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HS57 digital hybrid stepper servo driver

一、Product Introduction

1. Overview

HS57 is the latest digital hybrid step servo driver with serial port debugging function launched by Green IoT Technology Co., Ltd. It adopts the latest 32-bit DSP control technology and integrates MODBUS-RTU standard protocol specifications. Users can set any subdivision within 200-40000 and multiple parameters such as working mode through the host computer debugging software, which greatly enriches the practical functions of the product and can meet the application needs of most occasions.

The HS57 driver adopts a servo-like control principle, which is compatible with the dual advantages of open-loop stepping and servo systems, completely solving the problem of open-loop stepping step loss, greatly improving the performance of the stepping system, and reducing the heating and low-speed vibration of the motor. Compared with the servo system, it greatly reduces the difficulty of debugging, has the advantages of fast start and stop, no vibration when shutting down, and its small size, low cost, and high cost performance can meet the application of most occasions.

2. Features

- With serial port debugging function
- External dial selects the driver working mode
- New 32-bit DSP technology
- Small size, easy to install
- Optically isolated differential signal input
- Built-in micro-segmentation
- The impulse response frequency can reach up to 200KHz (higher can be modified)
- Subdivision setting range 200-40000
- Precise current control greatly reduces motor heating
- Low vibration and low noise
- The current is automatically halved when stationary
- With overvoltage, undervoltage, overcurrent and other protection functions

3. Application Areas

Suitable for various small and medium-sized automation equipment and instruments, such as: engraving

machines, marking machines, cutting machines, plotters, CNC machine tools, automatic assembly equipment, etc. It has a particularly good application effect in equipment applications where users expect low noise and high speed.

2. Electrical, Mechanical and Environmental Indicators

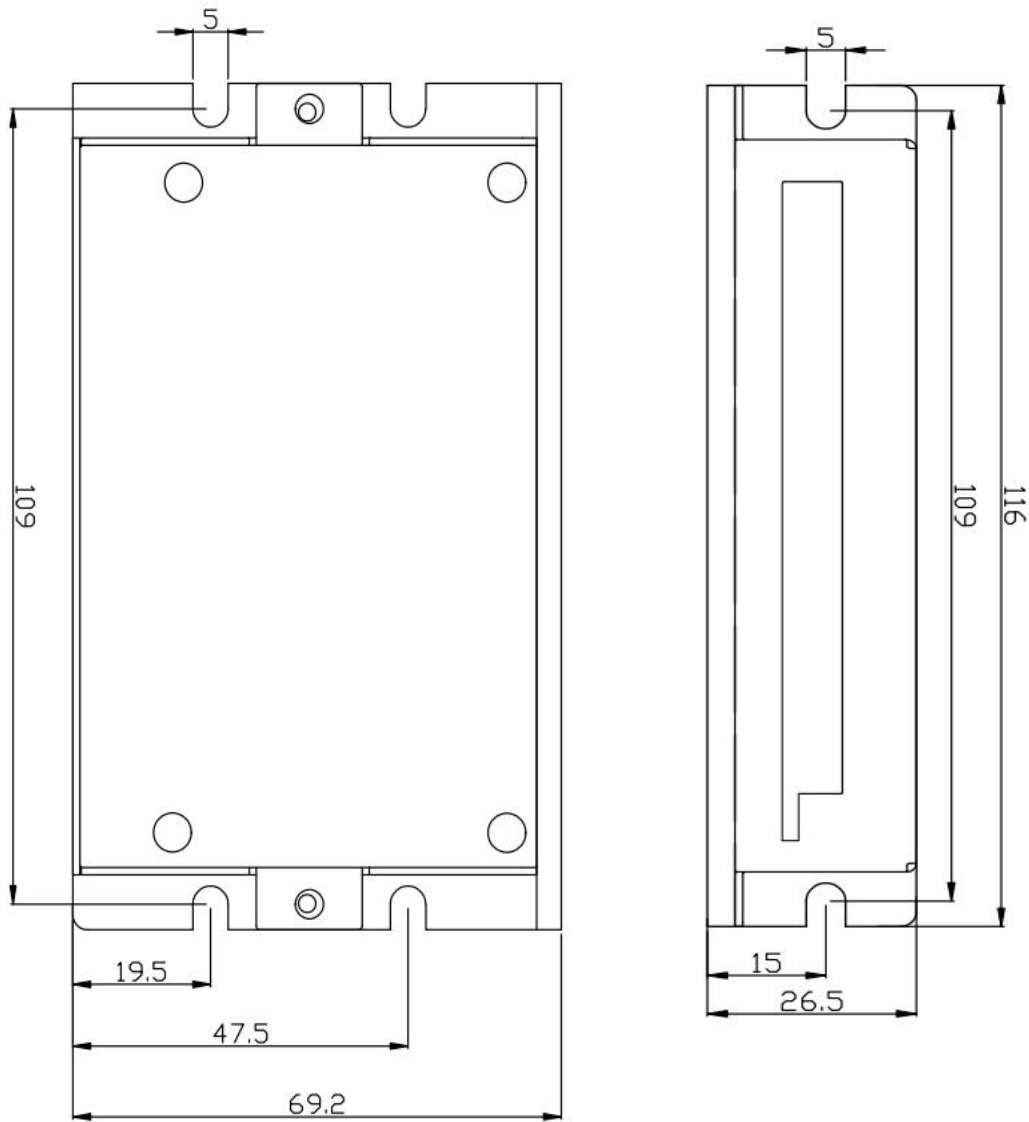
1. Electrical Specifications

illustrate	HS57			
	Minimu m	Typical Value	Maximu m	unit
Input power voltage	20	36	50	VDC
Control signal input current	7	10	16	mA
Step pulse frequency	0	-	200	KHz
Insulation resistance	50			MΩ

2. Use environment and parameters

Cooling method		Natural cooling, fan cooling
Usage	occasion	Do not place it near other heating equipment. Avoid dust, oil mist, corrosive gas, high humidity and strong vibration. Flammable gas and conductive dust are prohibited.
	temperatu re	0—50℃
Environme nt	humidity	40-90%RH
	vibration	10~55Hz/0.15mm
Storage temperature		-20℃~65℃

3. Mechanical installation drawing



Front installation diagram Side installation diagram
Figure 1 Installation dimensions (unit: mm)

※Side installation is recommended for better heat dissipation. When designing the installation dimensions, pay attention to the terminal size and wiring!

4. Enhanced heat dissipation

- 1) The reliable operating temperature of the driver is usually within 50°C, and the operating temperature of the motor is within 80°C;
- 2) It is recommended to select the automatic half-current mode when using, that is, when the motor stops, the current is automatically reduced by half to reduce the heating of the motor and driver;
- 3) When installing the driver, please install it sideways and allow strong air convection to form on the bottom of

the driver. If necessary, install a fan near the driver inside the machine to form air convection to assist in heat dissipation and ensure that the driver operates within a reliable operating temperature range.

3. Driver interface and wiring introduction

1. Interface Description

1) Control signal interface

name	Function
PLS+	Pulse control signal: +5V-+24V can be driven, rising edge is effective, every time the pulse changes from high to low, the motor takes a microstep. In order to reliably respond to the pulse signal, the pulse width should be greater than 2 μ s.
PLS-	
DIR+	Direction control signal: can be driven by +5V-+24V, high/low level signal. To ensure reliable commutation of the motor, the direction signal should be established at least 5 μ s before the pulse signal. The initial running direction of the motor is related to the motor
DIR-	
ENA+	Enable control signal: +5V-+24V can be driven, high/low level signal. Used to enable or disable the operation of the motor. When ENA+ is connected to +5V and ENA- is connected to a low level, the driver will cut off the current of each phase of the motor to
ENA-	

2) Output signal interface

name	Function
PEND+	In-position signal output: When the motor reaches the position specified by the control instruction, the in-position signal output is valid; PEND+ is connected to the pull-up resistor to the positive pole of the output power supply, and PEND- is connected to the signal input terminal of the controller; the maximum driving current is 50mA.
PEND-	
ALM+	Alarm signal output: When overcurrent, overvoltage, undervoltage or position out-of-tolerance alarm occurs, the alarm signal output is valid; ALM+ is connected to the pull-up resistor to the positive pole of the output power supply, and ALM- is connected to the signal input terminal of the controller; the maximum driving current is 50mA.
ALM-	

3) Encoder interface

name	Function
PB+	Encoder B phase input interface, please pay attention to the line sequence.
PB-	
PA+	Encoder A phase input interface, please pay attention to the line sequence.
PA-	
VCC	Encoder 5V power supply positive terminal.
EGND	Negative terminal of the encoder 5V power supply.

► **Note:** The wiring sequence of the encoder is marked on the label at the bottom of the closed-loop motor, and the wiring must be strictly in accordance with the label.

4) Strong power interface

name	Function
GND	DC power ground
+VDC	Positive power supply, range: DC20~50V, recommended +36V
A+, A-	For the motor A phase coil, pay attention to the line sequence.
B+, B-	For the motor B phase coil, pay attention to the line sequence.

► **Note:** The wiring sequence of the motor is marked on the label at the bottom of the closed-loop motor, and the wiring must be strictly in accordance with the label.

5) 232 communication interface

The serial communication interface of the HS57 driver uses an RJ12 terminal, which can be connected to the PC through a dedicated serial cable via a USB to TTL serial conversion tool. Do not plug or unplug the power supply! On the PC side, customers can set the required parameters, such as current, subdivision, working mode, etc. For details, please refer to the upper computer software interface.

Terminal No.	symbol	name	illustrate
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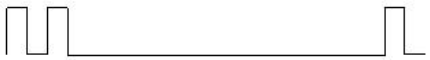
1	GND	RS232 communication	0V
2	TXD	RS232 transmitter	
3	NC	-	Internal Use
4	RxD	RS232 Receiver	
5	NC	-	Internal Use
6	NC	-	Internal Use

► **Note:** The cable connecting HS57 and PC must be a dedicated cable (provided with the computer depending on the user's needs). Please check before use to avoid damage.

6) Status Indicator

The green LED is the power indicator light. When the driver is powered on, the LED is always on; when the driver is powered off, the LED is off.

The red LED is a fault indicator. When a fault occurs, the indicator flashes in a cycle of 3 seconds. When the fault is eliminated by the user, the red LED goes out. The number of times the red LED flashes in 3 seconds represents different fault information. The specific relationship is shown in the following table:

Serial number	Number of flashes	Red LED flashing waveform	Fault Description
1	1		Overcurrent, phase short circuit or poor contact fault
2	2		Overvoltage fault (voltage>DC50V)
3	3		Undervoltage fault (voltage<DC20V)
4	5		Motor open circuit(Phase missing)

► **Note:** When the out-of-tolerance alarm occurs, the red LED is always on. If the out-of-tolerance alarm is caused by overvoltage or undervoltage, the red LED will flash rapidly and continuously. In addition, when an out-of-tolerance alarm occurs, the out-of-tolerance alarm signal can be cleared through the ENA terminal.

2. Control signal interface circuit

The HS57 driver control signal end adopts a differential interface circuit, which is applicable to differential signals, single-ended common cathode and common anode interfaces. It has a built-in high-speed optocoupler and has strong anti-interference ability in harsh environments. The interface circuit diagram is shown in Figure

2.

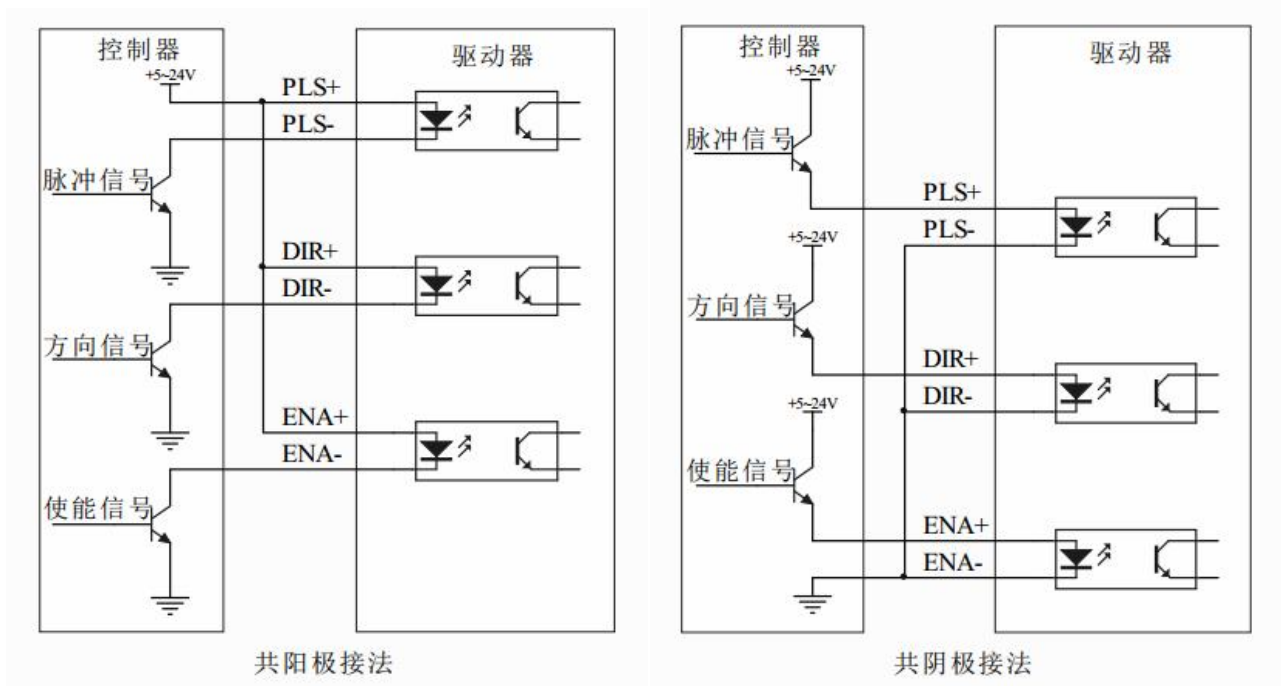


Figure 2 Input interface circuit

►Note: HS57 is a 5V-24V universal driver, so the signal control end does not need a series resistor!

3. Control signal timing diagram

In order to avoid some false actions and deviations, PLS, DIR and ENA should meet certain requirements, as shown in the following figure:

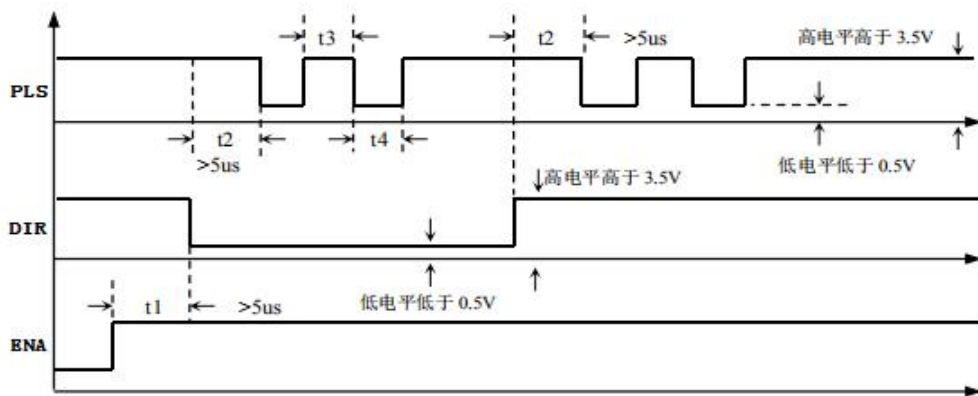


Figure 3 Control signal timing diagram

Notes:

1) t1: ENA (enable signal) should be at least 5ms ahead of DIR and determined to be high. In general, it is recommended that ENA+ and ENA- be left floating.

- 2) t2: DIR determines its state high or low at least 5 μ s in advance of the falling edge of PLS.
- 3) t3: The pulse width is at least 2.5 μ s.
- 4) t4: Low level width is not less than 2.5 μ s.

4. Control signal mode setting

Pulse trigger edge selection: The rising edge or falling edge of the pulse can be set to trigger effectively through the PC software.

5. Wiring requirements

- 1) In order to prevent the driver from being interfered, it is recommended that the control signal use shielded cable, and the shield layer is short-circuited with the ground wire. Except for special requirements, the shield line of the control signal cable is grounded at one end: the host computer end of the shield line is grounded, and the driver end of the shield line is suspended. Only the same point is allowed to be grounded in the same machine. If it is not a real ground wire, there may be serious interference. In this case, the shield layer is not connected.
- 2) The pulse and direction signal lines are not allowed to be wrapped side by side with the motor lines. It is best to separate them by at least 10 cm. Otherwise, the motor noise will easily interfere with the pulse direction signals and cause inaccurate motor positioning, system instability and other faults.
- 3) If one power supply supplies multiple drives, they should be connected in parallel at the power supply. Chain connection from one drive to another is not allowed.
- 4) It is strictly forbidden to plug or unplug the high-voltage terminals of the driver while it is powered on. When the motor is stopped, there is still a large current flowing through the coil. Plugging or unplugging the terminals while it is powered on will cause a huge instantaneous induced electromotive force that will burn out the driver.
- 5) It is strictly forbidden to connect the wire end to the terminal after tinning it, otherwise the contact resistance may increase and the terminal may be damaged by overheating.
- 6) The wiring ends must not be exposed outside the terminals to prevent accidental short circuits and damage to the driver.

四、DIP switch function setting

The HS57 driver uses a 10-bit DIP switch. SW1-SW4 is used for ALM, PEND output configuration settings,

algorithm selection, maximum peak current setting, and direction selection; SW5-SW8 is used for subdivision settings; and SW9-SW10 is used for working mode selection. The detailed description is as follows:

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Function settings				Segment settings				Working mode	

1. Function settings

1) ALM, PEND Output Configuration Settings

SW1 sets the output signal resistance state of ALM and PEND. When SW1=off, it is normally open; when SW1=on, it is normally closed.

2) Algorithm selection

SW2 is used to select the control algorithm of the driver. When SW2=off, it is algorithm A; when SW2=on, it is algorithm B.

3) Maximum current setting

SW3 sets the maximum output current of the driver. When SW3=off, it is a small current output, mainly suitable for 42 closed-loop motors; when SW3=on, it is a large current output, mainly suitable for 57 or 60 closed-loop motors.

4) Direction selection

SW4 sets the initial rotation direction of the motor. When SW4=off, it rotates in the forward direction; when SW4=on, it rotates in the reverse direction.

2. Segment settings

Steps/turn	SW5	SW6	SW7	SW8	Segment Description
400	on	on	on	on	When SW5, SW6, SW7, and SW8 are all off, the user can set any subdivision value from 200 to 40000 through the PC software, with a resolution of 1.
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	

3. Working mode settings

SW9	SW10	Working mode selection	Remark
off	off	Pulse+Direction	When SW9 and SW10 are both off, users can use the PC softwareSet the working mode yourself.
on	off	Pulse + direction with smoothing	
off	on	Double Pulse	
on	on	Spontaneous pulses	

► **Note:** After modification, power must be restarted for it to take effect.

五、Power supply selection

The power supply voltage can work normally within the specified range. The HS57 driver is best powered by a regulated DC switching power supply. It should be noted that the output current range of the switching power supply must be set to the maximum. An unregulated DC power supply can also be used, but it should be noted that the peak value of the rectified voltage ripple should not exceed the specified maximum voltage. It is recommended that users use a DC voltage lower than the maximum voltage to avoid grid fluctuations exceeding the driver voltage operating range.

► **Notice:**

- 1) When wiring, pay attention to the positive and negative poles of the power supply and do not connect them in reverse;
- 2) When wiring, pay attention to the position of the power interface and do not connect it to the motor port. After connecting, it is best to confirm whether it is connected correctly;
- 3) It is best to use a regulated DC switching power supply;
- 4) When using an unregulated DC power supply, the power supply current output capacity should be greater than 60% of the driver set current;
- 5) When using a regulated DC switching power supply, the output current of the power supply should be greater than or equal to the operating current of the driver;
- 6) To reduce costs, two or three drivers can share one power supply, but the power supply must be large enough.

六、Protection function

1. Short circuit protection

When a phase-to-phase short circuit or overcurrent occurs inside the driver, the driver red light flashes once and flashes repeatedly in a cycle of 3 seconds. At this time, the fault must be eliminated and the power must be turned on again for a reset.

2. Overvoltage protection

When the input voltage is higher than DC50V, the red light of the driver flashes twice and flashes repeatedly in a cycle of 3 seconds. At this time, the fault must be eliminated and the power must be turned on again for reset.

3. Undervoltage protection

When the input voltage is lower than DC20V, the red light of the driver flashes 3 times and flashes repeatedly in a cycle of 3 seconds. At this time, the fault must be eliminated and the power must be turned on again for reset.

4. Phase loss protection

When the power is initially turned on and the motor is out of phase, the driver red light flashes 5 times and flashes repeatedly in a 3-second cycle. At this time, the fault must be eliminated and the power must be turned on again to reset.

5. Out-of-tolerance alarm signal

When an out-of-tolerance alarm occurs, the red light of the driver will remain on or flash rapidly. At this time, the alarm can be cleared through the ENA terminal or reset by powering on again.