



2HSS57-N-XX

Hybrid Stepper Servo Drive

Manual



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Thanks for selecting Amtech Ltd stepper motor driver. We hope that the superior performance, outstanding quality, excellent cost performance of our product can help you accomplish your motion control project. The content in this manual has been carefully prepared and is believed to be accurate, but no responsibility is assumed for inaccuracies.

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1. Overview

The Amtech Ltd HSS57-N hybrid stepper servo drive system integrates the servo control technology into the digital stepper drive perfectly. And this product adopts an optical encoder with high speed position sampling feedback of 50 μ s, once the position deviation appears, it will be fixed immediately. This product is compatible the advantages of the stepper drive and the servo drive, such as lower heat, less vibration, fast acceleration, and so on. This kind of servo drive also has an excellent cost performance.

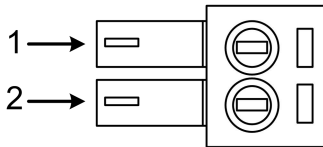
2. Features

- ◆ Without losing step, High accuracy in positioning
- ◆ 100% rated output torque
- ◆ Variable current control technology, High current efficiency
- ◆ Small vibration, Smooth and reliable moving at low speed
- ◆ Use DIP switch to choose open loop or close loop.
- ◆ Rich output control (alarm, brake control, and position output)
- ◆ Use DIP switch to choose PUL+DIR or PUL+PUL control mode.
- ◆ Accelerate and decelerate control inside, Great improvement in smoothness of starting or stopping the motor
- ◆ User-defined micro steps
- ◆ Compatible with 1000 and 2500 lines encoder
- ◆ No adjustment in general applications

- ◆ Over current, over voltage and over position error protection
- ◆ Green light means running while red light means protection or off line

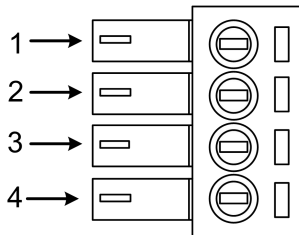
3. Ports Introduction

3.1 ALM signal output ports



| Port | Symbol | Name | Remark |
|------|--------|----------------|--------|
| 1 | ALM+ | Alarm output + | |
| 2 | ALM- | Alarm output - | |

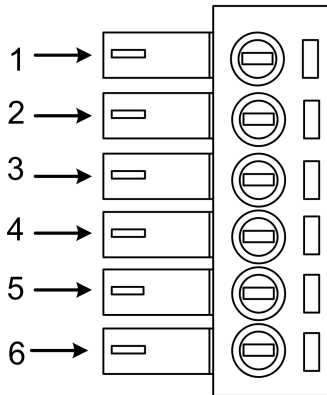
3.2 Brake and Position Signal Output Ports



| PIN No. | Symbol | Name | Description |
|---------|--------|------------------|-------------|
| 1 | BREAK+ | Brake Output+ | |
| 2 | BREAK- | Brake Output- | |
| 3 | PEND+ | Position Output+ | |
| 4 | PEND- | Position Output- | |

Note: Brake control output signal is the open collector circuit output, the user needs to use an external 24V power supply and relay to drive the brake (our company can provide brake driver board)

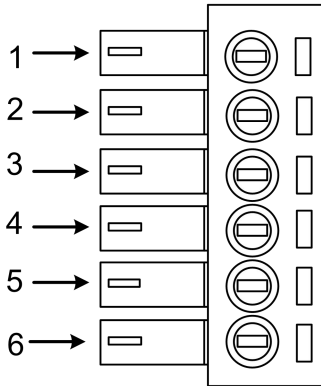
3.3 Control Signal Input Ports



| Port | Symbol | Name | Remark |
|------|--------|-------------------|----------------------------|
| 1 | PLS+ | Pulse signal + | Compatible with 5V and 24V |
| 2 | PLS- | Pulse signal - | |
| 3 | DIR+ | Direction signal+ | Compatible with 5V and 24V |
| 4 | DIR- | Direction signal- | |

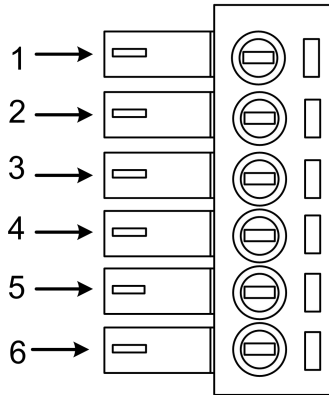
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|---|------|-----------------|-------------------------------|
| 5 | ENA+ | Enable signal + | Compatible with 5V and 24V |
| 6 | ENA- | Enable signal - | |

3.4 Encoder Feedback Signal Input Ports



| Port | Symbol | Name | Wiring color |
|------|--------|--------------------|--------------|
| 1 | PB+ | Encoder phase B + | Blue |
| 2 | PB- | Encoder phase B - | White |
| 3 | PA+ | Encoder phase A + | Yellow |
| 4 | PA- | Encoder phase A - | Green |
| 5 | VCC | Input power | Red |
| 6 | GND | Input power ground | Black |

3.5 Power Interface Ports



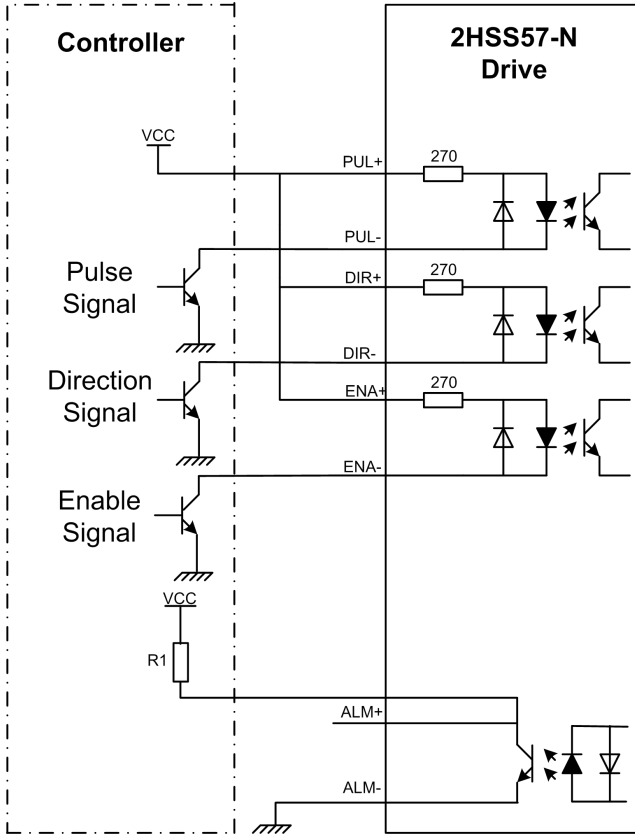
| Port | Identification | Symbol | Name | Remark |
|------|-------------------|--------|------------------|---------------------------|
| 1 | Motor Phase | A+ | Phase A+ (Red) | Motor Phase A |
| 2 | | A- | Phase A- (Blue) | |
| 3 | Wire Input Ports | B+ | Phase B+ (Green) | Motor Phase B |
| 4 | | B- | Phase B- (Black) | |
| 5 | Power Input Ports | VCC | Input Power + | 24-60VDC (36V Typical) |
| 6 | | GND | Input Power- | |

4. Technological Index

| | | |
|----------------------------|--|---|
| Input Voltage | 24~60VDC(36V Typical) | |
| Output Current | 4.5A 20KHz PWM | |
| Pulse Frequency max | 200K | |
| Communication rate | 57.6Kbps | |
| Protection | <ul style="list-style-type: none"> ● Over current peak value 8A±10% ● Over voltage value 80V ● The over position error range can be set through the Amtech HISU | |
| Overall Dimensions (mm) | 111.5×75.5×34 | |
| Weight | Approximate 300g | |
| Environment Specifications | Environment | Avoid dust, oil fog and corrosive gases |
| | Operating Temperature | 70°C MAX |
| | Storage Temperature | -20°C~+80°C |
| | Humidity | 40~90%RH |
| | Cooling method | Natural cooling or forced air cooling |

5. Connections to Control Signal

5.1 Connections to Common Anode

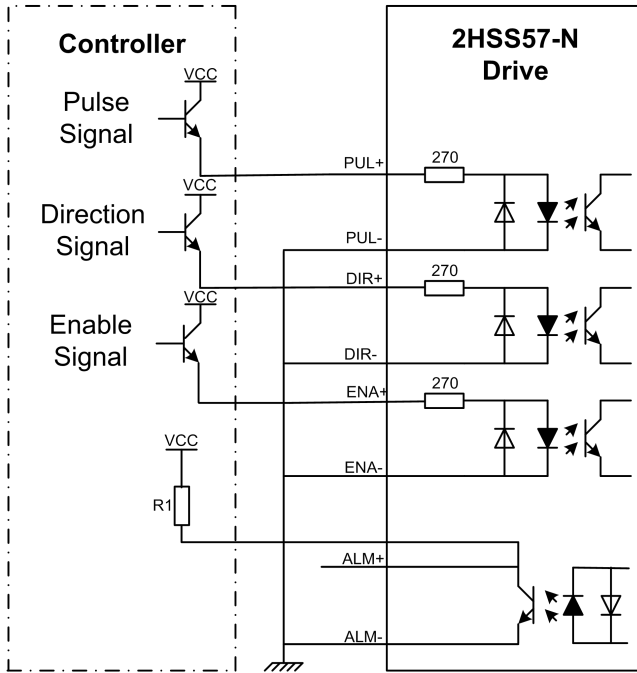


Remark:

The control signal can be compatible with 5V and 24V;

R1(3~5K) must be connected to control signal terminal.

5.2 Connections to Common Cathode

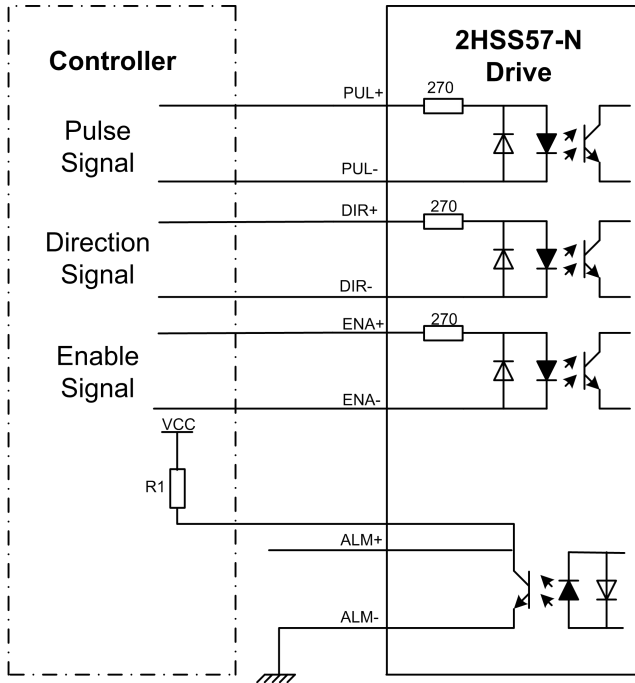


Remark:

The control signal can be compatible with 5V and 24V;

R1(3~5K) must be connected to control signal terminal.

5.3 Connections to Differential Signal

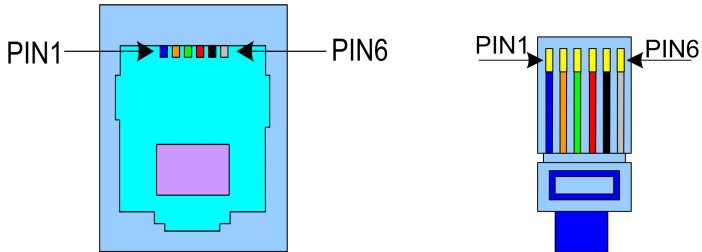


Remark:

The control signal can be compatible with 5V and 24V;

R1(3~5K) must be connected to control signal terminal.

5.4 Connections to 232 Serial Communication Interface



| Crystal Head foot | Definition | Remark |
|-------------------|------------|----------------------|
| 1 | TXD | Transmit Data |
| 2 | RXD | Receive Data |
| 4 | +5V | Power Supply to HISU |
| 6 | GND | Power Ground |

5.5 Sequence Chart of Control Signals

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:

6.2 SW2 Running Direction Setting

SW2 is used for setting the running direction, “off” means CCW, while “on” means CW.

6.3 SW3-SW6 Micro steps Setting

The micro steps setting is in the following table, while SW3、SW4、SW5、SW6 are all on, the internal default micro steps inside is activate, this ratio can be setting through the Amtech HISU. Unit

| Dip switch Micro steps | SW3 | SW4 | SW5 | SW6 |
|---------------------------|-----|-----|-----|-----|
| 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 |

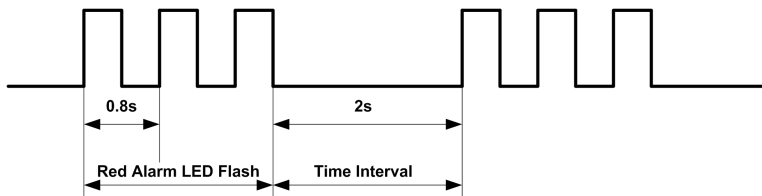
6.4 SW7 Pulses smoothness setting

SW7 sets the pulses smoothness, “off” means pulses smoothness function is off, “ on ” means the pulses smoothness function is on. In addition, the customer can also use the Amtech HISU parameter P19 to set the pulses smoothness degree. About the specific parameter settings, see parameter list description.

6.5 SW8 Open/Close loop mode selection

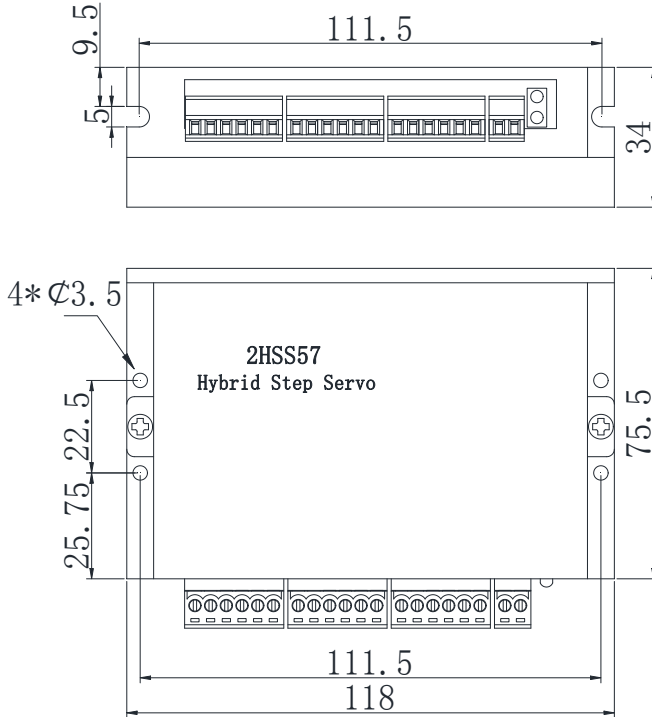
SW8 sets the open loop / closed loop operation mode, “off” means closed loop operation mode, “on” means open loop operation mode. If the customer chooses the open loop operation mode, the drive is an ordinary digital drive and can be run without encoder.

7. Faults alarm and LED flicker frequency



| Flicker Frequency | Description to the Faults |
|----------------------|---|
| 1 | Error occurs when the motor coil current exceeds the drives current limit. |
| 2 | Voltage reference error in the drive |
| 3 | Parameters upload error in the drive |
| 4 | Error occurs when the input voltage exceeds the drives voltage limit. |
| 5 | Error occurs when the actual position following error exceeds the limit which is set by the position error limit. |

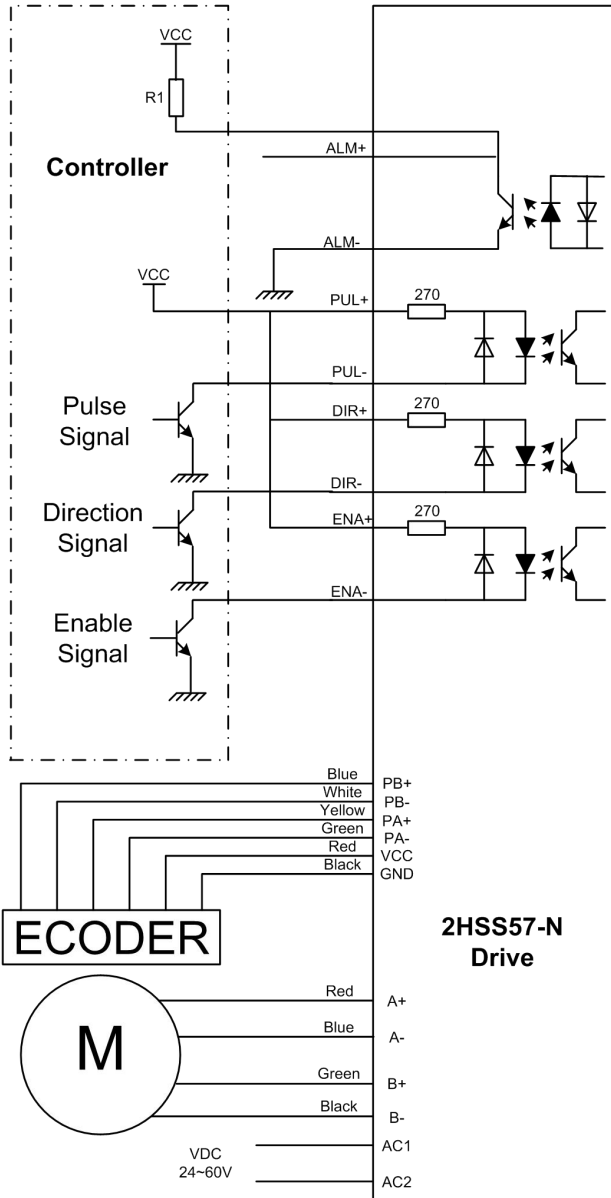
8. Appearance and Installation Dimensions



9. Typical Connection

This drive can provide the encoder with a power supply of +5v, maximum current 80mA. It adopts a quadruplicated-frequency counting method, and the resolution ratio of the encoder multiply 4 are the pulses per rotate of the servo motor. Here is the typical connection of

Amtech 2HSS57-N.



10. Parameter Setting

The parameter setting method of Amtech 2HSS57-A drive is to use a Amtech HISU adjuster through the 232 serial communication ports, only in this way can we setting the parameters we want. There are a set of best default parameters to the corresponding motor which are carefully adjusted by our engineers, users only need refer to the following table, specific condition and set the correct parameters.

Actual value = Set value × the corresponding dimension

| Mode | Definition | Range | Dimension | Drive Restart | Default Value |
|------|----------------------|--------|-----------|---------------|---------------|
| P1 | Current loop Kp | 0—4000 | 1 | N | 1000 |
| P2 | Current loop Ki | 0—1000 | 1 | N | 100 |
| P3 | Damping coefficient | 0—500 | 1 | N | 30 |
| P4 | Position loop Kp | 0—3000 | 1 | N | 2000 |
| P5 | Position loop Ki | 0—1000 | 1 | N | 200 |
| P6 | Speed loop Kp | 0—3000 | 1 | N | 300 |
| P7 | Position loop Ki | 0—1000 | 1 | N | 1000 |
| P8 | Open loop current | 0—40 | 0.1 | N | 30 |
| P9 | Close loop current | 0—20 | 0.1 | N | 20 |
| P10 | Alarm level | 0—1 | 1 | N | 1 |
| P11 | Reserved | | | | |
| P12 | Reserved | | | | |
| P13 | Enable signal level | 0—1 | 1 | N | 0 |
| P14 | Arrival level | 0—1 | 1 | N | 1 |
| P15 | Encoder line number | 0—1 | 1 | Y | 0 |
| P16 | Position error limit | 0—3000 | 10 | N | 400 |
| P17 | Reserved | | | | |

| | | | | | |
|------------|---------------------------------|-----------|----|---|----|
| P18 | Reserved | | | | |
| P19 | Speed smoothness | 0—10 | 1 | N | 7 |
| P20 | User-defined p/r | 4-1000 | 50 | Y | 8 |
| P21 | Reserved | | | | |
| P22 | Pulse filter | 0-1000 | 4 | Y | 3 |
| P23 | Driver enable lock | 0—1 | 1 | N | 0 |
| P24 | Reserved | | | | |
| P25 | Open and closed loop ratio | 0—40 | 1 | N | 20 |
| P26 | Position output threshold | 0—1000 | 1 | N | 10 |
| P27 | Reserved | | | | |
| P28 | Reserved | | | | |
| P29 | Reserved | | | | |
| P30 | Detect the lack of Phase | 0—1 | 1 | Y | 0 |
| P31 | Reserved | | | | |
| P32 | Reserved | | | | |
| P33 | Reserved | | | | |
| P34 | Reserved | | | | |
| P35 | Reserved | | | | |
| P36 | Reference Pulses | read only | | | |
| P37 | Feedback Pulses | read only | | | |
| P38 | Error of Reference and Feedback | read only | | | |
| P39 | Erase Software | 0-4000 | 1 | Y | 0 |

There are total 39 parameter configurations, use the Amtech HISU to download the configured parameters to the drive, the detail descriptions to every parameter configuration are as follows:

| Item | Description |
|----------------------------|---|
| Current loop Kp | Increase Kp to make current rise fast. Proportional Gain determines the response of the drive to setting command. Low Proportional Gain provides a stable system (doesn't oscillate), has low stiffness, and the current error, causing poor performances in tracking current setting command in each step. Too large proportional gain values will cause oscillations and unstable system. |
| Current loop Ki | Adjust Ki to reduce the steady error. Integral Gain helps the drive to overcome static current errors. A low or zero value for Integral Gain may have current errors at rest. Increasing the integral gain can reduce the error. If the Integral Gain is too large, the system may "hunt" (oscillate) around the desired position. |
| Damping coefficient | This parameter is used to change the damping coefficient in case of the desired operating state is under resonance frequency. |
| Position loop Kp | The PI parameters of the position loop. The default |

| | |
|------------------------------|--|
| Position loop Ki | values are suitable for most of the application, you don't need to change them. Contact us if you have any question. |
| Speed loop Kp | The PI parameters of the speed loop. The default values are suitable for most of the application, you don't need to change them. Contact us if you have any question. |
| Speed loop Ki | |
| Open loop current | This parameter affects the static torque of the motor. |
| Close loop current | This parameter affects the dynamic torque of the motor. (The actual current = open loop current + close loop current) |
| Alarm level Control | This parameter is set to control the Alarm optocoupler output transistor. 1 means the transistor is cut off when the system is in normal working, but when it comes to fault of the drive, the transistor becomes conductive. 1 means opposite to 0. |
| Enable Control | This parameter is set to control the Enable input signal level, 0 means low, while 1 means high. |
| Arrival level Control | This parameter is set to control the Arrival optocoupler output transistor. 1 means the transistor is cut off when the drive satisfies the arrival |

| | |
|-----------------------------|--|
| | command, but when it comes to not, the transistor becomes conductive. 1 means opposite to 0. |
| Encoder resolution | This drive provides two choices of the number of lines of the encoder. 0 means 1000 lines, while 1 means 2500 lines. |
| Position error limit | The limit of the position following error. When the actual position error exceeds this value, the drive will go into error mode and the fault output will be activated. (The actual value = the set value \times 10) |
| Speed smoothness | <p>This parameter is set to control the smoothness of the speed of the motor while acceleration or deceleration, the larger the value, the smoother the speed in acceleration or deceleration.</p> |
| User-defined p/r | This parameter is set of user-defined pulse per revolution, the internal default micro steps inside is activate while SW3、SW4、SW5、SW6 are all on, |

| | |
|--|---|
| | users can also set the micro steps by the outer DIP switches. (The actual micro steps = the set value \times 50) |
| Pulses filter | The function of this parameter is to set pulse filter degree. The larger the value, the bigger filter degree. If this parameter is 3(default value is 3), max external pulse frequency is 200K. If this parameter is 9, max external pulse frequency is 100K. |
| Driver enable lock | When the driver is in the state of EN_OFF, if this parameter is 0, the motor is not lock and driver don't cont pulses. If this parameter is 1, the motor will be locked and the driver don't cont pulses too. |
| Open and closed loop ratio | the threshold of open loop and close loop switch. |
| Position output threshold | This parameter is set of the threshold of position error to output position output signal. |
| Detect the lack of Phase | This parameter is set of detect the lack of phase. If this parameter is 0 (Default Value), turn off this function. If this parameter is 1, turn on this function. |
| Reference Pulses | Read this parameter can know the reference pulses. |
| Feedback Pulses | Read this parameter can know the feedback pulses (encoder unit). |
| Error of Reference and Feedback | Read this parameter can know the error of reference and feedback. |
| Erase Software | This parameter is set of erase software of drive. If set this parameter is 2929, the driver will be erased, |

| | |
|--|---|
| | then this driver will not work. Notice: This parameter is only used by Manufacturer. |
|--|---|

11. Processing Methods to Common Problems and Faults

11.1 Power on power light off

- No power input, please check the power supply circuit. The voltage is too low.

11.2 Power on red alarm light on

- Please check the motor feedback signal and if the motor is connected with the drive.
- The stepper servo drive is over voltage or under voltage. Please lower or increase the input voltage.

11.3 Red alarm light on after the motor running a small angle

- Please check the motor phase wires if they are connected correctly, if not, please refer to the 3.4 Power Ports.
- Please check the parameter in the drive if the poles of the motor and the encoder lines are corresponding with the real parameters, if not, set them correctly.

- Please check if the frequency of the pulse signal is too fast, thus the motor may be out of its rated speed, and lead to position error.

11.4 After input pulse signal but the motor not running

- Please check the input pulse signal wires are connected in a reliable way.
- Please make sure the input pulse mode is corresponding with the real input mode.