User manuel

2HSS Series Hybrid stepper servo drive
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1 Overview

HSS two-phase hybrid stepper servo drive system integrated servo control technology into the digital step driver. It adopts typical tricyclic control method which include current loop, speed loop and position loop. This product has the advantage of both step and servo system, and it’s a highly cost-effective motion control products.
2 Features

2.1 Full closed-loop control
2.2 Motor standard 1000 line encoder
2.3 Close to 100% of the output torque
2.4 High-speed response and high speed
2.5 There are a variety of input methods under Position the control mode:
   - Pulse + direction
   - Pulse + reverse direction
   - Double pulse
2.6 Optically isolated servo reset input interface ERC
2.7 Optically isolated fault alarm output interface ALM
2.8 Current loop bandwidth: (-3dB) 2KHz (typical value)
2.9 Speed loop bandwidth: 500Hz (typical value)
2.10 Position loop bandwidth: 200Hz (typical value)
2.11 Motor encoder inputs upright post: differential input (26LS32)
2.12 RS232 serial communication available to download or change the parameters
2.13 Over current, I2T, overvoltage, under voltage, over temperature, speeding, over-differential protection
2.14 Green light indicates running and a red light indicates that the protection or offline
3 Port description

3.1 ALM, PEND signal output port.

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>Sign</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PEND+</td>
<td>Reserved</td>
<td>Reserved</td>
</tr>
<tr>
<td>2</td>
<td>PEND-</td>
<td>Reserved</td>
<td>Reserved</td>
</tr>
<tr>
<td>3</td>
<td>ALM+</td>
<td>Alarm input positive</td>
<td>OUT</td>
</tr>
<tr>
<td>4</td>
<td>ALM-</td>
<td>Alarm input negative</td>
<td>GND</td>
</tr>
</tbody>
</table>
### 3.2 Control signal input port

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>Sign</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PLS+</td>
<td>positive pulse input</td>
<td>4~5V high effective</td>
</tr>
<tr>
<td>2</td>
<td>PLS--</td>
<td>negative pulse input</td>
<td>0~0.5V low effective</td>
</tr>
<tr>
<td>3</td>
<td>DIR+</td>
<td>positive direction input</td>
<td>4~5V high effective</td>
</tr>
<tr>
<td>4</td>
<td>DIR-</td>
<td>negative direction input</td>
<td>0~0.5V low effective</td>
</tr>
<tr>
<td>5</td>
<td>ENA+</td>
<td>positive enable input</td>
<td>4~5V high effective</td>
</tr>
<tr>
<td>6</td>
<td>ENA-</td>
<td>Negative enable input</td>
<td>0~0.5V low effective</td>
</tr>
</tbody>
</table>
### 3.3 Encoder feedback signal input port

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>Sign</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PB+</td>
<td>Encoder B phase positive input</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PB-</td>
<td>Encoder B phase negative input</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PA+</td>
<td>Encoder A phase positive input</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PA-</td>
<td>Encoder A phase negative input</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>VCC</td>
<td>Output power supply</td>
<td>50ma</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>ground</td>
<td></td>
</tr>
</tbody>
</table>
### 3.4 power port

<table>
<thead>
<tr>
<th>Terminal no.</th>
<th>identification</th>
<th>sign</th>
<th>Name</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor phase</td>
<td>A+</td>
<td>Motor A+</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>A-</td>
<td>Motor A-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>B+</td>
<td>Motor B+</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>B-</td>
<td>Motor B-</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Power supply input</td>
<td>AC1</td>
<td>AC Power supply</td>
<td>AC24V-75V</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>AC2</td>
<td>AC Power supply</td>
<td>AC24V-75V</td>
</tr>
</tbody>
</table>

![Diagram of terminal connections](image)
# Technical data

<table>
<thead>
<tr>
<th></th>
<th>2HSS57</th>
<th>2HSS86H</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power input</strong></td>
<td>24~48DC (36typical)</td>
<td>24~70VAC (50Vtypical)</td>
</tr>
<tr>
<td><strong>Continuous output current</strong></td>
<td>4.5A 20KHz PWM</td>
<td>7.5A 20KHz PWM</td>
</tr>
<tr>
<td><strong>The maximum pulse frequency</strong></td>
<td>200K</td>
<td>200K</td>
</tr>
<tr>
<td><strong>The default communication rate</strong></td>
<td>9.6Kbps  (The need for additional conversion interface)</td>
<td></td>
</tr>
</tbody>
</table>

**Protection**

- Action value over current peak 8A ± 10%
- Overload I2t current action value 100% 5S
- Overheating action value 80 °C
- 80V overvoltage voltage action value
- Action value 18V voltage undervoltage

- Action value over current peak 10A ± 10%
- Overload I2t current action value 100% 5S
- Overheating action value 80 °C
- 130V overvoltage voltage action value
- Action value 20V voltage undervoltage
<table>
<thead>
<tr>
<th></th>
<th>2HSS57</th>
<th>2HSS86H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall dimensions</td>
<td>$111.5 \times 75.5 \times 34$</td>
<td>$150 \times 97.5 \times 53$</td>
</tr>
<tr>
<td>Weight</td>
<td>About 300 grams</td>
<td>About 580 grams</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasions</td>
<td>Avoid dust, oil mist and corrosive gases</td>
<td></td>
</tr>
<tr>
<td>Working temperature</td>
<td>0~+70℃</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20℃~+80℃</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>40~90%RH</td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td>Natural cooling or forced air cooling</td>
<td></td>
</tr>
</tbody>
</table>
5 Control signal connection

5.1 Control signals using a single-ended common anode connection, as shown below:

Note: When VCC is 5V, R shorted;
When VCC is 12V, R is 1K, more than 0.125W resistance;
VCC is 24V, R is 2K, 0.125W greater resistance;
Resistance must be connected to the control signal terminal.
5.2 Control signals using a single-ended common cathode connection, as shown below:

Note: When VCC is 5V, R shorted;  
When VCC is 12V, R is 1K, more than 0.125W resistance;  
VCC is 24V, R is 2K, 0.125W greater resistance;  
Resistance must be connected to the control signal terminal.
5.3 Control signal use differential wiring, as shown below:
5.4 232 serial communication lines, wiring diagram, is shown below:

![Wiring Diagram]

<table>
<thead>
<tr>
<th>No.</th>
<th>DB9</th>
<th>crystal head</th>
<th>definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>1</td>
<td>TXD</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td>RXD</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>6</td>
<td>GND</td>
</tr>
</tbody>
</table>
6  DIP switch settings subdivision

6.1  quiescent current setting

SW1 DIP switch setting quiescent current, off means half the quiescent current is set to dynamic currents, on said quiescent current and dynamic current is the same.

6.2  logical direction setting

When DIP switch SW2 is switched off or on, you can change the direction of the current motor sport, off = CCW, on = CW.

6.3  Subdivision settings

subdivision setting as the table below, When SW3, SW4, SW5, SW6 are set to on, the default internal electronic gear ratio has school, internal electronic gear ratio setting with JmcStepMotor software.
<table>
<thead>
<tr>
<th>DIP switch</th>
<th>SW3</th>
<th>SW4</th>
<th>SW5</th>
<th>SW6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default</td>
<td>on</td>
<td>on</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>800</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>1600</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>3200</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>on</td>
</tr>
<tr>
<td>6400</td>
<td>on</td>
<td>on</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>12800</td>
<td>off</td>
<td>on</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>25600</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>51200</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>1000</td>
<td>on</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>2000</td>
<td>off</td>
<td>on</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>4000</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>5000</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>off</td>
</tr>
<tr>
<td>8000</td>
<td>on</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>10000</td>
<td>off</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>20000</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>40000</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
</tbody>
</table>
7 Install dimension

2HSS86H
Hybrid Step Servo
8 Wiring diagram

Typical wiring diagram closed loop stepper system are as follows: The driver can provide +5 V, maximum 80mA of power to the encoder. Four-octave counting mode, the encoder resolution is multiplied by four the number of pulses per servo motor revolution. 2HSS86H reference to the figure:
9 closed-loop stepper system parameter adjustment and settings

Closed-loop stepper system parameter control via a dedicated communication software serial ver set to adjust, serial ver software with system configuration, PID parameter adjustment, waveform acquisition, motion control and other functions.

9.1 connection

1) Make sure that the drive is compatible with motor
   Stepper drives and stepper motor to the normal operation
   should be paired with each other and achieve the desired results,
   before the connection should confirm whether the compatible.
   Or else may damage the motor and drive.

2) a hardware configuration
   PC (desktop or laptop)
   Requirements:
   CPU: Intel Pentium II above grade
   Memory: 64M or more
   Hard disk: 2GB or more
Display: Support for the resolution of 800 × 600 color display above
RS-232 serial communication interface: at least one
3) Software Operating System:
   Win95/Win98/WindowsNT/Windows 2000 / XP
   Servo control software: serial ver

4) Communication Cables
   This product is ready to connect the drive unit is located in front of the terminal, and computer terminals dedicated RS-232 connection cable (sold separately). The cable will be connected to the computer 232 level turn into TTL level for two different levels of communication connections.
   **Communications cable specifications:**
   - PC interface: DB9 Female
   - Device Interface: RJ-11 terminal
   - Length: 1m

5) hardware connection
9.2 **Software Installation**

Double-click the package file folder JmcStepMotor directly open the application.

![Software Interface](image)

9.3 **Software Operation**

1) **Software Function**
   
   serial ver digital servo drives adjust the software has a system configuration, PID parameter adjustment, waveform acquisition, motion control and other functions.

2) **Configure the communication port**
   
   The default port is COM1, 9600;
   Make sure before you start the software driver, motor, serial cable is properly connected and powered properly.
Software to configure the default communication parameters at startup and read the drive set the display to the interface. If the drives match the communication parameters and software, the software may be successfully started, otherwise the software can not establish a connection and drives, automatic pop-up "Communication Settings" dialog box, or click on the main menu "Port Control" → "Communication Settings" dialog box appears.

![Communication Config. dialog box]

Enter the correct port number and baud rate, click on the "Connect", and the driver can establish a connection, then the status bar will display [串口1：打开], and read the drive’s setting to the interface.

Configured to 57600 baud, temporarily can not use other baud, otherwise the communication is not normal.
3) System configure

Click on the main interface "System Configuration" pop System Configuration dialog box, set the electronic gear ratio, the numerator is the encoder resolution 4000, the denominator is the number of pulses per revolution needed columns such as:

Requirements 1600 pulse motor walk around,  
The electronic gear ratio of 4000/1600, during at least some points, was 5/2,
After setting the electronic gear ratio, just click to download, either the value written to the drive, the drive inside the upload parameters can be read out to confirm whether the download was successful.

4) Oscilloscope
when the motor is running, you can always viewed through An oscilloscope waveform of each parameter, you can adjust PID to improve the operating performance of the drive.
Click on the main menu, select "Wave Monitoring" to open the oscilloscope screen.

[Image of oscilloscope display]

a)The oscilloscope can simultaneously collect data four channels, which can display up to four parameter curve. Type and number of a graph can be flexibly set in the
"Settings" tab. Sampling time and the baud rate used, the higher the baud rate, the faster sampling, it is recommended to use 115200 baud rate.
b) Monitoring the time window you can select the option to display the range of time.
c) Adjusting the PID parameters can be carried out in the "gain" tab adjustment, press the Enter key after modifying parameters can be downloaded to the drive parameters take effect immediately.
d) "Statistics" tab to see the maximum, minimum and average values for each channel in the collected data.
e) When the data display range greatly exceeds the latest collected data, you can click scale "Refresh" button to adjust the scale.

5) Position loop parameter settings

Click on the main interface "position loop" button to pop up the position loop parameter settings dialog box. You can set the position proportion, Position feedforward, position differential, electronic gear numerator and denominator and fault protection value, modify the parameter press the Enter key or press the "OK" button to download the parameters to the drive, parameters take effect immediately.
6) The speed loop parameters
Click on the main interface "speed loop" button to pop up the speed loop parameter settings dialog box. You can set the speed ratio of the speed of integration, the rated speed and fault protection value, modify the parameter and press the Enter key or press the "OK" button to download the parameters to the drive parameters take effect immediately.

7) The current loop parameters

Click on the main interface parameters "current loop" button to pop up the current loop parameters dialog. You can set the current ratio of current integration, modify the parameter and press the Enter key or click "download" button to download the parameters to the drive parameters take effect immediately.
8) Troubleshooting

During operation, if the motor stops running, in a non-enabled status, you can click "Motor enable" on "Control Panel" to make the motor back in working condition, if this motor is still in the non-enabled status, you can cut off the power of the driver, then make power on to let the driver in working condition.

9.4 motion control function and quick adjustment

1) Adjustment of PID parameters

Servo system includes three feedback loops (position loop, speed loop, and torque (current) loop). The response speed of the most inner current loop is fastest, the response speed of middle part must be faster than the outside position loop. If not comply with this rule will result in shock or adverse reactions. Servo drive is designed to ensure that the current loop with a
good response performance. Users only need to adjust the position loop and speed loop parameters. Between the various parameters of the system is always mutual restraint, if only the position loop gain is increased, the output command of the position loop may become unstable, resulting in the entire servo system response may become unstable. Usually can adjust the system according to following steps:

◆ Set the position feedforward and position differential to 500, the position gain and velocity gain first set at a lower value 1000, then under condition of no abnormal noise and vibration, gradually increase the speed gain until there is a vibration then reduce at least 500-300.

◆ Increase position gain until have vibration. Then increase the position differential until no vibration.

◆ Increase the position feedforward to have a lag and minimum overshoot.

◆ If the motor is running with vibration, reduce the speed gain appropriately.

◆ If the motor have a vibration when stopped, reduce the position gain appropriately or increase the position differential.
◆ If the motor have electromagnetic noise, reduce the current gain appropriately.

If the entire response have no overshoot, and vibration, should set the position gain to a maximum value. Then fine-tuning speed gain, position feedforward and position differential to find the best value.

10 Common Problems and Trouble-Shooting

10.1 Power-on Have red alert when power-on
◆ Check whether the feedback signal cable is connected with the motor electrical power phase cable.
◆ Whether the servo drive input voltage is too high or too low.

10.2 Have a red alarm after running a small angle
◆ In the parameter of the driver, phase motor phase sequence is properly connected. Refer incorrectly identifies the drive motor phase sequence corresponding connection.
◆ Pulse input speed is greater than the rated speed, have a
position out tolerance.

10.3 Not rotate after pulse input

❖ Whether the connection of servo drive’s pulse input terminal is reliable.
❖ Whether the servo driver’s input mode is related with the pulse input.
❖ Whether the motor disabling is released.

10.4 Under speed control mode, when turning at low speed faster or slower

❖ Reduce the speed proportion and increase the speed integration until the speed is normal.