

Series HSV-180AS AC Spindle Drive

# User' s Manual



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Wuhan China

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# 1Safety Precautions

Thank you very much for buying AC spindle drive, HSV-180AS AC spindle drive unit and spindle motor are applicable to the general industrial environment, not to the strong vibrating environment. Pay attention to the followings:

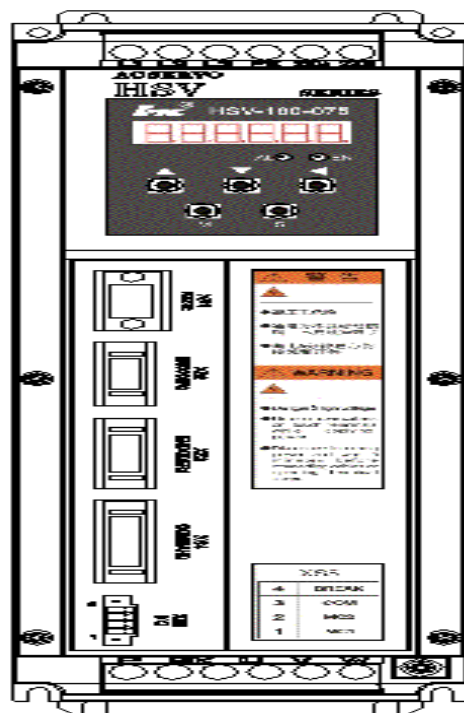
- It is inapplicable to the medical equipment which related to life safety.
- The spindle drive is not water proof. It must be avoid moisture and direct sunlight.
- Do not perform any change to the spindle drive and drive motor.

Before installation and wiring, read through this manual. Before operation, understand the safety information, safety precautions and operating instruction of this equipment.

## 1.1 Symbols of Safety Precautions

Symbols of safety precautions are displayed on the front panel of the spindle drive.

Figure 1-1 Symbol of safety precaution for HSV-180AS-035, 050, 075



**警告**

- 高压电危险
- 通电时不要移动接线，不要触摸端子
- 断电5分钟后方能接线和开盖

**WARNING**

- Danger! High voltage
- Do not move cables or touch terminals while applying power.
- Disconnect incoming power and wait 5 minutes before connecting cables or opening terminal cover.

## 1.2 Meaning of Safety Precaution Symbols

### Warning

← Safety precaution signage

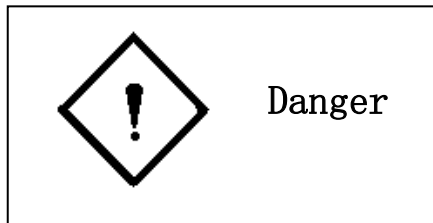
- Danger! High Voltage
- Don't move cables or touch terminals while applying power
- Disconnect incoming power and wait 5 minutes before connecting cables or opening terminal cover

← The meaning of each symbol

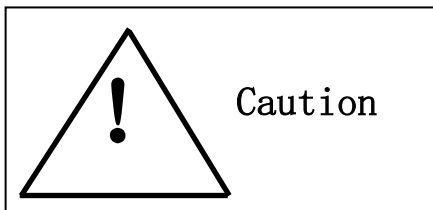
Precaution

Symbols of Safety

## 1.3 Explanation of Safety Precaution Symbols



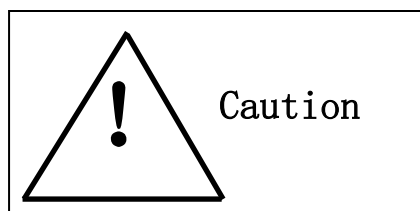
It indicates a potentially hazardous situation which, if not avoided, will result in death.



It indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury or death and damage to the machine.

## 1.4 Safety Regulations

### 1. Products Confirmation



Do not install damaged drive units.

Failure to follow this instruction could result in injury.

### 2. Installation



- Hold the bottom of the machine.

If only hold the panel, the main engine may fall off which may result in injury.

- Fit to noncombustible such as metal.

Failure to follow this instruction could result in fire hazard.

- If necessary, set a cooling fan and keep the inlet air at 45°C or less.

Overheating may result in fire and other hazards.

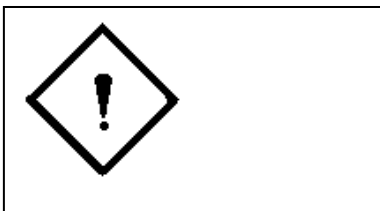
- Don' t block the inlet and outlet. Avoid foreign matter entering into the internal part of the machine.

It may cause the aging of internal components, which can result in malfunction or fire hazard.

- When installing, make sure a specified intervals between drive unit and control cabinet or other machines.

Failure to follow this instruction could result in fire hazard or malfunction.

### 3. Wiring




- Before wiring, confirm whether the power is off.

Failure to follow this instruction could result in electric shock and fire hazard.

- Only electrical engineer can do the wiring.

Failure to follow this instruction could result in electric shock and fire hazard.

- Make sure the ground terminal  grounded.

Failure to follow this instruction could result in electric shock and fire hazard.

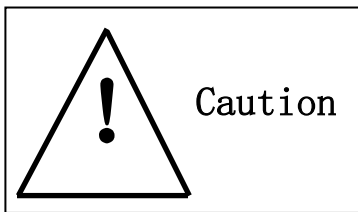


- After the wiring of the emergency stop circuit, check whether the wiring is effective.

Failure to follow this instruction could result in injury. (Users shall be responsible for the wiring.)

- Do not touch the output terminal directly nor connect external shield to the output wire of a spindle drive unit. Avoid short circuit of output wires.

Failure to follow this instruction could result in electric shock and short circuit.



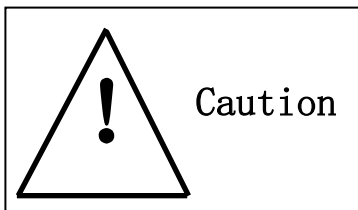
- Confirm whether the power voltage of the main AC circuit is subject to the rated voltage of the spindle drive unit.

Failure to follow this instruction could result in injury and fire hazard.

- Do not make withstand test for the spindle drive unit.

Failure to follow this instruction could result in damage to components such as semi-conductor.

- Do not connect power cable to the output U, V, W terminals so as to avoid damage of spindle drive unit internal parts.



- Do not connect capacitance and LC or LR noise filter to the output circuit so as to avoid damage of spindle drive.
- Do not connect electromagnetic switch and electromagnetic contactor to the U, V, and W output circuit. When the spindle drive running with load, surging current could activate over-current protection of the spindle drive unit.

#### 4. Testing and Commissioning



- Do not remove or modify anything when the external wirings are made, or the power is on.  
Failure to follow this instruction could result in electric shock.
- Do not approach to the machine on the trial-operations, after resetting of spindle drive unit (Take physical safety into consideration when perform electrical and mechanical design).
- Arrange an external emergency stop device.  
Failure to follow this instruction could result in injury.



- Before operating, reconfirm some information such as the use range of the motor and machines.  
Failure to follow this instruction could result in injury.
- Do not touch the machine while operating or just cut off the power, because the radiator, brake resistor motor etc. may be at high temperature.  
Failure to follow this instruction could result in burn.
- If necessary, arrange external brake. Do not touch the machine.

Failure to follow this instruction could result in injury.

- Do not check signal while operating to avoid damage to the equipment.

## 5. Troubleshooting

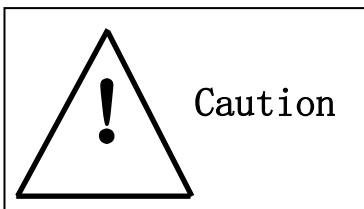


- Do not remove wiring within 5 minutes nor touch terminals after power-off of a spindle drive unit, because the high voltage will last for a while.

Failure to follow this instruction could result in electric shock.

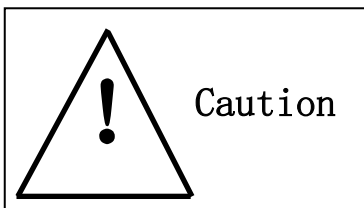
- Operations (such as wiring, installation, operation, remove and maintenance) must be performed by the specified professional personnel.

Failure to follow this instruction could result in electric shock and damage to the spindle drive unit.



- The control circuit board adopts the CMOS IC. When maintaining, do not touch it directly with your fingers, because electrostatic induction could damage the control circuit board.

## 6. System Configuration



- The rated torque of the spindle motor must be larger than continuous effective load torque. Otherwise, the spindle motor could be damaged by long-time overload operation.
- The ratio of load inertia and spindle motor inertia must be less than the recommended value.
- Make sure that the motor is properly matching the spindle drive unit.

Failure to follow this instruction could result in damage of the equipment.

## 7. Others



- Do not make alterations independently.  
Failure to follow this instruction could result in electric shock and injury.

## 2 Overview

Series HSV-180AS AC spindle motor drive is a new generation of full digital AC servo spindle drive developed by Wuhan Huazhong Numerical Control Co., Ltd.. This product features high performance, compact structure, easy-to-use operation, and high reliability.

## 2.1 Introduction

Series HSV-180AS AC spindle motor drive adopts the latest technologies such as special motion control digital signal processor (DSP), and intelligent power module (IPM), and achieves the closed-loop servo control of spindle motor. It has various specifications such as 035、050、075、100、150、200、300、450A and different ranges of power options. Users can configure various types of spindle drive motor and AC spindle motor to form high reliability and performance AC spindle drive systems.

### **Characteristics of Series HSV-180AS:**

#### 1. Easy and flexible operation

By modifying the parameter, you can modify the control methods of the spindle drive and the interior parameters so as to meet the requirements for different environment and conditions, and can be compatible with various types of spindle motors.

#### 2. Full display of status

Series HSV-180S provide a series of status display, which enables users to view related status parameters of the spindle drive during commissioning and operation. In addition, it provides a range of troubleshooting information.

#### 3. Various interfaces, and flexible control methods

HSV-180S spindle drive can provide various interfaces and flexible control methods as follows:

- Pulse input interface
- Analog input interface
- Feedback interface of spindle motor optical -electrical encoder
- Feedback interface of spindle motor encoder
- Serial communication interface
- Programmable I/O interface

#### 4. Spindle orientation function

Series HSV-180AS can provide an independent function for spindle orientation. Through feedback devices such as spindle motor optic-electrical encoder, spindle encoder and zero switch, it can realize the spindle orientation control independently.

#### 5. C axis function

Series HSV-180S achieve the closed-loop servo control of spindle motor. With the C axis function, it achieves the function for rigid tapping and thread cutting.

## 2.2 Introduction to Control Modes

Series HSV-180AS spindle drive motor provides four control modes:

#### 1. Position control mode (pulse interface)

Under this mode, HSV-180AS spindle drive can set to external position control mode by setting internal parameters. It can receive three types of external pulse command such as orthogonal pulse command, pulse + direction command, and positive and negative pulse command.

#### 2. External speed control mode (pulse interface)

Under this mode, HSV-180AS spindle drive can set to external speed control mode by setting internal parameters. It can receive three types of external pulse command such as orthogonal pulse command, pulse + direction command, and positive and negative pulse command.

#### 3. External speed control mode (analog interface)

Under this mode, HSV-180AS spindle drive can set to external speed control mode by setting internal parameters. It can receives external analog command with amplitude varies from -10V to 10V or from 0V to 10V.

#### 4. JOG mode

Under this mode, HSV-180S spindle drive can run based on the key setting (instead of external instruction). This mode is provided for users to test whether the spindle drive system is correctly installed and connected.

#### **5. Internal speed control mode**

Under this mode, HSV-180AS spindle drive can run at a present speed in the system without external instruction. This mode is provided for users to test whether the spindle drive system is correctly installed and connected.

## **3 Order Information**

### **3.1 Specifications of Spindle Drive**

#### **3.1.1 Specification for HSV-180AS**

The following figure shows the specification of HSV-180AS.

Figure 3-1 Current type of HSV-180AS

# HSV-180AS-□□□

Spindle drive      current type

035    050    075

100    150

200    300    450

## 3.1.2 Current Type of HSV-180AS

Table 3-1 Current Types of HSV-180AS spindle drives

Type		HSV-180AS-035		HSV-180AS-050		HSV-180AS-075	
Maximum power of applicable Motor (KW)		3.7KW	5.5KW	5.5KW	7.5KW	7.5KW	11KW
Rated output current (A)		16.8		21.9		31.4	
Short-time Peak Current (A)		22		28		42	
Circute breaker (A)		25	32	32	40	40	63
conector (A)		18	25	25	32	32	40
Input exchange reactor	Current (A)	10	15	15	20	20	30
	Inductance (mH)	1.4	0.93	0.93	0.7	0.7	0.47
Input filter(A)		10	15	15	20	20	30
Maximum braking resistor (A)		25		25		40	
Recommended Braking resistor	Resistor (Ω)	51 Ω		51 Ω		27 Ω	
	Power (W)	1500W		1500W		2000W	
	Quanlity	1		1		1	
Recomand value of main circute cable (mm <sup>2</sup> )		4	4	4	4	4	10

Type	HSV-180AS-100		HSV-180AS-150		
Maximum power of applicable Motor (KW)	11KW	15KW	18.5KW	22KW	
Rated output current (A)	43.8		62.8		
Short-time Peak Current (A)	56		84		
Circute breaker (A)	63	63	100	100	



conector (A)		40	50	63	80	
Input exchange reactor	Current (A)	30	40	50	60	
	Inductance (mH)	0.47	0.35	0.28	0.24	
Input filter(A)			40	50	65	
Maximum braking resistor (A)				75		
Recommended Braking resistor	Resistor ( $\Omega$ )	33 $\Omega$		27 $\Omega$		
	Power (W)	1500W		2000W		
	Quanlity	2		2		
Recomand value of main circute cable ( $\text{mm}^2$ )		10	16	16	25	

Type		HSV-180AS-200		HSV-180AS-300	HSV-180AS-450
Maximum power of applicable Motor (KW)		30KW	37KW	51KW	75KW
Rated output current (A)		85.7		125	170
Short-time Peak Current (A)		110		168	224
Circute breaker (A)		125	160	200	400
conector (A)		95	115	150	250
Input exchange reactor	Current (A)	80	90	150	250
	Inductance (mH)	0.17	0.16	0.095	0.056
Input filter(A)			100	150	250
Maximum braking resistor (A)				100	150
Recommended Braking resistor	Resistor ( $\Omega$ )	30 $\Omega$		30 $\Omega$	30 $\Omega$
	Power (W)	2500W		2500W	2500W
	Quanlity	3		4	6
Recomand value of main circute cable ( $\text{mm}^2$ )				70	120

### 3.1.3 Technical Specification of HSV-180AS

The following table describes the technical specification of HSV-180AS

Table 3-2 Technical specification of HSV-180AS spindle drives

Input power	Rated voltage, Range of voltage fluctuation Frequency	150A and below specifications: Three-phase AC380V -15%~+10% 50/60Hz 200A and above Specifications: 1. Single phase AC220V control power -15%~+10% 50/60Hz 2. Three-phase AC380V strong power -15%~+10% 50/60Hz
Control modes		Position control, External speed control, JOG control, Internal speed control
Characteristic	Speed frequency response	300Hz or higher
	Speed volatility	Lower than 5r/min (load 0%~100%)
	Speed range	1r/min~12000r/min
	Constant power range	1: 4
Position control	Types of pulse command	① Direction + pulse train ②CCW pulse +CW pulse ③Two-phase A / B quadrature pulse
	Form of pulse command	Non-insulated wire drive (about +5V)
	Frequency of pulse command	≤500kHz
Speed control	Types of pulse command	② Direction + pulse train ②CCW pulse +CW pulse ③Two-phase A / B quadrature pulse
	Form of pulse command	Non-insulated wire drive (about +5V)
	Frequency of pulse command	≤500kHz
	Analog command	DC 0~+10V or DC -10V~+10V
	Acceleration and deceleration function	0.1~180seconds

Type of spindle motor encoder		TTL composite incremental photoelectric encoder:1024line、2048line、2500line Sine and cosine incremental encoder: 256line Absolute encoder: ENDAT2.1/2.2 Protocol encoder (EQN1325/EQN1313)
Spindle encoder encoder type		Optical encoder (TTL) Sine and cosine analog signal (1Vpp)
Input and output Signal	Control input	Run enable Alarm clear Forward and reverse running enable Spindle orientation ready Control modes switch Indexing incremental orientation ratio input selection
	Control output	Spindle ready Spindle alarm Spindle orientation-finished Speed-reached Zero-speed reached
Spindle function	Spindle orientation	Accuracy: $\pm 1$ pulse; Position adjustment: Parameter setting
	Rigid tapping	Tapping deviation: $\pm 2\%$
	Other function	C-axis control, Thread cutting
Communication function		RS232 use MODBUS protocol
Monitoring function		Speed Flux current Torque current Motor load current Switch-value input status display Switch-value output status display Control mode display

Protecting function		Provides protection against: Over speed Main power over-voltage and under-voltage Over current Overload Motor over heat Big speed error IPM fault etc.
Operation		Six LED digital tubes, two light-emitting diodes(LED), five bottoms
Adaptive motor		2.2KW~75KWAC servo spindle motor
Use Enviro nment	Use place	Non-corrosive, flammable gas, prevent conductive objects, metal dust, oil mist and liquid from entering inside the drive unit.
	Use Temperature Storage Temperature	Use temperature :0℃~+40℃, More than 40 ℃ shall be derated. Storage temperature :-20℃~+60℃.
	Use humidity Storage humidity	Below 90% RH, non-condensing.
	Altitude	Below 1000m, Altitude above 1000m shall be derated.
	Vibration / impact resistance	Vibration Resistance $4.9\text{m/S}^2$ , Impact resistance $19.6\text{m/S}^2$

### 3.1.4 Dimension and Size of Spindle Drive

The following figures show the installation dimension of series HSV-180AS spindle drives.

1. Figure 3-2 Dimension and size of HSV-180AS-, 035, 050, 075 (without auxiliary devices Unit: mm)

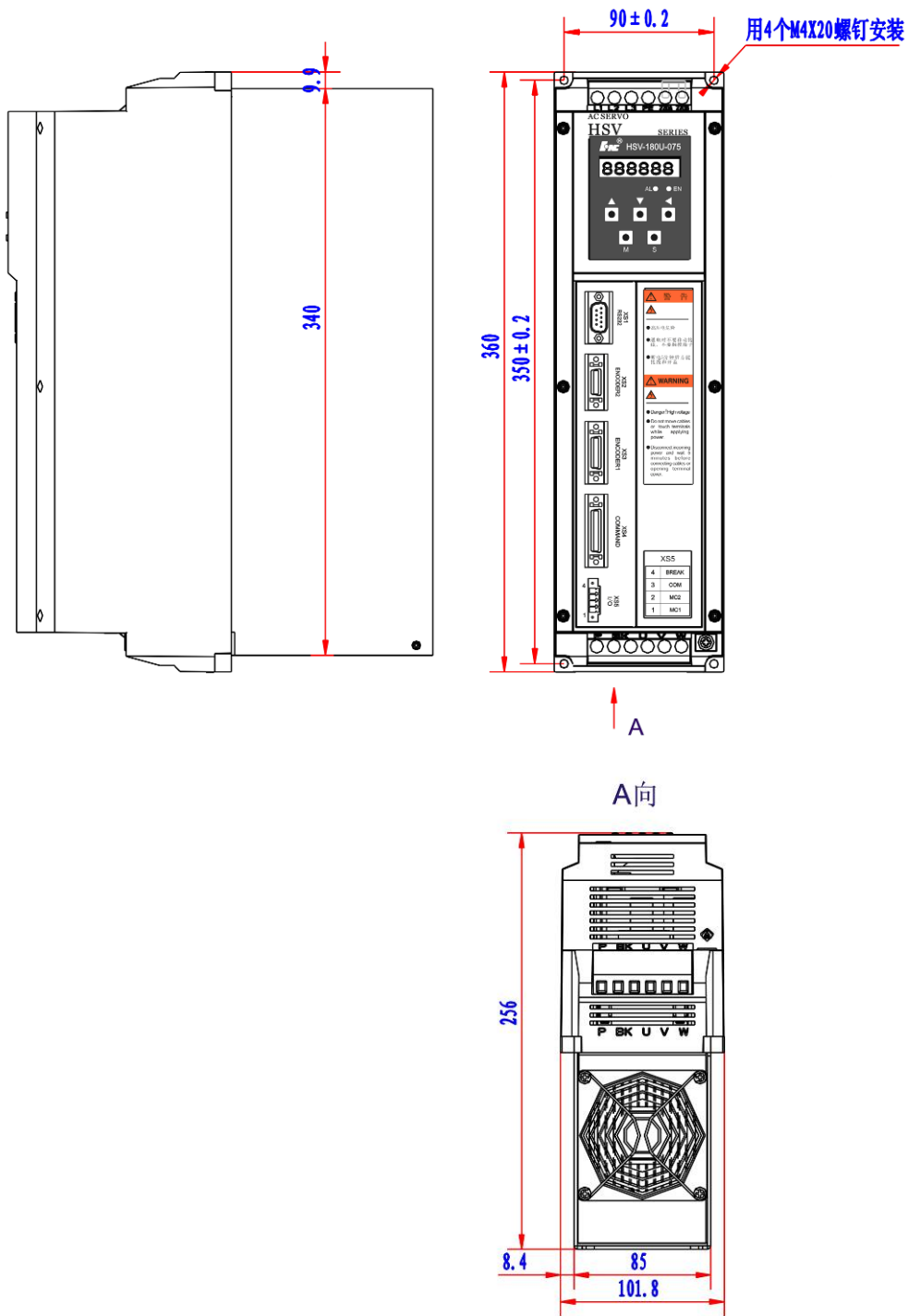


Figure 3-3 Dimension and size of HSV-180AS-025, 035, 050, 075 (with auxiliary devices Unit: mm)



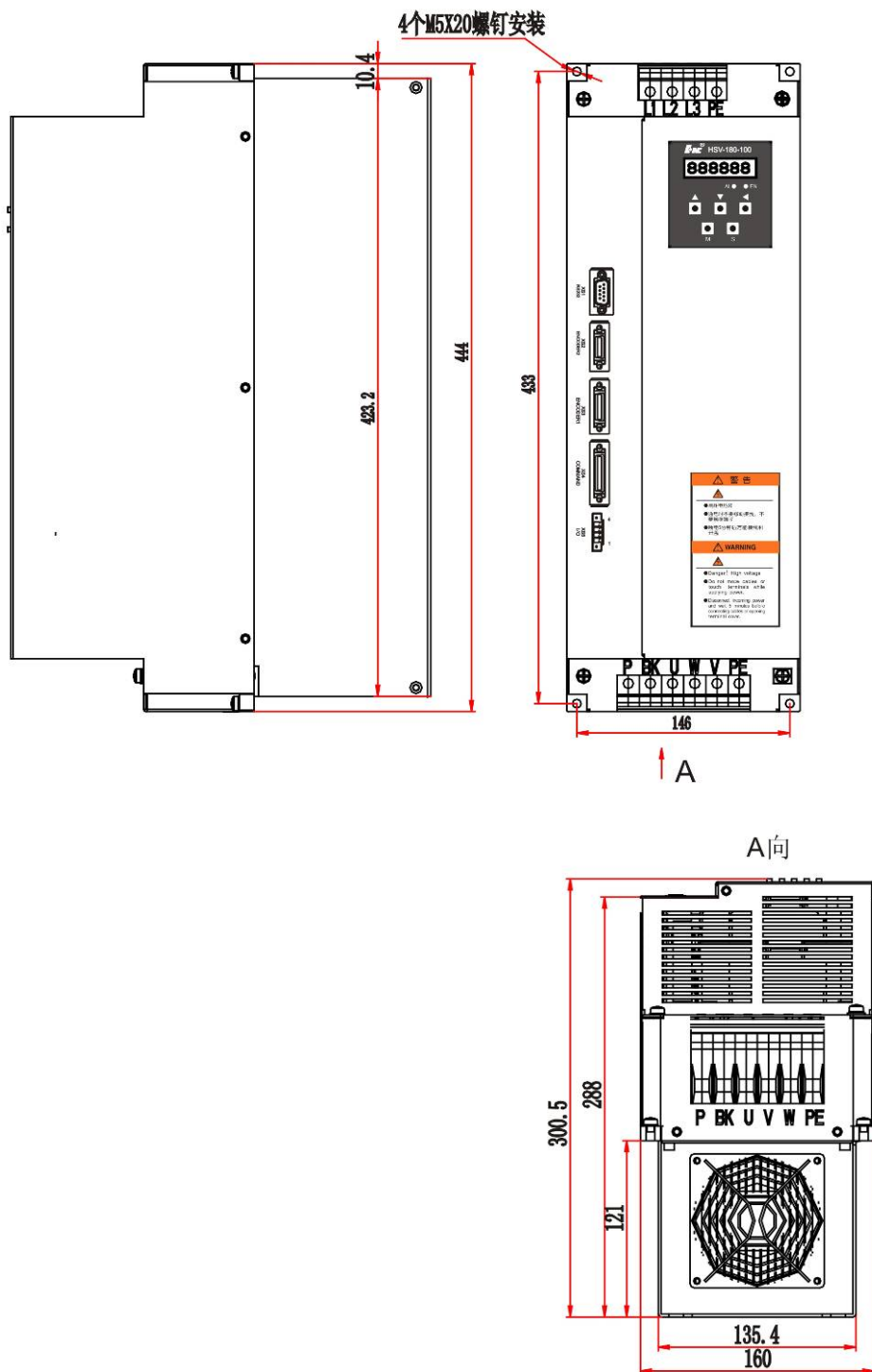


Figure 3-5 Dimension and size of HSV-180AS-100,150 (with auxiliary devices Unit: mm)





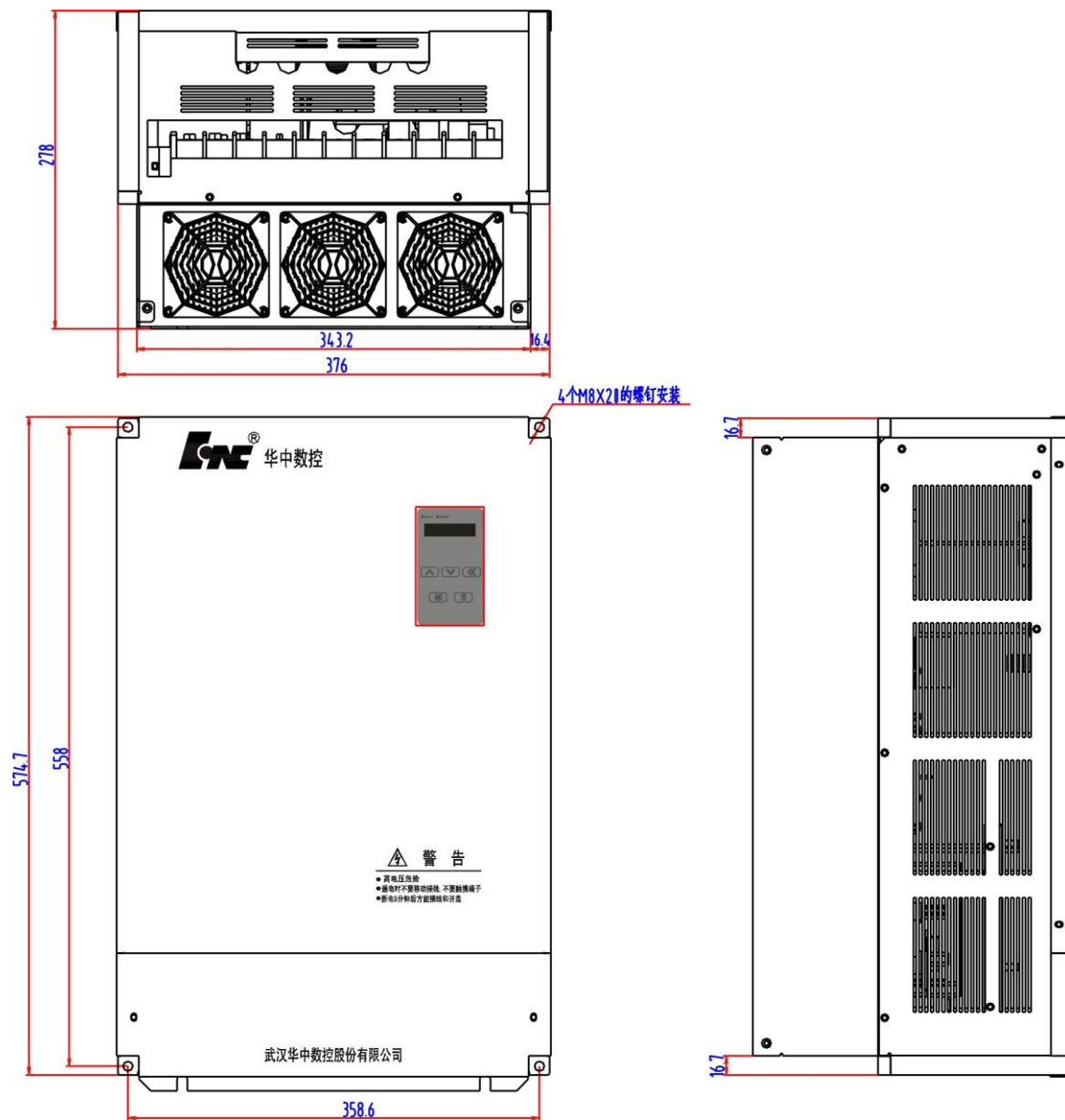
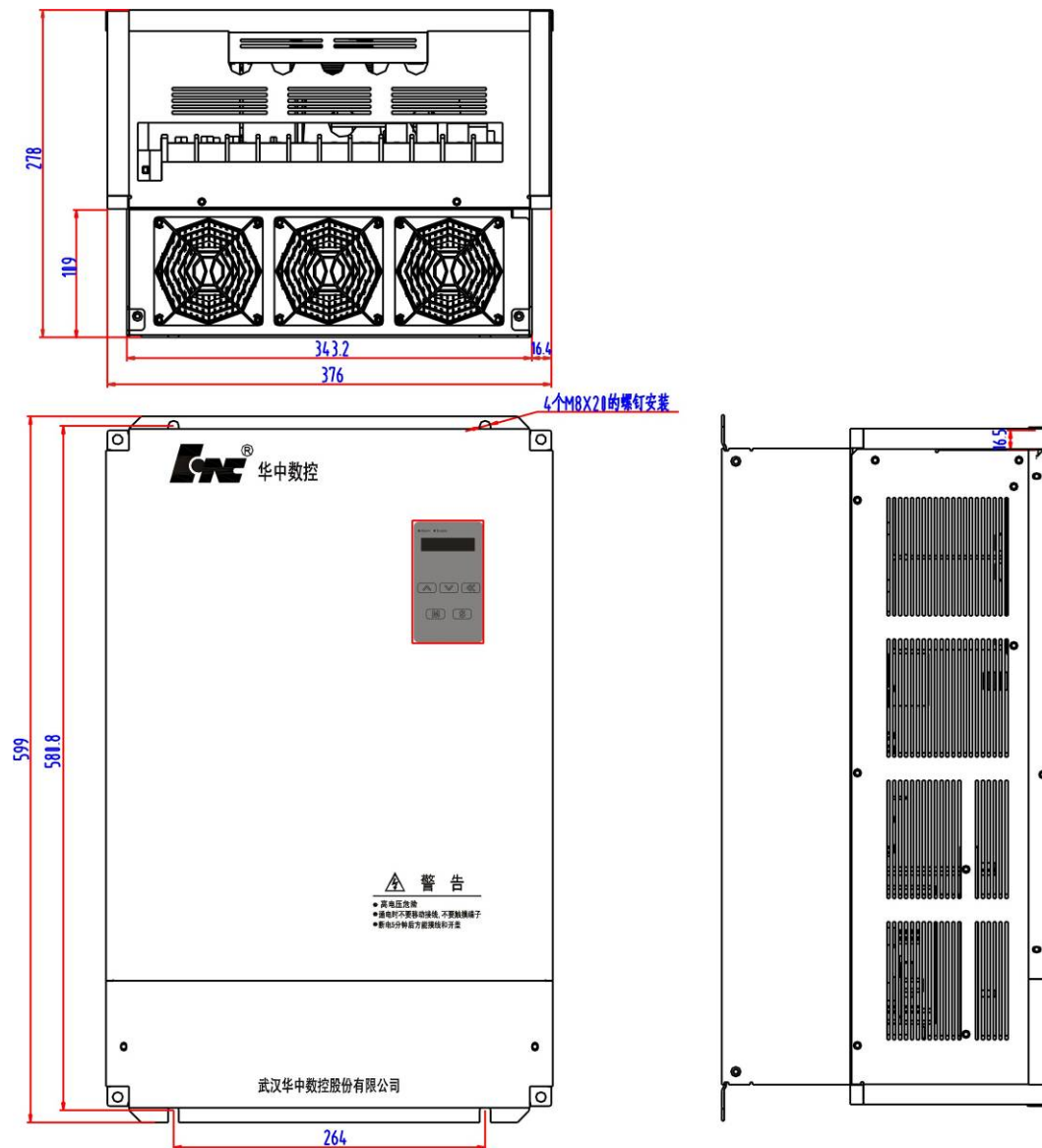


Figure 3-7 Dimension and size of HSV-180AS-, 200, 300, 450 (with auxiliary devices Unit: mm)



## 3.2 Specification of Spindle Motor

### 3.2.1 Introduction to Series GM7 AC Servo Spindle Motor

Series HSV-180AS spindle drive matched with the series GM7 AC servo spindle motor which achieves the closed-loop control and has an excellent performance. It is widely used in the fields that require AC servo spindles such as machine tool, building material, textile, light industry, machinery, and metallurgy industries.

Series GM7 AC servo drive consists of stator, rotor, low-noise fans, high-precision encoder and other components. Based on the structural

optimization design and magnetic circuit optimization, it adopts class F insulation structure, machine processing and high-precision dynamic balance technologies.

### 3.2.2 Features of Series GM7 AC Servo Spindle Motor

- Compact structure, small size, light weight, high power density
- Low magnetic vibration, low noise, high-precision rotation, large speed range of constant torque and wide constant power speed range
- Low rotor inertia and short response time
- Uniform air gap, high-precision dynamic balance, and small torque ripple
- Sealed design and the protection grade reached IP54
- Adopting class F insulation structure to preventing surge current and corona so as to ensure reliable and long-life operation
- High capability and low price

Figure 3-4 Series GM7 AC servo spindle motor



### 3.2.3 Technical index of Series GM7AC servo spindle motor

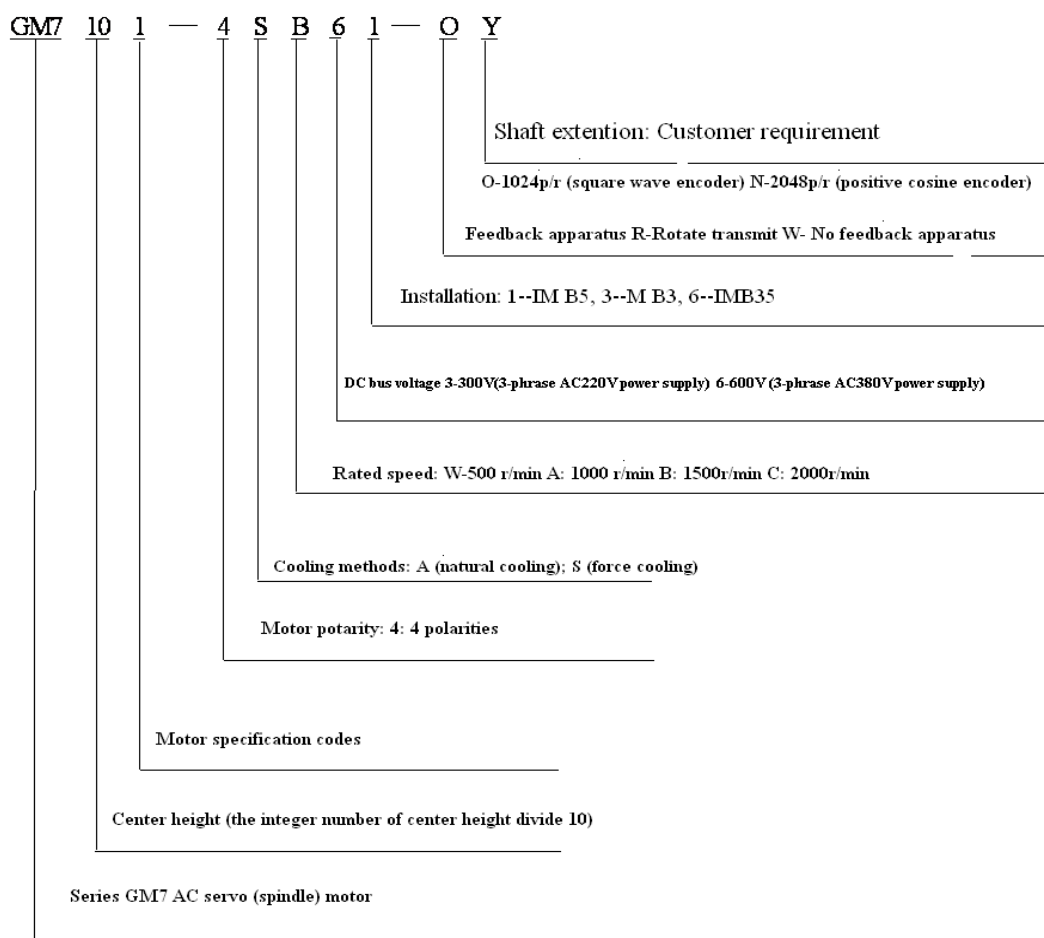
The following table describes the technical index of series AC GM7 servo spindle motor.

Table 3.3 Technical index of series GM7AC servo spindle motor

Item	Description
------	-------------

Motor type	Full-digital AC servo inverter motor (squirrel-cage AC induction motor)
Insulation class	Class F insulation, special insulation structure
Feedback component	Incremental square-wave encoder or incremental sine-wave encoder
Temperature protection	positive temperature coefficient (PTC) thermistor
Force cooling fun connection	● Terminal in the terminal box
optic-electrical encoder connection	● Circular socket connector
Types of mounting	● Types of mounting: IMB5 IMB35
Protection level	● Protection level: IP54 Alternative: IP55
Cooling	● Cooling: forced air cooling and air flow from drive end to non-drive end
Surface paint	● Flat grey paint or customized color
Bearing	● Deep groove ball bearing double sealed
Shaft ends	● Standard model: with key way and key, or determined by the customers' requirements
Vibration level& Rotation accuracy	Vibration level : Level N Alternative: level R Rotation accuracy: Level N Alternative: level R
Noise	100 and 132 base $\leq 70\text{dB (A)}$ 160base $\leq 72\text{dB (A)}$ 110base $\leq 76\text{dB (A)}$ 225base $\leq 77\text{dB (A)}$

### 3.2.4 Order information of series GM7 AC servo spindle motor



### 3.2.5 Technical index of series GM7 AC servo spindle motor

Adhere to the following principles when choosing the spindle drive:

- Generally the maximum current or rated current is equal or greater than 2.
- For rigid tapping, the maximum current or rated current is equal or greater than 3.
- For the situation that requires low inertia loads and common dynamic response characteristics, the maximum current or rated current is equal or greater than 1.6.

The following table describes the technical index of series GM7 AC servo spindle motor.

Table 3.4 Technical index of series GM7 AC servo spindle motor

Motor Type	Rated Power (KW)	Rated Torque (Nm)	Rated Current (A)	Rated Rotary speed (r/min)	Maximum Speed (r/min)	Adaptive Spindle Drive
GM7101-4SB61	3.7	23.6	10	1500	6000/ 9000	HSV-180AS-035 /2.2
GM7103-4SB61	5.5	35	13	1500	6000/ 9000	HSV-180AS-035 /1.7
						HSV-180AS-050 /2.1
GM7105-4SB61	7.5	47.8	18.8	1500	6000/ 8000	HSV-180AS-050 /1.5
						HSV-180AS-075 /2.2
GM7109-4SB61	11	70	25	1500	6000/ 8000	HSV-180AS-075 /1.7
						HSV-180AS-100 /2.2
GM7133-4SB61	15	95.5	34	1500	6000/ 8000	HSV-180AS-100 /1.6
						HSV-180AS-150 /2.5
GM7135-4SB61	18.5	117.8	42	1500	6000/ 8000	HSV-180AS-150 /2
GM7137-4SB61	22	140.1	57	1500	6000/ 8000	HSV-180AS-150 /1.5
GM7181-4SB61	30	191	72	1500	6500	HSV-180AS-200 /1.5
GM7183-4SB61	37	235.5	82	1500	6500	HSV-180AS-200 /1.4

GM7185-4SB6 1	51	325	120	1500	5000	HSV-180AS-30 0 /1.4
GM7189-4SB6 1	75	478	165	1500	5000	HSV-180AS-45 0 /1.4

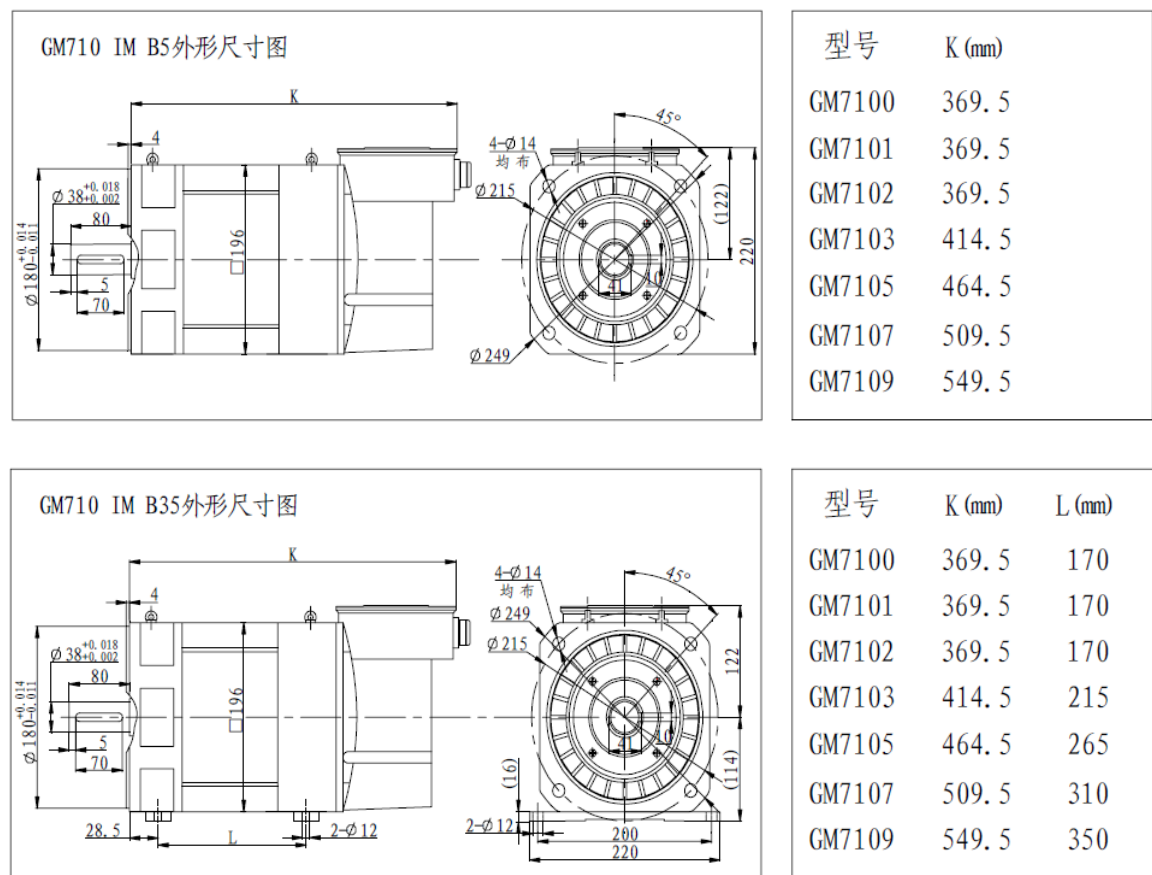
#### Note:

It is special mentioned that if configured with encoder made in China or Japan, the maximum rotary speed is 6000r/min; if configured with encoder made in Germany, the maximum rotary speed is 15000r/min.

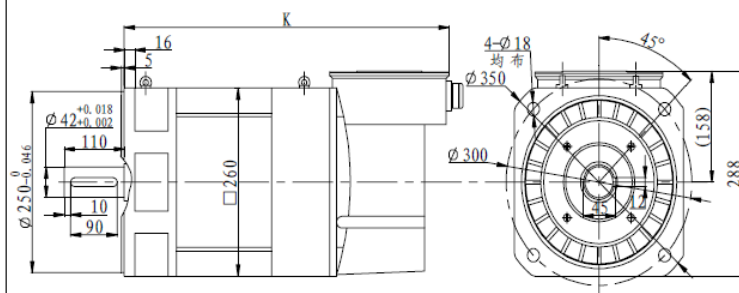
### 3.2.6 Installation Dimension of the Motor

The following figure shows the installation dimension of the series GM7AC servo spindle motor.

Figure 3-10 Installation dimension of series GM7 AC servo spindle motor



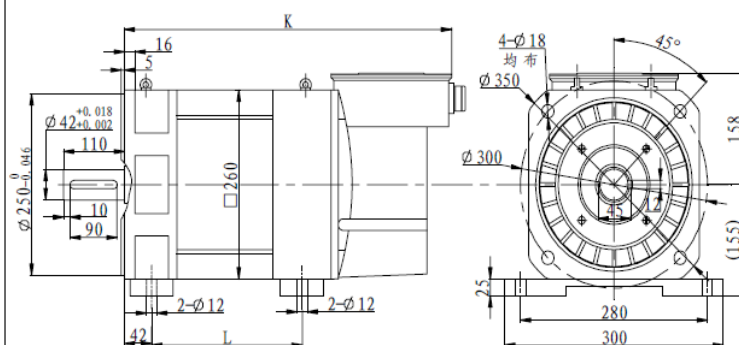
GM713 IM B5外形尺寸图



型号 K (mm)

GM7130	458.5
GM7131	538.5
GM7132	458.5
GM7133	538.5
GM7135	623.5
GM7137	623.5

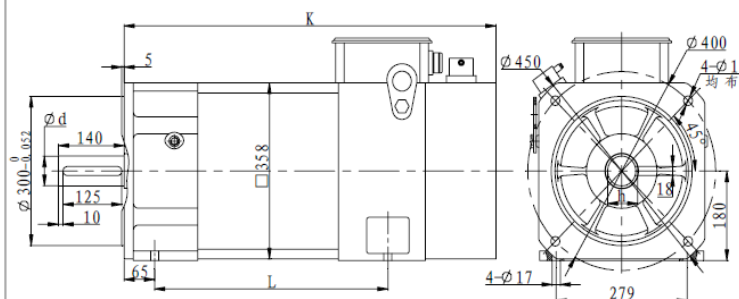
GM713 IM B35外形尺寸图



型号 K (mm) L (mm)

GM7130	458.5	195
GM7131	538.5	275
GM7132	458.5	195
GM7133	538.5	275
GM7135	623.5	360
GM7137	623.5	360

GM718 IM B35外形尺寸图



型号 K (mm) L (mm) d (mm) h (mm)

GM7181	703	369	60	64
GM7183	738	404	60	64
GM7185	808	474	60	64
GM7187	898	564	65	69
GM7189	948	614	65	69

NOTE: After GM710、GM713 assembling well, total length is K+61



### 3.2.7 Connect terminal definition

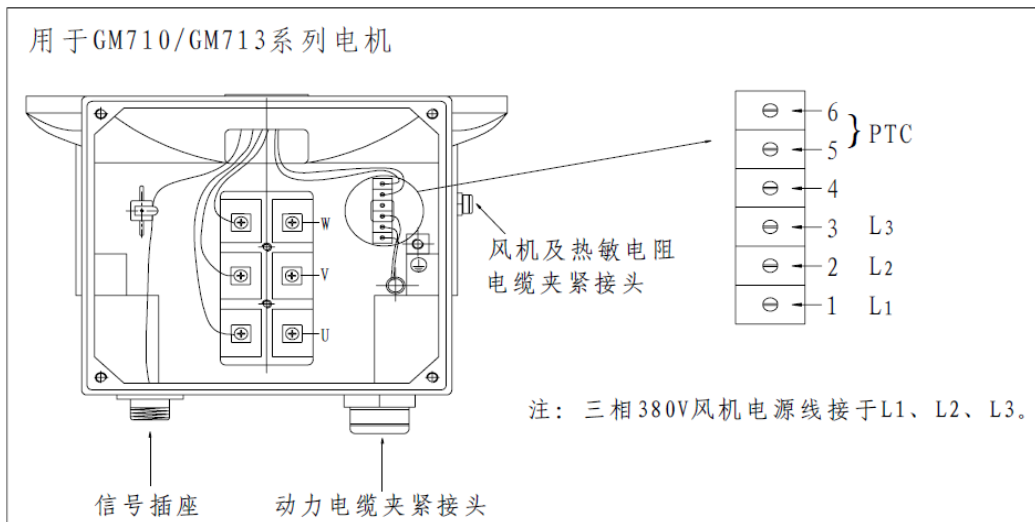
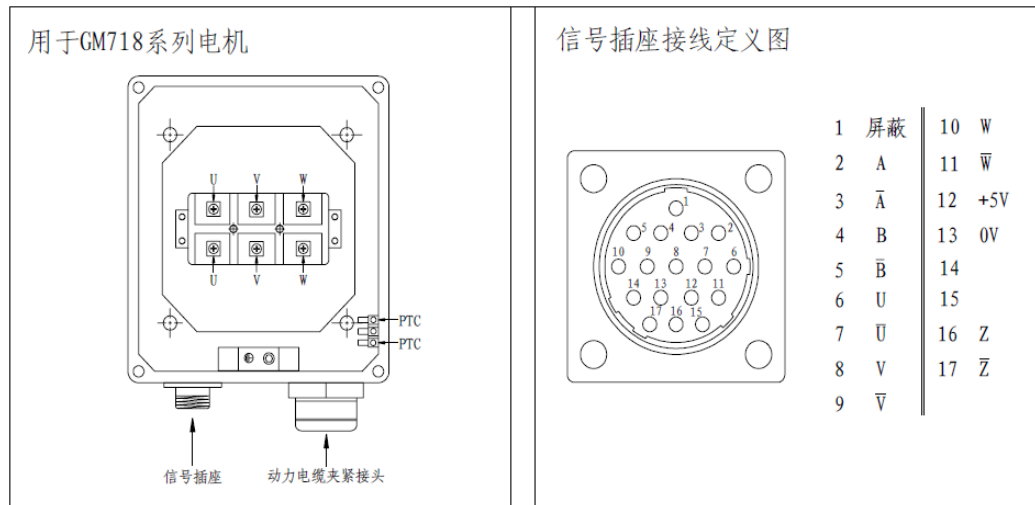


Figure 3-11 Connect terminal of series GM7 AC servo spindle motor

# 4 Installation

## 4.1 Products Check

After receiving products, users must check the items as the following table.

Item	Reference
Whether the product is damaged	Check the product appearance to make sure that the product is not damaged during transportation.
Whether the product type is in accordance with that in order	Check and make sure the type of the spindle drive unit and motor is in accordance with that in order
Whether the accessories are complete	Check the packing list and make sure that the accessory type and quantity is correct.
Whether the motor shaft can be easily turned by hand	Check and make sure that the motor shaft can be easily turned by hand, except motors with brakes.

If there are any problems, contact directly with the applier or our company.

Warning
<ul style="list-style-type: none"><li>● Do not install spindle drive which are damaged or with incomplete parts.</li><li>● The spindle drive units must be matched with the compatible spindle motor.</li><li>● Do not touch the spindle motor shaft directly, which can cause corrosive.</li></ul>

## 4.2 Installation Environment

### 4.2.1 Environment Temperature

The working environment temperature is between 0°C to 40°C. If the temperature over 40°C, de-rating required.

### 4.2.2 Humidity

Air relative humidity is equal or less than 90%. No condensation.

### 4.2.3 Altitude

Spindle drive units must be installed below 1000m altitude. If over 1000m altitude, de-rating required.

### 4.2.4 Vibration and Impulsion

Spindle drive is not load bearing and anti-collision. When installing and working, it must be free from oscillation and impact, and take measures to control the oscillation below 0.5G (4.9m/S<sup>2</sup>) .

### 4.2.5 Water

Spindle drive cannot be installed in the water spray or condensation location.

### 4.2.6 Air Pollution

The spindle drive must be free from air pollution. It must be installed in the electric cabinet which is resistant to corrosive and flammable gas, as well as prevent conductive object, mental dust, oil mist and liquid from entering to the interior of the equipment.

## 4.3 Installation of Spindle Drive

Warning
<ul style="list-style-type: none"><li>● The spindle drive must be installed in the electric cabinet with fine protective function.</li></ul>

- The spindle drive must be installed in accordance with the specified direction and interval to ensure enough cooling.
- The spindle drive cannot be installed near combustibles that may cause fire hazard.

#### **4.3.1 Installation Methods of HSV-180AS-035, 050, 075**

##### **1. Installation Methods**

There are three types of wall installation: directly installed without auxiliary devices, with auxiliary devices, and external heat sink installation. For their installation diagrams, see Figure 4-1, Figure 4-2, and Figure 4-3. You can use any of the three methods, and install the servo drive vertically.

##### **2. Installation Interval**

For the installation interval of single spindle drive, see Figure 4-4 and Figure 4-5.

For the installation interval of multiple spindle drive, see Figure 4-6.

During installation, leave enough intervals as possible to ensure a good heat emission.

##### **3. Cooling**

In the electric cabinet, there must be air blew through the radiator to prevent the ambient temperature of the spindle drive from overheating.

Figure 4-1 Wall installation diagram of HSV-180AS-035, 050, 075 spindle drive (without auxiliary devices)

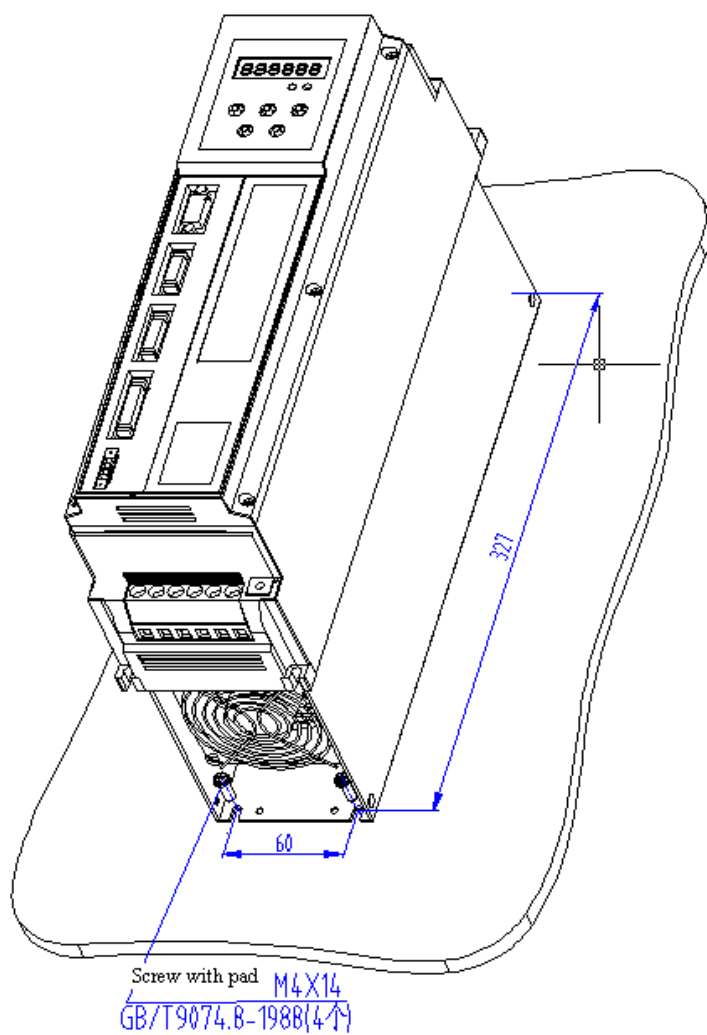


Figure 4-2 Wall installation diagram of HSV-180AS-035, 050, 075 spindle drive (with auxiliary devices)

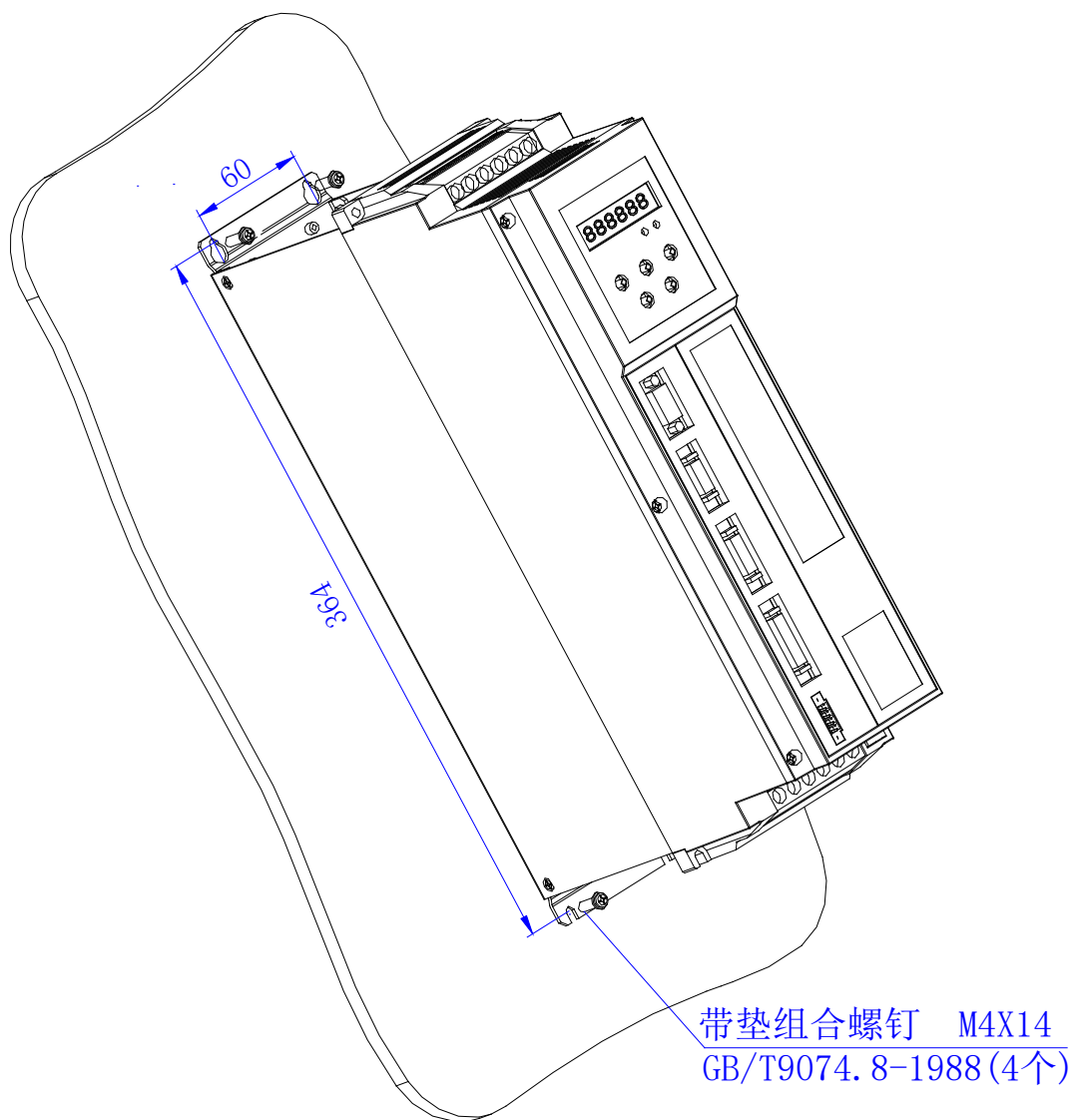


Figure 4-3 Wall installation diagram for external heat sink of HSV-180AS-035, 050, 075 spindle drive

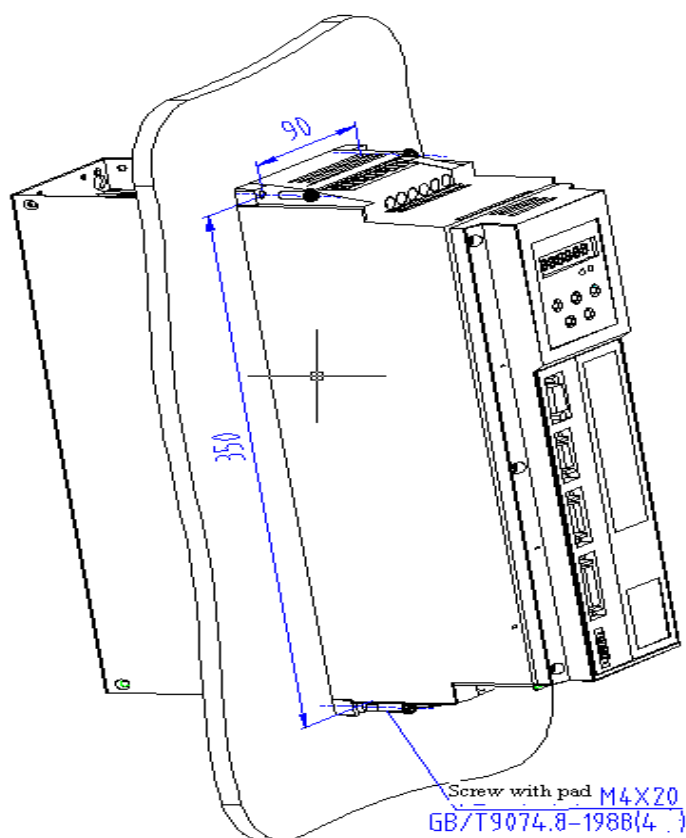


Figure 4-4 Installation interval of HSV-180AS- 035, 050, 075 spindle drive  
(Wall installation)

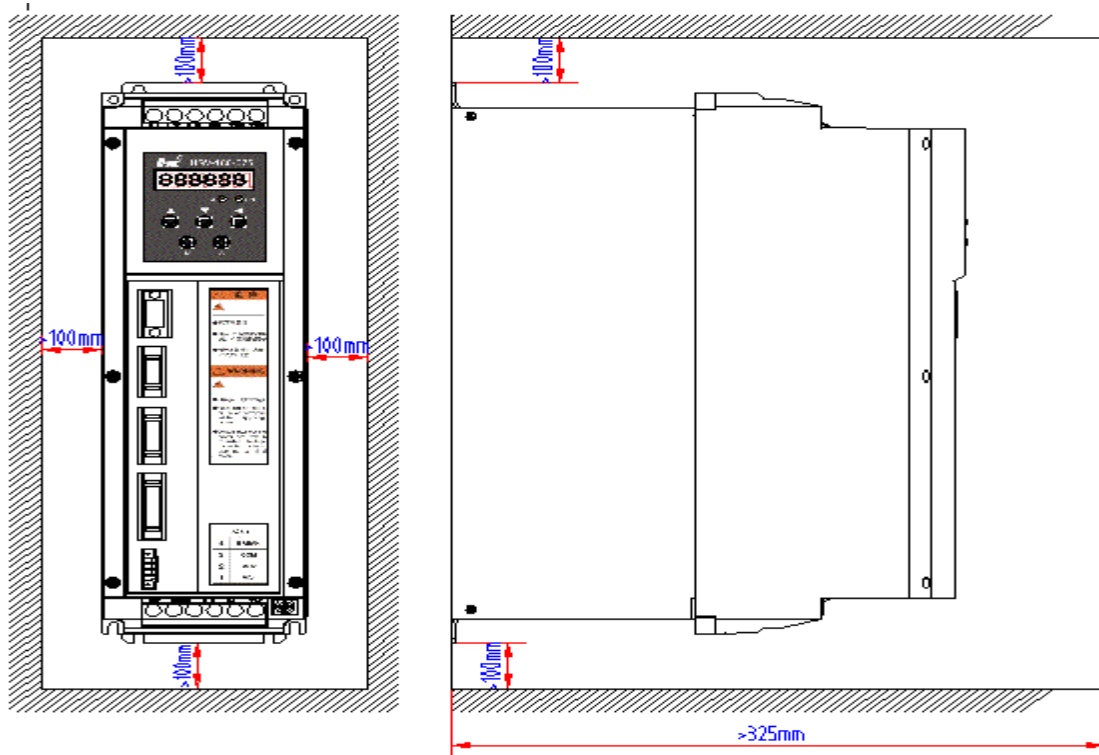


Figure 4-5 Installation interval of HSV-180AS- 035, 050, 075 single spindle drive

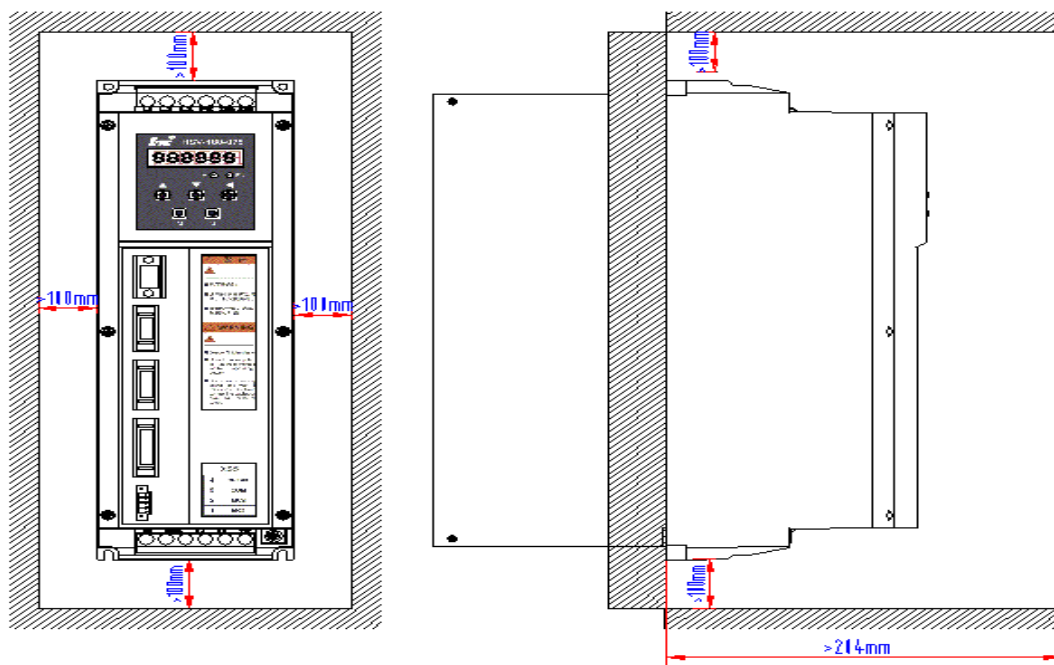
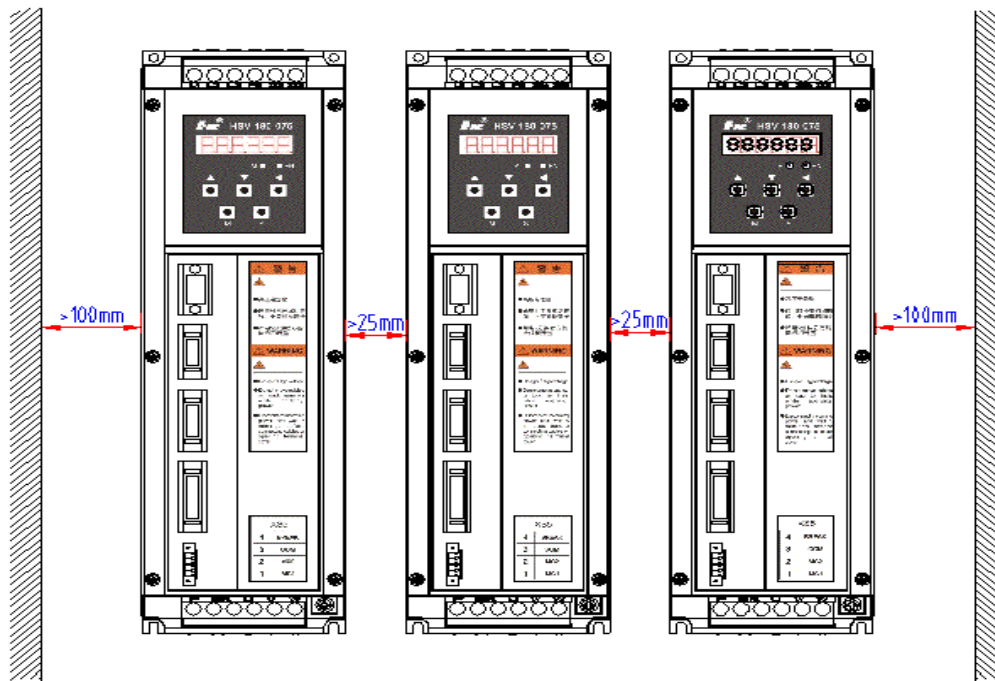




Figure 4-6 Installation intervals of HSV-180AS-035,050,075 multiple spindle drives



### 4.3.2 Installation Methods of HSV-180AS-100,150

#### 1. Installation Methods

There are two types of wall installation: directly installed with auxiliary devices, and external heat sink installation. For their installation diagrams, see Figure 4-7, Figure 4-8. You can use any of the three methods, and install the servo drive vertically.

#### 2. Installation Interval

For the installation interval of single spindle drive, see Figure 4-9 and Figure 4-10

For the installation interval of multiple spindle drive, see Figure 4-11

During installation, leave enough intervals as possible to ensure a good heat emission.

#### 3. Cooling

In the electric cabinet, there must be air blew through the radiator to prevent the ambient temperature of the spindle drive from overheating.

Figure 4-7 Wall installation diagram of HSV-180AS-100,150 spindle drive (with auxiliary devices)

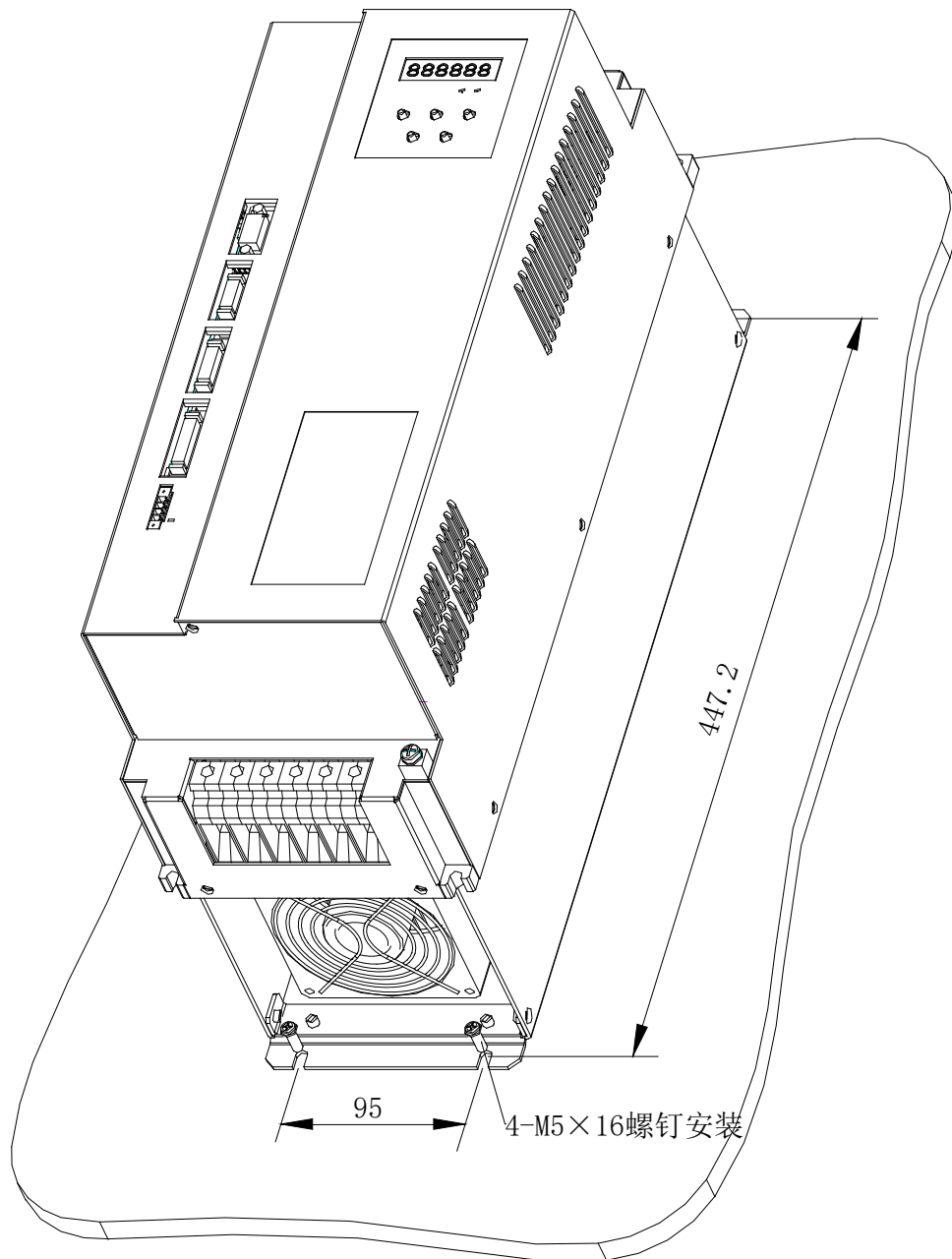


Figure 4-8 Wall installation diagram for external heat sink of HSV-180AS-100, 150spindle drive

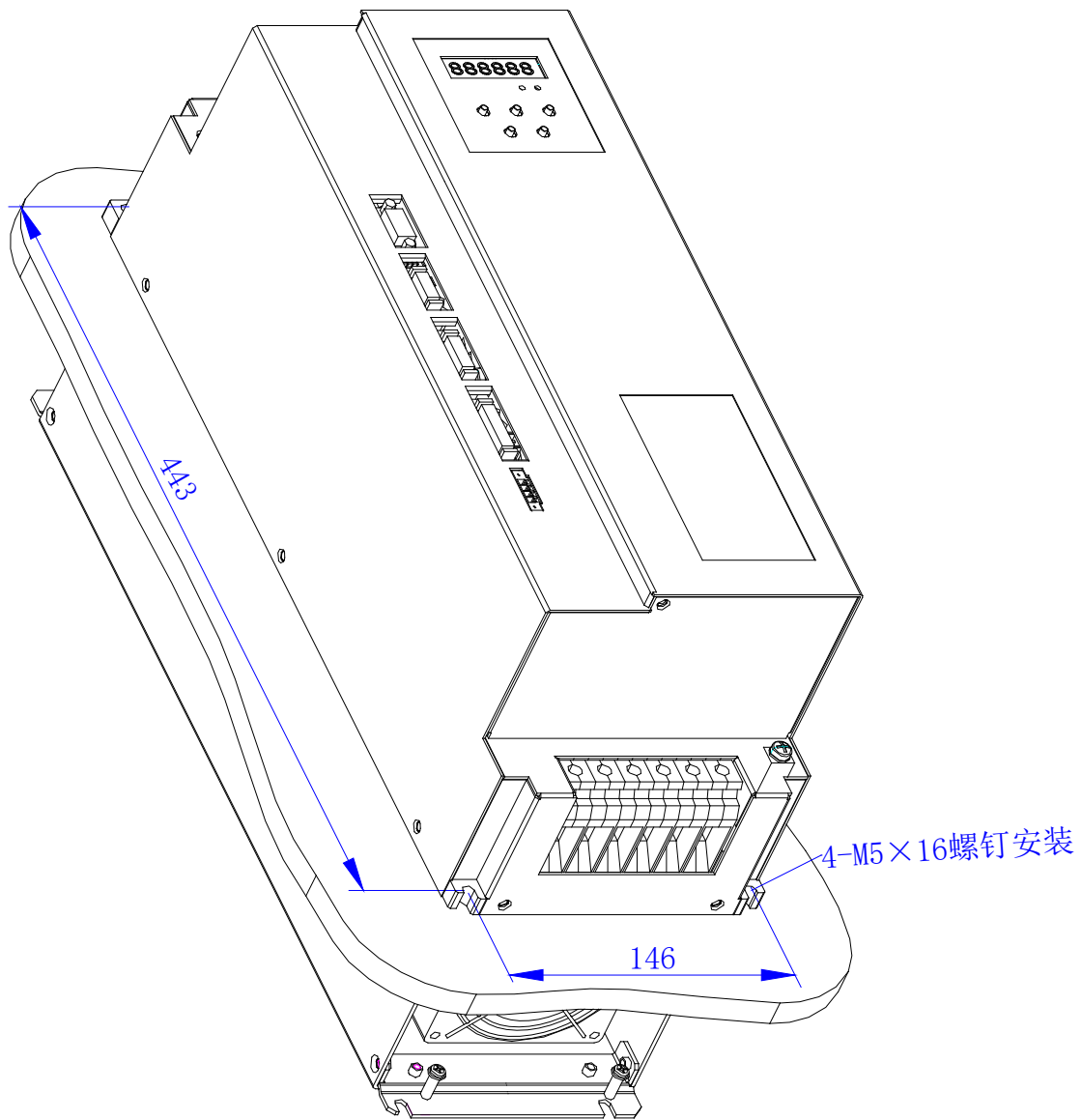


Figure 4-10 Installation interval of HSV-180AS- 100,150 single spindle drive  
(wall station)

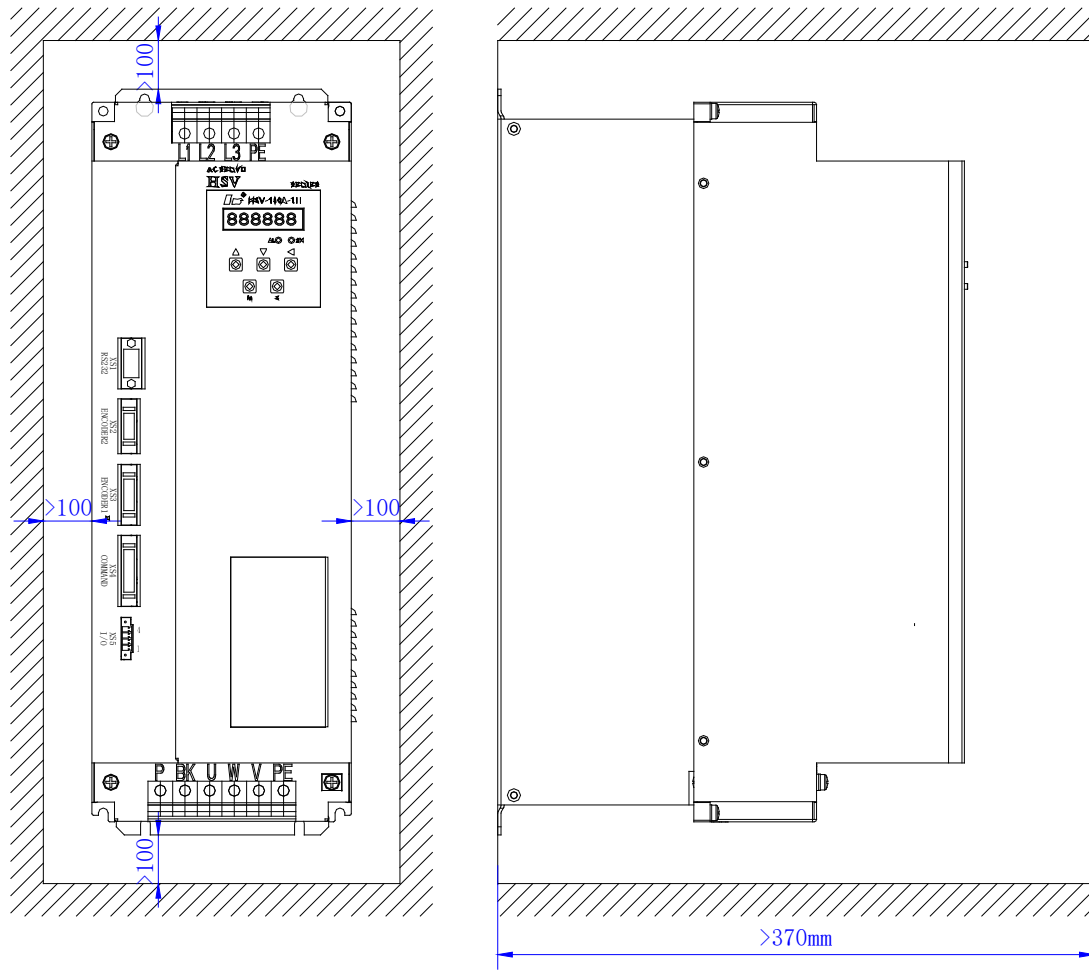


Figure 4-11 Installation interval of HSV-180AS- 100,150 single spindle drive

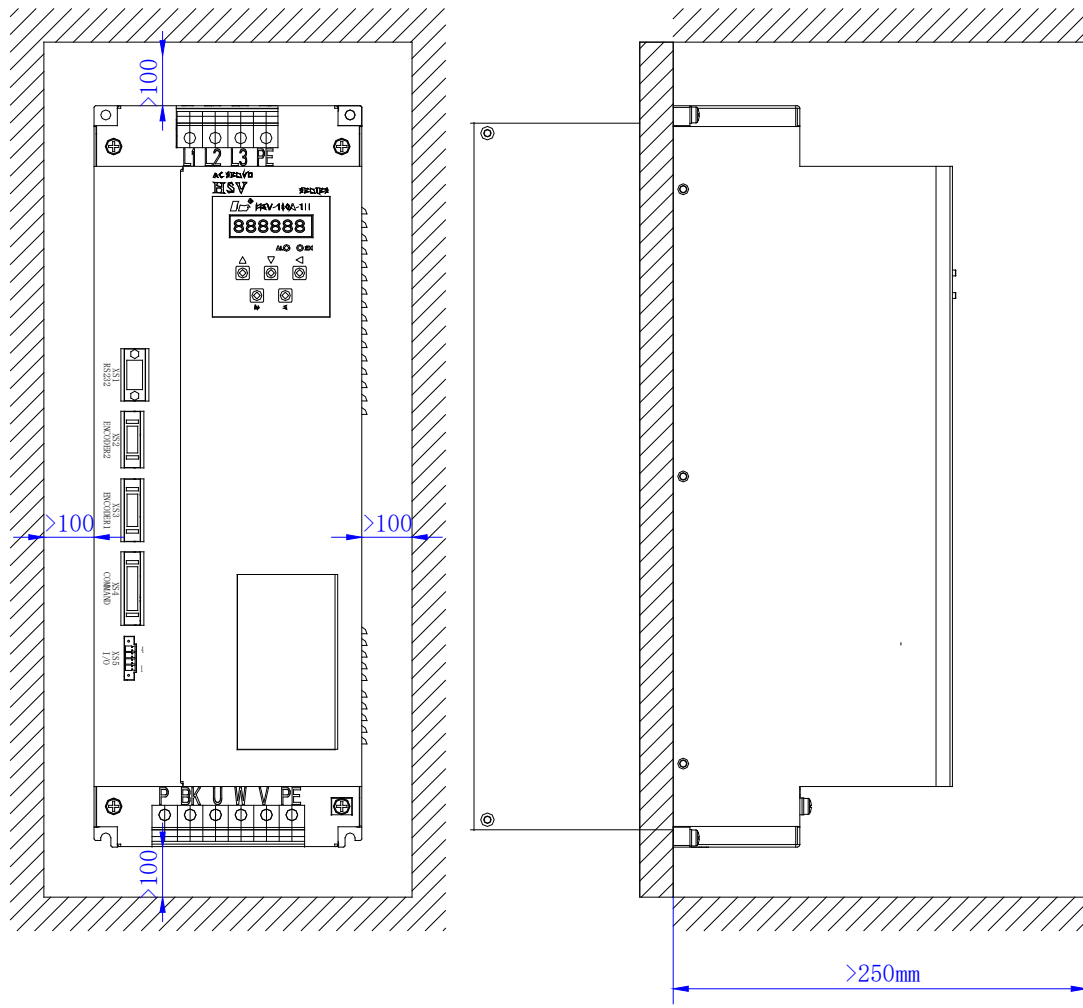
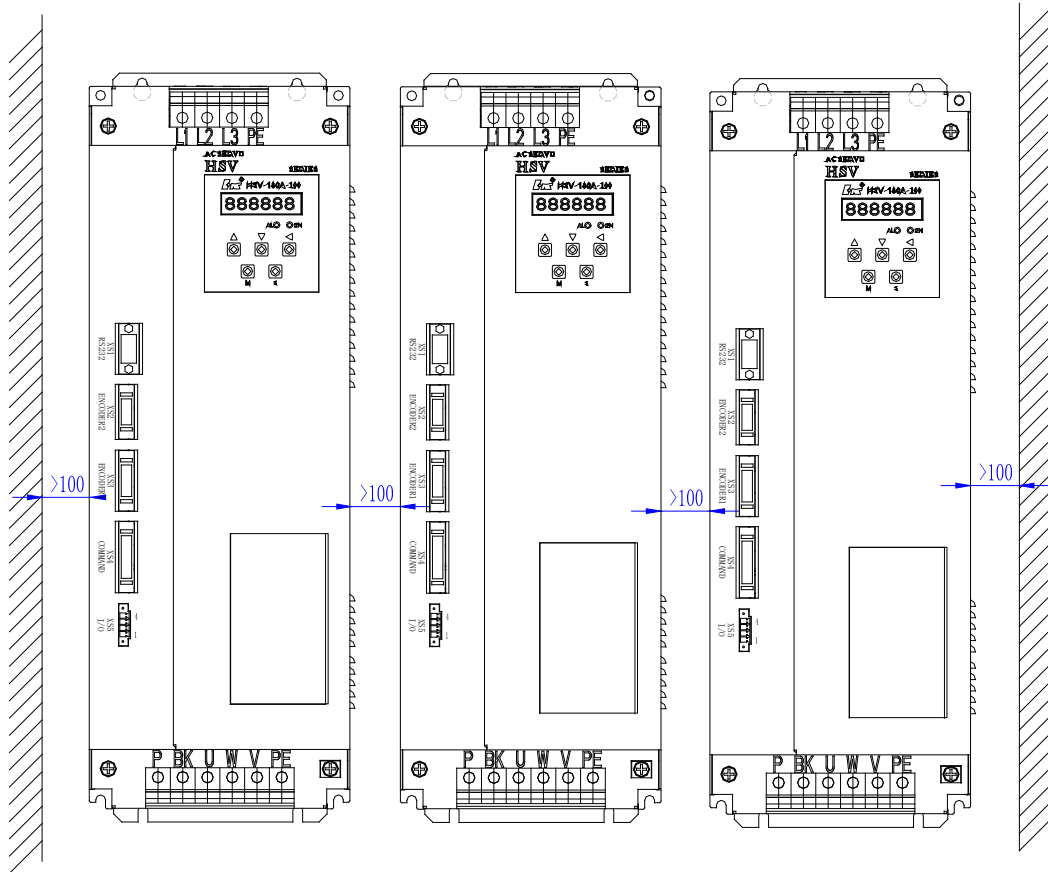


Figure 4-11 Installation interval of HSV-180AS- 100, 150 multiple spindle drive



### 4.3.3 Installation method of HSV-180AS-200, 300, 450

#### 1. Installation Methods

There are two types of wall installation: directly installed with auxiliary devices, and external heat sink installation. For their installation diagrams, see Figure 4-12, Figure 4-13. You can use any of the three methods, and install the servo drive vertically.

#### 2. Installation Interval

For the installation interval of single spindle drive, see Figure 4-14 and Figure 4-15

For the installation interval of multiple spindle drive, see Figure 4-16

During installation, leave enough intervals as possible to ensure a good heat emission.

#### 3. Cooling

In the electric cabinet, there must be air blew through the radiator to prevent the ambient temperature of the spindle drive from overheating.

Figure 4-12 Wall installation diagram of HSV-180AS-200, 300, 450 spindle drive (with auxiliary devices)

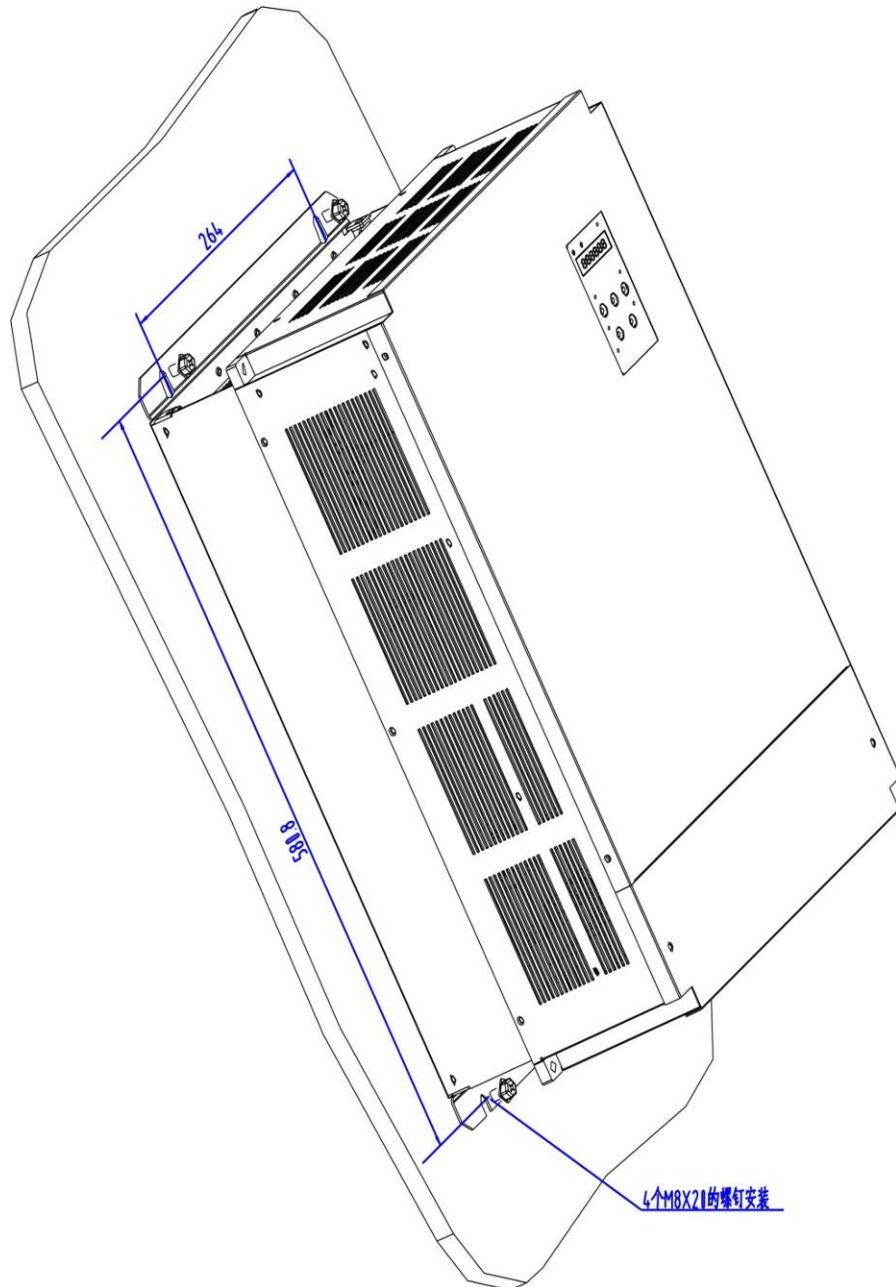


Figure 4-13 Wall installation diagram for external heat sink of HSV-180AS-200, 300, 450 spindle drive

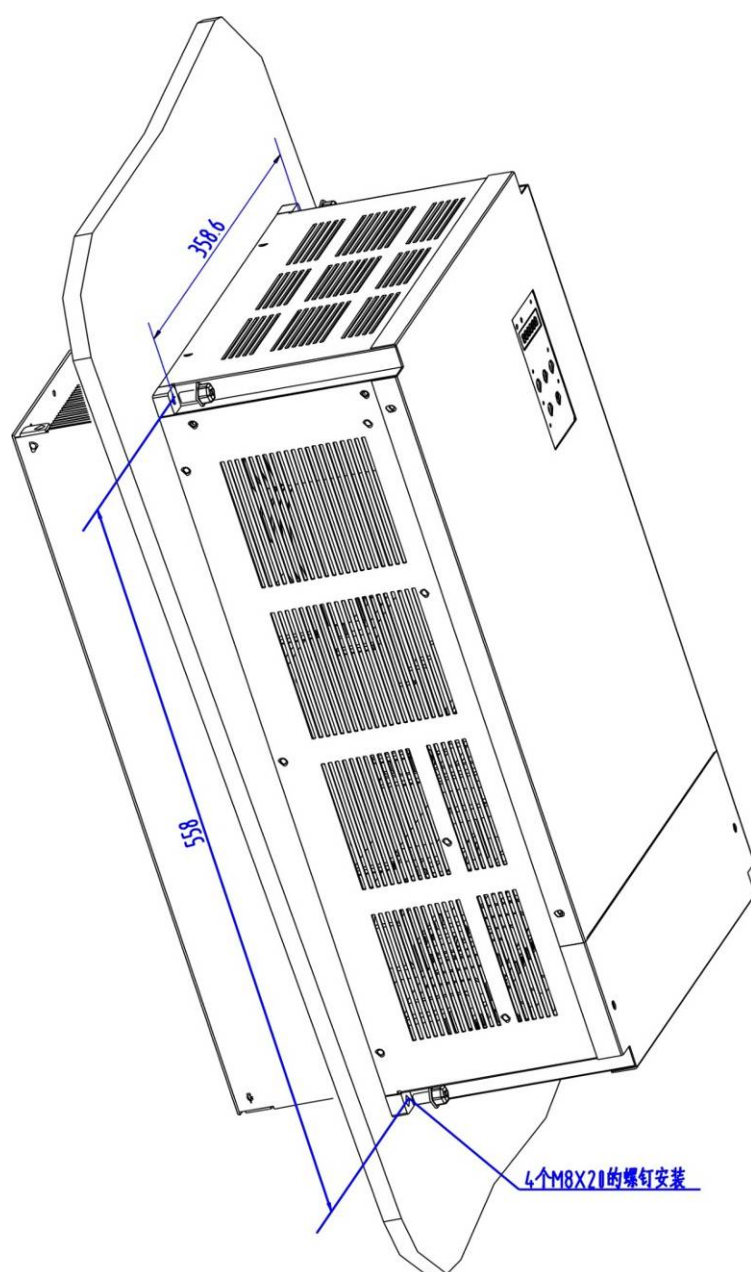


Figure 4-14 Installation interval of HSV-180AS- 200, 300, 450 single spindle drive  
(wall station)



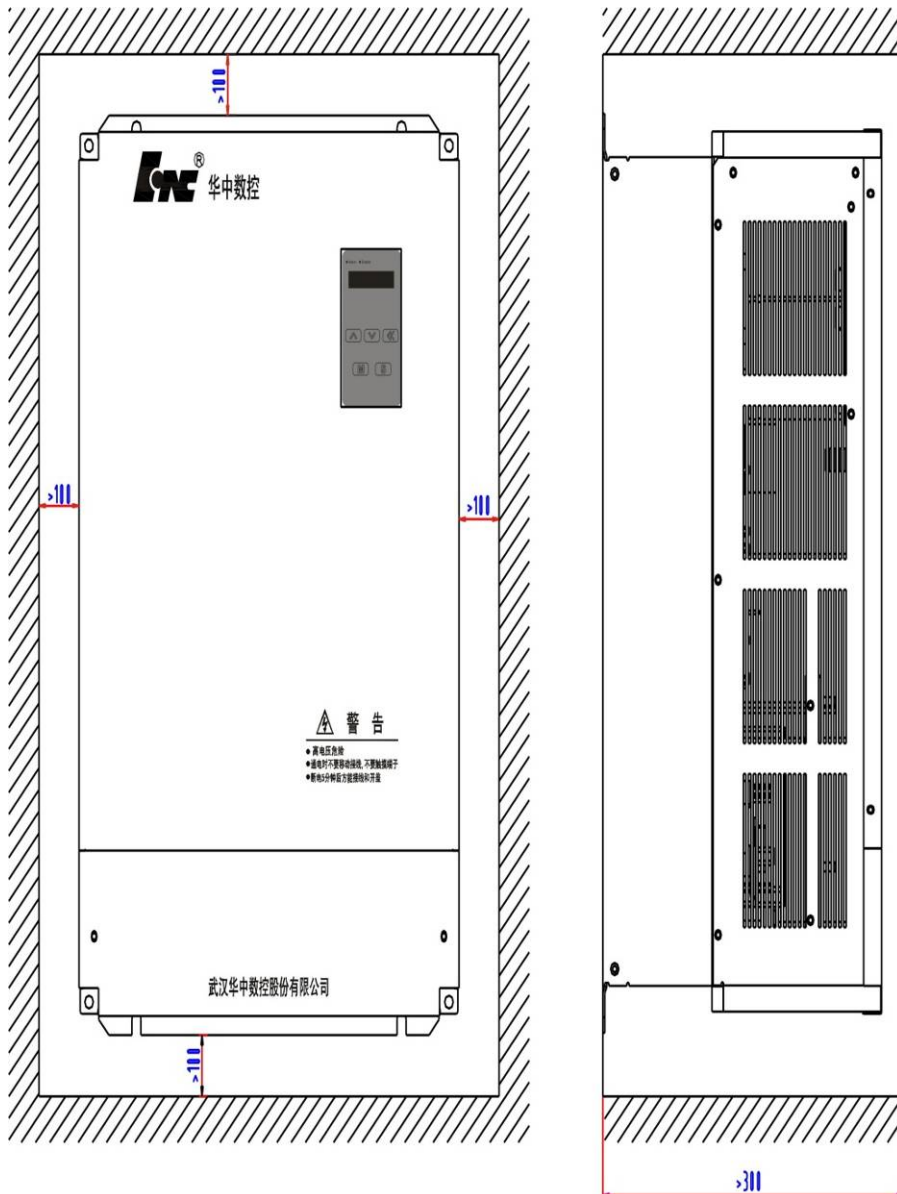


Figure 4-15 Installation interval of HSV-180AS- 200, 300, 450 single spindle drive

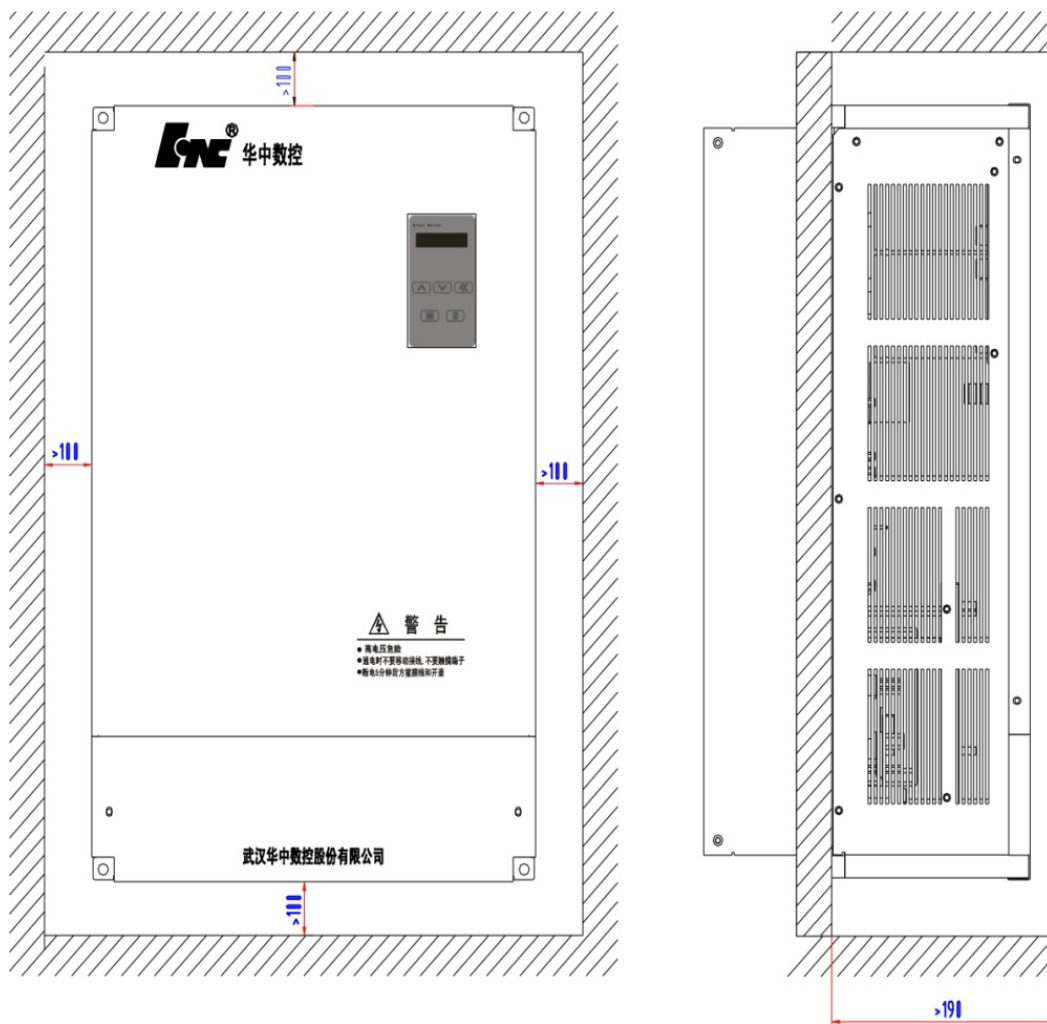
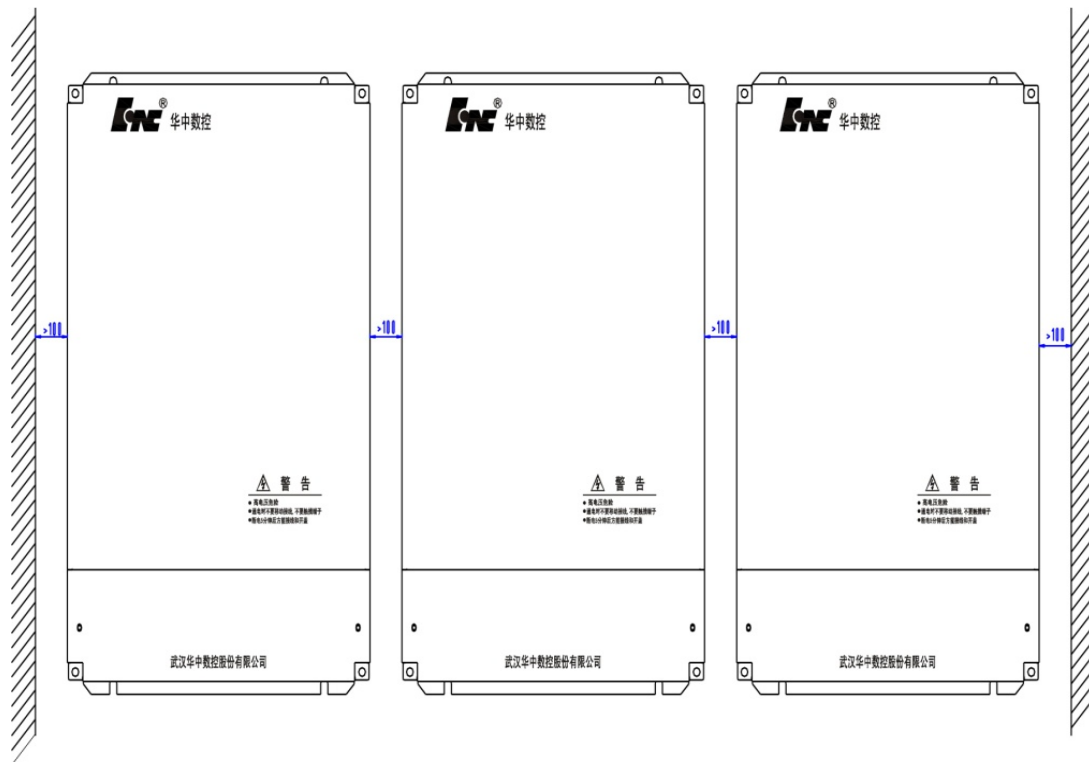


Figure 4-16 Installation interval of HSV-180AS- 200, 300, 450 multiple spindle drive



## 4.4 Installation of Spindle Motor

### Warning

- Do not knock the motor or encoder so as to prevent the motor from oscillation or impact.
- When carrying the motor, do not drag the motor shaft, leading-out wire or encoder.
- Do not overload motor shaft, otherwise the motor may be damaged.
- The motor must be firmly installed and prevent loosening.

### 4.4.1 Installation Environment

#### 1. Prevention

The spindle motor is not water-proof. When installing and operating, the motor must be guard against liquid spilling and prevent oil mist

from entering the motor through motor leads and motor shaft. If users need water-proof motor, make it clear when ordering.

## 2. Temperature and Humidity

The environmental temperature must be between 0 degree Celsius and 40 degree Celsius. Humidity cannot greater than 90% RH and there is no condensation. After long-time operation, the motor will heat up. It is recommended that you use forced cooling or use derating motors if there is less space or the motor is closed to heating equipments

## 3. Oscillation

The motor must be free from oscillation, and take measures to control the oscillation below 0.5 G ( $4.9\text{m/S}^2$ ) .

# 4.4.2 Installation Method

## 1. Installation Method

The GM7 series can be installed vertically and horizontally.

## 2. Installation Notes

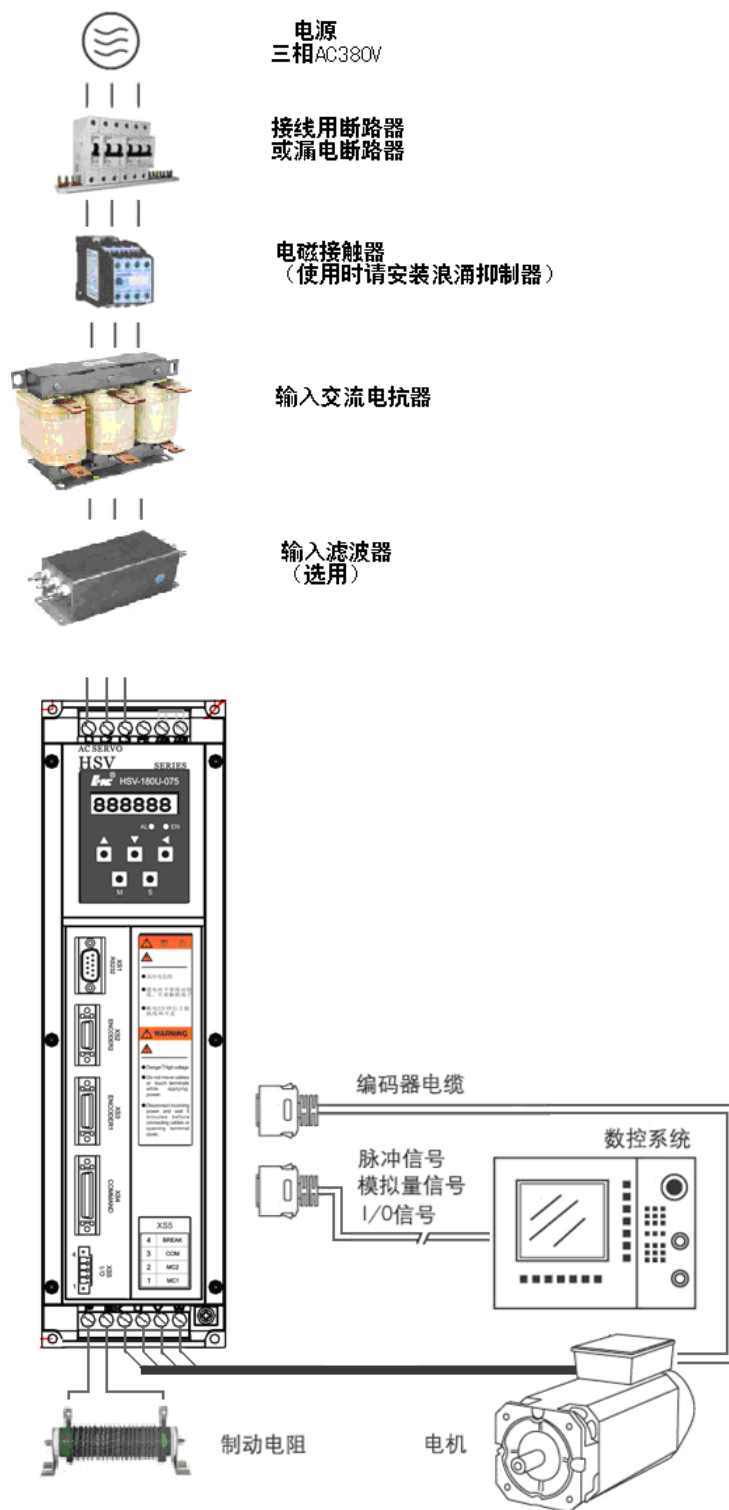
- During installing and removing pulley, do not knock the motor or motor shaft to prevent damaging the encoder. Use the spiral drawing tools to install and remove the thermal expansion expansion-type coupling.
- Series GM7 motor cannot withstand the larger axial load and radial load. It is recommended that you use the flexible coupling to connect the load.
- When fixing the motor, use spring washer to tighten the bolts to prevent loosening

## 5 Wiring

Warning
<ul style="list-style-type: none"><li>● Wiring and wiring inspection personnel must have required capabilities.</li><li>● Wiring and wiring inspection personnel must wait 5 minutes after power off for all wiring or wiring check to prevent from electronic shock.</li></ul>
Caution
<ul style="list-style-type: none"><li>● Must be wiring in accordance with the terminal voltage and the polarity to prevent from equipment damage or personal injury.</li><li>● Spindle drive unit and spindle motor must be reliably grounded.</li></ul>
<ul style="list-style-type: none"><li>● Do not directly hammer at the motor shaft when connect or disconnect its mechanic part to protect encoder from being damaged.</li><li>● Try to align the motor shaft to the optimum level to prevent from oscillation or bearing damage.</li></ul>

### 5.1 connectors

Figure 5-1 shows the interface configuration of HSV-180AS



## 5.2 Terminal Configuration

Figure 5-2 shows the interface configuration of HSV-180AS. In the figure, XT1 and XT2 are the terminal blocks; XS1 is a DB9 socket; XS2, XS3, and XS4 are high-density sockets; XS5 is a wiring terminal.

Figure 5-2 Interface configuration of HSV-180AS



5.3 Terminal Configuration

5.3.1 Terminals of HSV-180AS-035, 050, 075, 100, 150

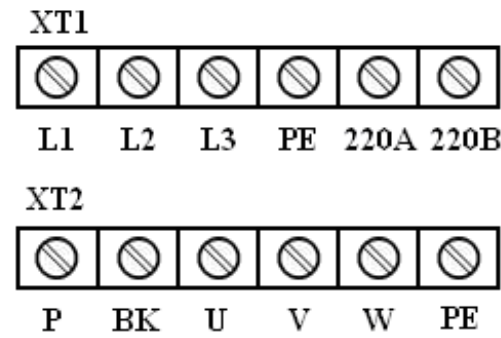


Figure 5-3 Soldering terminal of HSV-180AS-035, 050, 075

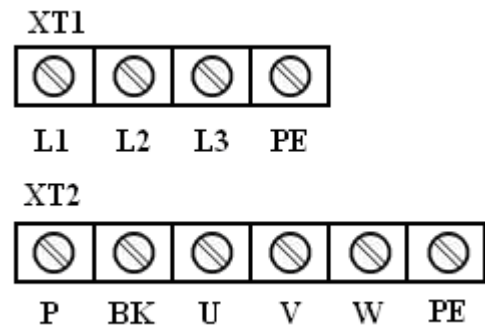


Figure 5-4 Soldering terminal of HSV-180AS-100, 150

Gram5.1 XT1 power input terminal of HSV-180AS-035, 050, 075

XT1 power input terminal of HSV-180AS-035, 050, 075			
NO.	Termina l Symbol	Signal	Function
1	220B		Reserved
2	220A		
3	PE	Ground terminal	Ground terminal, and the ground resistance is less than 4 Ω
4	L3	Three-phra se main circuit power input	Main circuit power supply input terminal
5	L2		Three phrase AC380V/ 50Hz
6	L1		
Note:			




		terminal	Do not connect to the output terminal U, V, W.
--	--	----------	--

**Gram5.2 XT1 power input terminal of HSV-180AS-100, 150**

XT1 power input terminal of HSV-180AS-100, 150			
NO.	Terminal Symbol	Signal	Function
1	PE	Ground terminal	Ground terminal, and the ground resistance is less than 4Ω
2	L3	Three-phase main circuit power input terminal	Main circuit power supply input terminal
3	L2		Three phase AC380V/ 50Hz
4	L1		<b>Note:</b> Do not connect to the output terminal U, V, W.

**Gram 5.3 Heavy Current Output Terminal of HSV-180AS-035, 050, 075, 100, 150**

HSV-180AS-035, 050, 075, 100, 150 XT2 heavy current output terminal			
NO.	Terminal Symbol	Signal	Function
1	P	Connection terminal for	<ul style="list-style-type: none"> <li>● Build-in 70Ω/500W braking resistors.</li> <li>● If only use the braking</li> </ul>

2	BK	external braking resistor	<p>resistor, the terminal P and BK must be disconnected to avoid short-circuit.</p> <ul style="list-style-type: none"> <li>If an external braking resistor is used, terminal P and BK must be connected to an external braking resistor.</li> </ul> <p><b>Note:</b></p> <p>Terminal P and BK cannot be shorted. Otherwise, the spindle drive may be damaged.</p>
3	U	Three-phra se output terminal of the spindle drive	It must be linked to the motor U, V, and W terminals correspondingly.
4	V		
5	W		
6	PE	Ground terminal	Ground terminal Ground resistance is less than 4 Ω
		Ground terminal	Ground terminal Ground resistance is less than 4 Ω Spindle drive housing ground terminal

### 5. 3. 2 Terminal Configuration HSV-180AS-200, 300, 450

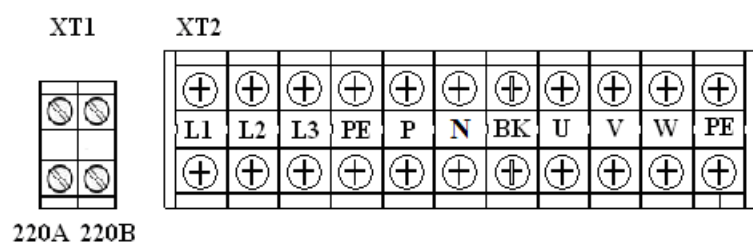



Figure 5-5 Soldering terminal of HSV-180AS-200, 300, 450

Gram5.4 XT1 power input terminal of HSV-180AS-200, 300, 450


XT1 power input terminal of HSV-180AS-035, 050, 075			
NO.	Terminal Symbol	Signal	Function
1	220A	single-phase input terminal of control power	single-phase input terminal of main circuit power AC220V/50Hz Main circuit power supply input terminal Three phase AC380V/ 50Hz
2	220B		

Gram 5.5 XT2 Heavy Current Output Terminal of HSV-180AS-200, 300, 450

HSV-180AS-200, 300, 450 XT2 heavy current input/output terminal			
NO.	Terminal Symbol	Signal	Function
1	L3	Three-phase main circuit power input terminal	Main circuit power supply input terminal Three phase AC380V/ 50Hz <b>Note:</b> Do not connect to the output terminal U, V, W.
2	L2		
3	L1		
4	PE	Ground terminal	Ground terminal Ground resistance is less than 4Ω
5	P	Positive Of generator	Terminal P and BK is used to DC current input or an external braking resistor. <b>Note:</b> Terminal P and BK cannot be shorted. Otherwise, the spindle

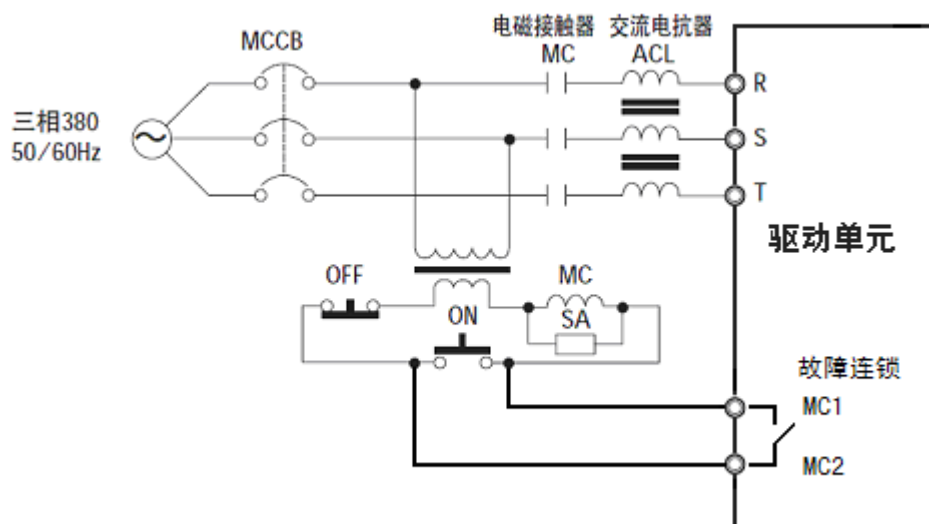
			drive may be damaged.
6	N	Negative of generator	Terminal P and BK is used to DC current input <b>Note:</b> Terminal P and BK cannot be shorted. Otherwise, the spindle drive may be damaged.
7	BK	Connection terminal for external braking resistor	There is no build-in braking resistors, must use an external braking resistor, terminal P and BK must be connected to an external braking resistor. <b>Note:</b> Terminal P and BK cannot be shorted. Otherwise, the spindle drive may be damaged.
8	U	Three-phase output terminal of the spindle drive	It must be linked to the motor U, V, and W terminals correspondingly.
	V		
	W		
9	PE	Ground terminal	Ground terminal Ground resistance is less than $4\Omega$
10		Ground terminal	Ground terminal Ground resistance is less than $4\Omega$ Spindle drive housing ground terminal

HSV-180AS-035, 050, 075, 100, 150 XT2 heavy current input/output terminal			
NO.	Terminal Symbol	Signal	Function
1	P	Connection terminal for external braking resistor	<ul style="list-style-type: none"> <li>● Build-in 70 <math>\Omega</math>/500W braking resistors.</li> <li>● If only use the braking resistor, the terminal P and BK must be disconnected to avoid short-circuit.</li> </ul> <p>If an external braking resistor is used, terminal P and BK must be connected to an external braking resistor.</p> <p><b>Note:</b> Terminal P and BK cannot be shorted. Otherwise, the spindle drive may be damaged.</p>
2	BK		
4	PE	Ground terminal	Ground terminal Ground resistance is less than 4 $\Omega$
8	U	Three-phase output terminal of the spindle drive	It must be linked to the motor U, V, and W terminals correspondingly.
	V		
	W		

9	PE	Ground terminal 1	Ground terminal Ground resistance is less than $4\Omega$
10		Ground terminal 1	Ground terminal Ground resistance is less than $4\Omega$ Spindle drive housing ground terminal

### 5.3.3 Side wiring of main circuit input

Figure 5-6 Soldering terminal of main circuit input



#### 1、Circuit Breaker (MCCB)

- Circuit breaker must be connected between the three-phase AC power supply and power input terminals L1, L2, L3 on XT1 so as to cut off the power when the spindle drive motor is over circuited or short circuited.
- MCCB capacity is generally 1.5 to 2 times of the rated motor current, refer to Table 3.1
- MCCB's time characteristics should considerate the drive unit (motor rated current 1.5 to 2 times, 1 min) and time characteristics.

- Each drive unit must be corresponding to a MCCB; when multiple drive unit share a MCCB, In order to cut off the power supply and prevent the failure expanding, suggest using the failure chain output relay of drive unit to control the line magnetic contactor to ensure safety。

## **2、leakage circuit breaker**

- When choosing a specific leakage circuit breaker, please select Operating current of drive unit above 30mA.
- When choosing a general leakage circuit breaker, please select Operating current of drive unit above 200mA,time is above 0.1S。
- Installing isolation transformer between a general leakage circuit breaker and drive unit could effectively avoid the breaker malfunction

## **3、Line electromagnetic contactor**

- Line electromagnetic contactor capacity is generally 1.5 to 2 times the rated motor current selection, please refer to Table 3.1
- Frequently using open / closed magnetic contactor will cause heating of the soft-start resistance, and even burning.
- Interval time of open / closed magnetic contactor should be more than 10 minutes

## **4、 Surge Suppressors**

In order to eliminate arc and damage, extend the life of the contactor connect a three-phase AC interrupter serve on output main contact of electromagnetic contactor

## **5、 Input AC reactor**

In order to protect the rectifier components from damage caused by the high-current's impacting to the input power circuit, the power input side need to connect to an input AC reactor and increase its power factor. It can effectively eliminate the influence of high harmonics, prevent other equipment from damage caused by the voltage wave changes, and eliminate the unbalanced input current caused by phase voltage unbalanced.

- Input AC reactor capacity is generally 1.5 to 2 times of the rated motor current, please refer to the Table 3.1.

## 6、Input filter

In order to reduce a high-frequency interference noise from source line coupling to drive unit, suggest install matching input filter on the current input of drive unit

- Input filter capacity is generally 1.5 to 2 times the rated motor current selection, please refer to Table 3.1.
- Please select the dedicated servo (inverter) input filter.
- Input filter should be well grounded

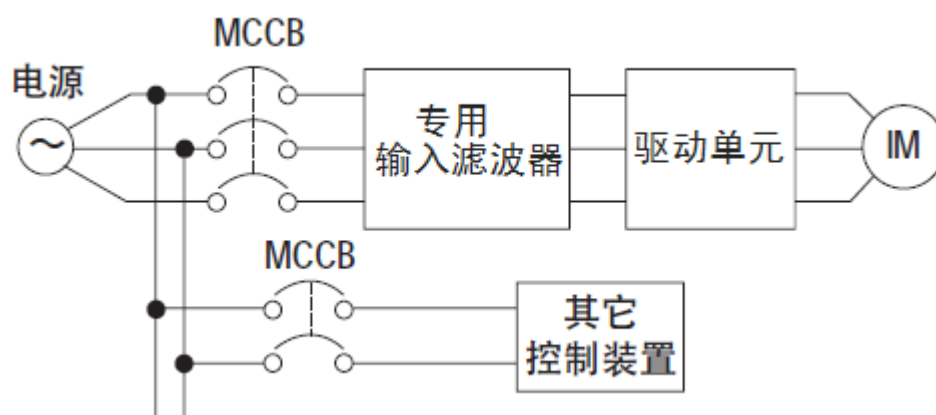


Figure 5-7 Input filter on the current input of drive unit

### 5.3.4 Control power wiring

HSV-180AS-200, 300, 450 drive unit must connect AC220V control power, during power-on process, you should connect AC220V control power firstly and then connect the AC380V strong electric power.

### 5.3.5 Output side wiring of main circuit

#### 1、motor connection

Output terminals U、V、W of drive unit should connected to terminals U、V、W of the three-phase AC motor according to the correct phase

- If A30 motor phase sequence error alarm appears at the first running,
- prompt users motor terminal phase sequence error will be wrong, you just need to exchange V,W
- Distance between drive unit and motor wiring should generally be less than 40 m

#### 2、External Braking Resistor



The braking voltage of HSV-180AS spindle drive is DC700 V. For the maximum braking current, see Table 3.1.

(1) A 70  $\Omega$ /500 W braking resistor has been built in HSV-180AS-035, 050, 075 and a maximum of five times overload is allowed (continuing for one second). An external braking resistor is required when the drive unit's load or inertia is big. The braking time is shorter when the load or inertia is bigger, and the resistance value is smaller and its power is bigger. However, the maximum braking current cannot exceed the drive's maximum braking current. Generally, the total braking power of the braking resistor is 10% to 20% of the rated motor power.

Connect **P** and **BK** terminals of the spindle drive with the external braking resistor if an external braking resistor is used. In this case, the internal resistor and the external resistor are serial connected. Table 5.8 shows the recommended external braking resistor.

(2) There is no braking resistor built in HSV-180AS-035, 050, 075, you have to connect to external braking resistor. The braking time is shorter when the load or inertia is bigger, and the resistance value is smaller and its power is bigger. However, the maximum braking current cannot exceed the drive's maximum braking current. Generally, the total braking power of the braking resistor is 10% to 20% of the rated motor power.

Connect **P** and **BK** terminals of the spindle drive with the external braking resistor if an external braking resistor is used. In this case, the internal resistor and the external resistor are serial connected. Table 5.8 shows the recommended external braking resistor.

### Spindle drive ↵

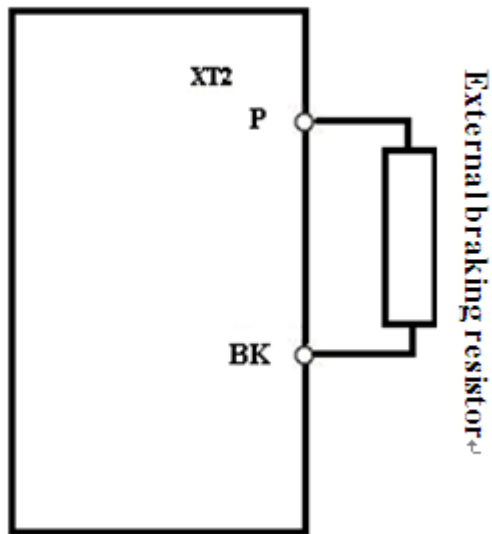


Figure 5-8 single external braking resistor standard wiring

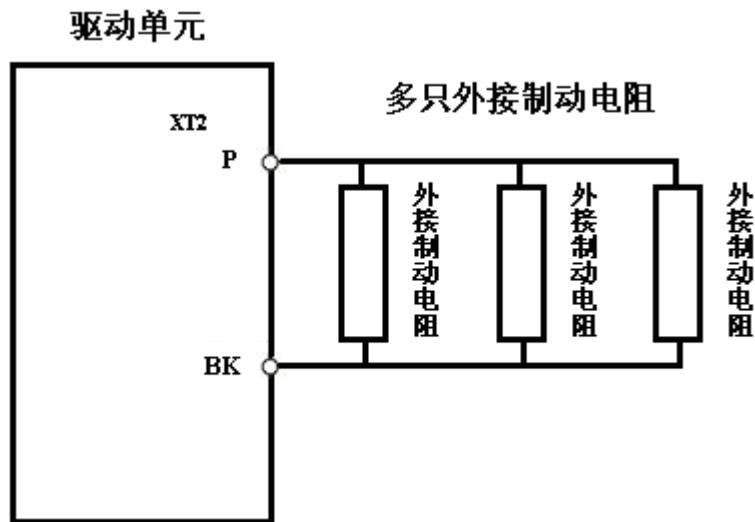


Figure 5-9 multiple external braking resistor standard wiring

### 3、Ground connection

- Ground terminal or PE 或  $\text{⏏}$  , be sure to ground.
- Ground resistance is less than  $4\Omega$
- Ground wire of drive unit can't use with welder and other power equipment at the same time.

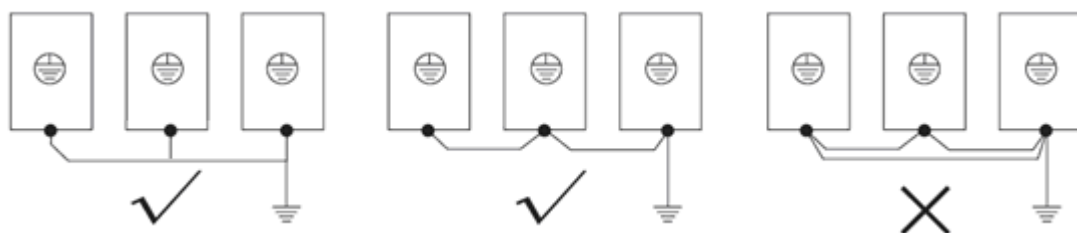


Figure 5.10 Ground connection

## 5.4 connection of control signal terminals

### 5.4.1 XS4 COMMAND input/ output terminals

Figure 5-11 XS4 command input/output interface

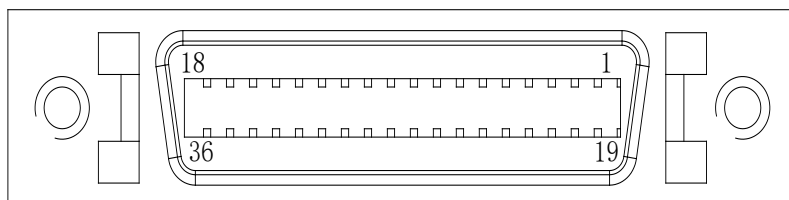


Figure 5-12 Plug of XS4 command input/output interface plug (looking from the plug)

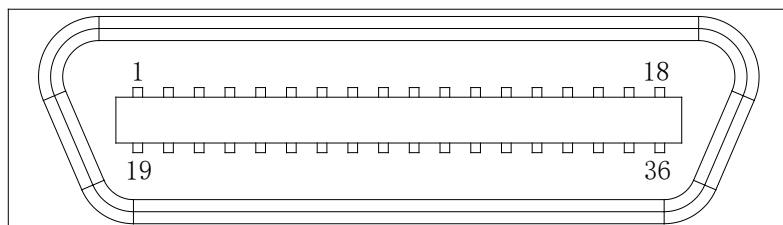
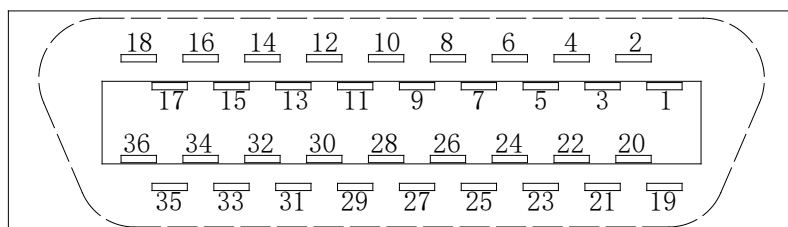


Figure 5-13 Soldering terminal of XS4 command input/output interface (looking from the soldering terminal)



#### 5.4.1.2 XS4 COMMAND Input/output Interface

Type	Terminal	Terminal Symbol	Function	Signal
------	----------	-----------------	----------	--------

Command pulse input	14	CP+	Input terminal for external command pulse Note: You can set the pulse input mode by setting the movement parameter <b>PA--22</b> . Command pulse + characters CCW/CW command pulse mode 2-phase command pulse mode	Line drive receiving RS422 standard
	15	CP-		
	16	DIR+		
	17	DIR-		
Spindle motor optic-electrical encoder	32	A+	Encoder A output	line drive output RS422 standard
	33	A-		
	18	B+	Encoder B output	
	36	B-		
	35	Z+	Encoder Z output	
	34	Z-		
	21, 22	Z_OUT	Z-phase pulse output	PNP output 100mA
	31	ZPLS_OUT	Z-phase pulse output	NPN output 100mA
	23, 24	GNDDM	Digital signal ground	0V
Analog output terminal	12	AN+	Analog output terminal	DC -10~+10V or 0~+10V
	13	AN-	Reference terminal for analog input	
	27, 28	GNDAM	Analog signal ground	0V
SW input signal	1	EN	Spindle enable input terminal <b>EN ON:</b> Enable the spindle drive <b>EN OFF:</b> The spindle drive stops working, and the motor is idle.	0V common point 0V input effective
	2	ALM_RST	Alarm clear input terminal <b>ACL ON:</b> Clear system alarm	

			ACL OFF: Keep system alarm															
	3	FWD	Spindle forward rotation input terminal FWD ON: Spindle motor running forward FWD OFF: Spindle motor stops running forward															
	4	REW	Reverse rotation input terminal REW ON: Spindle motor running reverse. REW OFF: Spindle motor stops running reverse.															
	5	INC_Sel1	Input terminal for selecting indexing incremental orientation angular ratio <table><tr><td>INC_Sel1</td><td>INC_Sel2</td><td>ratio</td></tr><tr><td>ON</td><td>ON</td><td>4</td></tr><tr><td>OFF</td><td>ON</td><td>3</td></tr><tr><td>ON</td><td>OFF</td><td>2</td></tr><tr><td>OFF</td><td>OFF</td><td>1</td></tr></table>	INC_Sel1	INC_Sel2	ratio	ON	ON	4	OFF	ON	3	ON	OFF	2	OFF	OFF	1
	INC_Sel1	INC_Sel2		ratio														
	ON	ON		4														
	OFF	ON		3														
ON	OFF	2																
OFF	OFF	1																
6	INC_Sel2																	
25	ORN	Spindle orientation ready input ORN ON: indicates that spindle orientation is begin ORN OFF: indicates that spindle orientation is cancelled.																
26	Mode_SW	Switch input terminal for control mode switching When the spindle running under the external analog speed mode, the operating mode can be switched to C-axis position control via this switch.																

			<p>The effectiveness can be tested by <b>STA—8</b> (STA-8: 0 indicates ineffective, 1 indicates effective)</p> <p><b>Mode_SW ON:</b> Spindle is running under the position mode.</p> <p><b>Mode_SW OFF:</b> Spindle is running under the external speed mode.</p>	
			<p>Input terminal for indexing incremental orientation</p> <p>In the orientation mode, <b>Mode_SW</b> is used to control the indexing incremental orientation.</p> <p>Each time the <b>Mode_SW</b> turned to ON, the spindle moves a preset angle along with the orientating direction. The angle is determined according to the value of <b>PA-40</b> as well as the terminal <b>INC_Sel1</b> and <b>INC_Sel2</b>.</p>	
SW output signal	7	ZSP	<p>Zero-speed reached input</p> <p>When the running speed is in the specified zero-speed range (by setting movement parameter <b>PA-29</b>), the zero-speed reached input is connected.</p>	NPN output10 0mA
	8	READY	<p>Spindle ready output terminal</p> <p><b>READY ON:</b> indicates proper power supply, and no drive alarm. The signal is connected.</p>	

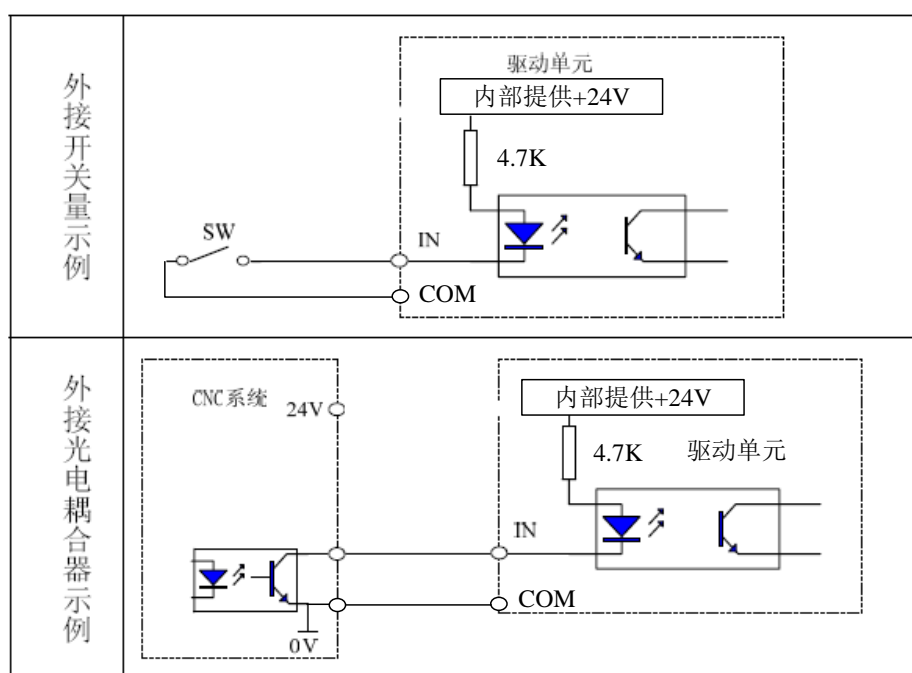
			<b>READY OFF:</b> indicates the main power is not switched on or a spindle drive alarm is reported. The signal is disconnected.	
	9	ALM	Spindle alarm output terminal <b>ALM ON:</b> indicates a spindle drive alarm is reported. The signal is connected. <b>ALM OFF:</b> indicates no spindle drive alarm. The signal is disconnected.	
	29	GET	Speed-reached output terminal When the speed error is within or less than the preset speed error range (specified by movement parameter <b>PA-11</b> ), the signal is connected.	
	30	ORN_FIN	Spindle orientation-finished output terminal In the spindle orientation mode, when the error between the actual spindle position and the preset spindle orientation position (specified by movement parameter <b>PA-39</b> ) is less than or equal to the preset spindle orientation-finished range (specified by the movement parameter <b>PA-37</b> ), the signal is connected ( <b>ORN_FIN ON</b> ). When the spindle orientation is cancelled( <b>ORN</b> is	

			switched to <b>OFF</b> ), the signal is disconnected ( <b>ORN_FIN OFF</b> ).	
	19, 20	COM	Public terminal of XS4 terminal switch-value input/output signal	0V

### 5.4.1.3 XS4 COMMAND Input / Output Interface

#### 1、Switch-value Input Interface

Figure 5-14 Switch-value input interfaces of HSV-180AS



#### Note:

- 1、 Two common wiring example, IN means input point: (EN, ALM\_RST, FWD, REW, INC\_Sel1, INC\_Sel2, Mode\_SW, ORN)
- 2、 The COM signal of the XS4 command input/output interface must be connected to the power ground of the external DC24V power supply. Otherwise, the spindle drive may work improperly.
- 3、The Darlington transistor is served as the output transistor which needs to be connected to a relay or an optical coupler. The external power supply is provided by users. Make sure that the polarity is not reversed. Otherwise, it may damage the spindle drive.
- 4、 XS4 command input / output interface of the COM signal must be connected with the ground signal of external DC24V, otherwise drive unit cannot work properly.



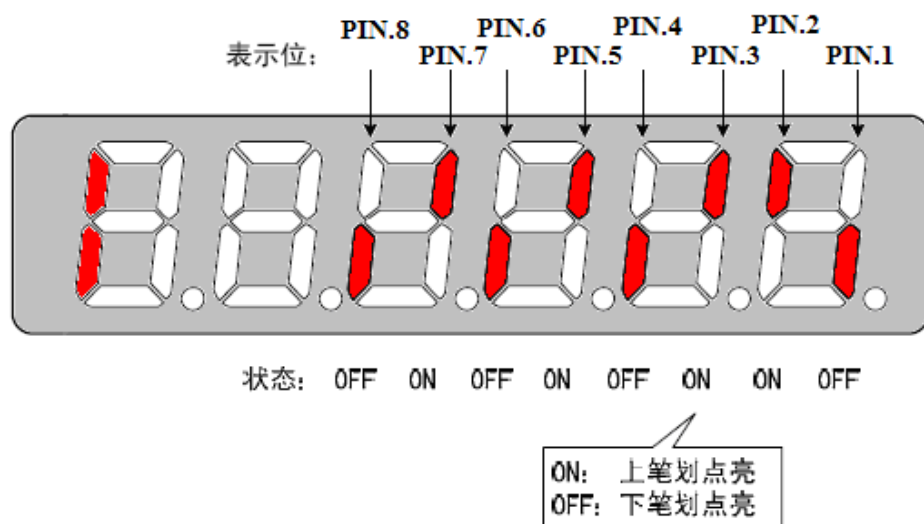


Figure 5-15 Status of switch output signal

## 2、Switch-value Output Interface

1. Two common wiring example, OUT means out point: (ZSP, READY, ALM, GET, ORN\_FIN)。

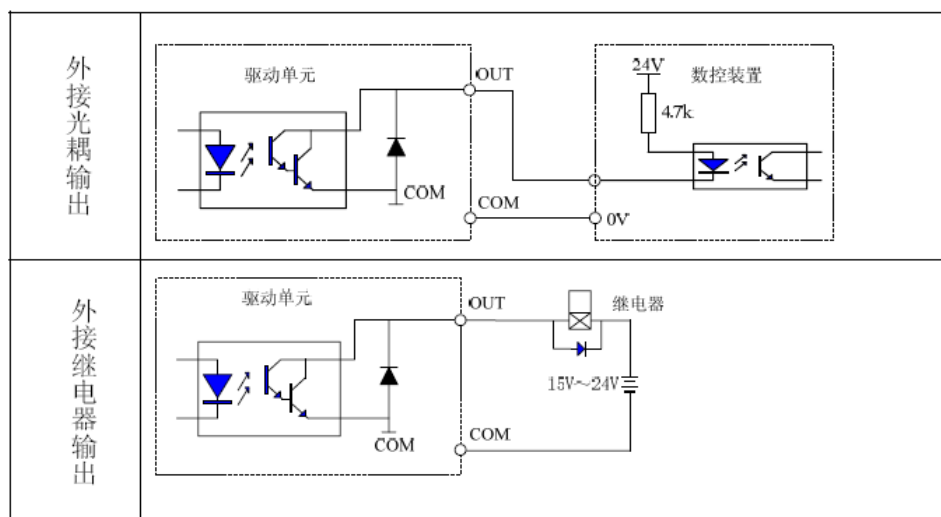
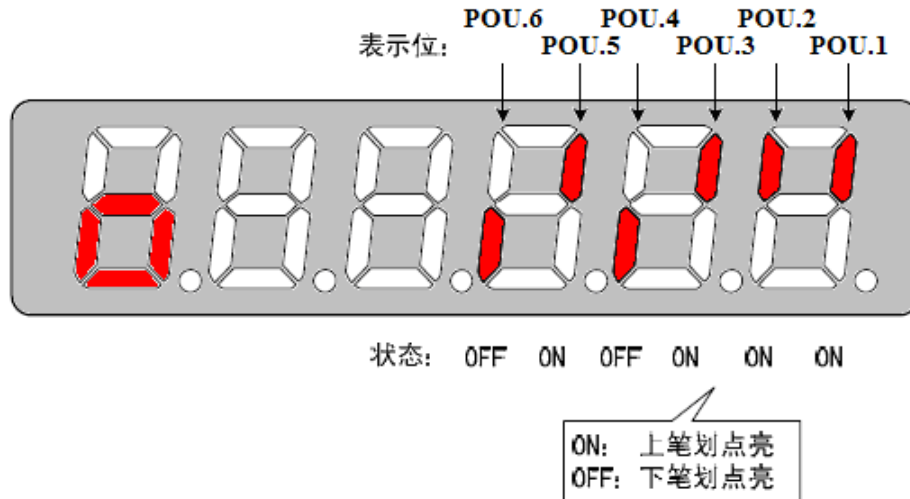


Figure 5-16 Connections of switch output signal

2. Input mode: NPN. The input switch-value state is determined by the spindle drive. When the input of isolation optical coupler is conducted, the input switch-value state is **ON**. When the input of isolation optical coupler is turned off, the input switch-value state is **OFF**



3. It provides open-collector output, with a maximum of 100 mA current and 25 V external power supply voltage. Therefore, the load of the switch-value output signal must meet the requirements. If the value exceeds the maximum value or the output terminal is directly connected to the power supply, it may damage the spindle drive.

4. If the load is an inductance load such as relay, it must be anti-parallel with the freewheeling diode (FWD) at both ends. The FWD cannot be reversed. Otherwise, it may damage the spindle drive.

5. The output transistor is Darlington Transistor. When it is conducted, the voltage drop between the collector and the emitter ( $V_{ce}$ ) is about 1V, which cannot meet the requirement of the TTL low level. So it cannot be directly connected to the TTL.

#### NOTE:

The output switch-value state is determined by the spindle drive. When the output of Darlington Transistor is connected, the output switch-value state is **ON**. When the output of Darlington Transistor is disconnected, the output switch-value state is **OFF**.

The state of the spindle alarm output switch (ALM) is the exception. When the output of Darlington Transistor is connected, the state of ALM is **OFF**, otherwise, it is **ON**.

### 3、Z-phase Pulse Open Collector Output Interface

(1) Incremental photoelectric encoder Z signal send to the CNC system by open collector, meanwhile providing two types of output :Z\_OUT(PNP)and ZPLS\_OUT (NPN)

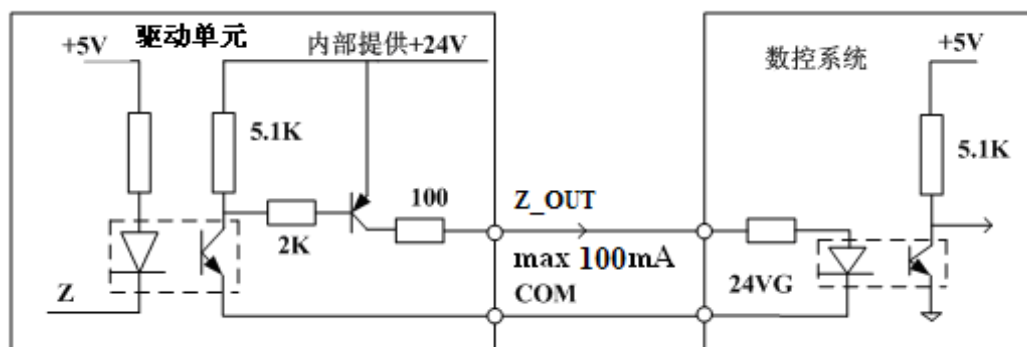


Figure 5-18Z-phase pulse open-collector output interface (PNP)

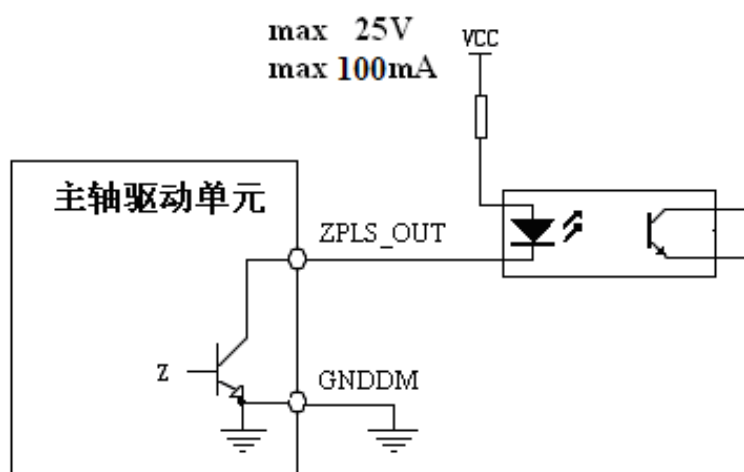


Figure 5-19Z-phase pulse open-collector output interface (NPN)

(2) Z-phase pulse signal is outputted by the open-collector., with a maximum of 100mA current

(3) The Z-phase pulse signal is usually very narrow. Therefore the PC must use a high-speed optical coupler receiver, such as 6N137.

(4) The output must be non-isolated output (non-insulated).

#### 4、Pulse Command Input Interface

Figure 5-20 Differential drive mode of the pulse input

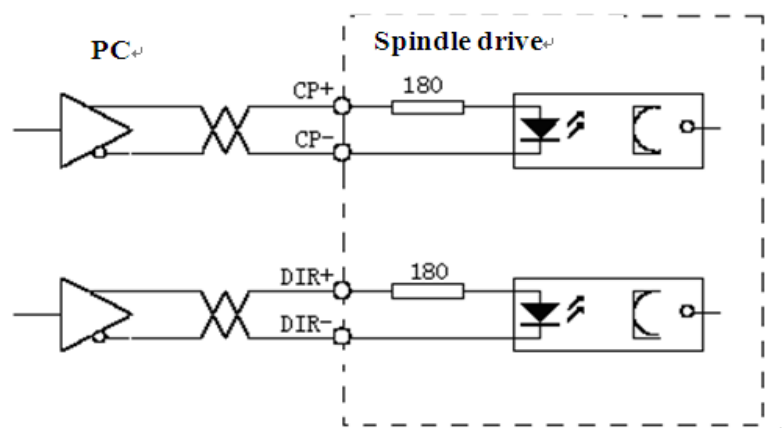
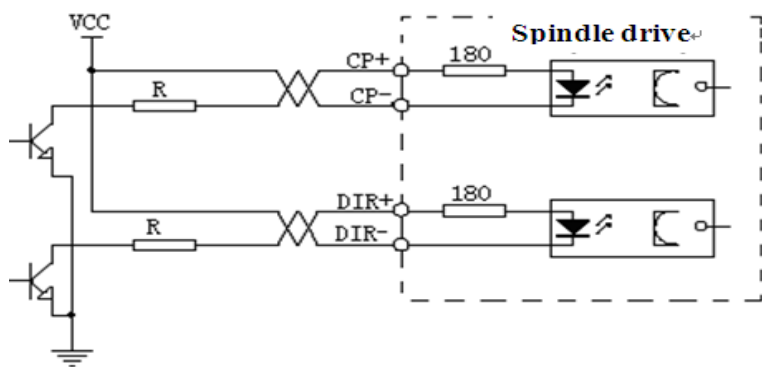


Figure 5-21 Single-ended drive mode of the pulse input



It is recommended that you use the differential drive mode (especially when the cable is too long) which uses AM26LS31, MC3487 drives or RS422 drives.

The single-ended drive mode can reduce the action frequency. You can determine the value of  $R$  according to a 10 to 15 mA drive current and a maximum of 25V external power supply voltage.

Generally, if the value of  $VCC$  is 24 V, the value of  $R$  is 1.3 K to 2 K ( $VCC = 24\text{ V}$ ,  $R = 1.3\text{ K to }2\text{ K}$ );

If the value of  $VCC$  is 12 V, the value of  $R$  is 510  $\Omega$  to 820  $\Omega$  ( $VCC = 12\text{ V}$ ,  $R = 510\text{ }\Omega\text{ to }820\text{ }\Omega$ );

If the value of  $VCC$  is 5 V, the value of  $R$  is 82  $\Omega$  to 120  $\Omega$  ( $VCC = 5\text{ V}$ ,  $R = 82\text{ }\Omega\text{ to }120\text{ }\Omega$ ).

In the single-ended mode, users provide the external power supply. Make sure that the polarity is not reversed. Otherwise, it may damage the spindle drive.

## 5、 Analog Command Input Interface

Figure 5-22 Differential analog input interface

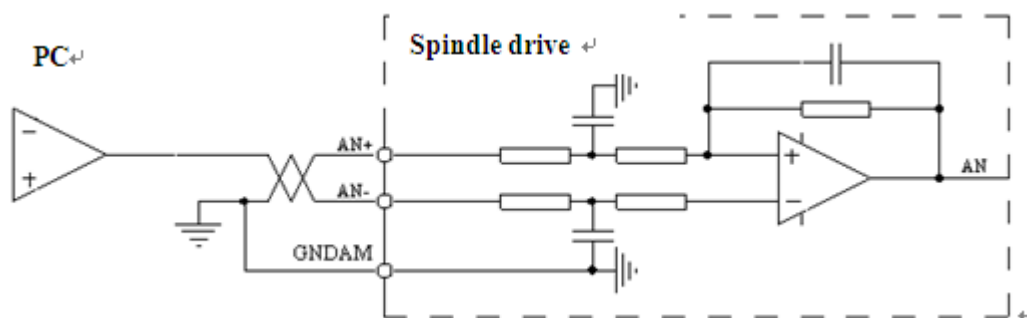


Figure5-23 Single-ended analog input interface

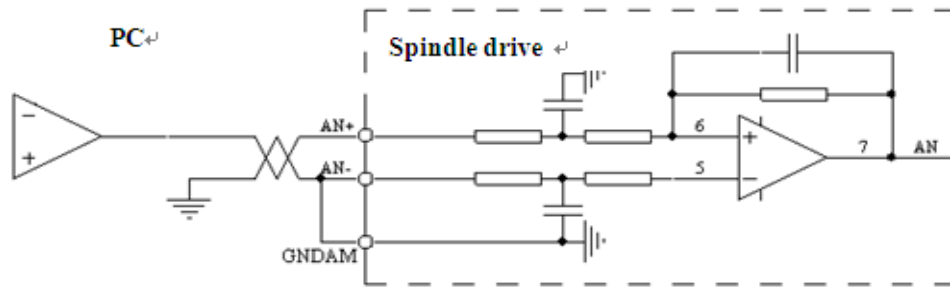


Figure 5-24 c Differential analog potentiometer input interface

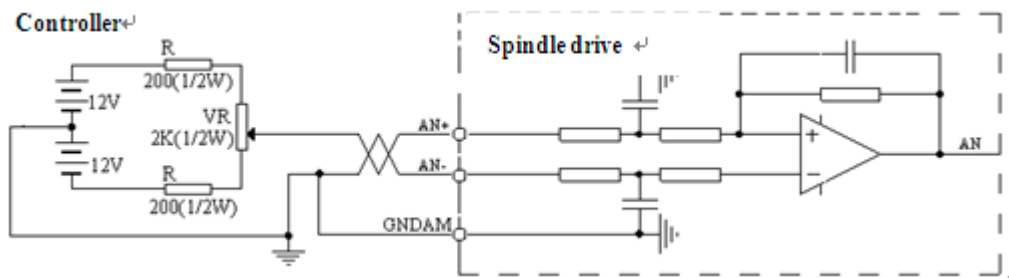
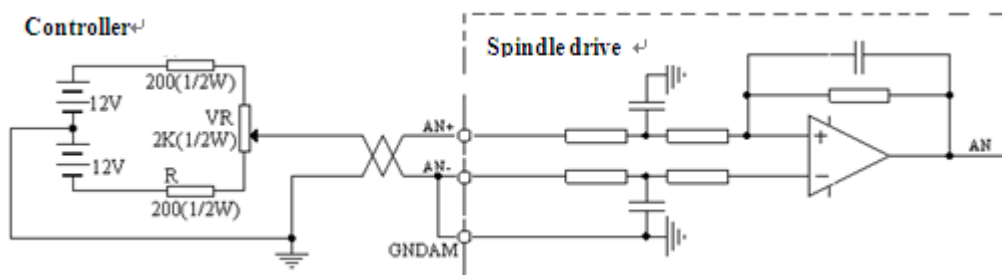


Figure 5-25 d Single-ended analog potentiometer input interface



The analog input interface is differential. According to different connection methods, it has two forms connection, differential connection and single-ended connection. The range of input voltage is  $-10\text{V}$  to  $+10\text{V}$ . In the differential connection, the analog ground wire is connected to the input reference terminal at the side of controller. Therefore, it needs three wires to connect the controller and drive unit. (see Figure 5-13 a)

In the single-ended connection, the analog ground wire is connected to the input reference terminal at the side of the drive. Therefore, it needs two wires to connect the controller and the drive. (see Figure 5-13 b)

The differential connection is superior to the signal-ended connection for its good anti-common-mode interference characteristic.

The input voltage cannot exceed the range from  $-10\text{V}$  to  $+10\text{V}$ . Otherwise it may damage the spindle drive.

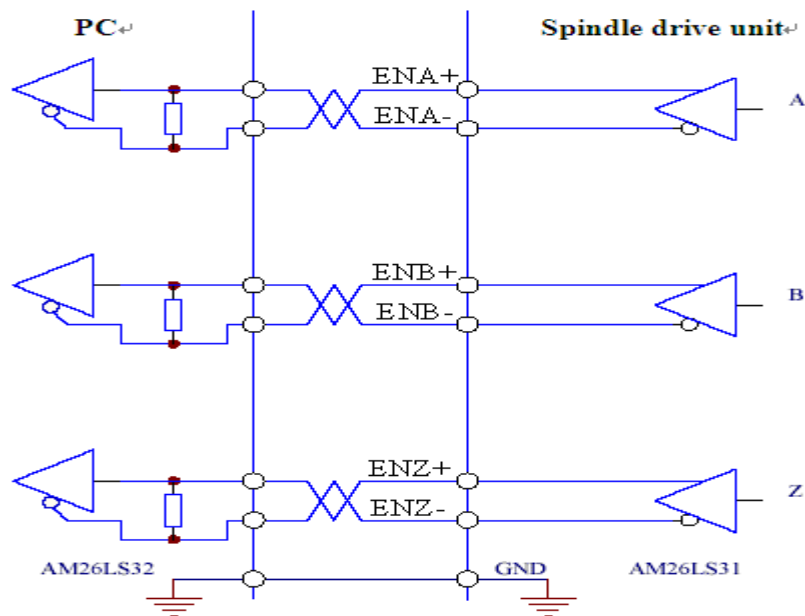
It is recommended that the shield cable be used to reduce the noise disturbance.

It is normal for the analog input interface has a zero bias which can be compensated by setting the movement parameter PA-8.

The analog interface is non-isolated.

## 6、Spindle Motor optic-electrical encoder/Spindle Encoder Output Interface

Figure 5-26 Spindle motor optic-electrical encoder/spindle encoder output interface



The encoder signal is outputted by the differential drive (AM26LS31). The controller input terminal can adopt AM26LS32 receiver and must be connected to an approximate  $330\Omega$  termination resistor.

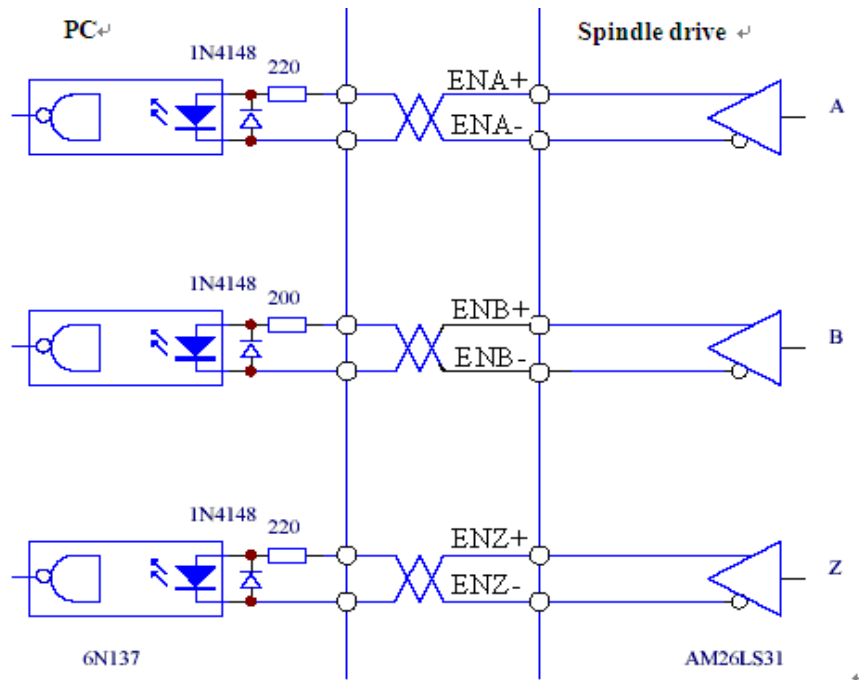
The controller ground wire and the drive ground wire must be reliably connected.

The output must be non-isolated output.

The controller input terminal can also adopt an optical coupler receiver.

However, the receiver must be a high-speed optical coupler, such as 6N137.

Figure 5-27 Spindle motor optic-electrical encoder/spindle encoder output interface



## 5. 4. 2 XS5 Input/output Terminal

XS5 Input/output Terminal Figure

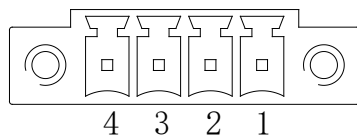


Figure 5. 25 XS5 Input/output Terminal

### 5. 4. 2. 2 XS5 I/O Input/output Terminal Function

NO.	Terminal Symbol	Signal	Function
1	MC1	Failure chain	Failure chain output terminal
2	MC2		The relay is connected when the relay is in the Normal Open state and the spindle drive runs properly. The relay is disconnected if there is any spindle drive faults.
3	COM		Reserved
4	BREAK		Reserved

### 5. 4. 2. 3 XS5 I/O Input/output Terminal Notations

(1) If the output terminal of the drive inductive loads, such as electromagnetic relays, electromagnetic contactor, should be retrofitted surge suppressor.

The surge suppressors should be nearby installed on end of electromagnetic relay or electromagnetic contactor coil

5.5Connection of the encoder signal terminal

5.5.1 XS3 ENCODER1 Spindle Motor Input Interface

HSV-180AS support three types of motor encoder: Incremental photoelectric encoder、Sine and cosine incremental encoder、ENDAT2.1/2.2of Absolute encoder。Details are as follows:

Incremental encoder	1. Number of encoder lines is 1024
	2. Number of encoder lines is 2048
	3. Number of encoder lines is 2500
	4. Sine and cosine incremental encoder
Absolute encoder	NDAT2.1/2.2of Absolute encoder

5.5.1.1 XS3 ENCODER1 Spindle Motor Input Interface Figure

Figure 5-29 XS3 Spindle Motor Input interface plug

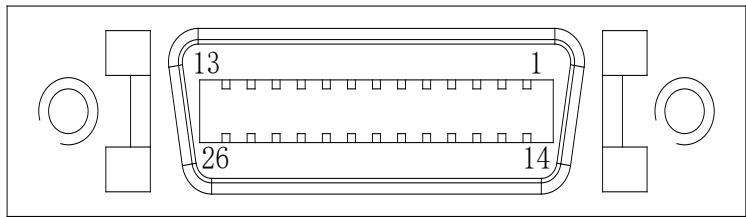


Figure 5-30 XS3 Spindle Motor Input interface plug (looking from the plug)

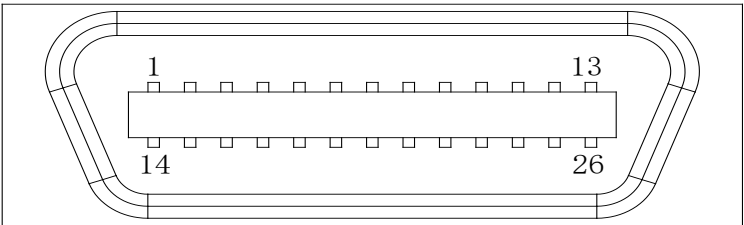


Figure 5-31 Soldering terminal of XS3 Spindle Motor Input interface plug (looking from the soldering terminal)

5.5.1.2 XS3 ENCODER1 Spindle Motor Input Interface Fuction

1、Spindle drive unit connect incremental photoelectric encoder

Chart5.8 signal function of XS3 ENCODER1 connect Incremental photoelectric encoder

NO	Terminal Symbol	Function	Symbol standard
1	A+/SINA+	Spindle motor encoder feedback A+ input	Line driver receive



2	A-/SINA-	Spindle motor encoder feedback A- input	RS422 standard
3	B+/COSB+	Spindle motor encoder feedback B+input	
4	B-/COSB-	Spindle motor encoder feedback B- input	
5	Z+	Spindle motor encoder feedback Z+(or R+) input	
6	Z-	Spindle motor encoder feedback Z-(or R-) input	
7, 8	Reserved		
9, 10	Reserved		
11, 12	Reserved		
13	OH1	Motor overheat detection Input terminal It is connect to the motor overheat detection sensor	
26	OH2		
16, 17 18, 19	+5V	Spindle motor encoder +5V power output terminal Connect the spindle motor optical-electrical encoder with 5 V power supply. If the cable is too long, use multiple wires to form serial connection.	DC +5V/150mA
23, 24, 25	GNDD	Spindle encoder power ground 0V	
20, 22	Reserved		
21	Reserved		
14, 15	PE	Shield ground It is connected to the motor housing	

**NOTE:** The homonyms pin connected has been shorting together in the internal circuit board

### **The spindle drive unit connect sine and cosine incremental encoder**

Chart5.9 Signal function of XS3 ENCODER1 connectSine and cosine incremental encoder

NO	Terminal Symbol	Function	Symbol standard
----	-----------------	----------	-----------------

1	A+/SINA+	Spindle motor encoder feedback SINA+ input	Line driver receive RS422 standard
2	A-/SINA-	Spindle motor encoder feedback SINA- input	
3	B+/COSB+	Spindle motor encoder feedback COSB+input	
4	B-/COSB-	Spindle motor encoder feedback COSB- input	
5	Z+	Spindle motor encoder feedback Z+(or R+) input	
6	Z-	Spindle motor encoder feedback Z-(or R-) input	
7, 8	Reserved		
9, 10	Reserved		
11, 12	Reserved		
13	OH1	Motor overheat detection Input terminal. It is connect to the motor overheat detection sensor	
26	OH2		
16, 17 18, 19	+5V	Spindle motor encoder +5V power output terminal Connect the spindle motor optical-electrical encoder with 5 V power supply. If the cable is too long, use multiple wires to form serial connection.	DC +5V/150mA
23, 24, 25	GNDD	Spindle encoder power ground 0V	
20, 22	Reserved		
21	Reserved		
14, 15	PE	Shield ground It is connected to the motor housing	

**NOTE:** The homonyms pin connected has been shorting together in the internal circuit board

Spindle drive unit connect ENDAT2.1 agreement of Absolute encoder

Chart5.10 Signal function of XS3 ENCODER1 connect ENDAT2.1 agreement of Absolute encoder

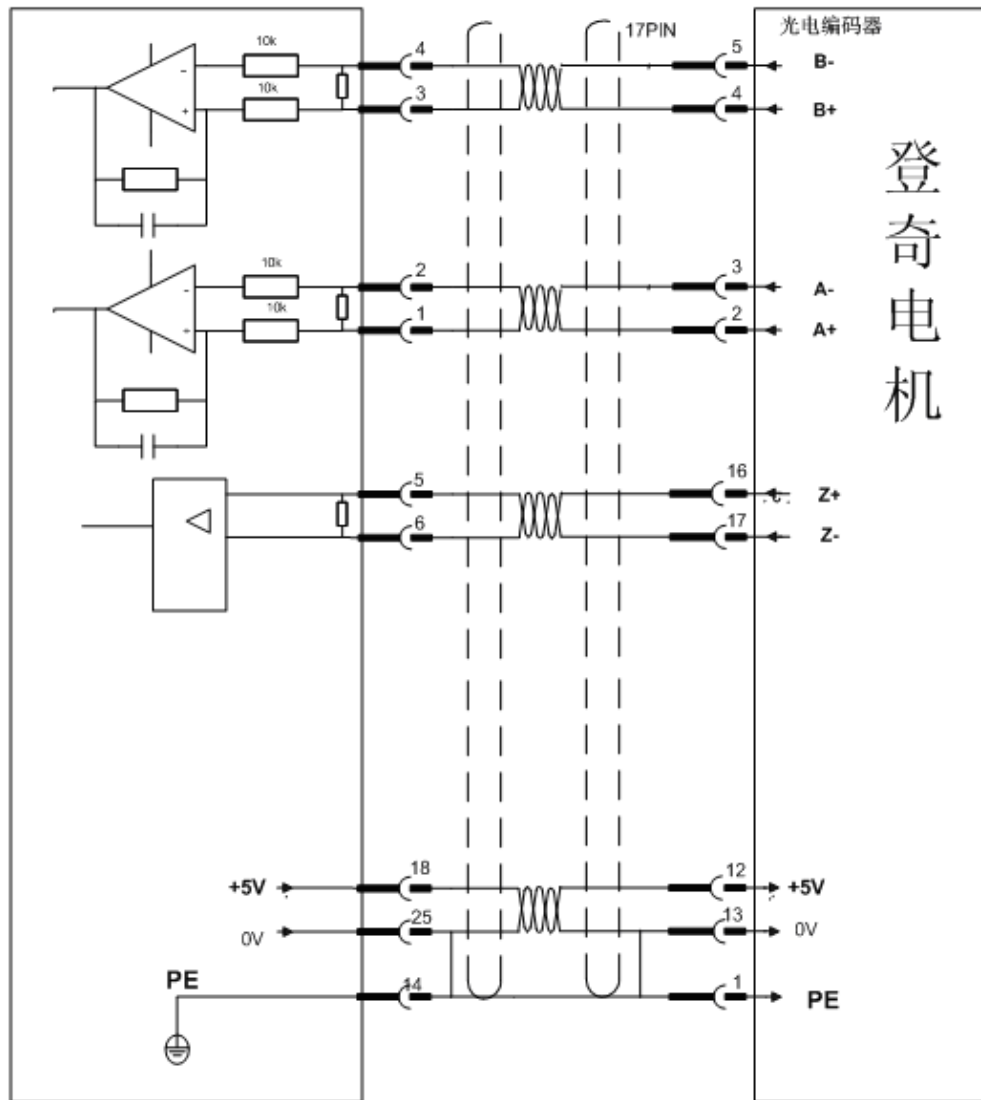
NO.	Terminal	Function	Symbol
-----	----------	----------	--------

	Symbol		standard
1	A+/SINA+	Spindle motor encoder feedback SINA+ input	Line driver receive RS422 standard
2	A-/SINA-	Spindle motor encoder feedback SINA- input	
3	B+/COSB+	Spindle motor encoder feedback COSB+input	
4	B-/COSB-	Spindle motor encoder feedback COSB- input	
7	U+/DATA+	Spindle motor encoder feedback DATA+ input	
8	U-/DATA-	Spindle motor encoder feedback DATA- input	
9	V+/CLOCK+	Spindle motor encoder feedback CLOCK+ input	
10	V-/CLOCK-	Spindle motor encoder feedback CLOCK- input	
5, 6	Reserved		
11, 12	Reserved		
13	OH1	Motor overheat detection Input terminal It is connect to the motor overheat detection sensor	
26	OH2		
16, 17 18, 19	+5V	Spindle motor encoder +5V power output terminal Connect the spindle motor optical-electrical encoder with 5V power supply. If the cable is too long, use multiple wires to form serial connection.	DC +5V/150mA
23, 24, 25	GNDD	Spindle encoder power ground 0V	
20, 22	Reserved		
21	Reserved		
14, 15	PE	Shield ground It is connected to the motor housing	

**NOTE:** The homonyms pin connected has been shorting together in the internal circuit board

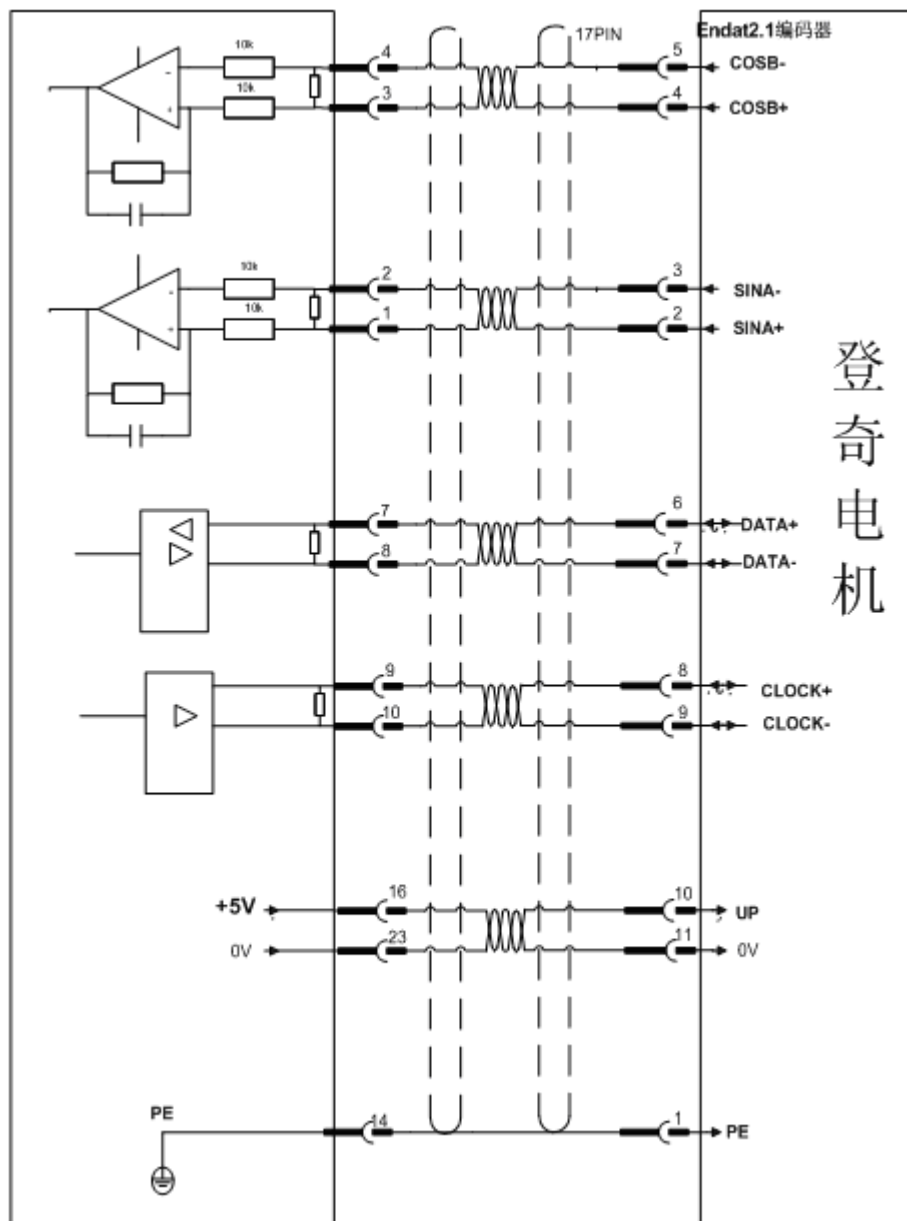
### 5.5.1.3 XS3 ENCODER1 spindle motor encoder input interface wiring diagram

1、Spindle drive connect with Incremental photoelectric encoder and Dench motor



2、Spindle drive connect with ENDAT2.1 agreement of Absolute encoder

and Dench motor



XS2 ENCODER2 Spindle Encoder Input Interface

### 5. 5. 2. 1XS2 ENCODER2 Spindle Encoder Input Interface Figure

Figure 5-34 XS2 Spindle Encoder Input interface plug

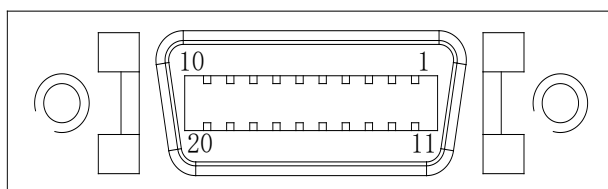


Figure 5-35 XS2 Spindle Encoder Input interface plug(looking from the plug)

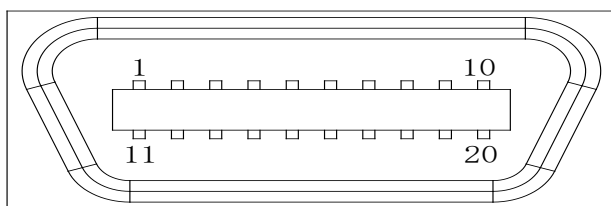
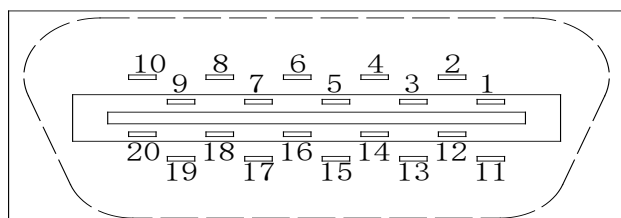


Figure 5-36 Soldering terminal of XS2 Spindle Encode Input interface plug (looking from the soldering terminal)



### XS2 ENCODER2 Spindle Encoder Input Interface Function

1、Drive spindle connect to Incremental photoelectric encoder

Figure 5.11 Signal function of XS2 ENCODER2 connect Incremental photoelectric encoder

NO	Terminal Symbol	Function	Symbol standard
11, 12	A+/SINA+	Spindle motor encoder feedback A+ input	Line driver receiver RS422 standard
1, 2	A-/SINA-	Spindle motor encoder feedback A- input	
13, 14	B+/COSB+	Spindle motor encoder feedback B+input	
3, 4	B-/COSB-	Spindle motor encoder feedback B- input	
15, 16	Z+/DATA+	Spindle motor encoder feedback Z+input	
5, 6	Z-/DATA-	Spindle motor encoder feedback Z-input	
7, 8	+5V	Spindle motor encoder +5V power output terminal Connect the spindle motor optical-electrical encoder with 5 V power supply. If the cable is too long, use multiple wires to form serial connection.	DC +5V/150mA
9, 10	GNDD	Spindle encoder power ground 0V	
19	CLOCK+	Reserved	

20	CLOCK-		
17, 18	PE	Shield ground It is connected to the motor housing	

## 5.6 Connection of the communication signal terminal

### 5.6.1 XS1 Serial Interface

Figure 5-37 XS1 Serial interface plug

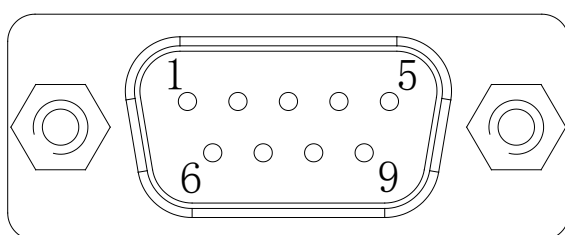


Figure 5-38 XS1 Serial interface plug (looking from the soldering plug)

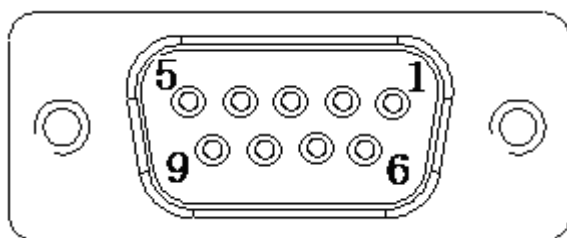
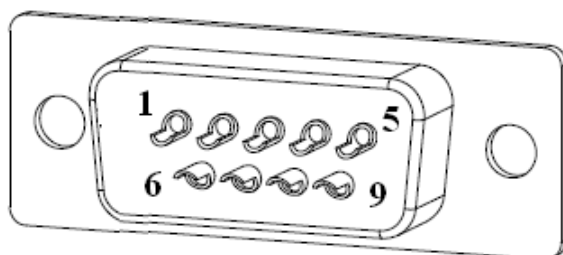


Figure 5-39 Soldering terminal of XS1 Serial interface plug (looking from the soldering terminal)



Figur5.12 Function of the communication signal terminal XS1

NO.	Terminal Symbol	Signal	Function
2	TX	RS232 Data transmission	It is connected to the serial data receiving interface (RX) of the controller or PC to

			achieve the serial communication.
3	RX	RS232 Data reception	It is connected to the serial data transmitting interface (TX) on the controller or PC to achieve the serial communication.
1, 5	GNDD	Signal ground	Data signal ground
4	CANL	Reserved	
6	CANH	Reserved	

## 5.7 Wiring

**Power input terminal XT1, and heavy current power output terminal XT2**  
Diameter

The terminal diameters of P, BK, L3, L2, L1, U, V, W, PE on TX1、TX2 of HSV-180S-025, 035, 050, 075 $\geq 2.5\text{mm}^2$  (2.2 kw).

The terminal diameters of P, BK, L3, L2, L1, U, V, W, PE on TX1、TX2 of HSV-180S-025, 035, 050, 075 $\geq 4\text{ mm}^2$  (3.0/3.7/5.5/7.5 kw).

Grounding

Grounding wire must be thick. The spindle drive and spindle motor must be connected to PE.

Grounding resistance  $< 4\Omega$

Use cold pre-insulated terminals to connect terminals and make sure that the connection is firm.

Install the non-fuse circuit breaker to promptly cut off the external power when a spindle drive fault occurs.

It is recommended that the power is supplied after passing the input AC power reactor and input filter to improving the anti-jamming capability.

It is recommended that shield cable be used to prevent other electrical equipments from interference.

**Control signal XS4, feedback signal XS3 for spindle motor**

**optic-electrical encoder, spindle encoder feedback signal XS2, and XS1**  
**Serial Interface**

Diameter

Shield cable is used (stranded shield cable is the best choice), and the cross-sectional area is greater than or equal to  $0.12\text{mm}^2$  (AWG24-26). The shielded layer must be connected to the metal shell of the connection plug.

Cable length



The cable must be short. The length of the control signal cable XS4 is not greater than 10 meters, and the length of the feedback signal cable XS2, XS3 is no more than 40 meters.

#### Wiring

The wiring must be away from the electric power circuit to prevent interference.

Install surge absorbers with inductive components (coils) of related circuits. Freewheeling diodes are antiparallel connected to the DC coils, and RC absorbed circuits are paralleling connected to the AC coils.

#### 3、I/O input/output terminal XS5

(1) Diameter: use ordinary cable or shielded cable, wire cross-sectional area  $\geq 1.5\text{mm}^2$ .

(2) Cable length: cable length as short as possible and not more than 10 meters.

## 5.8 Standard Wiring

### Caution

U, V, W on XT2 must be connected to the motor windings in corresponding order and cannot be reversed.

Cables and wires must be fixed and cannot be near the radiator of the spindle drive or motor. Otherwise, the insulation properties may be reduced due to overheat.

In the spindle drive, large-capacity of electrolytic capacitor exists, which leads to the remaining of high voltage even after power off. Therefore, do not touch the spindle drive or motor within five minutes after the power off.

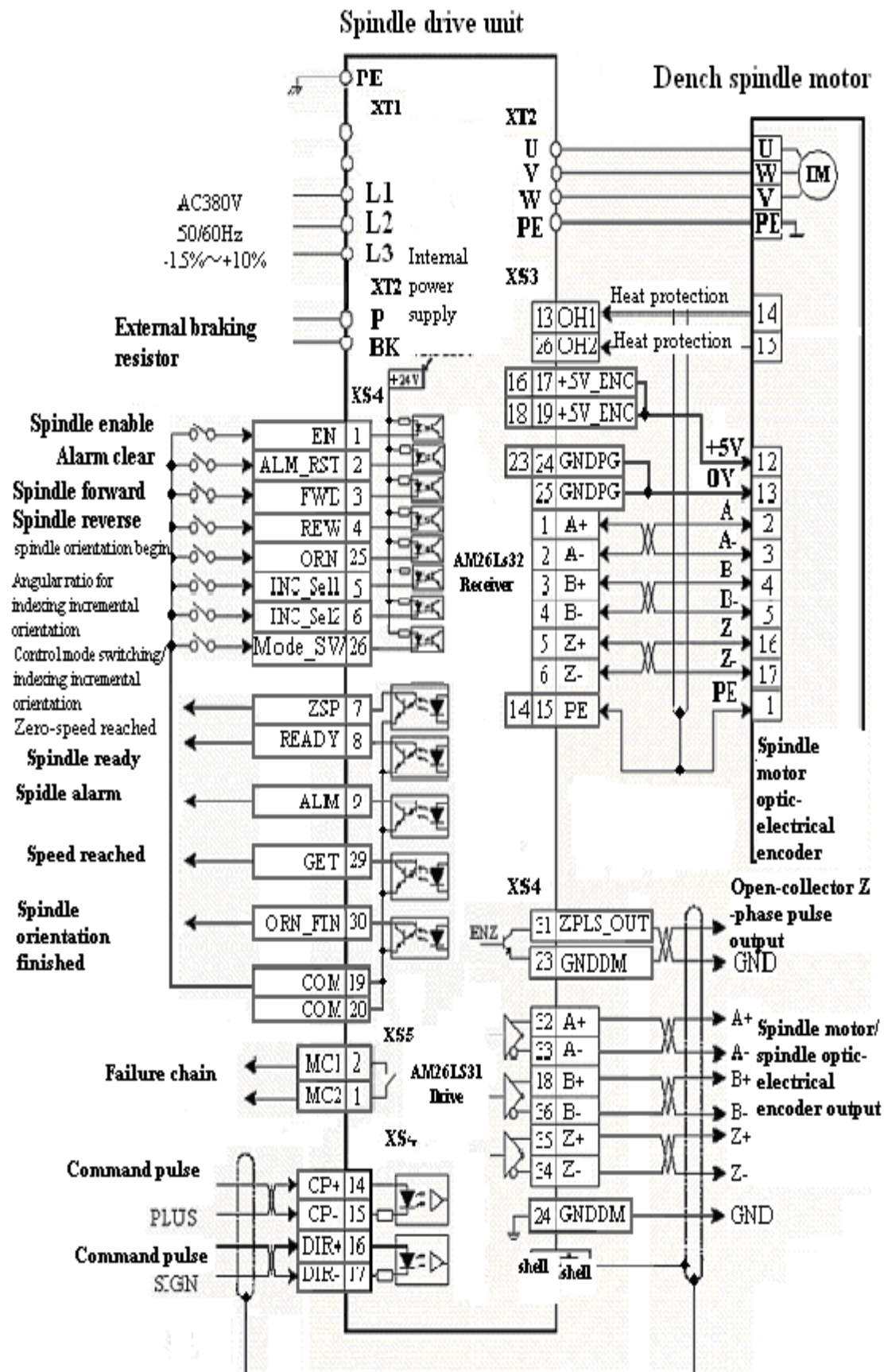
Terminals P, BK on XT2 are connected to the external braking resistor.

**Terminal P and BK cannot be shorted. Otherwise it will damage the spindle drive.**

“Shell” in the wiring diagram refers to the metal shell of the wiring plug. The cable shield must be connected to the metal shell. First unravel the shield and avoid twisting together. Then loop part of the shield and cut off the rest. Last cover the looped shield with casing, and weld the exposed shield to the metal shell. **Avoid too much solder to make sure the plug shield can be covered. It will be better, if you use a metal cable clip to form a 360-degree access and perform nearby grounded.**

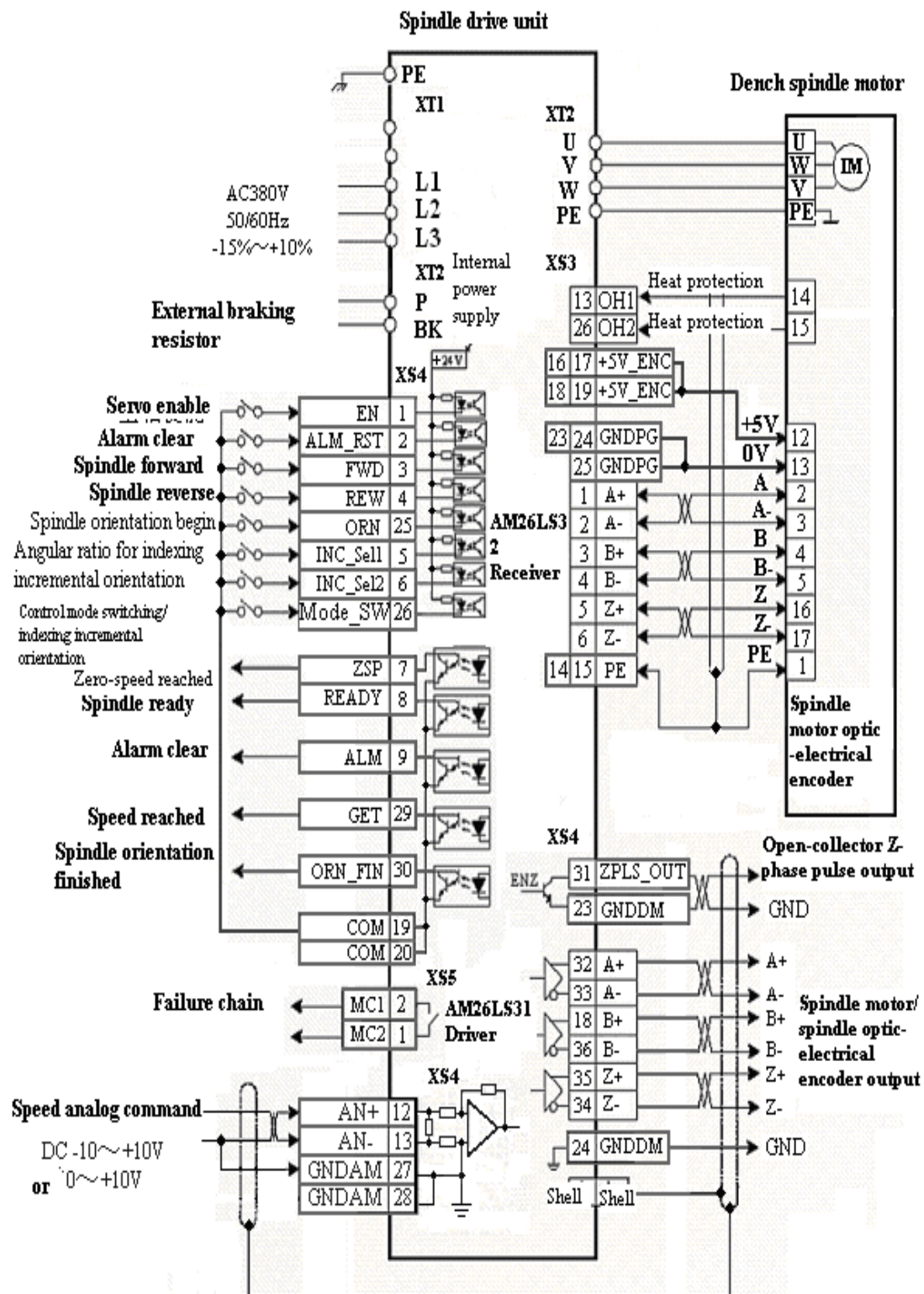
### 5.8.1 Standard Wiring for Position Control Mode (Pulse Interface)

Figure 5-40 Standard wiring for position control mode (pulse interface)



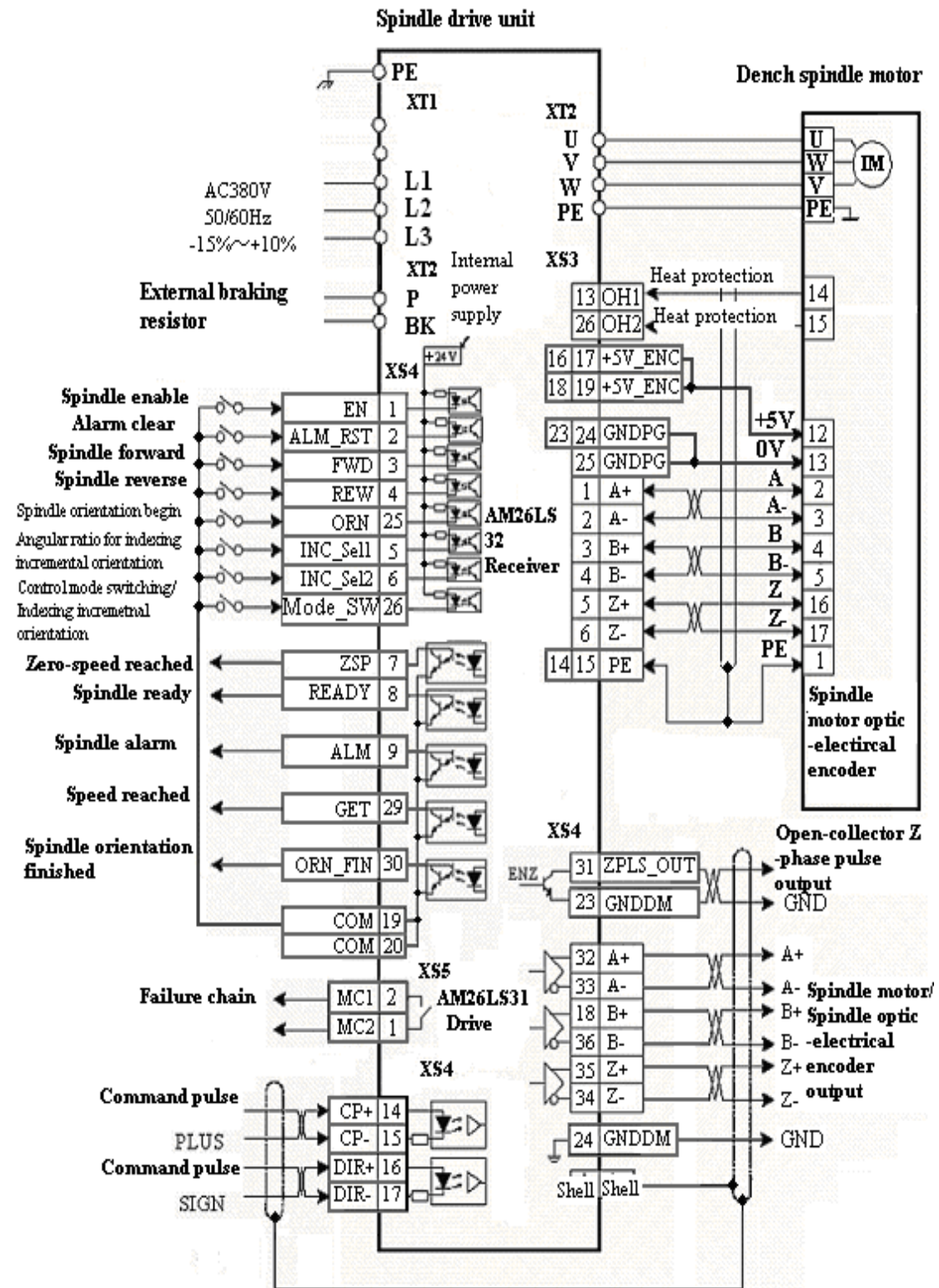
## 5.8.2 Standard Wiring for External Speed Control Mode (Analog Interface)

Figure 5-41 Standard wiring for external speed control mode (analog interface)



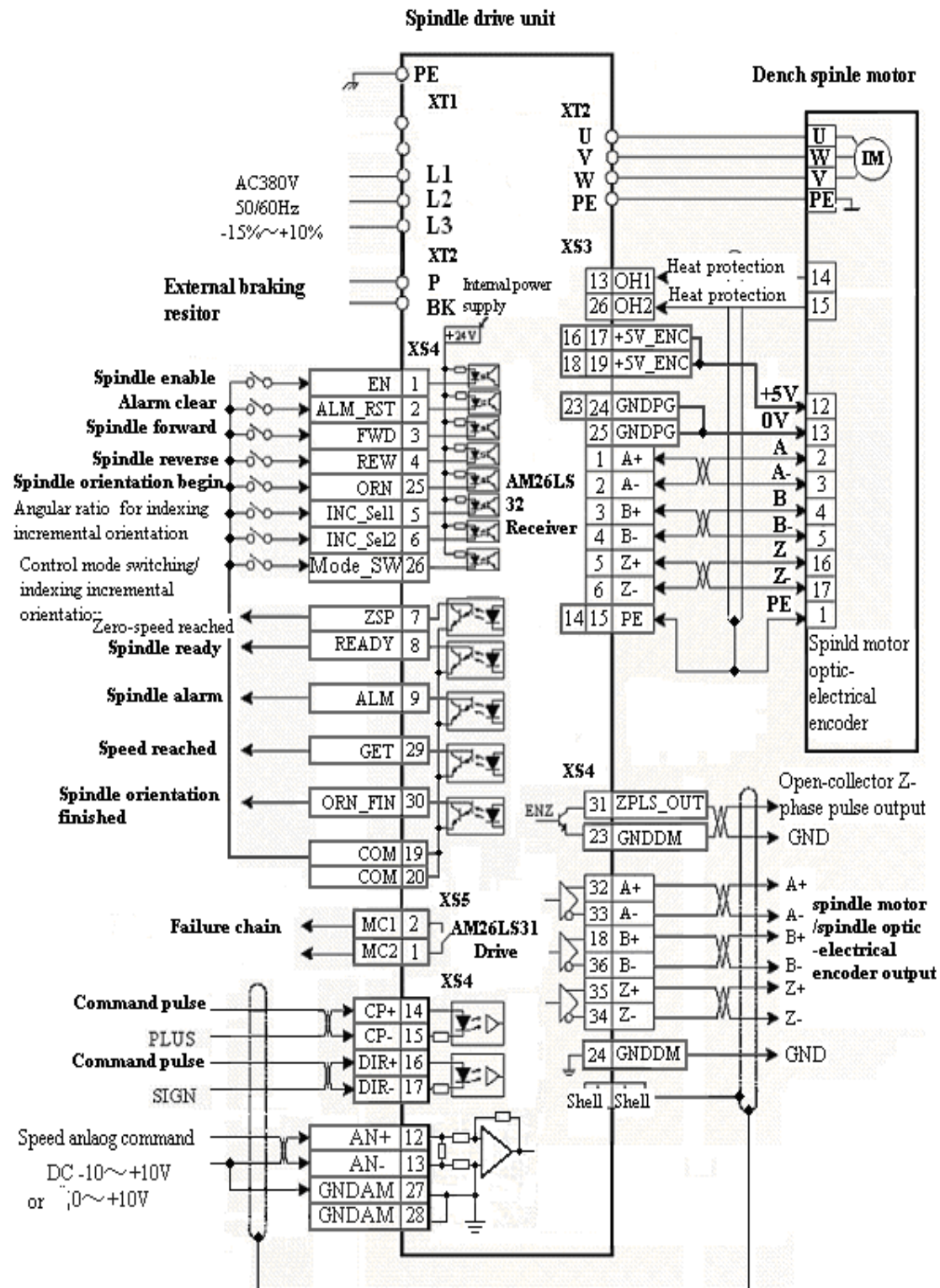
### 5.8.3 Standard Wiring for External Speed Control Mode (Pulse Interface)

Figure 5-42 Standard wiring for external speed control mode (pulse interface)

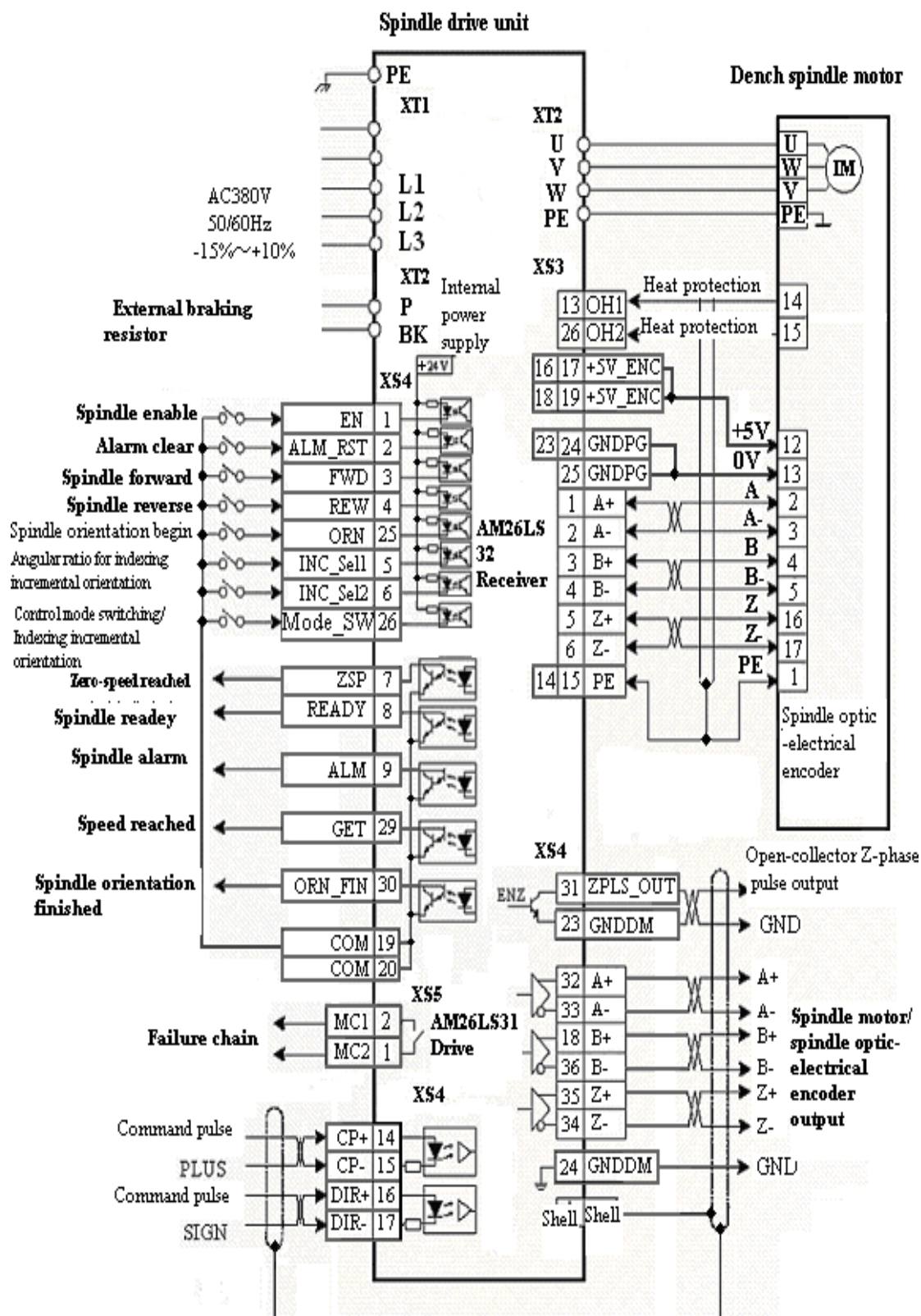




### 5.8.4 Standard Wiring for the Switching Between External Speed Control Mode (Analog Interface) and Speed Control Mode (Pulse Interface)



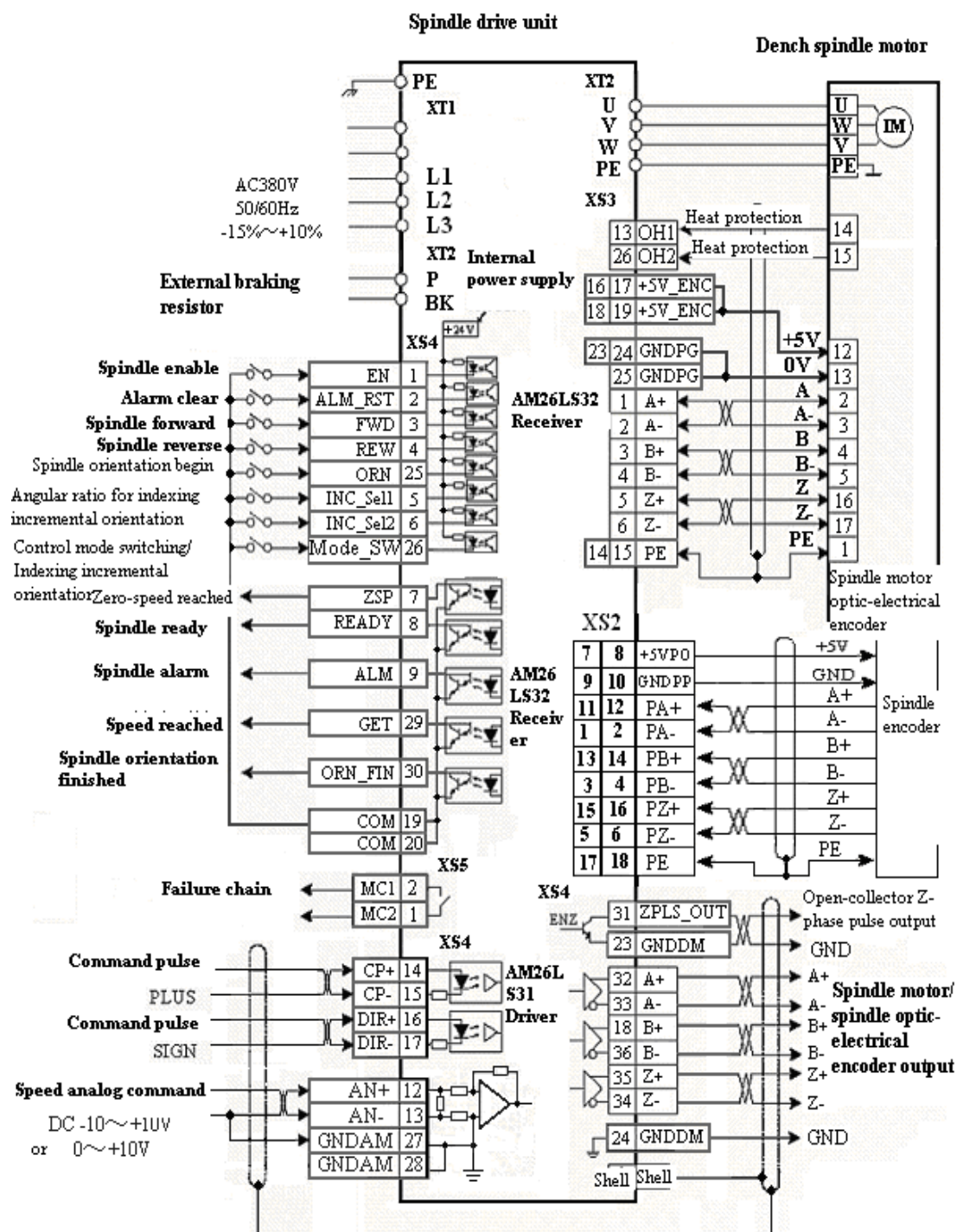
### 5.8.5 Standard Wiring For the Switching Between External Speed Control Mode (Pulse Interface) and Speed Control Mode (Analog Interface)



### 5.8.6 Standard Wiring for Spindle Encoder

Figure 5-45 Standard wiring for spindle encoder





## 6. Operation and Display

### 6.1 Overview

1. The drive unit panel consists of 6 LED digital displays, 5 buttons

↑、↓、←、M、S, and 2 light-emitting diodes.

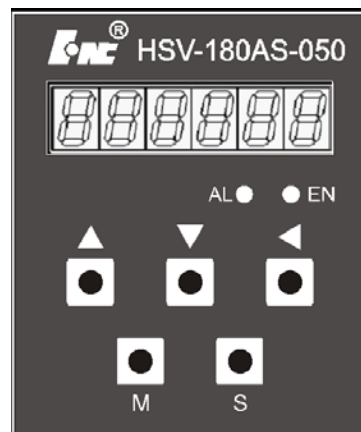


Figure 6-1 Digital display of series HSV-180AS spindle drive unit

- The 6 LED digital displays are used to display various statuses and set parameters.
- The red light-emitting diode is an alarming lamp (AL). When it is on, it means "drive unit alarm". The green light-emitting diode is an enable lamp (EN). When it is on, it means "spindle drive enable"

- The function of each button is as follows:

**M**: used for main menu mode switching

**S**: used for entering into the secondary menu, returning to the main menu mode, and input confirmation

**↑**: used for an increase in number and value, or moving to the next option

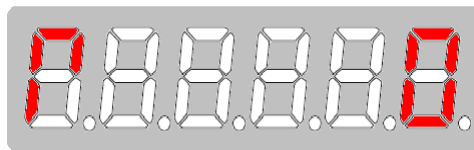
↓: used for a decrease in number and value, or moving back to the previous option

←: used for shifting

2. After the control power supply of the spindle drive is connected, the six LED digital displays on the panel all display "8", and change to "R 0" a second later.

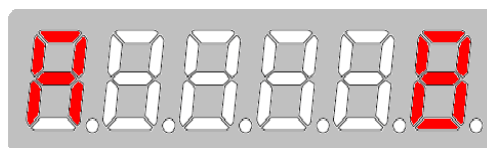
3. Users must operate based on the multi-level menus. The first-level menu is the main menu which includes five operation modes: display mode, movement parameter mode, auxiliary mode, control parameter mode, and alarm history display mode. Each operation mode contains a secondary menu.

Figure 6-2 R 0 display



4. The 6-bit LED digital tube displays various status and data of the system. If the first bit of the digital tube displays A , and at the same time the red light-emitting diode is on, an alarm is generated. The follow-up bit of the digital tube displays the alarm code. After the process of fault diagnosis and troubleshooting, you can reset the system by the alarm reset mode under the auxiliary mode or cutting off the power and then re-power to the spindle drive. When the red light-emitting diode is off, the system is reset.

Figure 6.3 A8 Alarm display



# 6.2 Operation in the Display Mode

1. Press **M** to switch the operation mode on the main menu” , and press **↑** and **↓** to enter the secondary menu for the display mode.

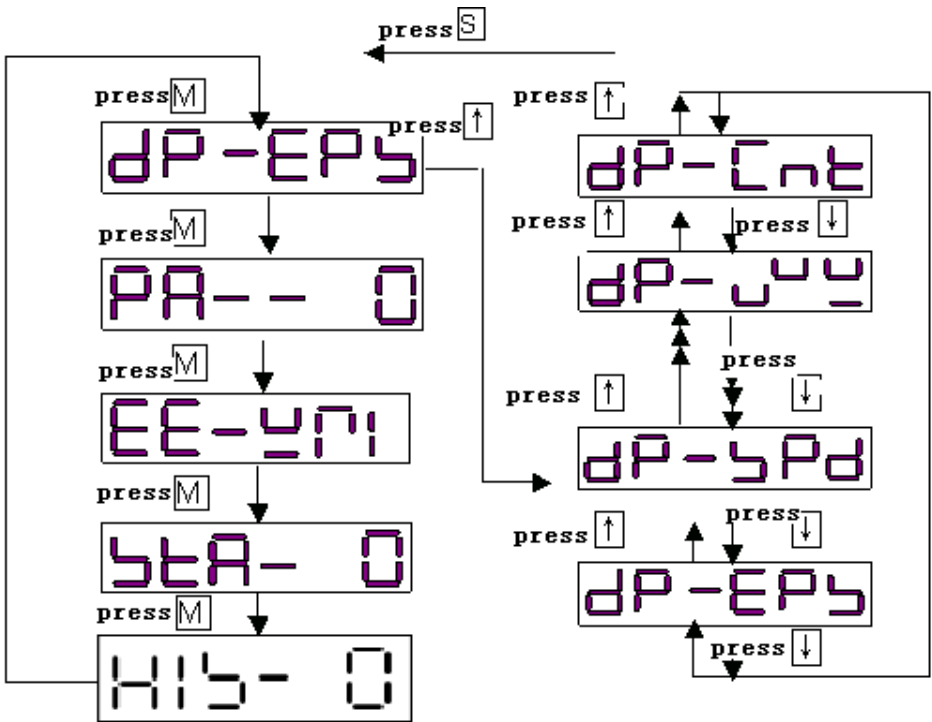






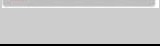

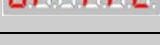

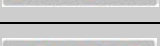
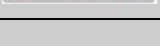




Figure 6-4 Main menu for the display mode








# 6.3 state surveillance mode

HSV-180AS spindle drive contains 21 types of display modes (see table 6.1). Press **↑** and **↓** to select a display mode as required. The display status can only be viewed and cannot be modified or set. Press **S** to display the detailed status, then press **S** to return to the secondary menu, and then press **M** to return to the main menu.



Table 6-1 Meaning of each symbol in the display mode

NO.	Symbol	Description
-----	--------	-------------

1		Display the speed tracking error unit: pulse
2		Display the actual speed (unit: 1r/m)
3		Display the actual torque current (Effective value ) unit: 0.1A
4		Display the actual magnetic field current (Effective value) unit: 0.1A
5		Display the magnetic field current command unit: 0.1A
6		Display the actual position of motor unit: pulse
7		Actual position = DP-PFM * 10000 + DP-PFL
8		Display speed command unit: 1r/min
9		Display alarm status
10		Display switch-value input status PIN.1: spindle drive enable PIN.2: alarm status reset PIN.3: CW control PIN.4: CCW control PIN.5: INC_Sel1 PIN.6: INC_Sel2 PIN.7: spindle orientation control PIN.8: control mode switch
11		Display the actual feedback value of the U-phase current
12		Display switch-value output status POU.1: zero-speed reached POU.2: drive system ready POU.3: alarm output POU.4: reserved POU.5: speed reached POU.6: spindle orientation-finished
13		Display the actual load current (Effective value ) unit: 0.1A
14		Display the number of the feedback pulse of the spindle motor optic-electrical encoder

15		Display the number of feedback pulse of the spindle encoder
16		Display the speed deviation
17		Display voltage reference output
18		Display position command unit: pulse
19		Actual position = DP-PRM * 10000 + DP-PRL
20		Display the single-turn absolute position value of Absolute encoder
21		Reserved

## 6.4 Operation in the Movement Parameter Mode

1. On the main menu, select "PA--0", and press  and  to enter the secondary menu for the movement parameter mode.
2. Series HSV-180AS spindle drive contains 60 movement parameters.

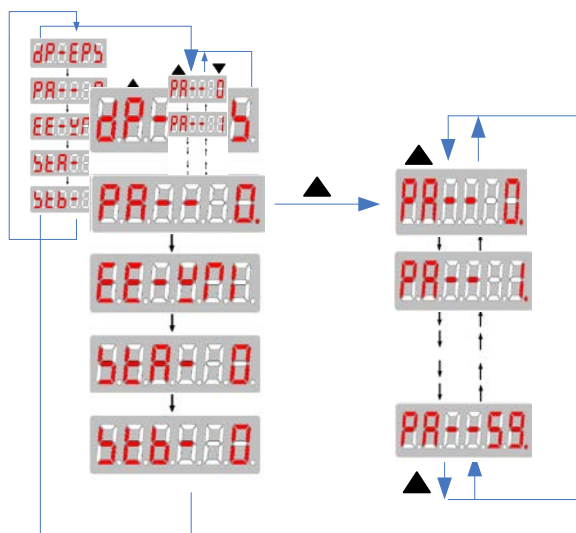




Figure 6-6 Secondary menu for the movement parameter mode

3. If the modified or changed parameters need to be saved, press  to switch to the "EE-WRI" mode, and then press  to save them to the EEPROM in the spindle drive. When the saving is finished, "FINISH"

is displayed. Press **M** to re-select the movement parameter mode or other modes. HSV-180AS spindle drive contains 16 types of display modes

- Set **PR-41** to **2003**, could open extension movement parameter mode  
HSV-180AS spindle unit have 16 extension parameters

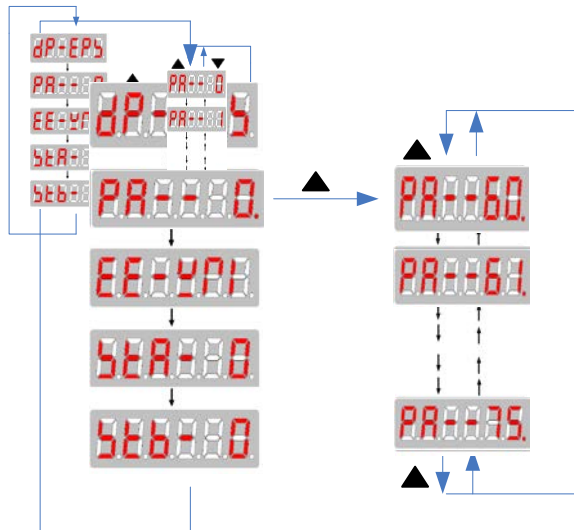


Figure 6-5 Secondary menu for extension movement parameter mode

## 6.5 Operation in the Auxiliary Mode

1. On the main menu, select “EE-WRI”, and press **↑** and **↓** to enter the secondary menu for the auxiliary mode.
2. Series HSV-180AS spindle drive contains 6 types of auxiliary modes

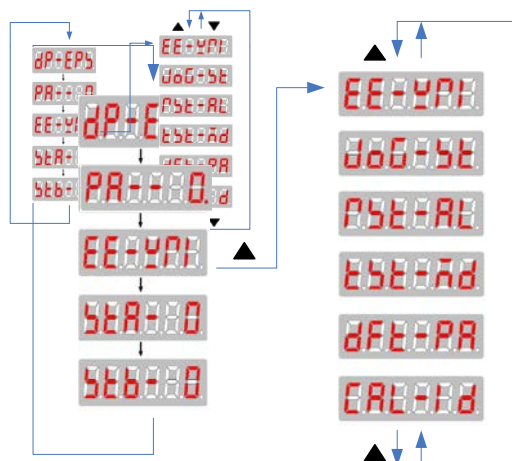


























Figure 6-8 Secondary menu for the auxiliary mode

- A. **EEPROM mode:** This method is effective only during the parameter changes and settings. If changing or setting parameters, you should firstly set  to , then save the new parameter values by pressing  in this mode. When “FINISH” is displayed, the parameter change and setting is completed. Press  to switch to another mode, or press  and  to select other operations in the auxiliary mode.
- B. **JOG mode:** This mode is effective only in JOG running. When the JOG speed parameter PA-21 is a non-zero value, on the main menu, press  to select the auxiliary mode, and press  and  to select the JOG running mode. “JOG—” is displayed through the digital display. Press , “R — ” is displayed, which indicates that the system enters into the running state. Press and hold , then the spindle drive and motor run at the speed specified by PA-21. Press , then the motor run at the speed specified by PA-21 in the opposite direction. Release the  or  to stop the motor. Press  to return to the auxiliary mode. Press  to switch to another mode, or press  and  to select other operations in the auxiliary mode.
- C. **Alarm resetting mode:** When the spindle drive unit generates an alarm, press  to reset the system in this mode. If the fault is cleared, the spindle drive unit returns to normal. Press  to switch to another mode, or press  and  to select other operations in the auxiliary mode.





1. On the main menu, select “STA-0”, and press  and  to enter the secondary menu for the control parameter mode.
2. Series HSV-180S spindle drive contains 16 types of control parameters.

## 6.7 Operation in the Auxiliary Mode



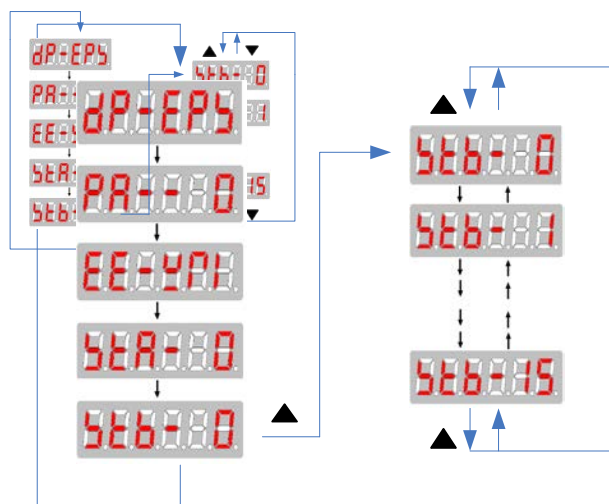

1. On the main menu, select “STA-0”, and press  and  to enter the secondary menu for the control parameter mode.
2. Series HSV-180AS spindle drive contains 16 types of control parameters.

Figure 6-10 Secondary menu for the auxiliary mode



## 6.8 Control Parameter Setting and Saving

### Caution

- The control parameter setting cannot take effect immediately. The new parameter can be confirmed by pressing  only in the “EE-WRI” of auxiliary mode, and it

takes effect after restarting the spindle drive.

- Wrong settings may cause improper operation that leads to accidents.

1. Select **PR--88** on the main menu, press **↑** and **↓** to select a control parameter number, and then press **S** to display the value of the parameter. Press **↑** and **↓** to change the parameter value.
2. The parameter value increase or decrease 1 every time you press **↑** or **↓** respectively.
3. After the parameter modification is completed, the corresponding decimal point on the LED digital tube light, press **S** to return to the control parameter mode menu.
3. The control parameter setting cannot take effect immediately. If changing or setting parameters, you should firstly set **PR--44** as **881230**, then save the parameter change by pressing **S** to return to the main menu and pressing **M** to select the auxiliary mode. Then press **↑** and **↓** to select "EE-WRI", and then press **S** to save the changed parameter value to EEPROM. The wire control box displays **FINISH**, indicating that the parameter value is saved.
4. The changed control parameter takes effect as a default control parameter after restarting the spindle drive.

**NOTE:**

If changing PA--24 to PA--28, PA--59, you should firstly set **PR--44** as **881230**.

## 7. Parameter Setting

### Attention

- Personnel that set parameters must understand the meanings of the parameters. Wrong setting could result in damage to the equipment and injuries.
- It is recommended that parameter modification be performed under the condition that spindle motor run without load.


### 7.1 Function Menu




#### 7.1.1 Parameters illustration

Users can set various parameters for series HSV-180AS spindle drive to adjust or set the performances and functions of the drive unit. This section describes the purpose and functions of these parameters. Understanding these parameters is essential for a best use and operation of the drive unit.

Series HSV-180AS spindle drive parameters can be divided into three categories: movement parameter ,control parameter and expanding control parameter (applicable to movement parameter mode , control parameter mode respectively and expanding control parameter mode). These parameters can be viewed, set and modified by keys or computer serial ports on the wire control box.

Table 7-1 Description of the three types of modes

Mode	Group	Parameter No.	Description
Movement parameter mode		0~59	Able to set speed regulator, speciality modification, and motor related parameters.

Expanding movement parameter mode		60~75	Able to set parameters related to the spindle motor
Control parameter mode		0~15	Able to set spindle orientation speed, orientation position.
Expanding control parameter mode		0~15	Could choose the speed feedback filter, spindle motor and so on.

### 7.1.2 Parameter operation instructions

This section describes the modify and view parameters during debugging and precautions, does not include the adjustment and adaptation of parameters

1、Drive unit can only view the movement parameter PA, status monitoring, auxiliary parameters and control parameters STA parameters after power on.

2、Set PA—41to 2003, you could view or modify parameters PA and STB.

3、Any time, PA--23 、PA--24、 PA—25、PA—26 are effective only when saving parameters and restarting power.

4、Before the drive unit running, you must modify parameter PA—59 (Notice: modify parameter PA—59 after setting PA—41 to 2003) 。

If the drive unit and motor code is not in Table 7.3, you need to set the parameters related to the motor manually, and refer to

7.2.Non-standard motor parameters

5、The drive unit performance debugging please refer to the relevant sections of 7.2.

6、The steps of trial operation of the drive unit, please reference the relevant sections of Chapter 8.

## 7.2 Movement Parameter Mode

### 7.2.1 Movement parameters

Series HSV-180AS spindle drive can provide 60 movement parameters.  
For details about the movement parameters, see Table 7-2, and Table 7-3.

In the application control mode:

**P:** indicates position control (suitable for spindle position control and spindle orientation)

**S:** indicates speed control.

Table 7-2 Movement parameters

No.	Parameter	Adaptive Control Mode	Value range	Default value	Unit
0	Position control mode Speed proportional gain	P	10~1500	200	0.1Hz
1	Torque filter time constant	P, S	0~499	4	0.1ms
2	Speed proportional gain 1	S	25~5000	350	
3	Speed integral time constant 1	S	5~32767	30	ms
4	Speed feedback filter factor	P, S	0~9	1	
5	Deceleration time constant	S	1~1800	40*	0.1s/8000r/min
6	Acceleration time constant	S	1~1800	40*	0.1s/8000r/min
7	Speed command input gain	S	10~12000	6000*	1r/min
8	Speed command zero drift compensation	S	-1023~1023	0	
9	Speed command gain adjusting	S	80~120	100	1%
10	Current amplitude	P, S	10~300	200	PA-53orPA-56

	limit for maximum torque				current ratio of the motor (10%~300%)
11	Speed reached range	P, S	0~32767	10	1r/min
12	Test range for position tolerance	P	1~32767	30	0.1r
13	Speed ratio numerator of spindle to motor	P	1~32767	1	Only applicable in orientation control
14	Speed ratio denominator of spindle to motor	P	1~32767	1	Only applicable in orientation control
15	Reserved				
16	C-axis feed forward gain	P	0~100	0	
17	Maximum speed limit	P, S	1000~25000	9000	1r/min
18	Overload current setting	P, S	10~200	150	PA-53 or PA-56 as a percentage of the motor rated current (10%~200%)
19	Overload time setting of the system	P, S	10~30000	100	0.1s
20	Internal speed	S	-20000~20000	0	1r/min
21	J JOG operation speed	P, S	0~500	300	1r/min
22	Command pulse input mode	P, S	0~3	1	
23	Selection of control mode	P, S	0~3	1	Select the control mode to the spindle drive ● 0: the C-axis position control mode

					<p>that receive position pulse input command</p> <ul style="list-style-type: none"> <li>● 1: the external speed control mode that receives the speed analog input command</li> <li>● 2: the external speed control mode that receives the speed pulse input command</li> </ul> <p>3: Internal speed control mode, and the internal speed command is set by the movement parameter PA--20</p>
24	<p>Magnetic logarithm of spindle motor</p> <p>◆</p>	P, S	1~8	2	
25	<p>Spindle motor encoder optical-electrical resolution</p> <p>◆</p>	P, S	0~3601	0	<p>0: 1024pps</p> <p>1: 2048pps</p> <p>2: 2500pps</p> <p>3: 256 Sine and cosine incremental encoder</p> <p>4: EQN1325/1313</p> <p>5: Other Sine and cosine incremental encoder</p> <p>Such as 1201 is 1200 line sine and cosine incremental</p>



					encoder, the bits 1 means sine and cosine signal
26	SM spindle motor offset compensation ◆	P, S	-32767 ~ 32767	0	
27	Current control proportional gain ◆	P, S	25~ 32767	1000	
28	Current control integral time ◆	P, S	1~ 32767	50	0.1ms
29	Zero-speed reached	P, S	0~300	10	1r/min
30	Speed rate	S	1~256	64	1/64
31	State control word 1		-32768 ~ 32767	4096	Correspond to STA15~STA0
32	State control word 2		-32768 ~ 32767	1	Correspond to STB15~STB0
33	Flux current	P, S	10~80	60	PA-53 as a percentage of the motor rated current (10%~80%)
34	Time constant of spindle motor rotor electric	P, S	1~4500	1500	0.1ms
35	Rated speed of spindle motor	P, S	100~ 12000	1500	1r/min
36	The minimum flux current	P, S	5~30	10	PA-33 as a percentage of flux current (5%~30%)
37	The range for spindle orientation	P	0~100	10	pulse

	finished				
38	Spindle orientation speed	P	40~600	100	1r/min
39	Spindle orientation position	P	-32767~32767	0	pulse
40	Incremental angle for indexing orientation	P	0~32767	0	<ul style="list-style-type: none"> <li>● The incremental angle for indexing orientation is <math>PA-40 \times 360/ppr0/8 \times</math> the angular ratio for indexing orientation</li> <li>● If the SET-13 is set to 0, the value of ppr0 is multiplying the resolution of spindle motor optic-electrical encoder by 4</li> <li>● If SET-13 is set to 1, the value of ppr0 is multiplying the spindle encoder resolution by 4</li> </ul> <p>The angular ratio for indexing incremental orientation is determined by INC_Sel1 and INC_Sel2</p>
41	Reserved		0~2003	351	Display software

					version 1230: Save parameter password 2003: View Extended Parameters 315: Modify the extended parameter
42	Speed proportional gain for position control mode	P	25~ 5000	450	
43	Speed integral time constant for position control mode	P	5~ 32767	20	1ms
44	Position proportional gain for orientation mode	P	10~ 1500	200	0.1Hz
45	Flux current for orientation mode	P	30~150	110	PA-33 Ratio of flux curren (30%~150%)
46	Flux current for position control mode	P	30~150	110	PA-33 PA-33 Ratio of flux curren (30%~150%)
47	Spindle encoder resolution	P, S	1~ 32767	4096	Spindle encoder resolution multiplied by 4
48	The offset angle for indexing orientation	P, S	0~18	0	20°
49	C-axis electronic gear ratio Molecular	P	1~ 32767	1	
50	C-axis electronic gear ratio Denominator	P	1~ 32767	1	

51	Serial communication baud rate	P, S	0~5	2	
52	Communication sub-station address	P, S	1~63	1	
53	IM motor rated current	P, S	60~1500	188	0.1A
54	IM Second speed point corresponds to the maximum load current	P, S	100~3000	200	Less than or equal to PA—10
55	IM second load current limiting speed	P, S	500~10000	2000	1r/min More than or equal to PA—35
56	PM spindle motor rated current	P, S	100~3000	420	0.1A
57	PM spindle motor rated rotation speed	P, S	100~5000	2000	1r/min
58	PM Weak magnetism adjusting coefficient	P, S	100~10000	2500	1r/min More than or equal PA—57
59	Drive unit and code of motor type◆	P, S	0~799	202	Hundred digit means drive unit Model: 0: 35A 1: 50A 2: 75A 3: 100A 4: 150A 5: 200A 6: 300A 7: 450A Ten and bit digit mean motor code (see figure 7.3)

**Note:**

If changing parameter, you should firstly set **PA0041** as **888230**, otherwise it's invalid.

Table 7-2 Movement parameters

Wuhan Huazhong Numerical Control Co., Ltd

Motor Type Code	Motor Type	Rated Power (KW)	Rated Torque (Nm)	Rated Electric current (A)	Adapter drive unit	PA-59 parameters
00	GM7101-4SB61	3.7	23.6	10	HSV-180AS-035	0
01	GM7103-4SB61	5.5	35	13	HSV-180AS-035	1
					HSV-180AS-050	101
02	GM7105-4SB61	7.5	47.8	18.8	HSV-180AS-050	102
					HSV-180AS-075	202
03	GM7109-4SB61	11	70	25	HSV-180AS-075	203
					HSV-180AS-100	303
04	GM7133-4SB61	15	95.5	34	HSV-180AS-100	304
					HSV-180AS-150	404
05	GM7135-4SB61	18.5	117.8	42	HSV-180AS-150	405
06	GM7137-4SB61	22	140.1	57		406

### 7.2.2 Parameters Related to Asynchronous Servo Motors

#### Description of the parameter setting:

Parameters related to spindle motors are effective under all control modes. HSV-180AS spindle drive adopts the indirect magnetic field orientation control mode which achieves the control for asynchronous motor. The key to the magnetic field orientation is the observation for flux, in other words, it is the calculation of slip angle frequency which is closely related to the motor parameter. Therefore, setting parameter correctly is the first and foremost.

#### PA--17

NO.	Parameter	Scope	Default value	Unit
PA--17	Maximum speed limit	1000~25000	9000	1r/min

Function and setting:

- ① According to motor type set maximum speed of the spindle motor.
- ② Regardless of the direction of rotation.

**PA--24**

NO.	Parameter	Scope	Default value	Unit
PA--24	Magnetic logarithm of spindle motor	1~8	2	

Function and setting:

- ① According to motor type set maximum speed of the spindle motor。

**PA--25**

NO.	Parameter	Scope	Default value	Unit
PA--25	Spindle motor encoder optical -electrical resolution	0~3601	0	

Function and setting:

- ① **PA--25** must be filled in based on the technical data of the motor.

- ② Setting parameters:

0: 1024pps

1: 2048pps

2: 2500pps

3: 256 Sine and cosine incremental encoder

4: EQN1325/1313

5: Other Sine and cosine incremental encoder

Such as 1201 is 1200 line sine and cosine incremental encoder, the bits 1 means sine and cosine signal

**PA--33**

NO.	Parameter	Scope	Default value	Unit
PA--33	IM Flux current	10~80	60	1%

Function and setting:

1. **PA--33** is the no-load current of the rated speed.

- For the 2.2KW to 11KW spindle motor, the no-load current is 40% to 60% of the rated current.

- For the 15KW to 22KW spindle motor, the no-load current is 30% to 40% of the rated current.
- If **PA-33**(flux current) is set too large, it will cause saturation flux which could result in motor oscillation, and a larger fluctuation in rotary speed.
- If the value of excitation current is set too small, it will cause insufficiency of magnetic flux stimulation which will lead to a great drop of motor output torque loop.

#### **PA-34**

NO.	Parameter	Scope	Default value	Unit
PA-34	IM Time constant of spindle motor rotor electric	1~4500	1500	0.1ms

Function and setting:

2. The value of **PA-34** (time constant of spindle motor rotor electric) can be specified based on the rotor inductance of the motor (self-inductance + leakage inductance) and rotor resistance.
  - For the 2.2KW to 11KW spindle motor, the time constant is from 1300 to 1800.
  - For the 15KW to 30KW spindle motor, the time constant is from 3000 to 4000.
  - If **PA-34** is set too large or too small, it will cause a greater deviation of the magnetic field oriented angle, which may cause a great drop of motor output torque loop.

#### **PA-35**

NO.	Parameter	Scope	Default value	Unit
PA-35	IM Rated speed of spindle motor	100~12000	1500	1r/min

Function and setting:

- ① **PA--35** must be filled in based on the technical data of the motor.

#### **PA--36**

NO.	Parameter	Scope	Default value	Unit
PA--36	IM The minimum flux current	5~30	10	1%

Function and setting:

**PA-36** (minimum flux current limit) is set for preventing the insufficiency of magnetic flux stimulation when the motor running at a high-speed. Generally **PA-36** is set to **0.1** times of the value of **PA-33** (flux current) or smaller.

#### **PA--53**

NO.	Parameter	Scope	Default value	Unit
PA--53	IM Motor rated current	60~1500	188	0.1A

Function and setting:

According to motor type set rated current of the spindle motor. After setting (**PA--59**) , this parameter will be automatically set.

## 7.2.3 Parameters Related to Movement Control

Table 7-10 Parameters related to movement control

NO.	Parameter	Function	Value Range
0	Position control mode Speed proportional gain	1. Set the parameters to the proportional gain of the position loop regulator under the position control mode  2. The greater of the parameter value, the greater of the gain and the rigidity, and the smaller of the position lag value at the same	10 to 9999 unit: 0.01 1/S



		<p>frequency of the command pulse. Note: the value is too large may cause oscillation or overshooting.</p> <p>3. The parameter value is determined according to the type of spindle drive and operating load.</p>	
12	Test range for position tolerance	<p>1. Set the parameters to the test range for C- axis position tolerance.</p> <p>2. Under the C-axis control mode, when the value for the position tolerance is over the parameter value, the tolerance alarm is generated.</p>	1 to 32767 pulse
16	Position feed forward gain	<p>1. Set parameters to the position feed forward gain.</p> <p>2. When the parameter is set to <b>100%</b>, the position lag value is <b>0</b> at any frequency of the command pulse.</p> <p>3. The high-speed response is improved as the feed forward gain of the position loop increased. This can cause instability and oscillation.</p> <p>4. If the fast response is not required, the parameter can be set to <b>0</b>.</p>	0 to 100
22	Command pulse input mode	<p>1. Set parameters to the command pulse mode</p> <p>2. Set parameters to one of the 3 types of input mode.</p>	0 to 3

		<ul style="list-style-type: none"> <li>● 0: indicates two-phase positive pulse input</li> <li>● 1: indicates pulse + direction</li> <li>● 2: indicates CCW pulse/CW pulse</li> </ul> <p>3. CCW is defined as forward for the spindle rotating counterclockwise (looking from the axial direction).</p> <p>4. CW is defined as reverse for the spindle rotating clockwise (looking from the axial direction).</p>	
23	Selection of control mode	<p>1. This parameter is used to select control mode for the spindle drive.</p> <ul style="list-style-type: none"> <li>● 0: indicates the C-axis position control mode, receiving the position pulse input command.</li> <li>● 1: indicates the external speed control mode, receiving speed analog input command.</li> <li>● 2: indicates the external speed control mode, receiving speed pulse input command.</li> <li>● 3: indicates the internal speed control mode. The internal speed command is set by movement parameter PA-20.</li> </ul>	0 to 3
42	Speed proportional	1. Set parameters to the proportional gain for speed regulator under the	25 to 32767

	gain	<p>position control mode.</p> <p>2. Gain and rigidity will be enhanced as the parameter value increases. This parameter is determined by the actual spindle drive system type and the load. Generally, load inertia grows as the value increases.</p> <p>3. It is recommended that the value be larger if no oscillation exists.</p>	
43	Speed integral time constant 2	<p>1. Set this parameter to the speed regulator integration time constant.</p> <p>2. Integration speeds up as the value decreases. This parameter is determined by the actual spindle drive system type and the load. Generally, load inertia grows as the value increases.</p> <p>3. It is recommended that the value be smaller if no oscillation exists.</p>	5 to 32767
46	Flux current for position control mode	<p>1. Set parameters to the flux current value under position control mode. The parameter is specified by <b>PA-33</b> and <b>PA-46</b>, and the flux current value is <math>\text{PA-33} \times \text{PA-46}</math>.</p>	10 to 100%

**Parameters setting in the position control mode (PA-23 is set to 0):**

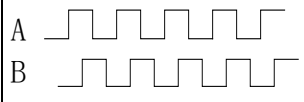
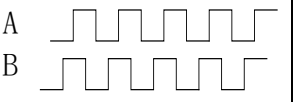
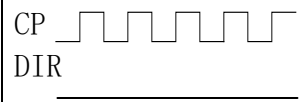
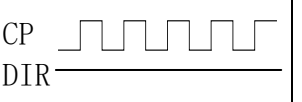
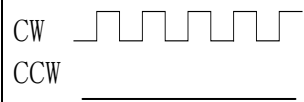
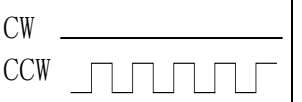
1. The position loop feature is adjusted by setting **PA-0**.
2. The speed loop feature is adjusted by setting **PA-42** and **PA-43**.
3. The current loop feature is adjusted by setting **PA-27** and **PA-28**.

4. The value of flux current is calculated by multiply **PA—53**by **PA-33** by **PA-46**. There is an example, if the value of PA—53 is 100, PA-33 is 50and PA-46 is 110, flux current value =  $100 \times 50\% \times 110 = 55$

**Note:**

In the position control mode, the spindle drive can receive three types of pulse command. You can select one of the three commands by setting the movement parameter **PA-22** (indicating the command pulse input mode).

Table 7.11 Command pulse

Signal input pin	pulse		Command Pulse Input Mode (movement parameter <b>PA-22</b> ) Setting
	Forward	Reverse	
CP XS4-14 XS4-15 DIR			0 (positive pulse)
XS4-16 XS4-17			1 (pulse + direction)
			2 (CW+CCW) (CW+CCW)

## 7.2.4 Parameters Related to Speed Control Mode

Table 7.12 Parameters related to speed control mode

NO.	Parameter	Function	Value Range
2	Speed proportion al gain 1	1.Set parameters to the proportional gain for the speed regulator. 2.Gain and rigidity will be enhanced as the parameter value increases. This parameter is determined by the actual spindle drive system type and the load. Generally, load inertia grows as the value increases. 3.It is recommended that the value be larger if no oscillation exists.	25 to 5000

3	Speed integral time constant 1	<p>1.Set this parameter to the speed regulator integration time constant.</p> <p>2.Integration speeds up as the value decreases. This parameter is determined by the actual spindle drive system type and the load. Generally, load inertia grows as the value increases.</p> <p>3.It is recommended that the value be smaller if no oscillation exists.</p>	5 to 32767mS
4	Speed feedback filter factor	<p>1.Set this parameter to the features of low-pass filter for speed feedback.</p> <p>2.Noise produced by motors and cut-off frequency decreases as the value increases. If the load inertia is large, decrease the value to prevent from slow response or oscillation.</p> <p>3.The cut-off frequency increases and speed feedback response becomes faster as the value decreases. If high speed feedback response required, decrease the value.</p>	0 to 9
5	Decelerati on time constant	<p>1. The value indicates the time required for motor slow down from the maximum speed to 0r/min.</p> <p>2. Deceleration features linearity.</p>	0 to 1800
6	Accelerati on time constant	<p>1. The value indicates time required for motor speed up from 0 r/min to the maximum speed.</p> <p>2. Acceleration features linearity.</p>	0 to 1800
7	Analogue speed command input gain	<p>1.Set this parameter to the relationship between voltage and rotary speed under analogue speed command mode.</p> <p>2.The value is the speed corresponding to the + 10 V voltage ( unit: 1 r/min)</p> <p>3.The valve is effective under the external speed control mode.</p>	0 to 12000
8	Speed command zero drift compensati on	<p>1. In the speed control mode, this parameter is used to adjust zero drift input by external analogue speed command. The method of adjustment is as follows:</p>	-1023 to 1023

		<ul style="list-style-type: none"> <li>● Perform short-connection between the analogue control input terminal and grounding wire for signal.</li> <li>● Set this parameter to the value that stops the operation of the motor.</li> </ul>	
9	Speed command gain adjusting factor	1. In the speed control mode, this parameter is used to adjust the amplification factor of PA--7. 2. The value is effective under the external speed control mode.	80% to 120%
11	speed reached range	1. Set parameters to speed reached. 2. In the non-position control mode, if the motor speed tracking error is less than the value, the switch signal for speed reached is connected, otherwise it is disconnected. 3. In the position control mode, this parameter is ineffective. 4. The parameter value has no relation to the rotary direction.	0 to 32767 r/min
17	Maximum speed limit	1. Set parameter to the maximum speed limit. 2. The parameter value has no relation to the rotary direction.	0 to 16000 (unit: 1r/min)
20	Internal speed	1. Set parameters to the internal speed. 2. In the internal control mode, select the internal speed as the speed command.	-20000 to 20000 (unit: 1r/min)
21	JOG operating speed	1. Set this parameter to the speed in the JOG mode.	0 to 500 (unit: 1r/min)
22	Command pulse input mode	1. Set parameters to the command pulse input mode. 2. Select one of the 3 types of input mode by setting the parameter. <ul style="list-style-type: none"> <li>● 0: indicates two-phase positive pulse input</li> <li>● 1: indicates pulse + direction</li> <li>● 2: indicates CCW pulse/CW pulse</li> </ul> 3. CCW is defined as forward for the spindle rotating counterclockwise as looking from the axial direction.	0 to 3

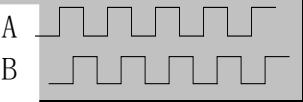
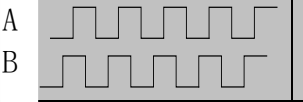
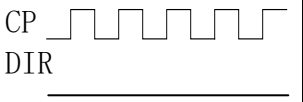
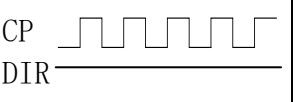
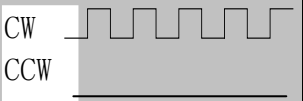
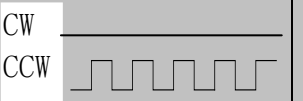
		4. CW is defined as reverse for the spindle rotating clockwise as looking from the axial direction.	
23	Selection of control mode	<p>1. This parameter is used to select the control mode for spindle drive.</p> <ul style="list-style-type: none"> <li>● <b>0</b>: indicates the C-axis position control mode, receiving the position pulse input command.</li> <li>● <b>1</b>: indicates the external speed control mode, receiving speed analog input command.</li> <li>● <b>2</b>: indicates the external speed control mode, receiving speed pulse input command.</li> <li>● <b>3</b>: indicates the internal speed control mode. The internal speed command is set by movement parameter <b>PA-20</b>.</li> </ul>	0 to 7
29	Zero-speed reached range	<p>1. Set parameters to the zero-speed reached range.</p> <p>2. In the non-position control mode, if the motor speed is less than the value of this parameter, the switch signal for zero-speed output is connected. Otherwise, it is disconnected.</p> <p>3. In the position control mode, this parameter is ineffective.</p> <p>4. The parameter value has no relation to the rotary direction.</p>	0 to 300(unit: 1r/min)

Parameter setting in the speed control mode (PA-23 is set to 1, 2 or 3):

1. Speed loop feature is adjusted by setting **PA-2** and **PA-3**.
2. Current feature is adjusted by setting **PA-27** and **PA-28**.
3. Flux current value is determined by setting **PA-33**.
4. When **PA-23** is set to **1**, it can receive the internal analog command with the voltage amplitude no more than 10V (-10V ~+10V or 0~+10V).
5. When **PA-23** is set to **2**, it can receive three types of external pulse commands (positive pulse, pulse + direction, positive and negative pulse). For the command pulse mode, see Table 7-11.

6. When **PA-23** is set to **3**, in the internal control mode, the spindle drive running at the speed specified by **PA-20** (without the external command).

Table 7.12 Command pulse

Signal input pin	pulse		Command Pulse Input Mode (movement parameter <b>PA-22</b> ) Setting
	Forward	Reverse	
CP			0 (positive pulse)
XS4-14 XS4-15 DIR			1 (pulse + direction)
XS4-16 XS4-17			2 (CW+CCW)

### 7.2.5 Parameters Related to Output Torque Regulation

Table 7-13 Regulating parameters

NO.	Parameter	Function	Value range
1	Torque filter time constant	1. Set parameters to the filter time constant for the torque command. 2. The responding speed becomes slower as the value increases, which may cause instability and oscillation. 3. The parameter is generally set to <b>4</b> if a slow response is not needed.	0 to 499 Indicates the range is 0~49.9ms
10	Current amplitude limit for maximum torque	1. Set parameters to the current amplitude limit for maximum torque. Usually the value is between 0.1 to 3 times of the rated current of the motor 2. The value is effective at any time.	10 to 300
18	Overload current setting	1. Set parameters to the overload current of spindle motor. Usually the value is between 0.1 to 2 times of the rated	10 to 200



		current of the motor 2.The value is effective at any time.	
19	Overload time	1. Set this parameter to the allowable overloading time of the system. 2. The value indicates the overloading time per time unit (unit: 0.1s). For example, if the value is <b>200</b> , the allowable overloading time is <b>20s</b> . 3. The value is effective at any time.	10 to 30000
27	Current control proportional gain	1. Set this parameter to the proportional gain of current loop. 2. Decrease the value to decrease the loud noise of current during motor operation. 3. However, a small value will decrease the feedback response.	25 to 32767
28	Current control integration time	1. Set this parameter to the integration time of current loop. 2. Increase the value to decrease the loud noise of current during motor operation. 3. A big value will decrease the feedback response.	1 to 32767

## 7.2.6 Parameters Related to the Oriented Control

Table 7-16 Oriented Parameters

NO.	Parameter	Function	Value Range
2	Speed proportional gain 1	1.Set parameters Speed proportional gain of spindle to motor 2. The larger of the setting value, the higher of the gain value and stiffness. Parameter values depend on the spindle drive unit model and load value.	25to 5000
3	Speed integral time constant 1	1.Set parameters speed integral time of spindle to motor 2. The smaller of the setting value, the faster of the integral value. The parameter values depend on the type and load of the spindle drive system	5to 32767
13	Speed ratio	1. Set parameters to the speed ratio of spindle to motor.	1 to 32767

	numerator of spindle to motor	2. PA-13 is the numerator and PA-14 is the denominator of the speed ratio. During operation, if the spindle makes three turns per time and the spindle motor makes five, the value of PA-13 is 5 and PA-14 is 3.	
14	Speed ratio denominator of spindle to motor		1 to 32767
37	Spindle orientation finished range	1. Set parameters to the minimum position error range in the spindle orientation finished. 2. When the position error is smaller than the value, the orientation-finished output switch (ORN_FIN) is connected.	0 to 100 Pulse
38	Spindle orientation speed	1. Set parameters to the spindle orientation speed.	40 to 600 (1r/min)
39	Spindle orientation position	1. Set parameters to the spindle orientation speed. The value is set by taking the zero pulse position of the motor encoder or spindle encoder as a reference.	-3276 to 32767
40	Incremental angle for indexing orientation	Set parameters to the incremental angle for indexing orientation	0 to 32767
44	Position proportional gain for orientation mode	1. Set parameters position proportional gain for orientation mode. 2. The larger of the setting value, the higher of the gain value and stiffness. Parameter values depend on the spindle drive unit model and load value.	10~2000
45	Flux current for orientation mode	1. Set parameters Flux current for orientation mode.	30~100
47	Spindle encoder	1. The spindle encoder resolution is four times of the frequency	1~32767

	resolution		
48	The offset angle for indexing orientation	1.Set parameters offset angle for indexing orientation	0~18

#### Parameters setting in the orientation mode:

1. The position loop feature is adjusted by setting **PA-44**.
2. The speed loop feature is adjusted by setting **PA-2** and **PA-3**.
3. The current loop feature is adjusted by setting **PA-27** and **PA-28**.
4. The flux current value is specified by multiplying **PA-53\*PA-33** by **PA-46**. For example, if **PA-53=100** (10A), **PA-33=60** (80%), **PA-46=110** (110%), the flux current value is  $100*60\%*110\%=66$  (6.6A)

#### A. Spindle Orientation

##### 1. Spindle motor optic-electrical encoder orientation

- In the spindle motor optic-electrical encoder orientation mode, connect the encoder to the input interface XS3 for feedback.
- Set **PA-13** (indicates speed ratio numerator of spindle to motor) to 1 and **PA-14** (indicates speed ratio denominator) to 1
- According to the actual requirement, set **PA-37**
- Set the control parameter **STA-13** to 0, and spindle optic-electrical encoder is used for position feedback, in this case, the command input/output interface XS4 outputs the position of the spindle optic-electrical encoder.
- Set the control parameter **STA-15** to 0, spindle motor optic-electrical encoder is used for orientation, and according to the actual requirement, set **STA-14** (indicates the spindle orientation direction).

- The spindle motor optic-electrical encoder orientation is applicable in the condition of the speed ratio of spindle to motor is 1:1.

#### **B. Spindle encoder orientation**

- In the spindle encoder orientation mode, connect the spindle optic-electrical encoder to the input interface XS3 for feedback, and connect spindle encoder to the interface XS2 for feedback.
- Set the movement parameter PA-25 (indicates the spindle motor optic-electrical encoder resolution) to 0 (indicates that the resolution is 1024), and set PA-47 according to the actual used spindle encoder.
- According to the actual requirement, set PA-37, PA-38, and PA-39, in this case, the range for spindle orientation position is from 0 to the value of PA-47.
- Set the control parameter STA-13 to 1, and the command interface uses spindle encoder to feedback position. In this case, the interface XS4 outputs the position of the spindle optic-electrical encoder.
- Set STA-15 to 1 (indicates spindle encoder orientation), and set STA-14 (spindle orientation direction) according to the actual requirement.

#### **Note:**

- To prevent interference, the interface XS2 adopts AM26LS32 differential receiver to receive differential input signal. The spindle encoder adopts the differential drive output mode with the AM26LS31, MC3487 or similar RS422 line drive.
- Connect the spindle encoder to a +5V power supply.

- The spindle motor optic-electrical encoder orientation is not applicable in the condition of the speed ratio of spindle to motor is 1:1.

### C. Zero switch Orientation

- In the zero switch orientation mode, connect A, B-phase of spindle motor optic-electrical encoder to the interface XS3 for feedback, disconnect the Z-phase of spindle motor optic-electrical encoder, and connect the Z-phase of zero switch to the XS3.
- Set **PA-13** (indicates speed ratio numerator of spindle to motor) to 1 and **PA-14** (indicates speed ratio denominator) to 1, set **PA-25** (indicates the spindle optic-electrical encoder resolution) to 0 (indicates that the resolution is 1024).
- According to the actual requirement, set **PA-37**, **PA-38**, and **PA-39**, in this case, the range for spindle orientation position is from 0 to  $4096 \times n$  (n indicates the speed ratio of spindle to motor).
- Set the control parameter **STA-13** to 0, and the command interface uses spindle motor optic-electrical encoder to feedback. In this case, the interface XS4 outputs the position of the spindle optic-electrical encoder.
- Set **STA-15** to 0 for spindle motor optic-electrical encoder orientation, and according to the actual requirement, set **STA-14** (indicating the spindle orientation direction).
- Zero switch orientation is applicable in the condition of the speed ratio of spindle to motor is 1:1.

#### Note:

- To prevent interference, the drive uses zero differential output switch.

## 7.2.7 Non standard motor parameter settings

Select HSV-180AS series spindle drive unit, refer to table7.3.

If the code cannot be found in Table 7.3, or use other manufacturers IM spindle motor, you must manually set the operating parameters. Details as follows:

1. Confirm whether the spindle motor specifications match with the drive unit specifications
2. Confirm whether the spindle drive unit is installed to support the spindle motor encoder.

3. Setting parameters according to the type of IM spindle motor:

Setting PA—41 to 2003

Setting PA—59 according to the type of spindle motor

HSV-180AS-035: Setting PA—59 to 1

HSV-180AS-050: Setting PA—59 to 102


HSV-180AS-075: Setting PA—59 to 203

HSV-180AS-100: Setting PA—59 to 304

HSV-180AS-150: Setting PA—59 to 405

According to the actual requirement, set PA—17, PA—24, PA—25, PA—33, PA—34, PA—35and PA—53

4. For non-standard spindle motors (other than the motor in Table 7.3), PA-33, according to the following method to adjust the parameters: spindle motor running at a constant speed by no loading ,

Observe , appropriately transfer PA-33 to ensure that the display is 20,000 which is a appropriate value.

5. Setting PA—41 to 1230, saving parameters in the secondary menu , and restart the drive unit.
6. Confirmation weather phase sequence of the spindle motor is correct.
7. Drive unit access systems up to running after confirmation.

## 7.3 Control Parameter Mode

Series HSV-180S spindle drive unit provides 16 control parameters, see Table 7-6,7-7. For the parameter operation, setting, modifying and saving.

### 7.3.1 Control Parameter

Table 7-6 Control Parameters(state control number is 1 )

NO.	Parameter	Function	Description
0	STA-0	Command source selection	0: setting Parameters according to PA20 1: NCUC

1	STA-1	This parameter is used to specify the direction of position command pulse or the inversion of speed command input.	0: Normal direction
			1: Opposite direction of position command pulse or speed command.
2	STA-2	This parameter is used to specify whether feedback break-off alarm is allowed.	0: Allow
			1: Not allow
3	STA-3	This parameter is used to specify whether system overspeed alarm is allowed.	0: Allow
			1: Not allow
4	STA-4	This parameter is used to specify whether position over-tolerance alarm is allowed.	0: Allow
			1: Not allow
5	STA-5	This parameter is used to specify whether system overload alarm is allowed.	0: Allow
			1: Not allow
6	STA-6	This parameter is used to specify whether the internal SVR-ON control start is allowed.	1: Internal enable 0: External enable
7	STA-7	This parameter is used to specify whether system main power undervoltage alarm is allowed.	1: Not allow 0: Allow
8	STA-8	This parameter is used to specify whether control mode switch is allowed.	1: Allow 0: Not allow
9	STA-9	Reserved	
10	STA-10	This parameter is used to specify whether select the external switch orientation	0: Not select 1: select
11	STA-11	This parameter is used to specify whether spindle encoder A, B phase exchange is	1: Allow 0: Not allow

		allowed.	
12	STA-12	This parameter is used to specify whether motor overheat alarm is allowed.	1: Not allow 0: Allow
13	STA-13	Command interface uses spindle encoder or spindle motor optic-electrical encoder to feedback.	1: Spindle encoder feedback 0: Spindle motor optic-electrical encoder feedback
14	STA-14	This parameter is used to set the spindle orientation rotary direction.	1: Reverse orientation (CW) 0: Forward orientation (CCW)
15	STA-15	This parameter is used to set the spindle encoder orientation or spindle motor optic-electrical encoder orientation	1: Spindle encoder orientation 0: Spindle motor optic-electrical encoder orientation

### 7.3.2 Extended control parameters

Figure 7-7 Description of the extended control parameters  
(State control word 2)

NO.	Parameter	Function	Description
0	STB-0	This parameter is used to set speed feedback filter	0: First-order low-pass filter.
			1: Second-order low-pass filter
1	STB-1	This parameter is used to set type of spindle motor	0: IM spindle motor
			1: PM spindle motor
2	STB-2	This parameter is used to set methods of IM Weak magnetic	0: Closed-loop control method
			1: Open-loop correction method
3	STB-3	IMSlip compensation selection	0: No compensation
			1: compensation
4	STB-4	Whether the drive unit Overheating alarm is allowed	0: Allowed
			1: Not allowed
5	STB-5		
6	STB-6	PWM frequency	0: 10K



		Selection	1: 5K
7	STB-7		
8	STB-8		
9	STB-9		
10	STB-10		
11	STB-11		
12	STB-12		
13	STB-13		
14	STB-14		
15	STB-15	Lock control of the operation keys	0: Do not lock the operation keys
			1: Lock keys (Unlock:SET+MODE)

## 8. Operation and Modification

Caution
<ul style="list-style-type: none"> <li>● The spindle drive and motor must be reliably grounded, and PE terminal must be connected with the grounded terminal of the equipment reliably.</li> <li>● The power can be connected only after the wiring is correct.</li> <li>● Emergency stop circuit must be provided to make sure the power could be stopped at once in case of emergency.</li> <li>● If a drive alarm is reported, make sure the alarm is cleared</li> </ul>

and the spindle enable input signal (EN) is ineffective before restarting the drive unit.

- After the spindle drive and motor are power off, do not touch the spindle drive within 5 minutes to avoid electronic shock.
- Be cautious to prevent burning as the temperature may get higher after the spindle drive and motor running for a period of time.

## 8.1 Power Connection

### 8.1.1 Checking Before Running

After the installation and connection is completed, check the following items before power on:

- Whether the type of drive unit HSV-180AS-200 and above is correct and reliable? Whether the input voltage is correct?
- Whether the strong power terminal (L1、L2、L3、U、V、W、P、BK、PE) is correct and reliable? Whether the input voltage is correct?
- Whether the power lines or motor lines is short circuited or grounded.
- Whether the encoder cable connection is correct?
- Whether the control signal terminal connection is correct? Whether the polarity and size are proper?
- Whether the spindle drive and motor are fixed firmly?

### 8.1.2 Power On Sequence

- For HSV-180AS-035, 050, 075, 100, 150, connect the main circuit power (three-phase AC380V) and external DC 24V power supply. The digital tube of the spindle drive is light, spindle alarm (ALM) is disconnected, and the failure chain relay normally-open contact on interface XS5

closed. If an alarm is reported, power the spindle drive off and check the trouble.

- For HSV-180AS-200, 300, 450, connect the drive unit control power (single-phase AC380V) and external DC 24V power supply. The digital tube of the spindle drive is light, spindle alarm (ALM) is disconnected, and the failure chain relay normally-open contact on interface XS5 closed. If an alarm is reported, power the spindle drive off and check the trouble. If an alarm is not appear, connect the main circuit power (three-phase AC380V)
- After 1 second, the spindle enable signal (EN) is received. If the spindle drive have no faults and the spindle enabling function is effective, the motor is activated and in the state for running. If an alarm is reported and the spindle enabling function is ineffective, the motor is idle. At this time, power off the main circuit power and check the trouble.
- In the external speed running mode (analog interface), the PC outputs the spindle forward (FWD) or spindle reverse (REW) control signal to spindle drive. And operate PC to send analog command to spindle drive. The motor runs according to the command.
- In the position running mode (pulse interface) or the external speed running mode (pulse interface), the PC to send pulse command to spindle drive. The motor runs according to the command.

### **8.1.3 power connection and alarm sequence**

Figure 8-1 HSV-180AS-035, 050, 075, 100, 150 Sequential diagram for power connection (analog command)

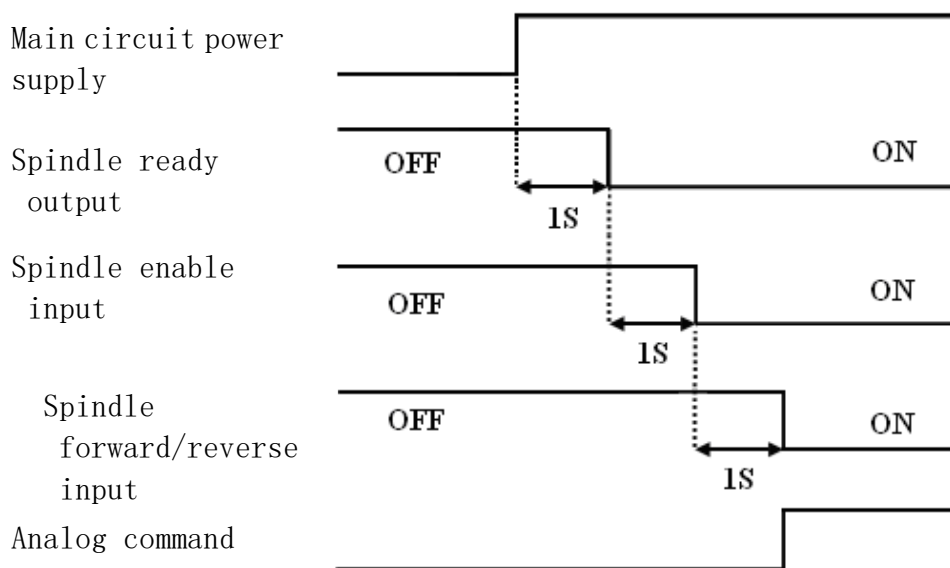


Figure 8-2 HSV-180AS-200, 300, 450 Sequential diagram for power connection (analog command)

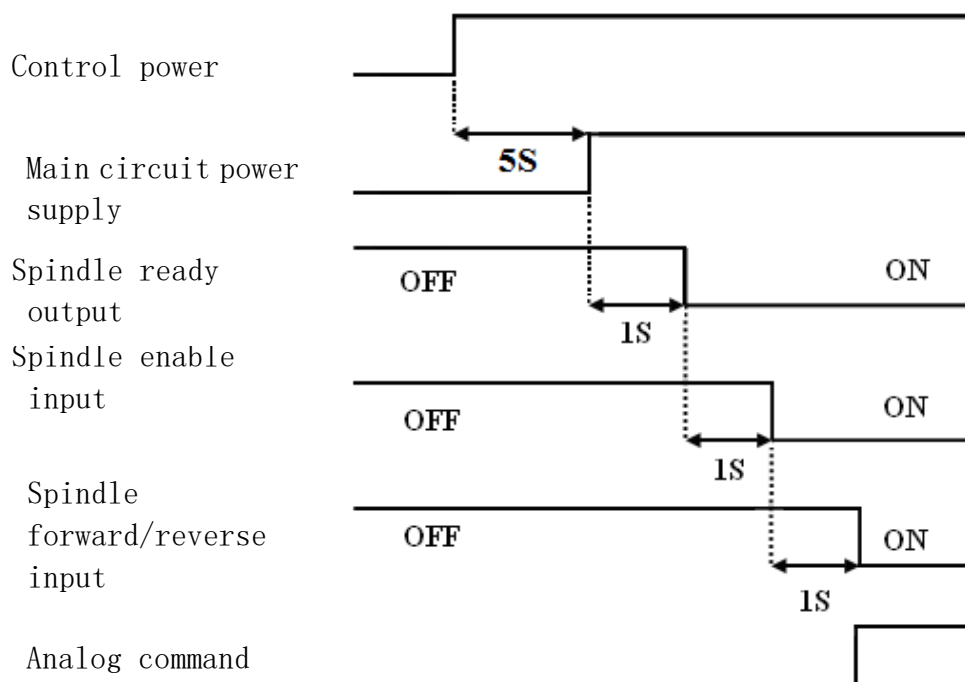


Figure 8-3 HSV-180AS-035, 050, 075, 100, 150 Sequential diagram for power connection (pulse command)

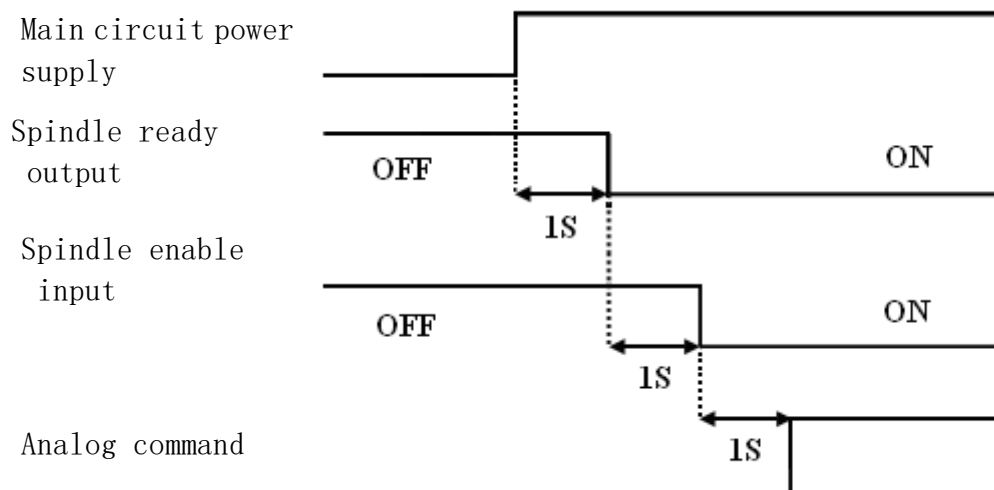


Figure 8-4 HSV-180AS-200, 300, 450 Sequential diagram for power connection (pulse command)

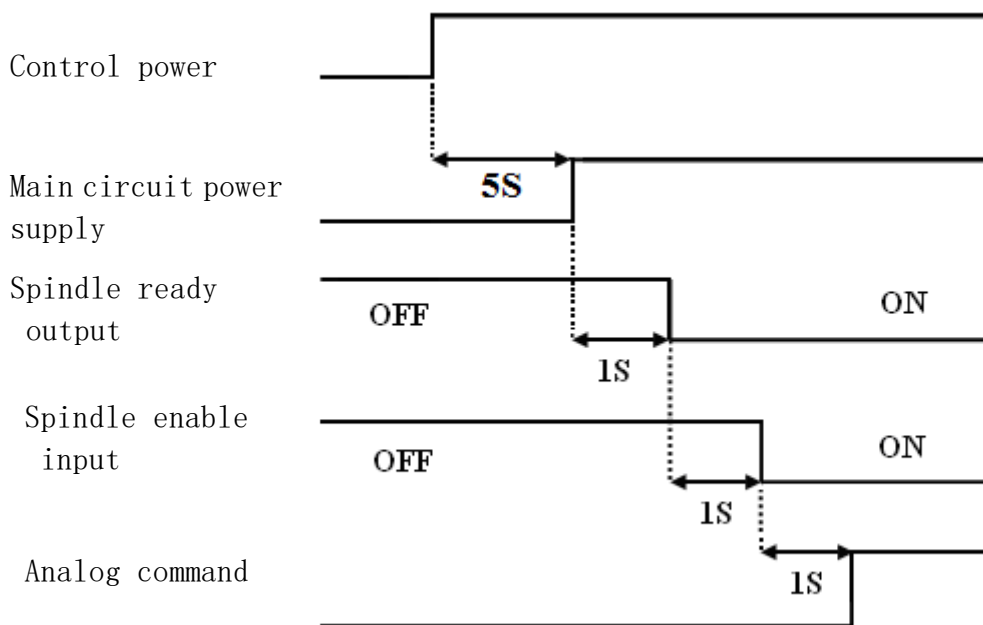
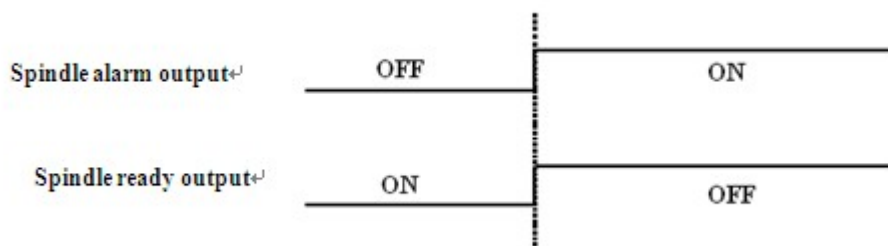


Figure 8-5 Sequential diagram for alarming



Note:

When a spindle drive alarm is reported, cut off the external control circuit power immediately based on the spindle alarm output signal (ALM) or the failure chain input/output terminal XS5.

#### 8.1.4 Power Off Sequence

- For HSV-180AS-035, 050, 075, 100, 150, disconnect the main circuit power (three-phase AC380V) of the spindle drive. If the spindle enable signal (EN) keep outputting "ON" signal, **A-1** (indicates main power low-voltage) is displayed, the green enable light (EN) on the drive unit panel is off, and the red alarm light (AL) is on (indicates alarm).
- For HSV-180AS-200, 300, 450, firstly disconnect the main circuit power (three-phase AC380V) of the spindle drive, and then disconnect the drive unit control power (single-phase AC380V) and external DC 24V power supply. When spindle detect heavy electricity disconnected, if the spindle enable signal (EN) keep outputting "ON" signal, **A-1** (indicates main power low-voltage) is displayed, the green enable light (EN) on the drive unit panel is off, and the red alarm light (AL) is on (indicates alarm).
- After disconnect the main circuit power, the internal capacitor storage energy of the spindle drive could not be released immediately. Do not connect nor disconnect wire within five minutes.
- Avoid frequently turning on and off the main circuit power in a short period of time, which may damage the soft-start circuit.

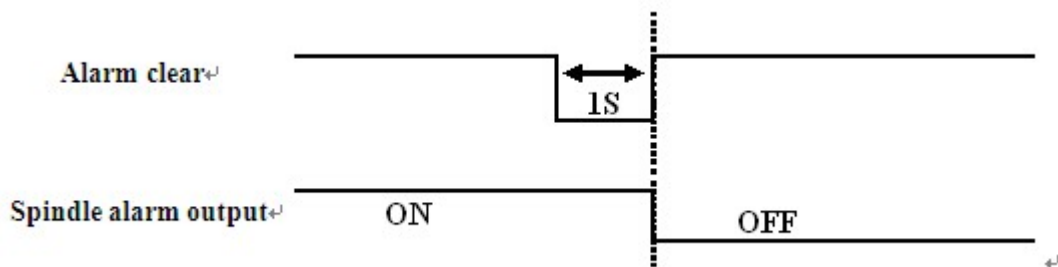
#### 8.1.5. Alarm Clear

There are three methods to clear the alarm:

- Turn off the power (three-phase main power), after the fault source is cleared; repower the spindle drive to clear the alarm. (Some alarm can only be cleared by this method).

- Do not turn off the power, after the fault source is cleared, and enter the auxiliary mode to reset the internal alarm to clear the alarm. After the alarm is reset, the red alarm light is off (indicating the alarm is cleared), the spindle alarm (ALM) output is disconnected and the failure chain relay normally-open contact on the input/output terminal XS5 is connected.
- Do not turn off the power, after the fault source is cleared, reset the external alarm to clear the alarm via the alarm clear input signal (ALM\_RST), see Figure 8-4. After the alarm is reset, the red alarm light is off (indicates the alarm is cleared), the spindle alarm (ALM) output is disconnected and the failure chain relay normally-open contact on the input/output terminal XS5 is connected.

Figure 8-4 Sequential diagram for external alarm clear



## 8.2 Trial Operation

Before operating any modes as follows, you must check whether the motor parameter setting of spindle drive and phase sequence of motor power line is right. Steps as follows:

- 1、For HSV-180AS-150 spindle drive and below, disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.
- 2、For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.
- 3、Modify control parameters and movement parameters:  
Setting STA—0 to 0, STA—6 to 1

According to the spindle drive and type of motor encoder, setting follow parameters: PA—41, PA—24, PA—25 and PA—59.

4、Changing PA—41 to 1230 after completing setting,, enter auxiliary parameter setting mode to save parameter, and turn off at last.

5、Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、If the spindle motor free running or alarm (A30 or A33) after power on and enable, motor phase sequence reversed, exchangeable motor power line V, W phase sequence.

**Note:** Operating 2 steps above, the motor shaft must be no load.

### 8.2.1 JOG Running Mode

1、For wiring, see Figure 5.8 in Chapter 5

2、 For HSV-180AS-150 spindle drive and below ,disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、 Modify control parameters and movement parameters:

Setting STA—0 to 0; Setting STA—6to 1;

According to the type of spindle drive, setting follow parameters STB—1 (IM: 0, PM:1) ;

Setting PA—41to 2003, PA—24, PA—25 and PA—59


4、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

5、Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.




For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、Connect the main circuit power (three-phase AC380V) of the spindle drive. If there are no alarms or abnormal situation, the green enable lamp (EN) is light, which indicates the drive is working properly. The motor is activated and in the zero speed state.

7、 In the auxiliary mode, select the JOG mode, and JOG— is displayed through the digital cube. Press  to enter into the JOG mode. RUN— is

displayed through the digital cube. Press and hold , the servo motor



runs at the JOG speed. Release , and then the motor stops and enters the zero-speed state. Press and hold , the motor runs at the JOG speed in the opposite direction. Release , and then the motor stops and enters the zero-speed state.

### 8.2.2 Internal Speed Running Mode

- 1、For wiring, refer to Figure 5.8 in Chapter 5
- 2、For HSV-180AS-150 spindle drive and below ,disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above ,disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

- 3、 Modify control parameters and movement parameters:

Setting STA-0to 0; STA-6to 1

Setting PA—41to 2003; PA—23to3;

Setting PA—24; PA—20to 0;

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—25 and PA--59;


- 4、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

- 5、 Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

- 6、 If there are no alarms or abnormal situation, the green enable lamp (EN) is light, which indicates the spindle drive is operating normal. The motor is activated and in the zero speed state.

- 7、 Set the movement parameter **PA-20** (internal speed). Press  to confirm, and then the motor will run at the specified speed.

### 8.2.3 External Speed Running Mode (Analog interface)

- 1、 For wiring, see Figure 5.8.2 in Chapter 5.
- 2、 For HSV-180AS-150 spindle drive and below ,disconnect motor cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、Modify control parameters and movement parameters:

Setting STA-0to 0; STA-6to0; PA—23to 1

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—41to 2003; PA—24,PA—25and PA--59

Setting PA—7 and PA—8

4、Save the parameter settings to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds.

5、Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、Verify no alarm or abnormal condition is reported. The green enable lamp (EN) is on, which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.

7、Use PC outputs forward or reverse control signal to the third pin (FWD) and the forth pin (REW) and outputs analog signal to the 27, 28, 12, 13 pin (GNDAM, AN+, AN-) on the command input/output interface XS4. The motor rotate forward or reverse.

#### **8.2.4 External Speed Running Mode (Pulse interface)**

1、For wiring, see Figure 5.8.3 in Chapter 5.

2、For HSV-180AS-150 spindle drive and below ,disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above ,disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、Modify control parameters and movement parameters::

Setting STA-0 to 0; STA-6to0; PA—23to 2;

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—41to2003;

Setting PA—24, PA—25,PA—59and PA—22.

4、Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

5、Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、 If there are no alarms or abnormal situation, the green enable light (EN) is on which indicates the spindle drive working properly. The motor is activated and in the zero speed state.

7、 PC sends pulse command to the 14、 15、 16、 17 (GNDAM、 AN+、 AN-) pins on the command input/output interface XS4. The motor runs according to the command.

### 8.2.5 Position Running Mode (Pulse interface)

1、 For wiring, see Figure 5.8.1 in Chapter 5.

2、 For HSV-180AS-150 spindle drive and below ,disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and a above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、 Modify control parameters and movement parameters:

Setting STA-0to 0; STA-6to 0; PA—23 to 0;

Setting PA—24

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—41to2003;

Setting PA—24, PA—25, PA—59and PA—22.

4、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

5、 Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、 If there are no alarms or abnormal situation, the green enable light (EN) is on, which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.

7、 The PC sends pulse command to the 14,15,16,17 pins on the command input/output interface XS4. The motor runs according to the command.

## 8.2.6 Switching Between External Speed Running Mode (Analog Interface) and Position Running Mode

- 1、For wiring, see Figure 5.8.4 in Chapter 5.
- 2、For HSV-180AS-150 spindle drive and below, disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.  
For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.
- 3、Modify control parameters and movement parameters:  
Setting STA-0 to 0; STA-6 to 0; PA-23 to 0;  
Setting PA-24  
According to the type of spindle drive, setting parameter STB-1 (IM: 0, PM:1);  
Setting PA-41 to 2003;  
Setting PA-25, PA-59, PA-7, PA-8 and PA-22.
- 4、Save the parameter to EEPROM after setting PA-41 to 1230. Turn off the power, wait for 30 seconds
- 5、Connect encoder and power line of motor:  
For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.  
For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.
- 6、If there are no alarms or abnormal situation, the green enable light (EN) is on, which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.
- 7、Switching between external speed running mode (analog interface) and position running mode is controlled by the 26 pin (Mode\_SW) on interface XS4 (indicating the switch input for control mode switching). When the **Mode\_SW** is **OFF**, the spindle runs under the analog speed mode. Use PC to output forward or reverse control signal to the third pin (FWD) and the fourth pin (REW) on XS4 and output analogue signal to the 27, 28, 12, 13 pin (GNDAM, AN+, AN-) on XS4. The motor rotates forward or reverse. When the **Mode\_SW** is **ON**, the spindle runs under the position running mode. Operate PC outputs pulse command to the 14, 15, 16, 17 pin (CP+, CP-, DIR+, DIR-) on the XS4 interface. The motor runs according to the command.

### 8.2.7 Switching Between External Speed Running Mode(Pulse Interface) and Position Running Mode(Pulse Interface)

- 1、For wiring, see Figure 5.8.5 in Chapter 5.
- 2、For HSV-180AS-150 spindle drive and below , disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.  
For HSV-180AS-200 spindle drive and above , disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.
- 3、Modify control parameters and movement parameters:  
Setting STA-0 to 0; STA-6 to 0; STA-8 to 1  
Setting PA-23 to 1  
According to the type of spindle drive, setting parameter STB-1 (IM: 0, PM:1) ;  
Setting PA-41 to 2003;  
Setting PA-24, PA-25, PA-59 and PA-22.  
Save the parameter to EEPROM after setting PA-41 to 1230. Turn off the power, wait for 30 seconds.
- 5、Connect encoder and power line of motor:  
For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.  
For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.
- 6、If there are no alarms or abnormal situation, the green enable light (EN) is on, which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.
- 7、Switching between external speed running mode (analog interface) and position running mode is controlled by the 26 pin (Mode\_SW) on interface XS4 (indicates the switch input for control mode switching) .  
When the **Mode\_SW** is **OFF**, the spindle runs under the external speed mode. Use PC to output pulse command to the 14, 15, 16, 17 pin (CP+, CP-, DIR+, DIR-) on XS4. The motor runs according to the command. When the **Mode\_SW** is **ON**, the spindle runs under the position running mode. Use PC to output pulse command to the 14, 15, 16, 17 pin (CP+, CP-, DIR+, DIR-) on the interface XS4. The motor runs according to the command.

### 8.2.8 Spindle Orientation

- 1、For wiring, see Figure 5.8 Standard wiring diagram in Chapter 5.

2、 For HSV-180AS-150 spindle drive and below , disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above , disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、 Modify control parameters and movement parameters:

Setting STA-0 to 0; STA-6 to 0;

Setting PA-23 to 1 or 2

According to the type of spindle drive, setting parameter STB-1 (IM: 0, PM:1) ;

Setting PA-41 to 2003;

Setting PA-24, PA-59.

According to the actual operation, set PA-37, PA-38, PA-39 PA-47, STA-13 , STA-14 and STA-15

4、 Save the parameter to EEPROM after setting PA-41 to 1230. Turn off the power, wait for 30 seconds

5、 Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、 If there are no alarms or abnormal situation, the green enable light (EN) is on which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.

7、 Output the control signal for spindle orientation begin to the 25 pin (ORN) on the XS4 command input/output interface. The spindle motor orientate at the preset spindle orientation speed. When the deviation between the actual position and preset orientation position is equal or less than the preset range for spindle orientation finished, the 30 pin (ORN\_FIN) on the XS4 outputs signal for spindle orientation finished. When the output signal is absent, the state of spindle orientation is finished.

### **8.2.9 Spindle Indexing Incremental Orientation**

1、 For wiring, see Figure 5.8 Standard wiring diagram in Chapter 5.

2、 For HSV-180AS-150 spindle drive and below , disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、 Modify control parameters and movement parameters:

Setting STA-0 to 0; STA-6 to 0;

Setting PA—23 to 1 or 2

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—41to2003;

Setting PA—24, PA—25, PA—59

According to the actual operation, set PA—37, PA—38, PA—39 PA—47, STA-13 , STA-14 and STA-15

4、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

5、 Connect encoder and power line of motor:

For HSV-180AS-150 and below specifications: only need to connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

6、 If there are no alarms or abnormal situation, the green enable light (EN) is on, which indicates the spindle drive working properly. The motor is activated and in the zero speed state.

7、 Output the control signal for spindle orientation begin to the 25 pin on XS4. The spindle motor orientates at the preset spindle orientation speed. When the deviation between the actual position and the preset orientation position is equal or less than the preset range for spindle orientation finished, the 30 pin (ORN\_FIN) on the XS4 outputs signal for spindle orientation finished.

Output the control signal for indexing incremental orientation to the 26 pin (Mode SW) on the XS4 and the indexing incremental orientation is begin. When the orientation is finished, the 30 pin (ORN\_FIN) on XS4 outputs spindle orientation finished signal. When the control signal for orientation begin (ORN) is absent, the state of spindle indexing incremental orientation is finished.

### 8.2.10 Full closed-loop

1、 For wiring, see Figure 5.8 Standard wiring diagram in Chapter 5.

2、 For HSV-180AS-150 spindle drive and below , disconnect motor coding cable and motor power line, connect the main circuit power (three-phase AC380V) of the spindle drive.

For HSV-180AS-200 spindle drive and above, disconnect motor coding cable and motor power line, connect the main circuit power (single-phase AC220V) of the spindle drive.

3、 Modify control parameters and movement parameters:

Setting STA-0to 0; STA-6to 0;

Setting PA—13 to 0; STA-15 to 0

According to the type of spindle drive, setting parameter STB--1 (IM: 0, PM:1) ;

Setting PA—41to2003;

Setting PA—24, PA—25, PA—59

4、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

5、 Connect encoder of motor:

For HSV-180AS-150 and below specifications: connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: connect single-phase AC220V of control power.

6、 Manually rotate the spindle motor, observe the value of DP-PFL, DP-PFM, confirm the count direction of feedback pulse when reversing.

7、 Modify the parameters to make the system run in closed loop mode:

Setting STA-13, STA-15 and PA—47

8、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

9、 Connect encoder of spindle:

For HSV-180AS-150 and below specifications: connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: connect single-phase AC220V of control power

10、 Manually rotate the spindle motor, observe the value of DP-PFL, DP-PFM, confirm the count direction of feedback pulse when reversing is consist with the direction as steps 6

If the count direction is not consist with the direction as steps 6, set STA-11 to 1, and invert spindle encoder feedback pulse.

11、 Save the parameter to EEPROM after setting PA—41to 1230. Turn off the power, wait for 30seconds

12、 Connect power line of motor:

For HSV-180AS-150 and below specifications: connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

13、 Adjust parameters PA-17, PA-21 to be smaller, test by JOG point dynamic. If tests are normal, turn off the power, and wait 30 seconds.

14、 Connect command line of motor:

For HSV-180AS-150 and below specifications: connect the three-phase AC380V of strong electric.

For HSV-180AS-200 and above specifications: Firstly connect single-phase AC220V of control power, and then connect the three-phase AC380V of strong electric.

15 、 If there are no alarms or abnormal situation, the green enable light (EN) is on, which indicates the spindle drive is working properly. The motor is activated and in the zero speed state.



16、.Operate PC outputs pulse command to the 14, 15, 16, 17 pin (CP+, CP-, DIR+, DIR-) on the XS4 interface. The motor run according to the command.

## 9 Fault Troubleshooting

### Caution

- Maintenance personnel must have related knowledge and abilities.
- Do not touch the spindle drive or motor within five minutes after power-off to prevent electric shock or burns.
- If a spindle drive alarm is reported, do not use the spindle drive only after the alarm is cleared based on the alarm code.
- Before the alarm reset, make sure that the EN signal is ineffective to prevent accidents caused by a sudden start.

### 9.1 Protection and Fault Identification

1. Series HSV-180AS of spindle drive provides 30 different protection functions and fault identification. If one protection function is activated, alarm information can be displayed through the digital tube on the spindle drive panel, the spindle alarm output (ALM) is connected, and the failure chain relay normally-open contact on the input/output terminal XS5 is disconnected.
2. It is required to connect the alarm output (ALM) or XS5 terminal to the PC. When the protection function of the spindle drive is activated, the PC can promptly take emergency measures.
3. After the fault source is cleared, you can turn off three-phase main power , and then the repower the spindle drive to clear the alarm, or enter the auxiliary mode to reset the internal alarm to

clear the alarm, or reset the external alarm to clear the alarm via the alarm clear input signal (ALM\_RST).

4. The protection function with "\*" cannot be cleared by resetting the external or internal alarm. It can only be cleared by cutting off the power, and then repower the spindle drive after the fault source is cleared.

Table 9.1 Alarm information

No.	Alarm Type	Description
0	Normal	No alarming
1	Under-voltage supply	Whether the three-phase main voltage is c? Whether the three-phase main voltage is too low?
2	Over-voltage supply	Whether the built-in braking resistor of drive unit is intact? Whether external braking resistor specifications and wiring is correct? Whether the circuit power supply voltage is too high?
3	IPM failure◆	Whether the cooling of drive unit is normal? Whether the system is overload? Whether parameter settings are appropriate? Whether connection of motor power line is correct and reliable ? Whether connection of Shielded cable is complete, and reliable?
4	Brake failure◆	Whether external braking resistor is correct? Whether external braking resistor specifications and wiring is correct?
5	Reserved	
6	Motor overheat	Temperature of motor is too high STA-12 is set to 1to shield alarm
7	The encoder data signal error	Whether encoder cable is connected and reliable? Whether the encoder cable is too long?
8	The type of encoder error	Whether encoder cable is connected? Whether setting of P-25 is correct ?

9	system software overheat	Whether the phase sequence of motor power line is correct?
10	Overcurrent◆	Whether setting of PA--10、PA--18、PA--19 is correct? Whether setting of PA--26 is correct? Whether the drive unit is overload?
11	Motor overspeed	Whether setting of PA--17 is correct? Whether the r feedback signal of encode is correct? If the system work in full closed loop mode: whether direction of full closed-loop feedback pulse is consistent with the direction of semi-closed loop feedback pulse?
12	Overlarge tracking deviation	Whether the phase sequence of motor is correct? Whether setting of P-12 is correct?
13	Motor overload for a long time	Whether setting of PA--18、PA--19 is correct? Whether the phase sequence of motor is correct?
14	Control parameters read fault◆	Resave parameters
16	Control board hardware failure◆	DSP and FPGA communication failure Resave parameters
17	Drive unit overheat	Temperature of the drive unit exceeds the set value (100℃) STB--4 is set to 1to shield alarm
18	Reserved	
19	ADConversion failure◆	ADconversion data communications failure or current sensor failure
23	Reserved	
24	Reserved	
25	Reserved	
26	Motor encoder signals Communication fault	Absolute encoder communication failure Whether the connection of encoder cable is correct? Whether parameter PA - 25 is consistent with the motor encoder?
29	Drive and motor model code matching fault◆	Whether setting of PA--59 is correct? If motor type is non-standard, refer to 6.5 modify parameters

30	phase sequence fault◆	The connection of U, V, W phase sequence of motor is wrong Exchange V, W phase sequence
31	Orientation fault	Function of spindle orientation is abnormal Check whether the feedback pulse of encoder is correct?
32	Z pulse encoder loss	Check the encoder cable
33	Overlarge speed deviation	Whether the motor phase sequence is reversed? Whether setting of PA--5、PA—6 is correct? Whether motor load and inertia matching is appropriate?

**Version history of HSV-180AS spindle drive:**

- 1 Series HSV-180AS spindle drive User's Manual V1.00 2012.4
  - a. Applicable to HSV-180AS-035, 050, 075, 100, 150, 200, 300, 450 spindle drive
  - b. Software version V 3.51