1600	On	Off	On	On
3200	Off	Off	On	On
6400	On	On	Off	On
12800	Off	On	Off	On
25600	On	Off	Off	On
51200	Off	Off	Off	On
1000	On	On	On	Off
2000	Off	On	On	Off
4000	On	Off	On	Off
5000	Off	Off	On	Off
8000	On	On	Off	Off
10000	Off	On	Off	Off
20000	On	Off	Off	Off
40000	Off	Off	Off	Off

Subdivision precision (electronic gear ratio): When S1, S2, S3, S4 are all on, the driver micro-step subdivision adopts the default internal subdivision number, and the initial value of the default subdivision number is 400 Pulse/rev. Electronic gear ratios can also be set via tuning software. SW5 sets the motor direction. When it is ON, the motor rotates clockwise (CW). When it is OFF, the motor rotates counterclockwise (CCW); SW6 function mode selection, when it is OFF, the driver is in space vector control mode (FOC), when it is on, the driver is in point movement mode (PM), the mode start and stop effect is better.

Motor	SW7	SW8
60SC30	ON	ON
86SC45	OFF	ON
86SC85	ON	OFF
86SC120	OFF	OFF

5. Protective function

1) Overvoltage protection

When the input voltage of SC2 is higher than 75Vac or 100Vdc, the driver will stop working. At this time we must remedy of the trouble and reset when power-on.

2) Undervoltage protection

When the input voltage of SC2 is lower than 22vac or 28Vdc, the driver will stop working. At this time we must remedy of the trouble and reset when power-on.

3) Overcurrent protection

When overcurrent of SC2 occurs, the driver will stop working. At this time we must remedy of the trouble and reset when power-on.

4) tracking error over tolerance

When the tracking error is over tolerance, the driver stops working. At this time we must remedy of the trouble and reset when power-on.

△ **Remark:** Since the driver does not have the power supply reverse polarity protection function, so before power again make sure the positive and negative power supply wiring is correct. Reverse polarity will lead to burn the fuse in the driver!

6. Common problems

6.1 common problems and solutions in application

Phenomenon	Possible problems	Solutions
Motor not running	Power light is off	Check the power supply circuit, normal power supply
	Motor shaft has torque	The pulse signal is weak and increase the current to 7-16mA
	Too small subdivision	Choose right subdivision
	If the current setting too small	Choose right current
	Driver is protected	Re-power
	The enable signal is low	This signal is pulled high or not connect
	open circuit of motor line	Check and connection right
	Voltage is too high or too low	Check the power supply
	Motor or driver damaged	Change the motor or driver
Wrong position	The signal is disturbed	Eliminate interference
	No connect grounding	Grounding right
	Motor circuit is open	Check and connection right
	Wrong subdivision	Set right subdivision
The motor can't run when acceleration	Acceleration time is too short	Acceleration more time
	Too small motor torque	Select a large torque motor
	Low voltage	Increase the voltage

6.2 Driver FAQ

1) What are the advantages of subdivision driver?

- Increasing step uniformity by reducing the step angle,so that can improve the control accuracy.
- Can greatly reduce the motor vibration, low-frequency oscillation is the inherent characteristics of the stepper motor, using of subdivision is the best way to eliminate it.
- can effectively reduce the torque ripple, increase the output torque.

These advantages are generally recognized by the user, and bring them benefits, so we recommend use subdivision driver.

2) Why does my motor only operate in one direction?

- The direction signal may be too weak, or the wiring polarity is wrong, or the signal voltage is too high, burnout direction current limiting resistor.
- Pulse mode mismatch, signal is pulse / direction, driver must be set to this mode; drive must be in the same mode if the signal is CW / CCW (double pulse mode), or the motor will run in only one direction.

Brasiltec

intelligent solutions worldwide

AUTOMAÇÃO INDUSTRIAL

RIO DO SUL - SC

(047) 3525-4790

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(047) 98839-0936

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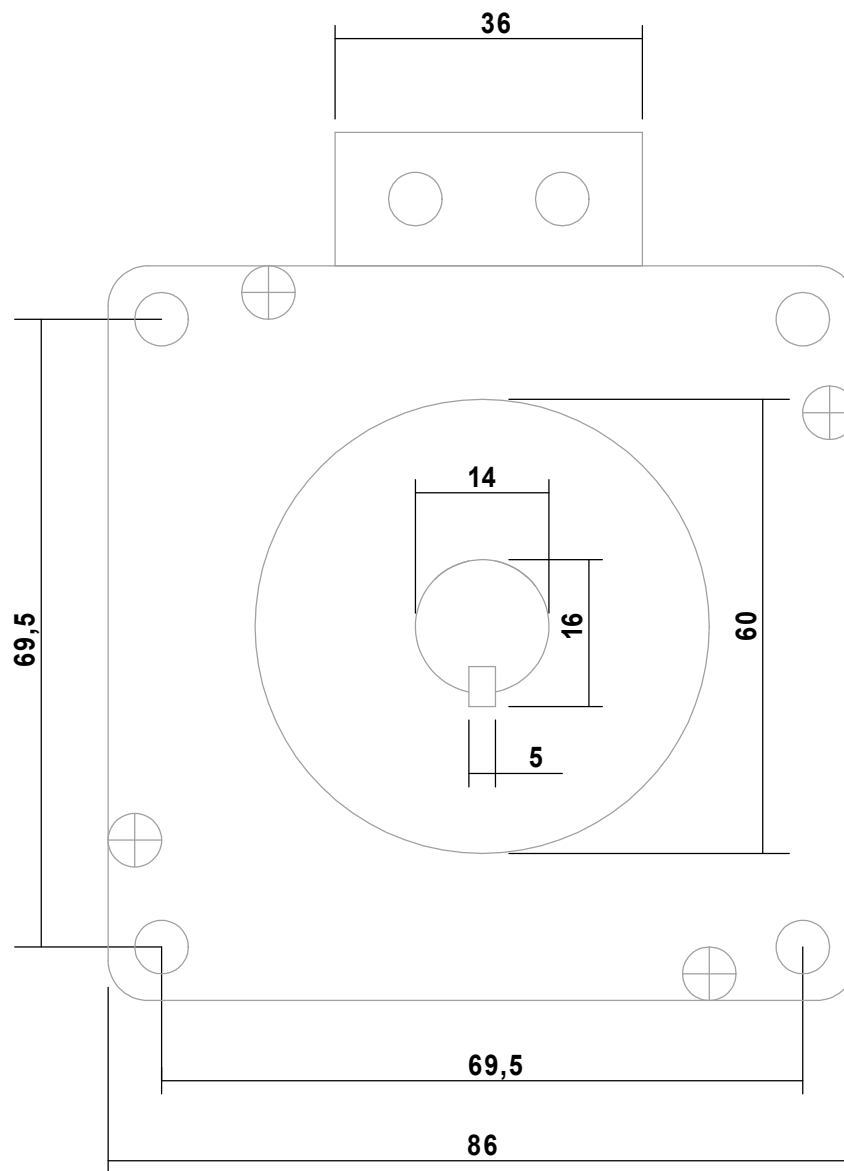
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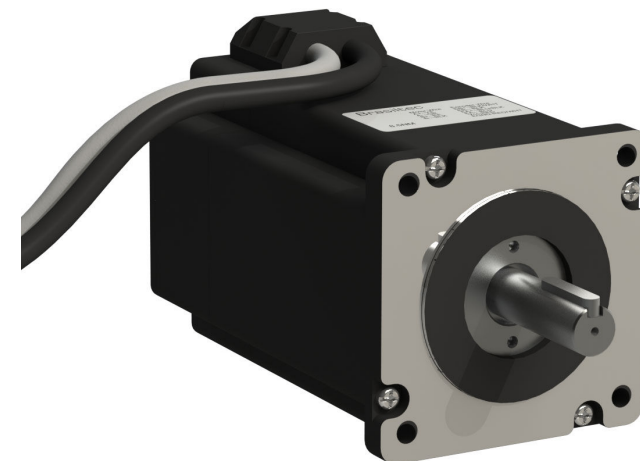
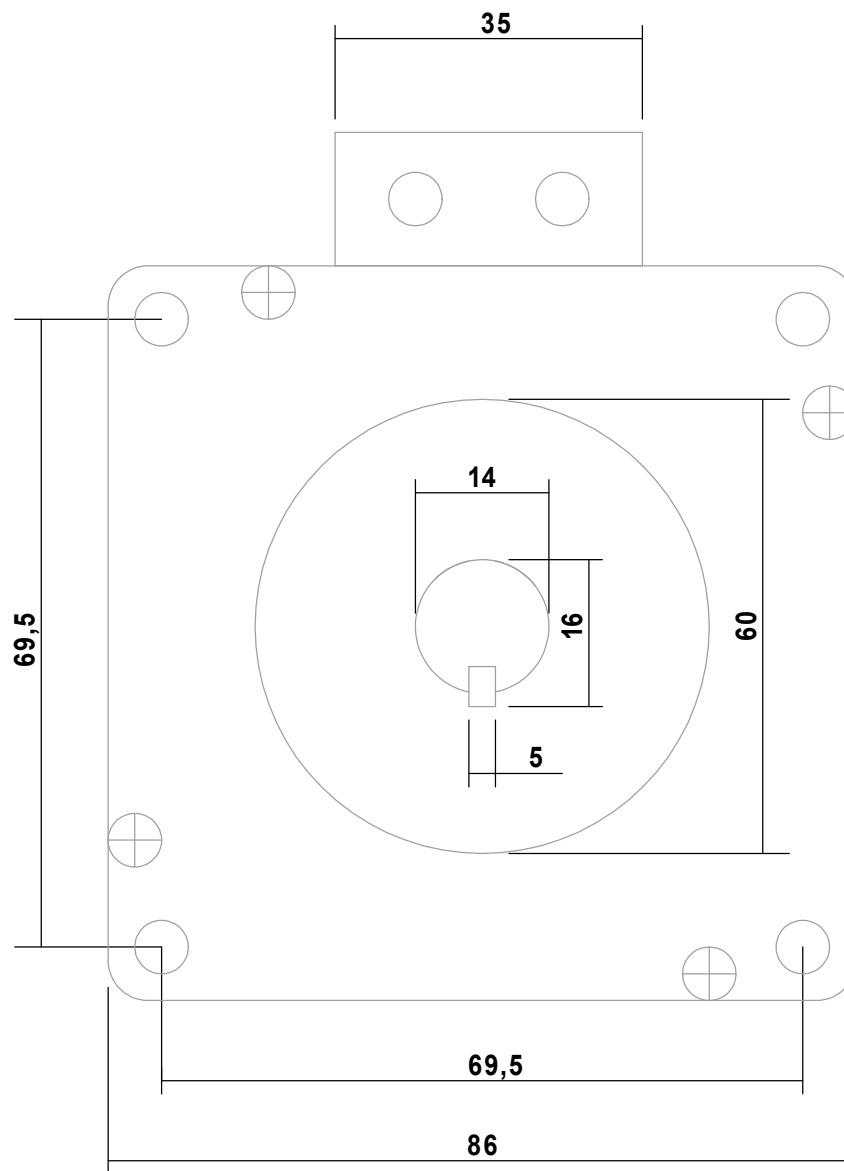
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