



# Servo Drive User Manual

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## Foreword

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This manual is for VD1 series Servo drive.

In order to use this series of Servo driver correctly, please read this manual carefully beforehand, and keep it for future use.

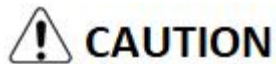
If user has any doubts about the function and performance of this device during use, please contact our technicians to get relevant help.

Wecon products are constantly being improved and upgraded. The contents of this manual are subject to change without notice.

This manual is suitable for beginners and intermediate readers. All interpretation rights of this book belong to Wecon company.



Serious injury or death may be caused by improper operation.



Moderate or minor injury and equipment damage may be caused by improper operation.

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# 1. Safety Instruction

## 1.1 Precautions for Safety

This section explains important items that users must observe, such as product confirmation, storage, transportation, installation, wiring, operation, inspection, and disposal. Follow the steps required in this manual for trial operation.

### **WARNIN**

- ◆ After the power is turned off for more than 5 minutes and the power indicator is off, use a multimeter to confirm that the voltage across the high-voltage capacitor has dropped to a safe voltage, and then perform the disassembly of the driver, otherwise electric shock may be caused due to residual voltage.
- ◆ Do not touch the inside of the Servo drive, otherwise electric shock may be caused.
- ◆ To avoid an electric shock, insulate the connections of the power supply terminals.
- ◆ To prevent an electric shock, always connect the protective earth (PE) terminal (marked) of the Servo to earth well.
- ◆ Install the Servo drive, Servo motor, and external brake resistor on incombustible material. Installing them directly or close to combustibles would lead to smoke or a fire.
- ◆ Always connect the magnetic contactor and the non-fuse breaker between the power supply and the main circuit power supply of the Servo driver (three-phase is L1, L2, L3). otherwise, when the device fails, the high current may not be cut off. This could cause a fire.
- ◆ Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the Servo drive and Servo motor.
- ◆ When the Servo motor and the machine are connected, if an operation error occurs, it would not only cause mechanical damage, but may also lead to personal safety accidents.
- ◆ Do not damage or pull the cable with force, do not subject the cable to excessive force, or place heavy objects under it, otherwise electric shock may occur, causing the product to stop operating or burn out.
- ◆ Do not use the brake function of motor for normal braking, otherwise it may cause a malfunction.
- ◆ Except for the designated operator, please do not set up, disassemble or repair the equipment, otherwise electric shock or injury may be caused.
- ◆ Do not remove the cover, cables, connectors, and optional accessories while the power is on. Otherwise, electric shock may occur.
- ◆ Install a stop device on the machine side to ensure safety.
- ◆ Please take measures to ensure that the personal safety would not be endangered when restarting, otherwise it may cause injury.
- ◆ Do not modify this product, otherwise it may cause personal injury or mechanical damage.

## 1.2 Precautions for Storage and Handling

### CAUTION

Please keep and install in the following environment:

- ◆ Locations without direct sunlight.
- ◆ Locations where the ambient temperature does not exceed the product specifications.
- ◆ Locations where the relative humidity does not exceed the product specifications.
- ◆ Locations where condensation does not occur due to rapid temperature changes.
- ◆ No corrosive gas or flammable gas.
- ◆ No flammable materials nearby.
- ◆ Locations with less dust, salt and metal powder.
- ◆ Locations without water, oil, medicine plashing etc..
- ◆ Locations where vibration or shock would not affect the product (places that exceed product specifications).
- ◆ Location that would not be exposed to radiation.

Storage or installation in environments other than those described above could cause product failure or damage:

Please use proper method for transportation according to the weight of the product.

Do not hold the motor cable or motor shaft for transportation.

When operating the Servo unit and Servo motor, pay attention to sharp parts such as the corners of the equipment.

## 1.3 Precautions for Installation

### CAUTION

- ◆ Do not install this product in a place where it would be splashed with water or an environment prone to cause corrosion.
- ◆ Please follow the requirements of the installation direction, otherwise it may cause equipment failure.
- ◆ When installing, please ensure that the specified distance between the Servo drive and the inner surface of the electrical cabinet and other machines is proper, otherwise fire or equipment failure may be caused.
- ◆ Do not apply excessive impact, otherwise it may cause equipment failure.
- ◆ Do not sit on this product or place heavy objects on it, otherwise personal injury may be caused.
- ◆ Do not use this product near flammable gas or combustible materials, otherwise there may be danger of electric shock or fire.
- ◆ Do not block the air intake and exhaust ports, and do not allow foreign matter to enter the product, or the equipment may be damaged due to the aging of internal components or cause a fire.

## 1.4 Precautions for Wiring

### CAUTION

- ◆ Do not connect three-phase power to the output terminals U, V, and W of the Servo drive, otherwise it may cause equipment damage or fire.
- ◆ Connect the Servo drive power output (U/V/W) to the Servo motor power input (U/V/W) directly. Do not let a magnetic contactor. Otherwise malfunction may be caused.
- ◆ When DO output is connected to the relay, please pay attention to the polarity of the freewheeling diode, otherwise the driver may be damaged and the signal may not be output normally.
- ◆ Please securely fix the power terminals and motor terminals, otherwise fire may be caused.
- ◆ Do not connect the 220V Servo drive directly to the 380V power supply.
- ◆ Do not pass power cables and signal cables through the same pipe or bundle them together. Power cables and signal cables should be separated by more than 30cm.
- ◆ Twisted shielded cables are used for signal lines and encoder cables, and the shield layers are grounded at both ends.
- ◆ The wiring length of the signal input line is recommended to be within 3M, and the wiring length of the encoder is recommended to be within 15M.
- ◆ When using in the following places, please take proper shielding measures:
  - When interference occurs due to static electricity.
  - Places with strong electric or magnetic fields.
  - Places where there may be radiation.
- ◆ When checking, make sure that the CHARGE indicator is off.

## 1.5 Precautions for Operation

### CAUTION

- ◆ During trial operation, in order to prevent accidents, please run the Servo motor with no load (not connected to the drive shaft), otherwise injury may be caused.
- ◆ When the Servo motor is running, do not touch rotating parts, otherwise injury may be caused.
- ◆ Be sure to set proper inertia ratio, otherwise vibration may be caused.
- ◆ When installing drive on a machine a, please set the parameters corresponding to the machine in advance. Otherwise it may cause the machine to run out of control or malfunction.
- ◆ When installing drive on a machine, please put the Servo motor in a state that could be stopped immediately at any time, otherwise injury may be caused
- ◆ When using a Servo motor on a vertical axis, install a safety device to prevent the workpiece from falling in an alarm or overtravel condition. In addition, please set the Servo lock stop when overtravel occurs, otherwise the workpiece may fall down during overtravel.
- ◆ Extreme parameter adjustments and setting changes could cause the Servo system to become unstable. Therefore, do not do this, otherwise injury may be caused.



- ◆ When an alarm occurs, reset the alarm after clearing the cause and ensuring safety, and restart the operation, otherwise injury may be caused.
- ◆ Except for special purposes, do not change the maximum speed value (P1-10). Inadvertent changes could damage the machine or cause injury.
- ◆ When the power is turned on and for a period of time after the power is turned off, the heat sink of the Servo driver, external regenerative resistor, Servo motor, etc. may become hot. Do not touch it, otherwise injury may be caused.
- ◆ If the power supply is restored after an instantaneous power failure during operation, the machine may restart suddenly, so please do not approach the machine, and press the non-stop button during power failure, and then operate after the power supply is stable

## 1.6 Precautions for Maintenance and Inspection

### CAUTION

- ◆ Power on and off operations should be performed by professional operators.
- ◆ During testing the insulation resistance of the driver, please cut off all connections with the driver first, otherwise it may cause drive failure.
- ◆ Do not use gasoline, alcohol, acid and alkaline detergents, otherwise discolored or damaged may be caused.
- ◆ When replacing the servo driver, please transfer the original servo driver user parameters to the new one before operation, otherwise equipment failure may be caused.
- ◆ Do not change the wiring while running, otherwise electric shock or injury may be caused.
- ◆ Do not disassemble the Servo Motor, otherwise electric shock or injury may be caused.

# 2. Product Information

## 2.1 Servo Drive Products

### 2.1.1 Servo Drive Model

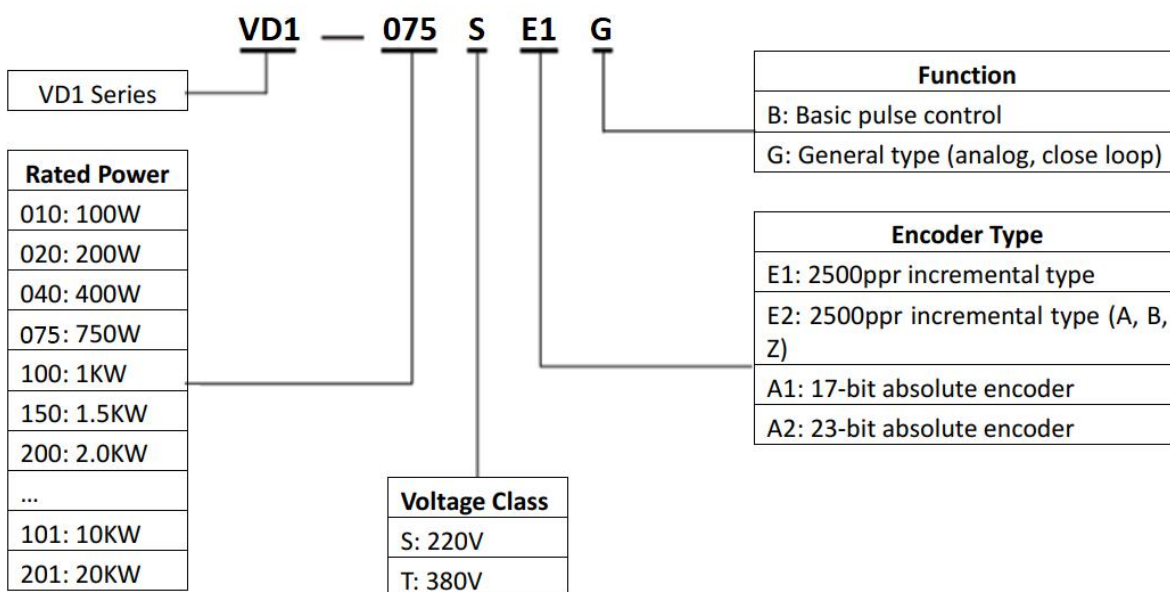


Figure 2- 1 Servo Drive Naming Rule

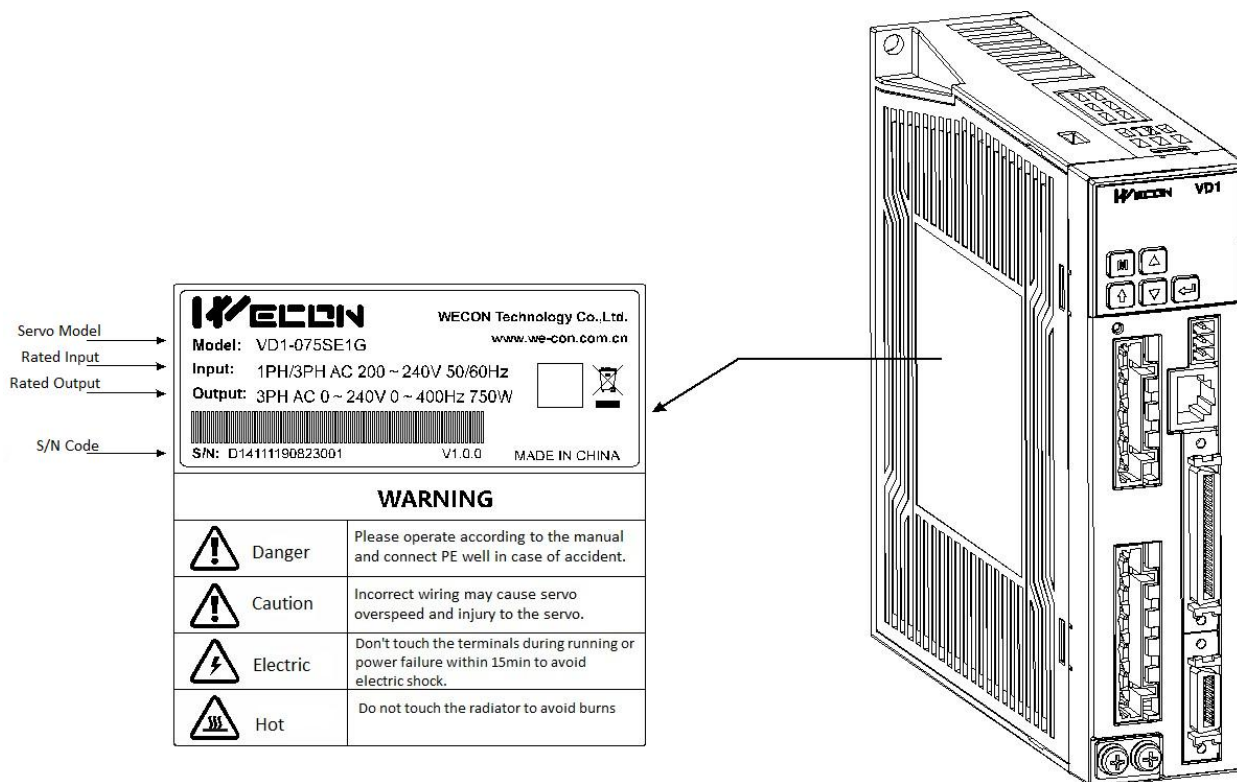


Figure 2- 2 Servo Drive Rating Plate

### 2.1.2 Servo Drive Parts Identification

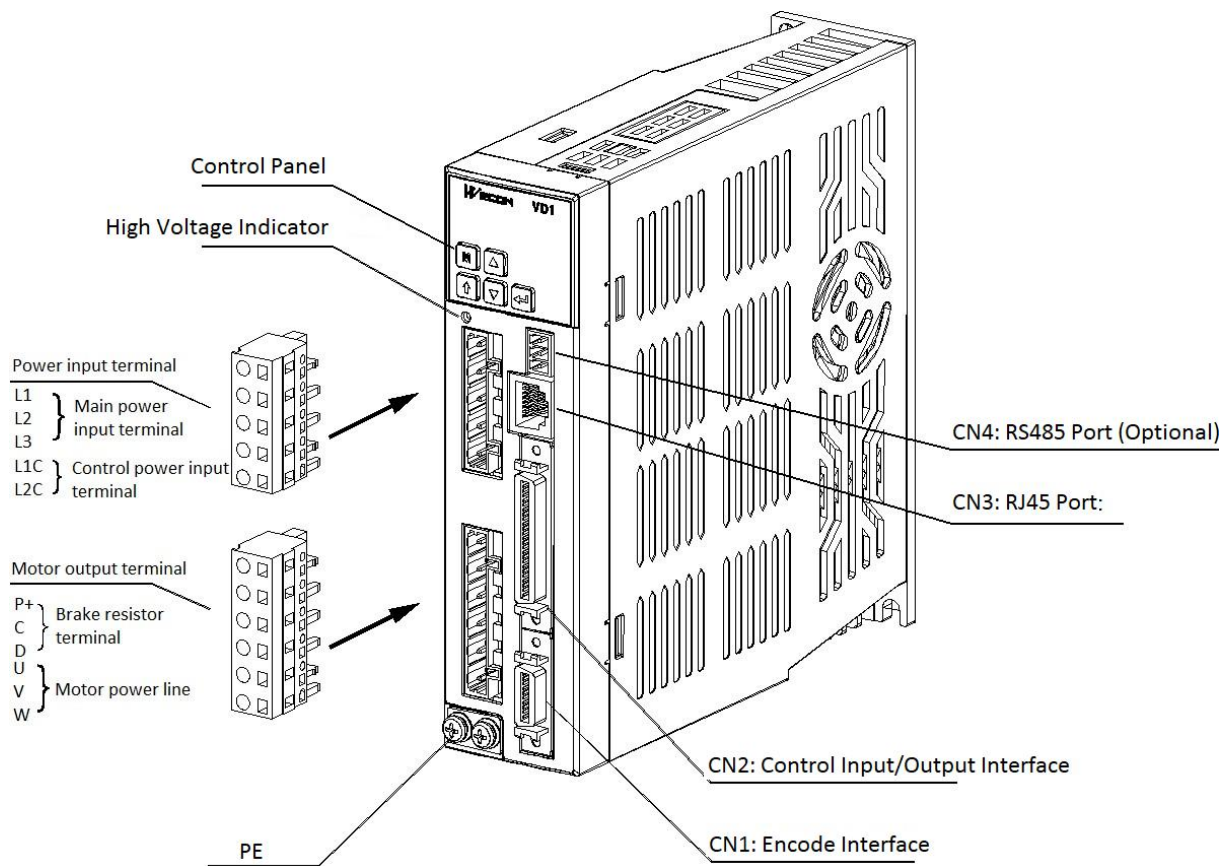
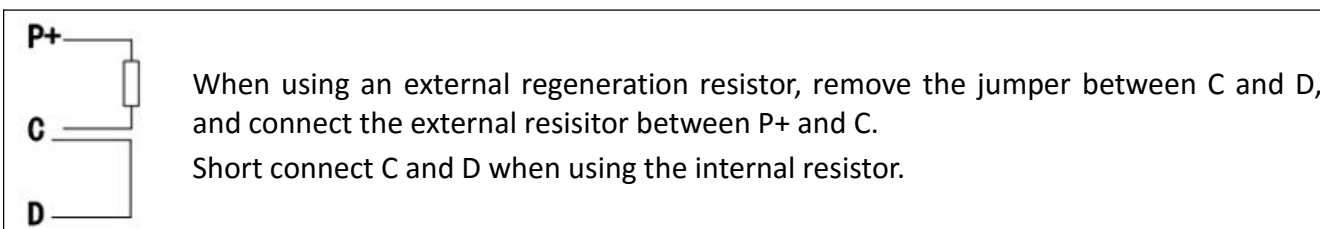


Figure 2- 3 Servo Drive Structure

**Note:**

When using an external regenerative resistor or an internal regenerative resistor, a short-circuit treatment is required, as shown in the figure below:



### 2.1.3 Specifications of the Servo Drive

Servo model	VD1-010Sxx	VD1-020Sxx	VD1-040Sxx	VD1-075Sxx
Output current (A)	1.8	2	2.8	4.1
Maximum output current(A)	5.5	7.5	8.6	12.5
Braking method	Built-in regenerative resistor, or external regenerative resistor			
Main circuit power	Single phase, 3 phases 220V -10%+10% 50/60Hz			
Control power	Single phase 220V -10%+10% 50/60Hz			

## 2.2 Servo Motor

### 2.2.1 Servo Motor Model Name

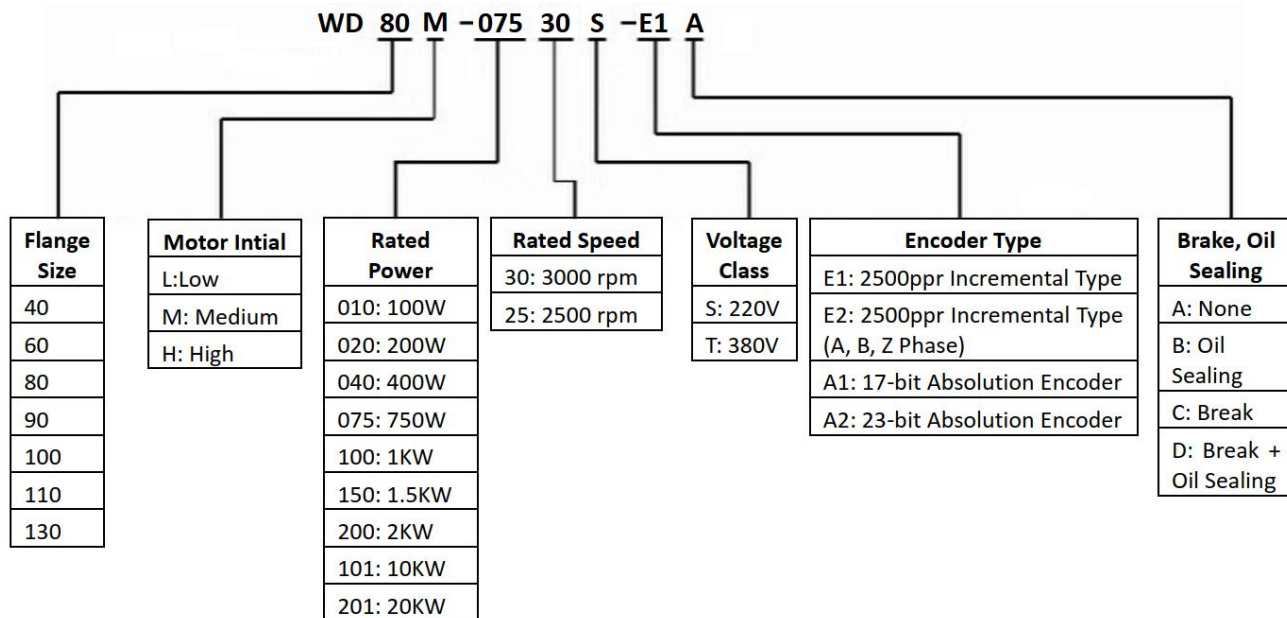


Figure 2- 4 Servo Motor Naming Rule

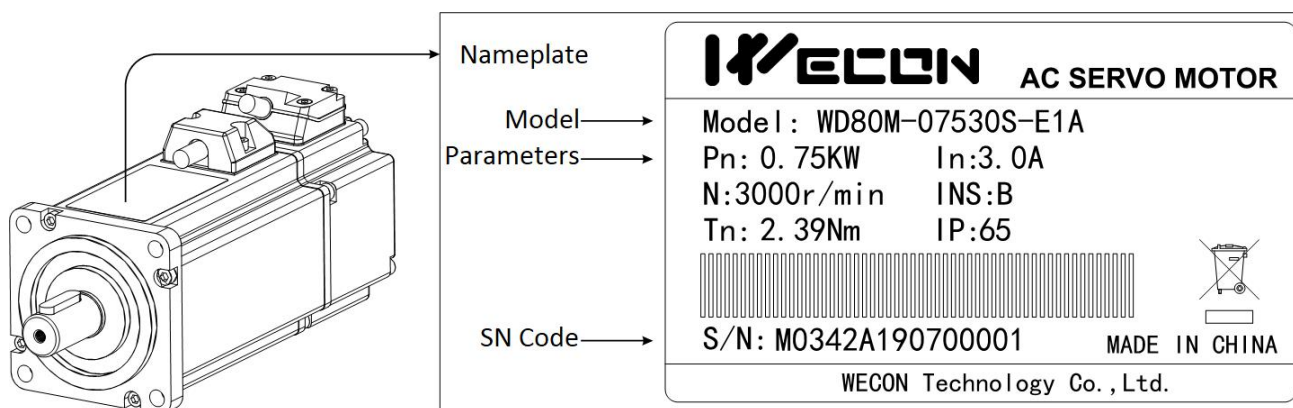


Figure 2- 5 Servo Motor Rating Plate

### 2.2.2 Servo Motor Parts Identification

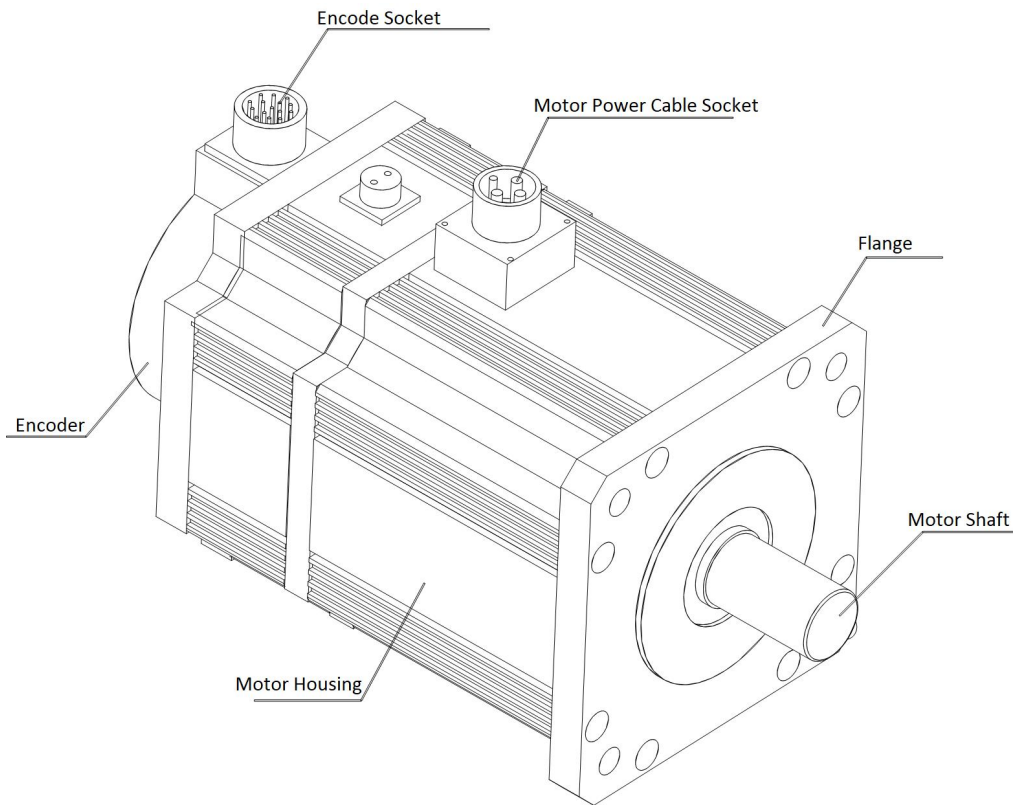


Figure 2- 6 Servo Motor Structure (1.0KW-2.3KW)

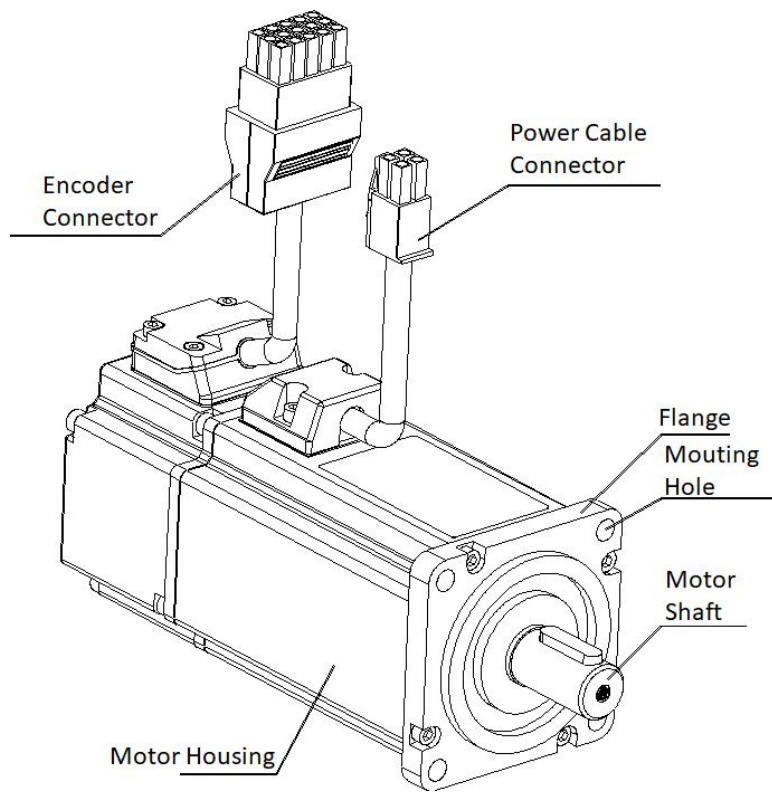


Figure 2- 7 Servo Motor Structure (400W-750W)

### 2.2.3 Specifications of the Servo Motor

Model	Flange (mm)	Rated Power (KW)	Rated Current (A)	Rated Torque (N.m)	Voltage (V)	Rated Speed (rpm)	Encoder Type	Motor Structure
WD60M-02030S-E1B	60	0.20	1.8	0.64	220	3000	2500ppr incremental	No break
WD60M-04030S-E1B	60	0.40	2.6	1.27	220	3000	2500ppr incremental	No break
WD80M-04030S-E1B	80	0.40	2	1.27	220	3000	2500ppr incremental	No break
WD80M-07530S-E1B	80	0.75	3	2.39	220	3000	2500ppr incremental	No break
WD80M-10025S-E1B	80	1.00	4.4	4	220	2500	2500ppr incremental	No break
WD130M-10025S-E1B	130	1.00	4	4	220	2500	2500ppr incremental	No break
WD130M-15015S-E1B	130	1.50	6	6	220	1500	2500ppr incremental	No break
WD130M-15025S-E1B	130	1.50	6	6	220	2500	2500ppr incremental	No break
WD130M-20025S-E1B	130	2.00	7.5	7.7	220	2500	2500ppr incremental	No break
WD130M-23015S-E1B	130	2.30	9.5	15	220	1500	2500ppr incremental	No break

## 3. Servo Drive and Servo Motor Installation

### 3.1 Servo Drive Installation

#### 3.1.1 Dimension (unit: mm)

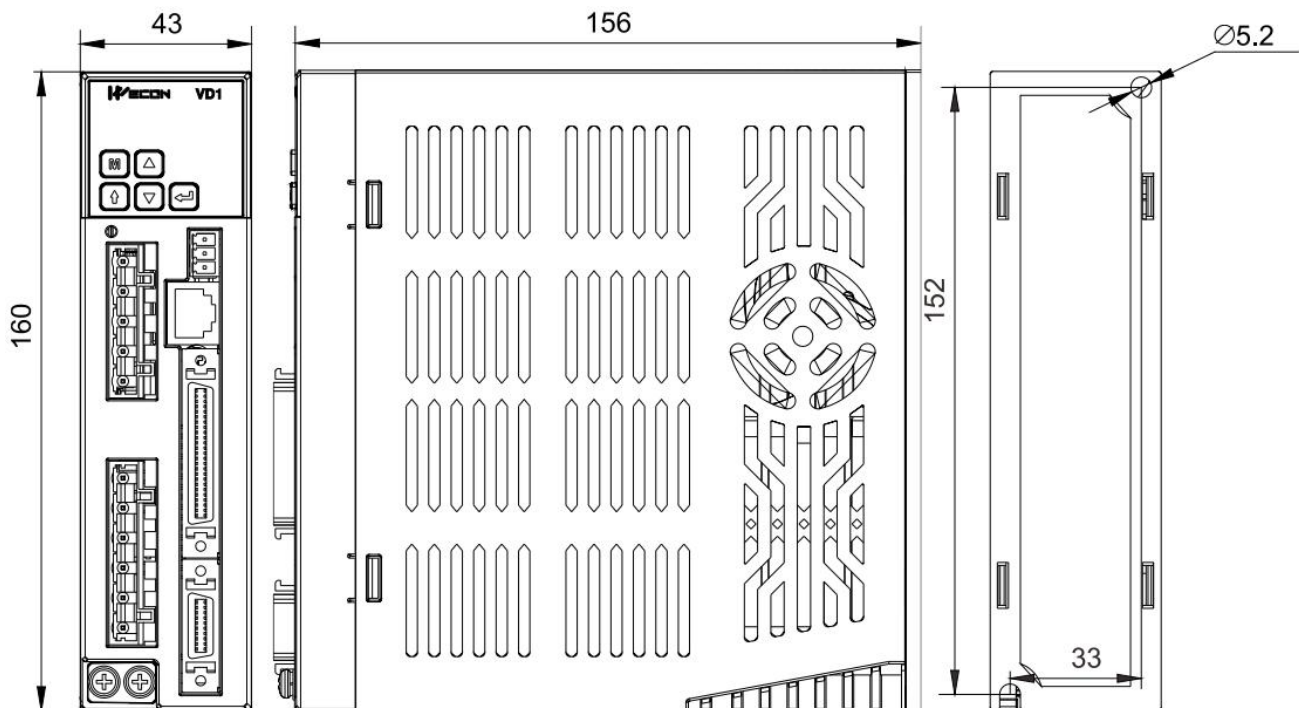


Figure 3- 1 Servo Drive Dimension

#### 3.1.2 Installation Site

- 1) Please install in the cabinet to keep out of sun and rain.
- 2) Location without vibration.
- 3) Please do not install in the environment of high temperature, humidity, dust, metal dust.
- 4) Do not use this product near the environment with corrosive and flammable gases such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, flammable materials, etc..



### 3.1.3 Installation Environment

The environment in which the Servo drive is installed has a direct impact on the normal function of the drive and its service life. Therefore, the environment in which the Servo drive is installed must meet **the following conditions**:

Item	Description
Operating temperature	-10°C-40°C (Non-freezing)
Operating enhumidity	-20%-90%RH (Non-Condensing)
Storage temperature	-20°C-60°C
Storage humidity	-20%-90%RH (Non-Condensing)
Protection class	IP65
Vibration	< 0.5G (4.9m/s <sup>2</sup> ),10-60Hz (Discontinuous operation)
Power system	TN system*

\*: The neutral point of the power system is directly connected to the ground, and the exposed metal components are connected to the ground through a protective ground conductor.

### 3.1.4 Installation Precaution

#### 1) Specification

In order to make the cooling cycle work well, during installing the Servo drive, ensure that there is sufficient ventilation space around it. Be sure to follow the installation standards in the control cabinet as shown in the figure below, otherwise the driver may fail.

**Typical installation dimensions:** see Figure 3-2 (a).

#### 2) Install side by side

When multiple units are installed in parallel, a minimum distance of 20mm between each other and a minimum distance of 100mm in the longitudinal direction are required (as shown in Figure 3-2 (b)). To prevent the high temperature, a cooling fan could be placed on the upper part. For smaller installation pitch, please consult our company.

#### 3) Installation direction

When installing the Servo drive, make the front side of the Servo drive (panel control interface) face the operator so that the Servo drive is perpendicular to the wall.



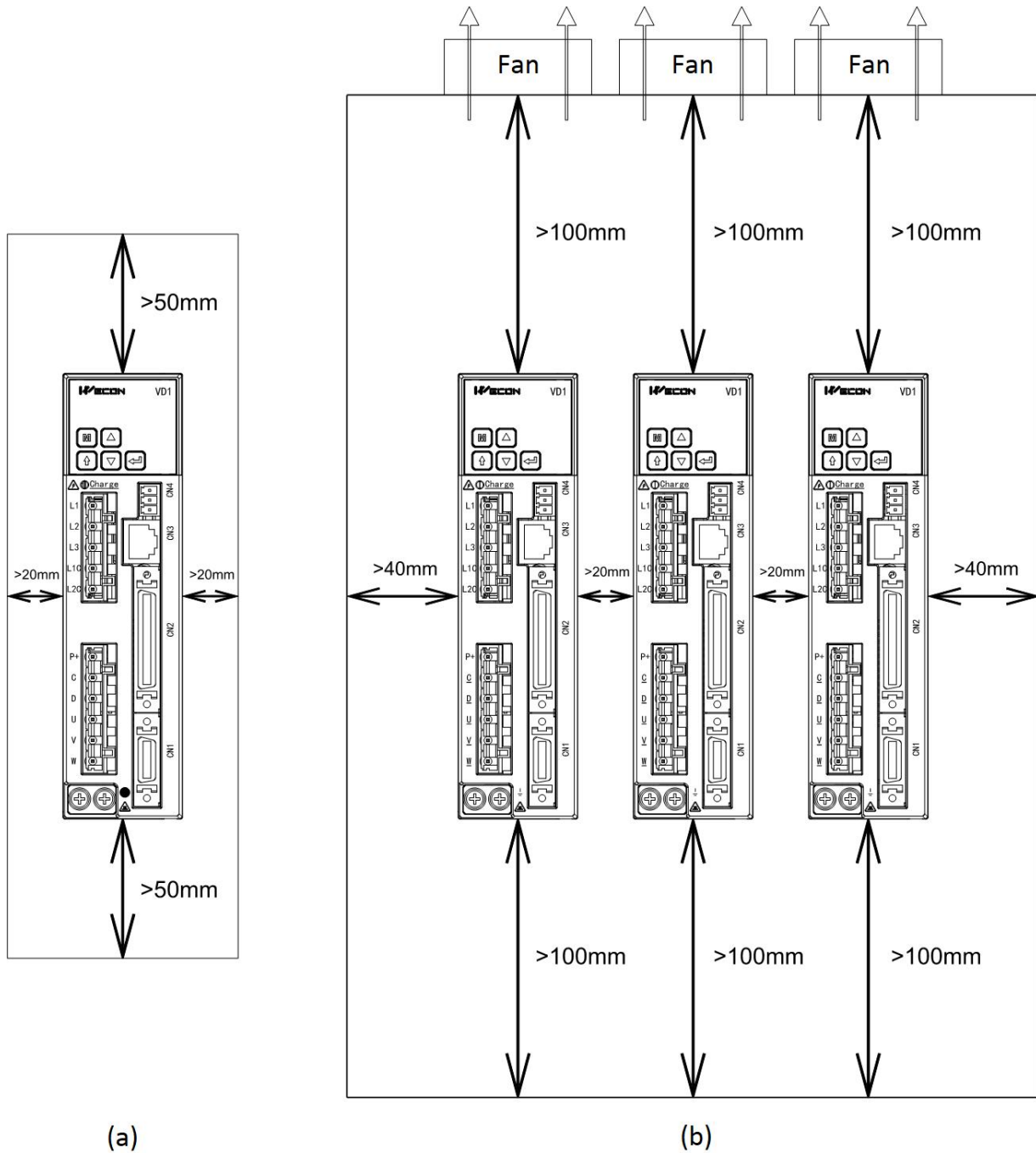


Figure 3- 2

## 3.2 Servo Motor Installation

### 3.2.1 Dimension (unit: mm)

#### 1) 60 Flange Series Motor

Specification	60 Flange Series Motor		
Rated torque(N.m)	0.64	1.27	1.91
LA without brake holding(mm)	109	135	156
LA with brake holding(mm)	157	183	204

~

Figure 3- 3 60 Flange Series Motor

#### 2) 80 Flange Series Motor

Specification	80 Flange Series Motor			
Rated torque(N.m)	1.3	2.4	3.5	4
LA without brake holding(mm)	124	151	179	191
LA with brake holding(mm)	166	193	221	233

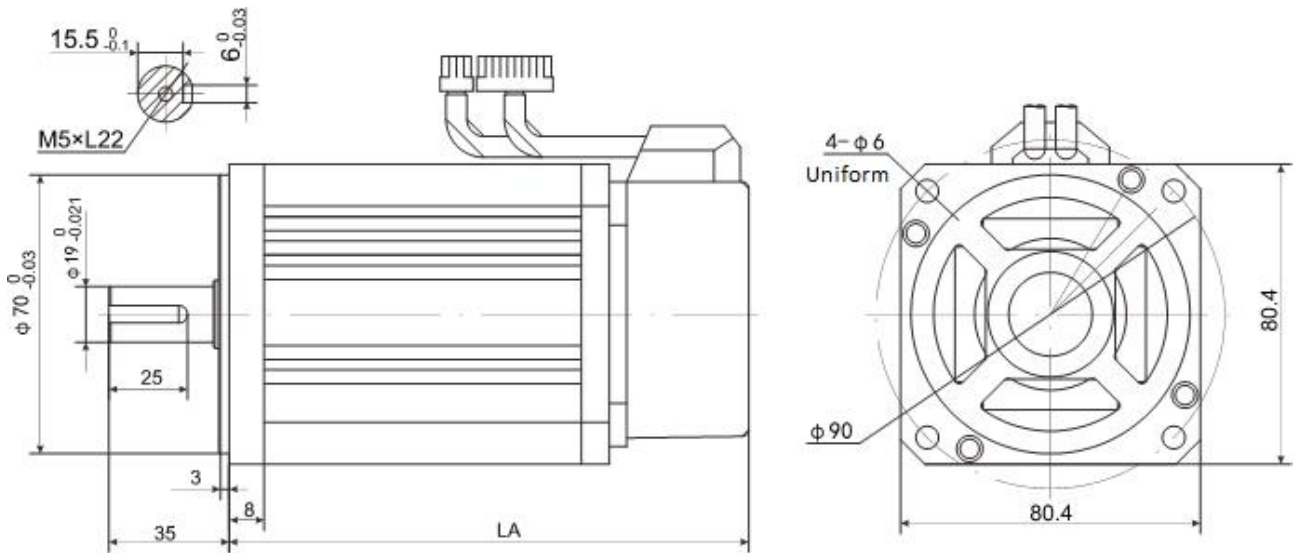


Figure 3- 4 80 Flange Series Motor

### 3) 130 Flange Series Motor

Specification	130 Flange Series Motor								
Rated torque(N.m)	4	5	6	7.7	10			15	
					1000 rpm	1500 rpm	2500 rpm	1500 rpm	2500 rpm
LA without brake holding(mm)	166	171	179	192	213		209	241	231
LA with brake holding(mm)	223	234	242	255	280		276	308	298

Figure 3- 5 130 Flange Series Motor

### 3.2.2 Installation Location

- 1) Do not use the motor near the environment where there is corrosion of hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, flammable gases, combustible materials, etc.
- 2) Do not remove the oil seal in places with grinding fluid, oil mist, iron powder, etc..
- 3) Do not use the motor in a closed environment. Closed environment would lead to high temperature of the motor and shorten the service life.
- 4) A place away from heat sources such as stoves.

### 3.2.3 Installation Environment

The installation environment of the Servo motor has a direct impact on the normal function of the motor and its service life. Therefore, the installation environment of the Servo motor must meet **the following conditions:**

Item	Description
Operating temperature	-10°C-40°C (Non-freezing)
Operating enhumidity	-20%-90%RH (Non-Condensing)
Storage temperature	-20°C-60°C
Storage humidity	-20%-90%RH (Non-Condensing)
Protection class	IP65
Vibration	< 0.5G (4.9m/s <sup>2</sup> ),10-60Hz (Discontinuous operation)

### 3.2.4 Installation Precautions

Item	Description
Rust Inhibitor	Before installation, please wipe off the [rust inhibitor] of the Servo motor shaft, then do the relevant antirust treatment.
Encoder	<ul style="list-style-type: none"> <li>● During installing a pulley on a Servo motor shaft with a keyway, use a screw hole on the shaft end. In order to install the pulley, first insert a stud into the screw hole of the shaft, use a washer on the surface of the coupling end, and gradually lock the pulley with a nut.</li> <li>● For a Servo motor shaft with a keyway, use the screw holes on the shaft end for installation.</li> <li>● For shafts without keyways, use friction coupling or similar methods.</li> <li>● When removing the pulley, the pulley remover should be used to prevent the strongly impact from the load.</li> <li>● To ensure safety, install a protective cover or similar device in the rotating area.</li> </ul>
Alignment	During connecting with the machine, use a coupling and keep the axis of the

	Servo motor and the axis of the machine in a straight line
Direction	Servo motor could be installed in horizontal or vertical direction
Oil and water countermeasures	<p>When using in a place with water drops, please confirm the protection level of the Servo motor before use. When using in a place with oil drops, do not remove the oil seal of the Servo motor.</p> <p>Conditions for using Servo motor with oil seal:</p> <ul style="list-style-type: none"> <li>● Please ensure that the oil level is lower than the lips of the oil seal when using.</li> <li>● The oil seal could be used in a state where there is splash of oil.</li> <li>● When the Servo motor is installed in vertical direction, be careful not to allow oil to accumulate on the lips of the oil seal.</li> </ul>
Stress condition of the cable	Do not [bend] or apply [tension] to the wires, especially the signal wires (diameter is 0.2mm or 0.3mm). During the wiring process, do not stretch cable too tightly.
Connect interface	<p>For the connector, please note the following:</p> <ul style="list-style-type: none"> <li>● During connecting the connector, make sure there are no foreign objects such as garbage or metal pieces in the connector.</li> <li>● During connecting the connector to the Servo motor, be sure to connect it from the side of the main circuit cable of the Servo motor first, and the ground of the main cable must be connected reliably with earth. If encoder side cable is connected first, the encoder may malfunction due to the potential difference with PE.</li> <li>● During connecting, please make sure the pins are arranged correctly.</li> <li>● The connector is made of resin. Do not apply impact to avoid damaging the connector.</li> <li>● Do not apply stress to the connector when carrying the Servo drive with the cables connected. If you apply stress to the connector part, the connector may be damaged.</li> </ul>

## 4. Wiring

### 4.1 Main Circuit Wiring

#### 4.1.1 Terminals of the Servo Drive

Figure 4- 1 Terminal

Terminal	Description	Function
L1	Main power input terminals	Connect with three-phase 220V power supply. Single-phase 220V input only need to connect L1 and L3.
L2		
L3		
L1C	Control power input terminal	Connect to any two-phase or single-phase power of three-phase power.
L2C		
P+	For external regenerative resistor	Internal regenerative resistor: shortconnect C-D (default).
C		External regenerative resistor: Disconnect the short wire between C-D, and then connect the external regenerative resistor between P + and C.
D		
U	Motor power line terminal	It is connected to the U, V, and W of the motor to supply power to the motor.
V		
W		
PE	PE	Grounding terminal of the Servo drive.

### 4.1.2 Diagram of Power Wiring

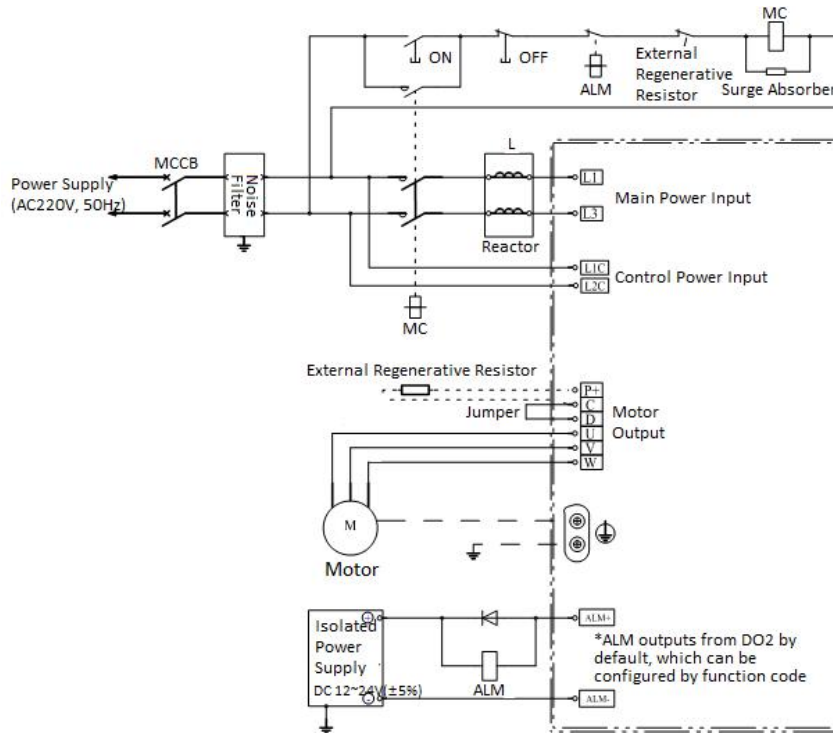


Figure 4- 2 1-phase 220V Power Supply

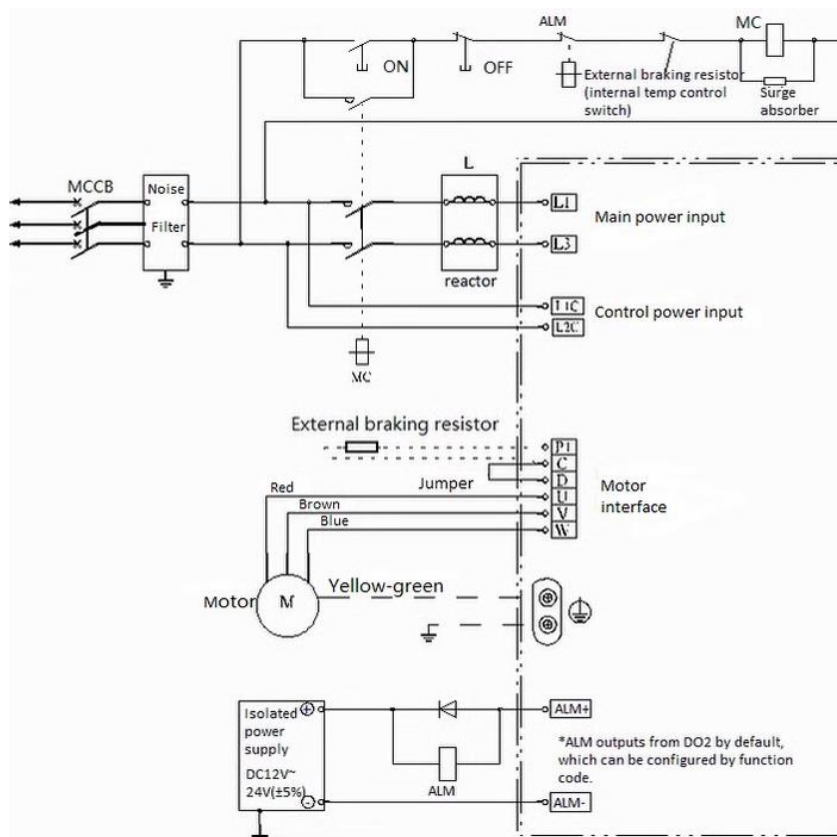


Figure 4- 3 3-phase 220V power supply

### 4.1.3 Wiring of Motor Cables between Servo Drive and Servo Motor

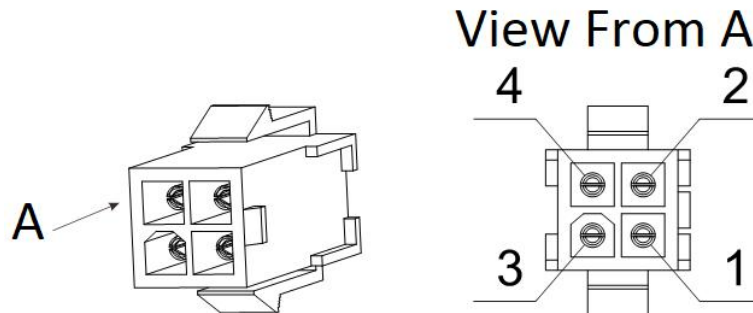


Figure 4- 4 Power cable

Pin	Defination	Color
1	U	Red
2	V	Brown
3	W	Yellow
4	GND	Bule/green

## 4.2 Wiring of encoder terminal

Figure 4- 5 CN1 Terminal

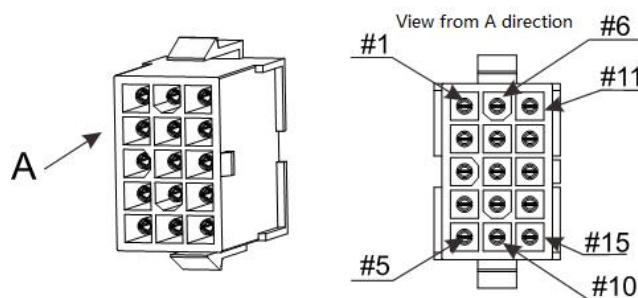


Figure 4- 6 CN1 Outlet Terminal



CN1 Pin	Default Function	Color	Outlet Pin
1	A+	Brown	4
2	A-	Brown/White	14
3	B+	Red	9
4	B-	Red/White	13
5	Z+	Orange	7
6	Z-	Orange/White	5
9, 10	GND	Purple	3
11	U+	Yellow	6
12	U-	Yellow/Black	8
13	V+	Green	10
14	V-	Green/White	12
15	W+	Blue	11
16	W-	Blue/White	15
19, 20	5V	Purple/White	2

## 4.3 Wiring of Input/Output Control Terminal CN2

### 4.3.1 CN2 Pinout

•

Figure 4- 7 Servo Drive Input/Output CN2 Pinout

PIN	Function	PIN	Function	PIN	Function
1	AI_2-	16	DI2	31	SIGN+
2	AI_2+	17	DI3	32	PULS-
3	GND	18	DI4	33	PULS+
5	DO1-	20	PAO+	34	PL
6	DO1+	21	PAO-	40	DI5
7	DO2-	22	PBO+	41	DI6
8	DO2+	23	PBO-	42	DI7
9	DO3-	24	PCO+	43	DI8
10	DO3+	25	PCO-	48	GND
11	DO4-	26	AI_1+	49	GND
12	DO4+	27	AI_1-	50	GND
13	DICOM	28	GND		
15	DI1	30	SIGN-		

### 4.3.2 Wiring Diagram for Each Mode

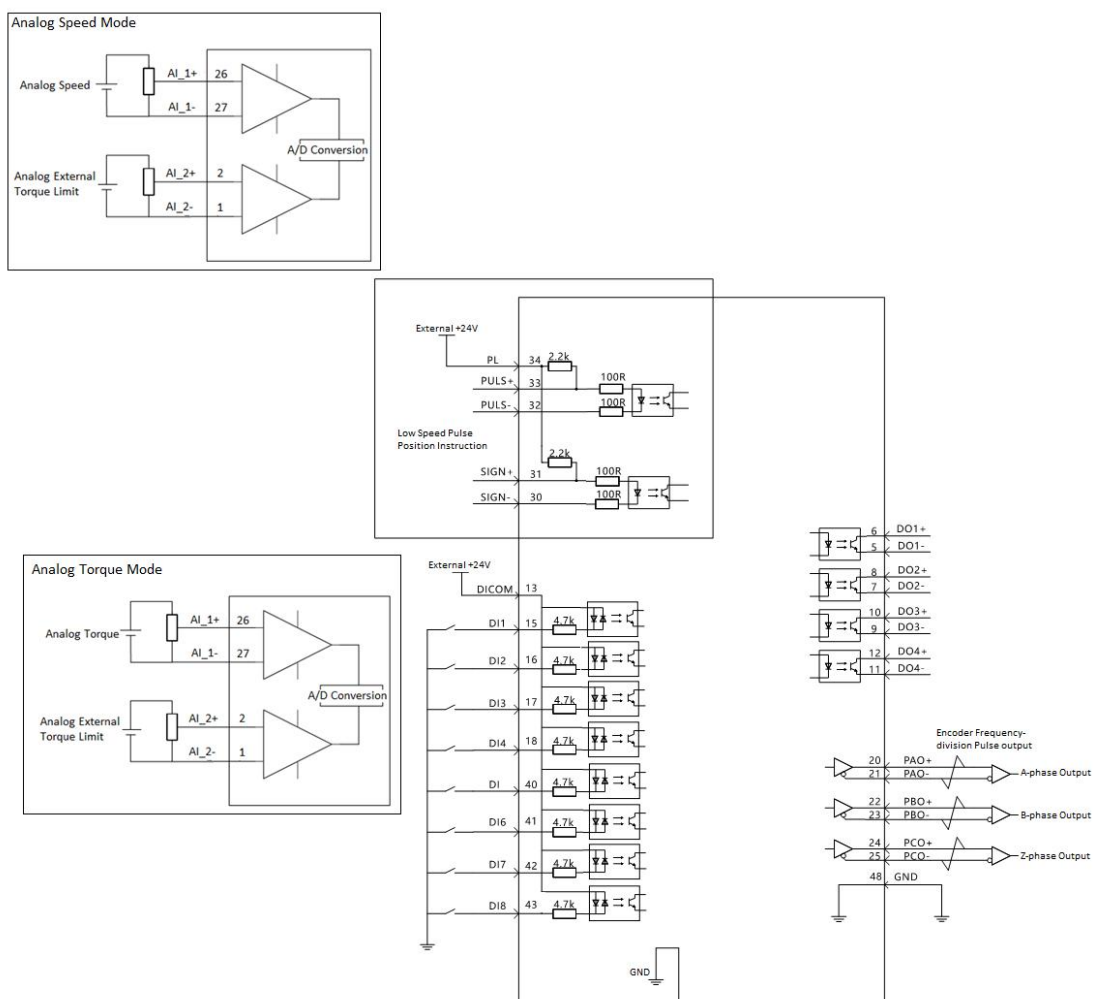


Figure 4- 8 Position mode

### 4.3.3 Position Command Input Signal

PIN	Function	Description
33	PULS+	Low-speed pulse input mode: differential input and open collector. The input pulse contains three modes: 1) Direction+pulse (positive logic). 2) CW/CCW pulse. 3) A, B phase quadrature pulse (4 times frequency).
32	PULS-	
31	SIGN+	
30	SIGN-	
34	PL	External power input terminal of reference pulse

The reference pulse and symbol signal output circuit on the host controller side could be either differential drive output or OC output. The following table lists the maximum input frequency and minimum pulse width of these output modes.

Pulse Mode	Differential	Open Collector
Maximum Frequency	500K	200K

#### Low-speed Pulse Input

- 1) Differential drive mode

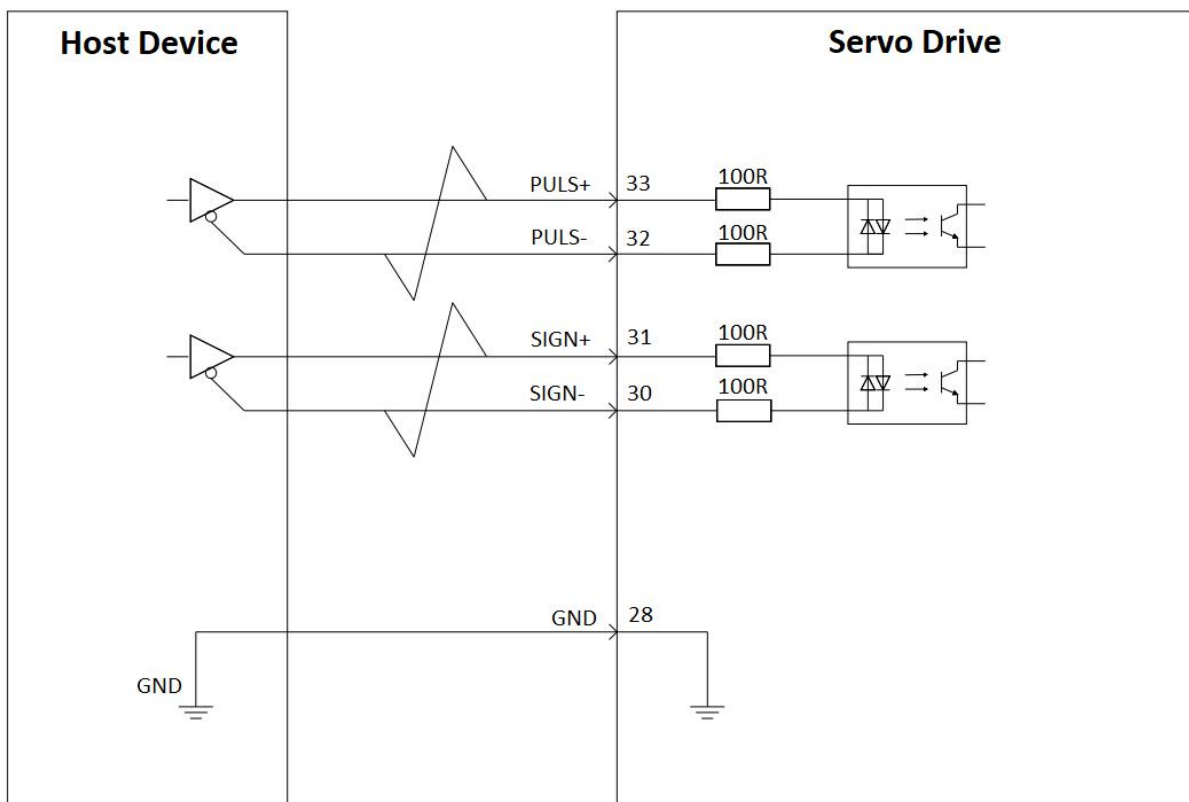


Figure 4- 9

2) OC mode

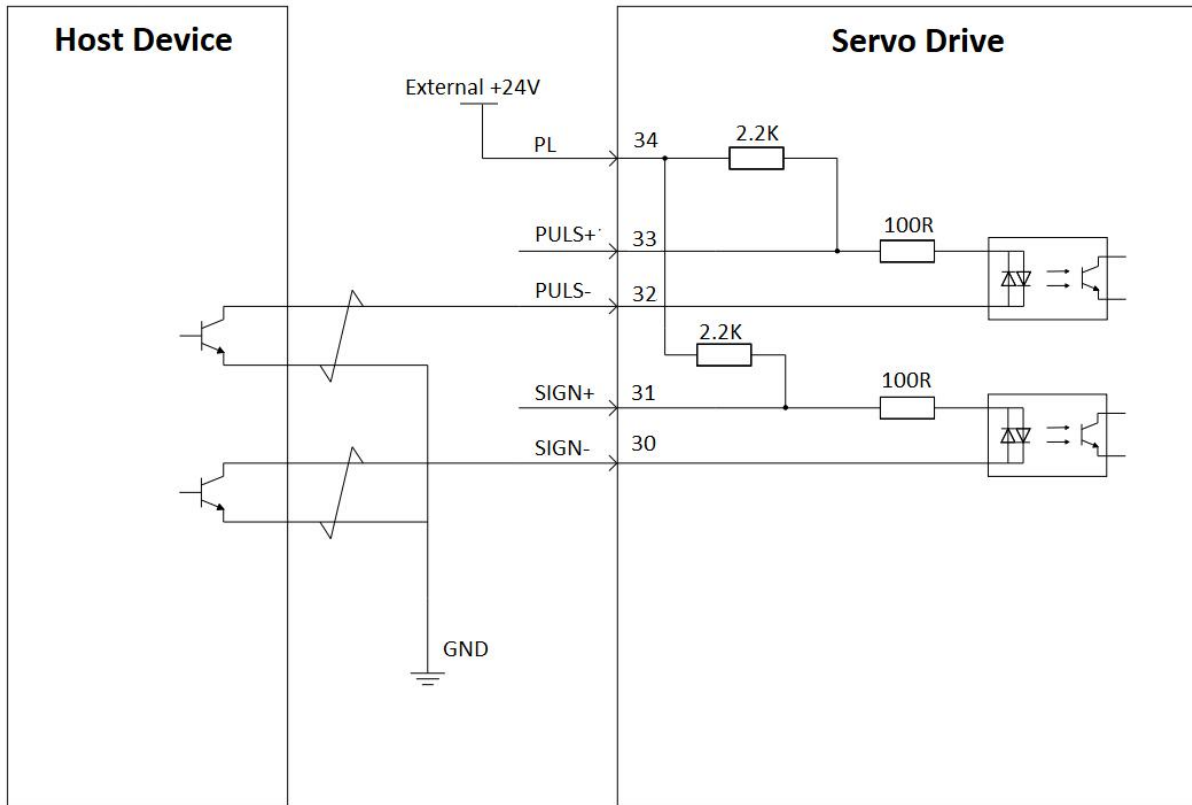


Figure 4- 10

4.3.4 Analog Input Signals

PIN	Function	Description
26	AI_1+	AI_1 analog input signal with 12-bit resolution and input voltage range: -10V- + 10V.
27	AI_1-	
2	AI_2+	AI_2 analog input signal with 12-bit resolution and input voltage range: -10V- + 10V.
1	AI_2-	
3	GND	Analog input signal ground
28	GND	

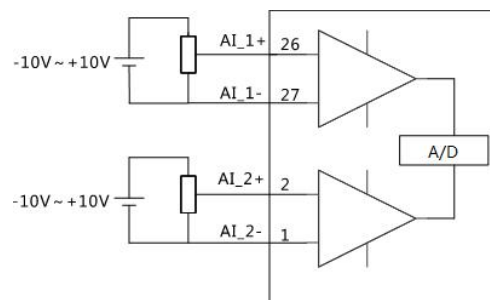


Figure 4- 11

### 4.3.5 Digital Input and Output Signals

PIN	Function	Description
15	DI1	Servo enable
16	DI2	Clear alarm
17	DI3	Forward drive disable
18	DI4	Backward drive disable
40	DI5	Reverse direction
41	DI6	Pulse input inhibited
42	DI7	Reserved
43	DI8	Reserved
13	DICOM	Power supply(12-24V)
5	DO1-	Rotation detection
6	DO1+	
7	DO2-	Alarm signal
8	DO2+	
9	DO3-	Servo ready
10	DO3+	
11	DO4-	Position completed
12	DO4+	

#### Digital input signal

1) The host controller provides relay output.

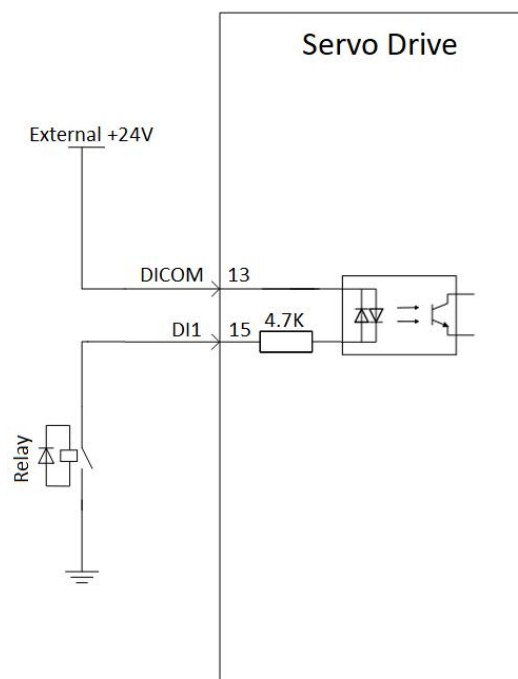


Figure 4- 12

2) The host controller provides OC output.

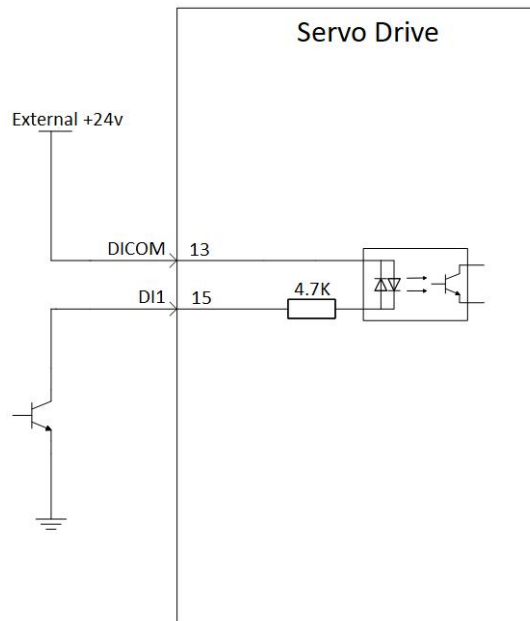


Figure 4- 13

**Digital output signal**

1) The host controller uses relay input.

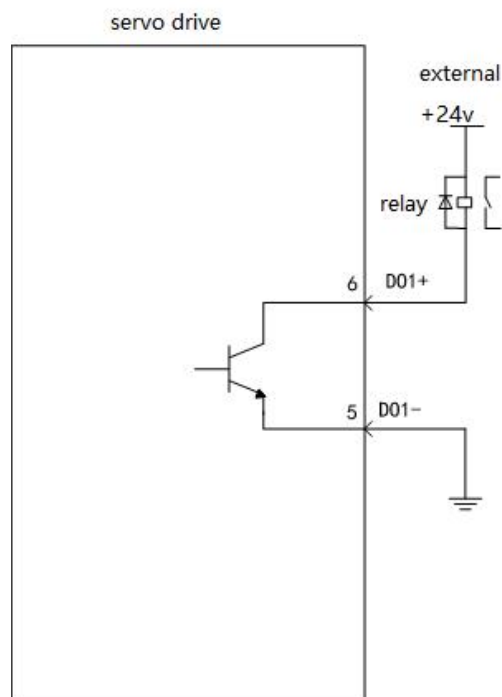


Figure 4- 14

2) The host controller uses optocoupler input.

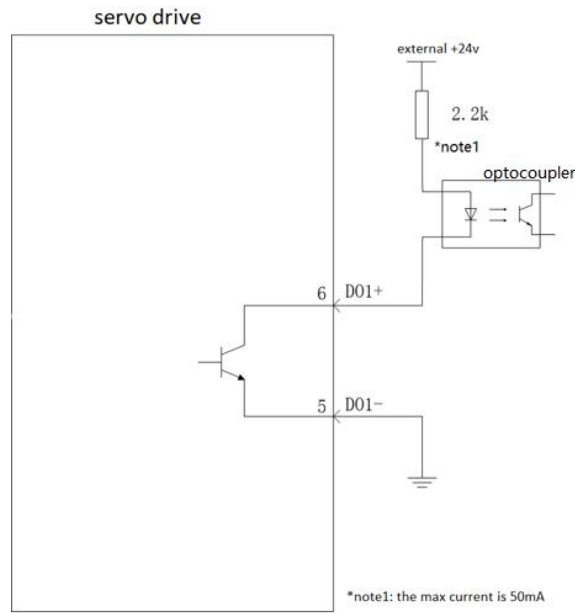


Figure 4- 15

## 4.4 Wiring to Communication Signal Terminal Connectors CN3/CN4

### 4.4.1 Wiring Diagram of Communication Signal Terminals

1) CN3 pinout

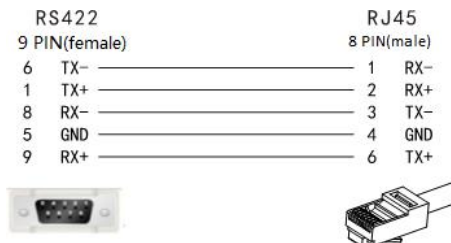


Figure 4- 16

PIN	Function	Description
1	RX-	Negative send end of pc(negative receive end of Servo)
2	RX+	positive send end of pc(positive receive end of Servo)
3	TX-	Negative receive end of pc(negative transmit end of Servo)
4	GND	Ground
5	NC	Not connected
6	TX+	Positive receive end of pc(positive transmit end of Servo)
7	NC	Not connected
8	NC	Not connected

2) CN4 pinout

Figure 4- 17

4.4.2 RS422 Communication Connection with PC

The PC communicates with the driver through the CN4 (RJ45 port) interface via RS-422.

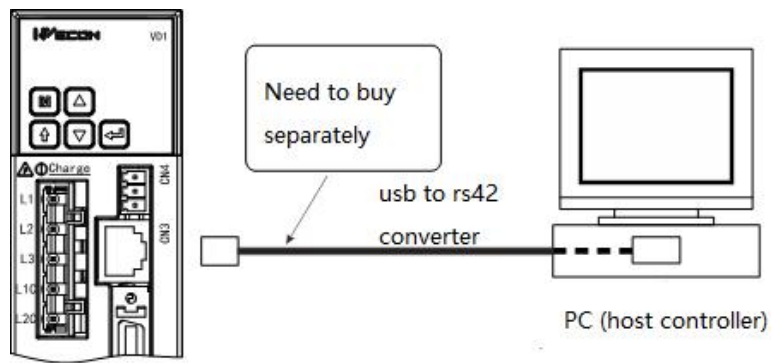


Figure 4- 18



## 5. Operation Panel

### 5.1 Operatoin Panel Composition

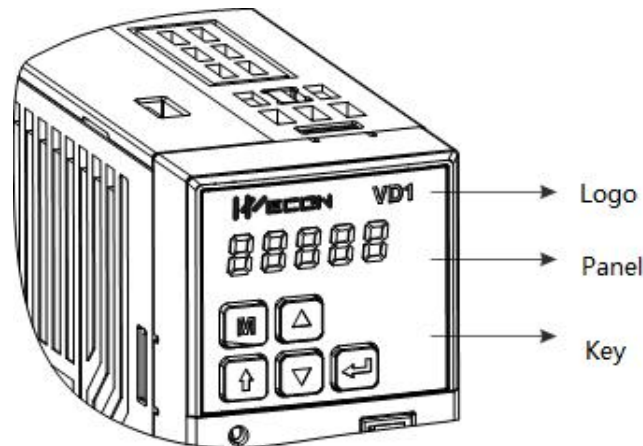


Figure 5- 1 Panel Schematic

Icon	Function	Description
	Mode	Switch between modes. Back to previous menu
	Up(increase)	Increase the value of the flashing LED
	Down(decrease)	decrease the value of the flashing LED
	Shift	Change the flashing position of the LED
	Return(enter)	Enter the next level menu. Execute commands such as storing parameter settings

When the Servo drive is running, the panel for displaying Servo status, parameter, error and monitoring.

**Status display:** Displays the current running status of the Servo drive.

**Parameter display:** Display the function code and the setting value of the function code corresponding to different functions.

**Error display:** displays the error code of the Servo drive.

**Monitor display:** display the operating parameter value of the Servo drive to be observed.

## 5.2 Panel Display

### 5.2.1 Display Shift

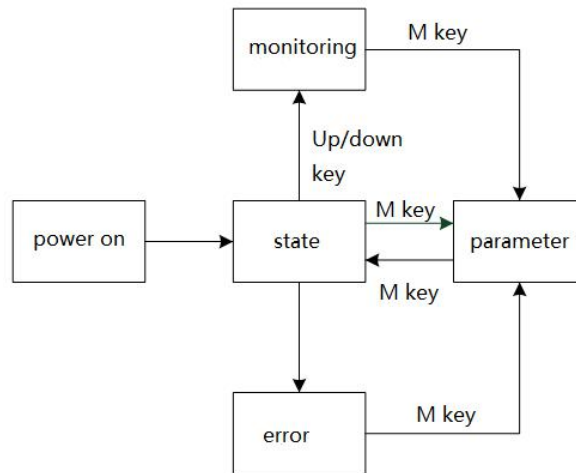


Figure 5- 2

**Description:**

While the power is on, the panel of the Servo would enter the status display mode. If there is an error, the panel switches from the parameter display mode to the error display mode. The status display mode could be switched to the monitoring mode by pressing the up / down button. Press the mode button in the monitoring mode to enter the parameter display. The status display and parameter display could be switched by mode button.

### 5.2.2 State Display

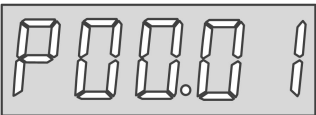
Display	Condition	Description
	Moment at Servo power on (within one second)	The Servo drive is in initialization state.
	Very short time after displaying [88888]	Initialization completed
	Servo is ready	The Servo drive is ready for running, and waits for the S-ON signal from the host controller.
	The Servo ON (S-ON) signal is active.	The Servo drive is in running state
	The Servo drive is in jog running state.	The Servo drive is in jog running state.

### 5.2.3 Parameter Display

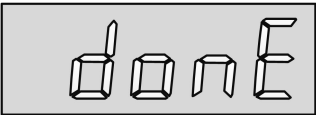
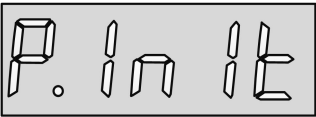
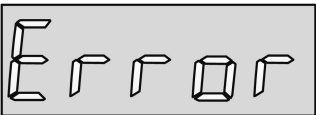
#### 1) Function Code Group

Parameter display is for different function codes. The format of the function code is PXX.YY, where PXX represents the group number of the function code, and YY represents the group number of the function code.

Display	Function	Description
PXX.YY	Function code group	XX: Function code group YY: Function code number

Display	Function	Description
	Control mode, function code is P00.01	00: function code group 01: function code number

#### 2) Parameter display

Display	Function	Description
	Completed parameter settings	Completed and saved parameters in Servo Drive. Then, Servo Drive could execute other operations.
	Parameter initialization	The Servo drive executes parameter initialization.
	When entering the JOG mode, an error occurs or the parameter setting exceeds the limit (or the setting is not allowed)	There is an error when entering JOG mode, return to the previous menu

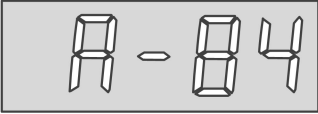
### 5.2.4 Fault Display

The keypad displays the current or history faults and warnings. For analysis and rectification of faults and warnings, refer to Chapter 7 Troubleshooting.

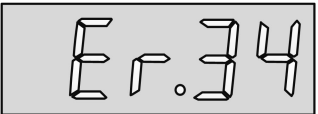
When a single fault or warning occurs, the keypad displays the fault or warning code. When multiple faults or warnings occur, the keypad displays the fault code of the highest level.

When a fault occurs, the corresponding fault or warning code would be displayed when switching from the auxiliary function to the parameter display function. User could view the current fault and warning codes and the past five fault and warning codes through the monitoring display of the panel.

### 5.2.5 Warning Display

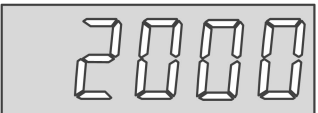

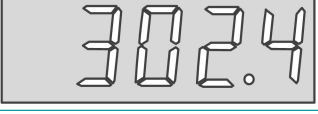
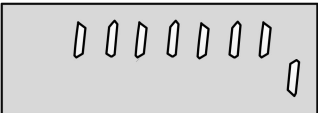

Display	Function	Description
	Restart Servo Drive	Need to restart Servo drive to make modified parameters take effect

### 5.2.6 Error Display

Display	Function	Description
	Motor is overloaded	Motor is overloaded

### 5.2.7 Monitoring display

After the Servo drive is powered on or after the Servo enable is ON, user could use the [Up / Down] key to enter the monitor display mode.

Display	Code	Function	Units	Description
 	U0-02	motor speed	rpm	The actual running speed of the Servo motor(decimal)
	U0-31	Bus voltage	V	The voltage value between driver P + and-, DC bus voltage
	U0-17	input signal state	-	Represents the level status corresponding to the 8 DI terminals. The upper part of the digital tube indicates a high level, and the lower half indicates a low level.
	U0-19	Output signal state	-	Represents the level status corresponding to the 6 DO terminals. The upper part of the digital tube indicates a high level, and the lower half indicates a low level.

### 5.3 Panel Operation

#### 5.3.1 Parameter Setting

Parameter display, take P0-1 as an example to set the parameters, and change the Servo drive from the position control mode to the speed control mode.

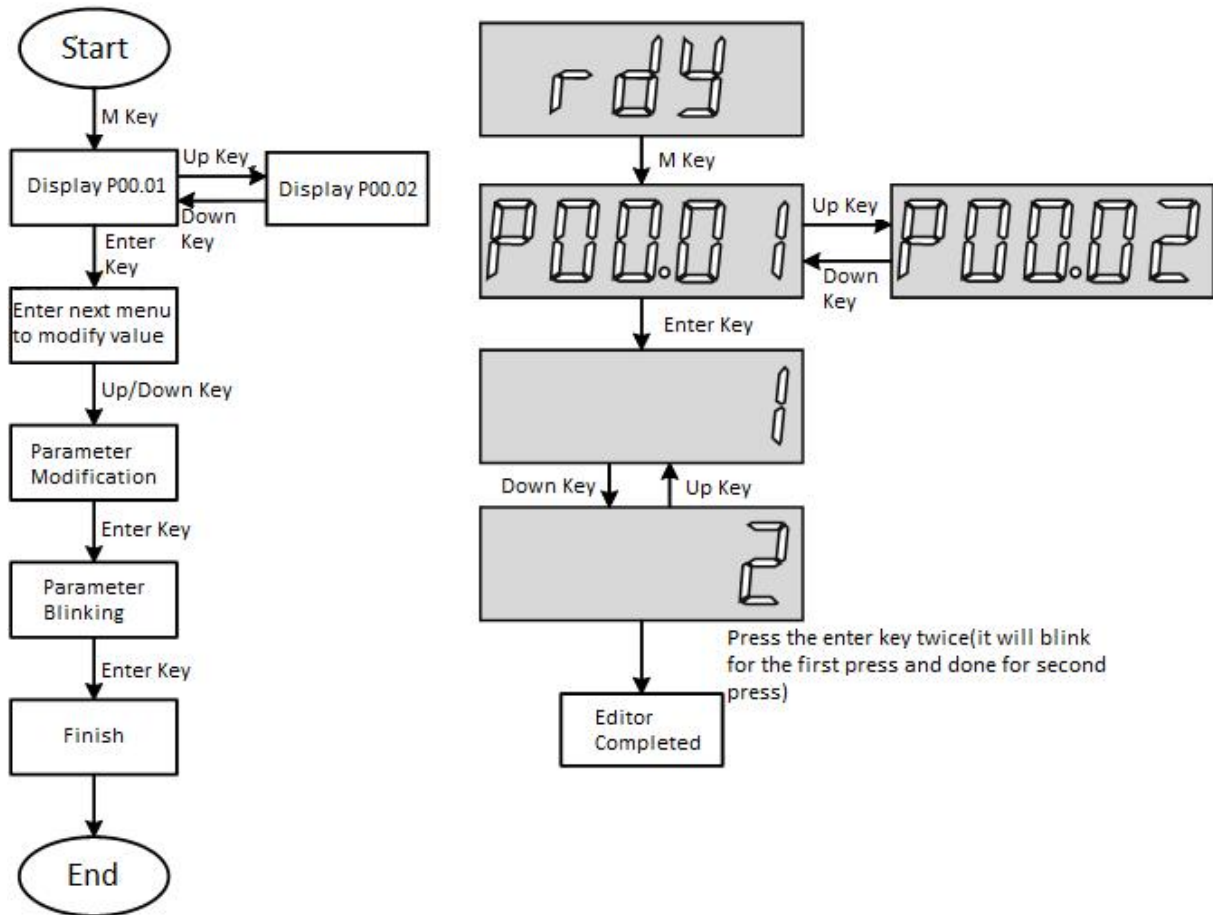


Figure 5-3

### 5.3.2 Jog Operation

During the trial operation of the Servo motor and Servo drive, the function of jog operation could be used. **The operating steps are as follows:**

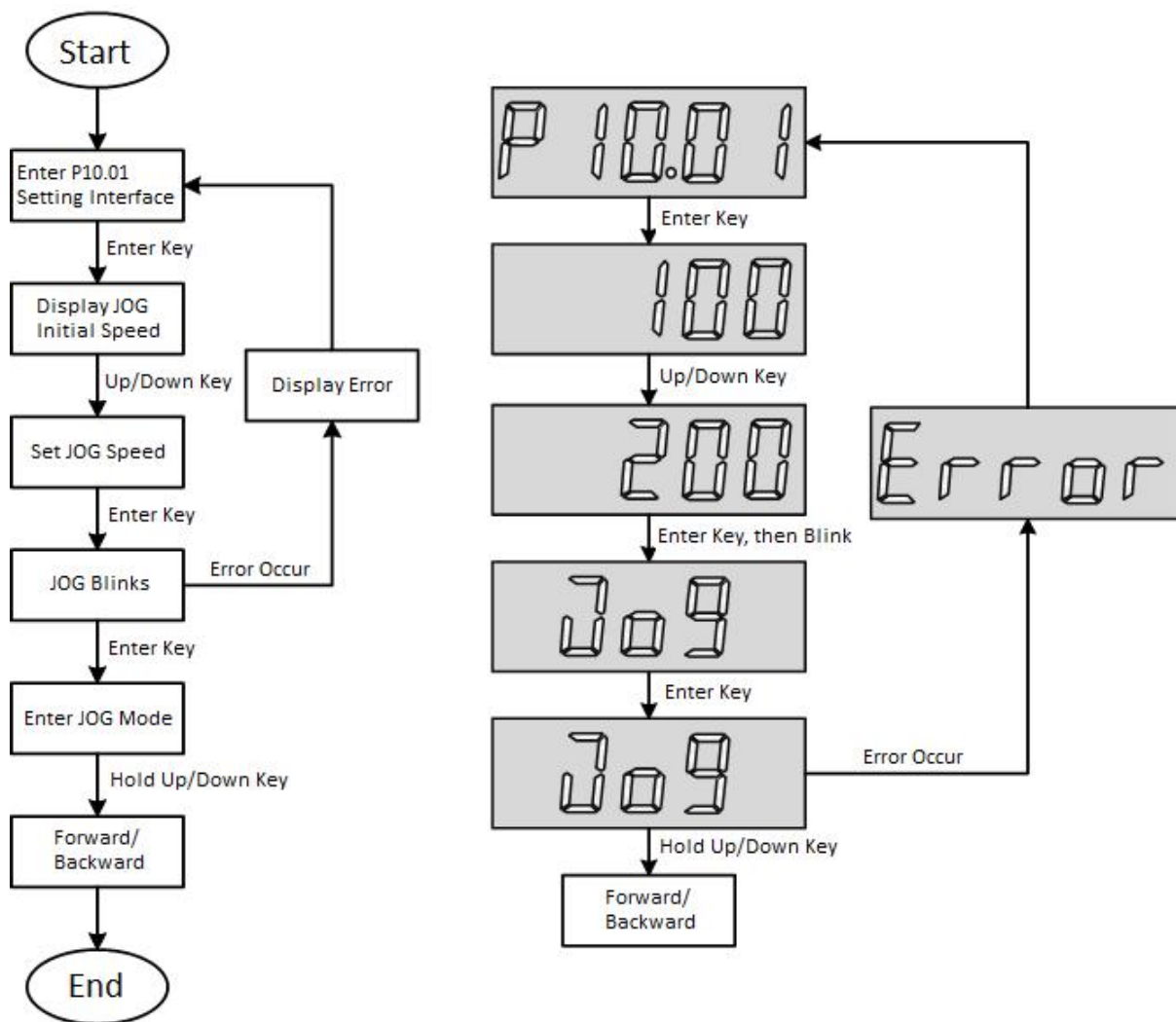


Figure 5- 4

**Operating procedures:**

- 1) After power on, adjust the function code to P10.01.
- 2) Press the enter key to enter the next menu and set the JOG speed.
- 3) After the JOG speed is completed, press the enter key, the JOG is blinking, press the enter key again to enter the JOG mode.
- 4) Press and hold the [Up] and [Down] keys to achieve forward and reverse rotation of the motor.

**Cause of error:** The encoder of the Servo drive is not connected to the motor.

### 5.3.3 Restor to Default Setting

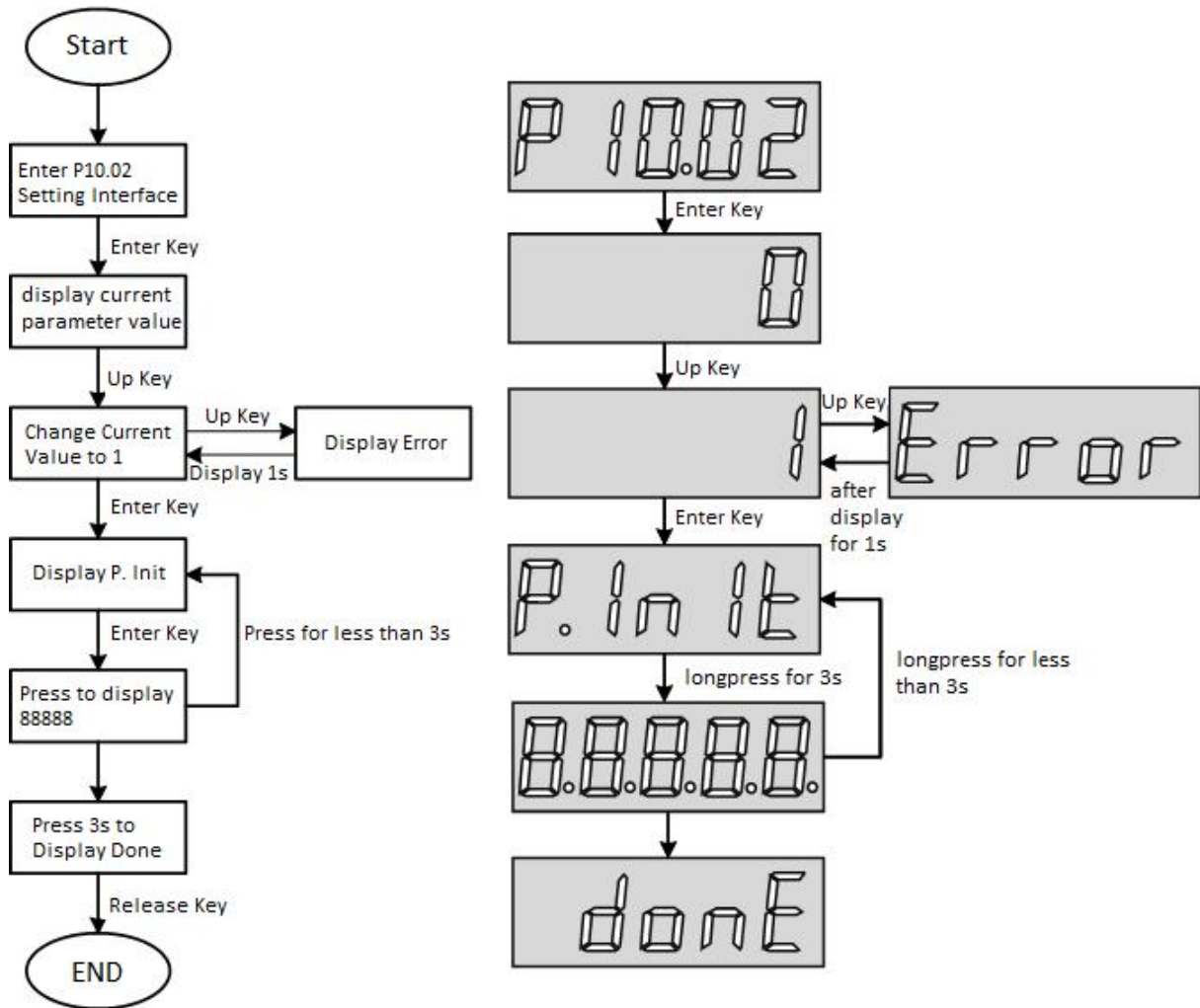


Figure 5- 5

**Operating procedures:**

- 1) After power on, adjust the function code to P10.02
- 2) Press the enter key to enter the next menu and set the parameters.
- 3) After the parameter setting is completed, press the enter key then panel would display P.init.
- 4) Press and hold the enter key for 3s, the panel digital tube would light up from left to right until 88888 is displayed.
- 5) After done is displayed at the end, release the enter key to indicate that the factory reset is complete.

**Cause of Error:** value of P10.02 exceeds the set range (0 - 1).

## 6. Control mode

### 6.1 Basic Setting

#### 6.1.1 Check Before Running

NO.	Activity
Wiring	
1	The servo drive's control circuit power input terminals (L1C, L2C) and main circuit power input terminals(L1,L2,L3) are connected correctly.
2	The main circuit output terminals U, V, W of the servo drive are properly connected to the power cables U, V, W of the servo motor in correct phase sequence
3	No short circuit exists in the main circuit power input terminals (L1,L2,L3) and output terminals (U, V, W) of the servo drive.
4	The signal wires of the servo drive are connected correctly. The external signal wires such as brake and limit switch are connected reliably.
5	The servo drive and motor are grounded reliably.
6	The jumper between terminals C and D has been removed when the external regenerative resistor is used.
7	The cable tension is within the permissible range.
8	The wiring terminals have been insulated.
Environment and mechanical conditions	
1	No foreign objects, such as wire end or metal powder, which may cause short circuit of the signal wire and power cables, exist inside and outside of the servo drive.
2	The servo drive or external regenerative resistor is not placed on flammable objects.
3	Installation and shaft and mechanical connection are reliable.

#### 6.1.2 Power Supply Connection

(1) Connect the power supply of the control circuit and main circuit.

**Connect the power supply of the control circuit (L1C, L2C) and main circuit:**

The main circuit power terminals are L1, L2, L3 for the 3-phase 220 V and three-phase 380 V models.

- ✧ After connecting the power supply of the control circuit and main circuit, if the bus voltage indicator is in normal display and the keypad displays "rdy", it indicates that the servo drive is ready for running and waiting for the S-ON signal from the host controller.
- ✧ If the keypad displays the fault code, please refer to the "Fault and alarm table".

(2) Turn off the S-ON signal



### 6.1.3 Jogging

Jog operation could be realized in two ways, one is panel jog operation, and the jog operation could be realized through the buttons on the servo panel. the other is jog operation through the debug tool running on pc.

#### (1) Jogging via the Keypad

Switch to [P10-1] on the keypad to enter the jogging mode, and the keypad displays the default jogging speed.

Press key UP/DOWN to set the jogging speed, after that press enter key.

The keypad displays "JOG" and blinks. Then, press enter key again to access the jog mode.

Long press the up/down key to achieve forward and reverse rotation, press key MODE to exit the jogging mode.

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P10-1	JOG speed	During running	Immediate	0~3000	Set the jogging speed value	rpm	100

#### (2) Jogging via debug tool

Open We-con servo debugging tool, set the speed value of the jog in the "Set Speed" in the "Manual Operation" column, and then click the "Servo On" button on the interface. Click "Forward" or "Reverse" button to realize forward/reverse jogging. When the "servo off" button is clicked, the jog mode is exited.

### 6.1.4 Selection of Rotating Direction

Set [P0-4] to change the motor rotating direction without changing the polarity of the input reference.

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-4	Rotating direction selection	At stop	Power-on again	0~1	Forward direction: viewed from the motor shaft. 0: CW direction as the forward direction 1: CCW direction as the forward direction	-	0

Limit switches (positive over travel POT and reverse over travel NOT), POT has the same direction set in [P0-4](Rotating direction selection).

### 6.1.5 Braking resistor

When the servo motor is in the generator state when decelerating or stopping, the motor would transfer the energy back to the driver, which would increase the bus voltage. When the bus voltage exceeds the braking point, the driver could use the braking resistor to consume the energy. The braking resistor could be built-in or external, but it could not be used at the same time. When the external braking resistor is connected, the jumper on the servo drive needs to be removed.

The judge whether to use a built-in braking resistor or an external braking resistor

(1) The calculated maximum braking energy > the maximum braking energy that the capacitor could absorb, and the calculated braking power  $\leq$  the power of the built-in braking resistor, then use the internal braking resistance.

(2) When the calculated value of the maximum braking energy > the maximum braking energy that the capacitor could absorb, and the calculated value of the braking power > the power of the built-in braking resistor, then we should use an external braking resistor.

Relevant function code:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-9	Braking resistance	At stop	Immediate	0~3	0- Use built-in braking resistor. 1- Use external braking resistor and natural cooling. 2- Use external braking resistor and forced air cooling. 3- No braking resistors are used, all rely on capacitor absorption.	-	0
P0-10	External braking resistance	At stop	Immediate	0~655 35	set the resistance value of the external braking resistor.	$\Omega$	50
P0-11	External braking resistor power	At stop	Immediate	0~655 35	Used to set the power of external braking resistor.	W	100

### 6.1.6 Servo Running

(1) Turn on the S-ON signal

When the servo drive is ready for running, the keypad displays "Run". but if there is no reference input, the servo motor is in locked state.

S-ON could be configured and selected through DI terminal function selection.

(2) After a reference is input, the servo motor starts to rotate

Enter the appropriate command during operation, running the motor at low speed firstly, and observe whether the rotation is in accordance with the set rotation direction. Observe the actual motor speed, bus voltage and other parameters through the debug tool running on pc. It could be adjusted according to Chapter 7 to make the motor work in its expected condition.

(3) Power-on time sequence

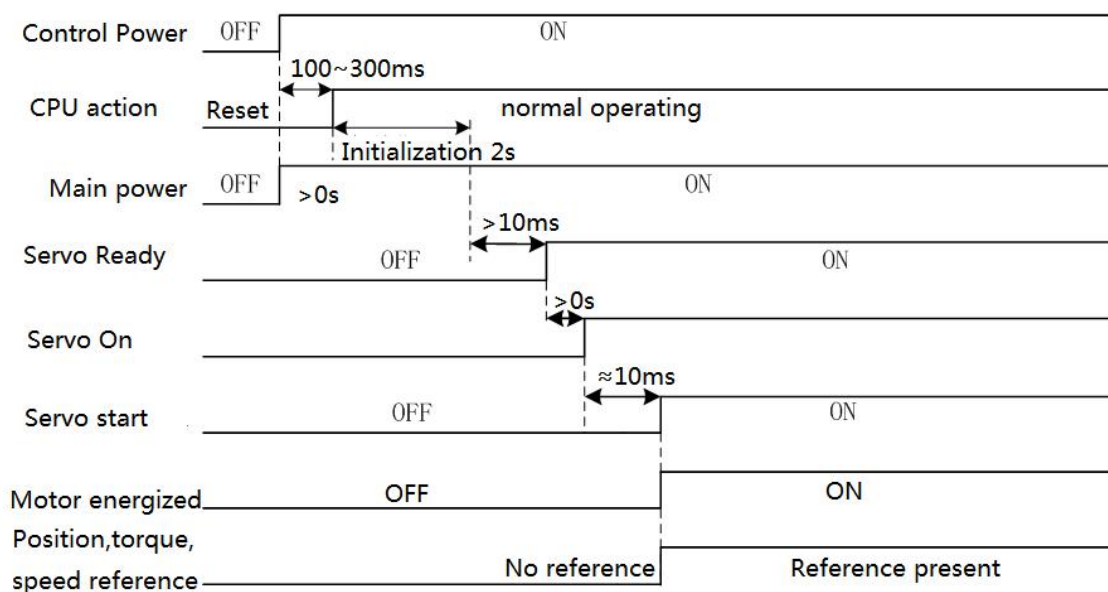


Figure 6-1 Power-on time sequence

6.1.7 Servo Stop

Servo stop includes coast to stop and zero-speed stop based on the stop mode, and de energized state and position lock based on the stop state.

Stop mode	Coast to stop	Stop at zero speed
Description	The servo motor is de-energized and decelerates to stop gradually. The deceleration time is affected by the friction inertia and mechanical.	The servo drive outputs the reverse braking torque and the motor decelerates to 0 quickly.
Characteristic	This mode features smooth deceleration and small mechanical impact, but the deceleration process is long.	This mode features quick deceleration but a larger impact.

(1) Stop at S-ON Signal Off

Relevant function code:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-5	Stop mode at S-ON OFF	At stop	Immediate	0~1	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping de-energized	-	0

					state		
--	--	--	--	--	-------	--	--

### (2) Emergency Stop

The default is the free stop mode, the motor shaft remains free, and the corresponding configuration and selection could be made by configuring the DI terminal function selection.

### (3) Stop at Limit Switch Signal Active

Over travel means that the movable part of the machine exceeds the setting area. In some horizontal or vertical movements, the servo needs to limit the movement range of the work piece. Over travel generally uses limit switches, photoelectric switches or multiple turns of the encoder for detection, that is, hardware over travel or software over travel.

Once the servo drive detects the action of the limit switch signal, it would immediately force the speed in the current running direction to 0 to prevent the forward movement, which would not affect the reverse operation. Over travel stop is fixed as zero speed stop, and the motor shaft keeps the position locked.

The corresponding configuration and selection could be made through the DI terminal function selection. The default setting of DI3 is POT, DI4 is NOT.

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P6-08	DI_3 function	During running	Power-on again	0~16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damp control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed	-	03-POT

					command selection 3 16: J-SEL, Inertia ratio switch		
P6-9	DI_3 logic selection	During running	Power-on again	0~1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-	0
P6-10	DI_3 input source selection	During running	Power-on again	0~1	0-hardware DI3 1-VDI3	-	0
P6-11	DI_4 function	During running	Power-on again	0~16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damper control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-	04-NOT
P6-12	DI_4 logic selection	During running	Power-on again	0~1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input.	-	0

					Active when on (switch open).		
P6-13	DI_4 input source selection	During running	Power-on again	0~1	0-hardware DI3 1-VDI3	-	0

(4) Stop at Fault Occurrence

If the machine breaks down, the servo would perform fault shutdown operation. The current shutdown mode is fixed to free stop mode, and the motor shaft remains free.

## 6.2 Position Control Mode

Position control mode is the most important and commonly used control mode of servo system. Position control refers to controlling the position of the motor through position commands, determining the target position of the motor based on the total number of position commands, and the frequency of the position command determines the rotation speed of the motor. The servo drive could achieve fast and accurate control of the position and speed of the machine. Therefore, the position control mode is mainly used in applications requiring positioning control, such as manipulators, chip mounters, engraving machines, CNC machine tools, etc.

The block diagram of position control is as follows:

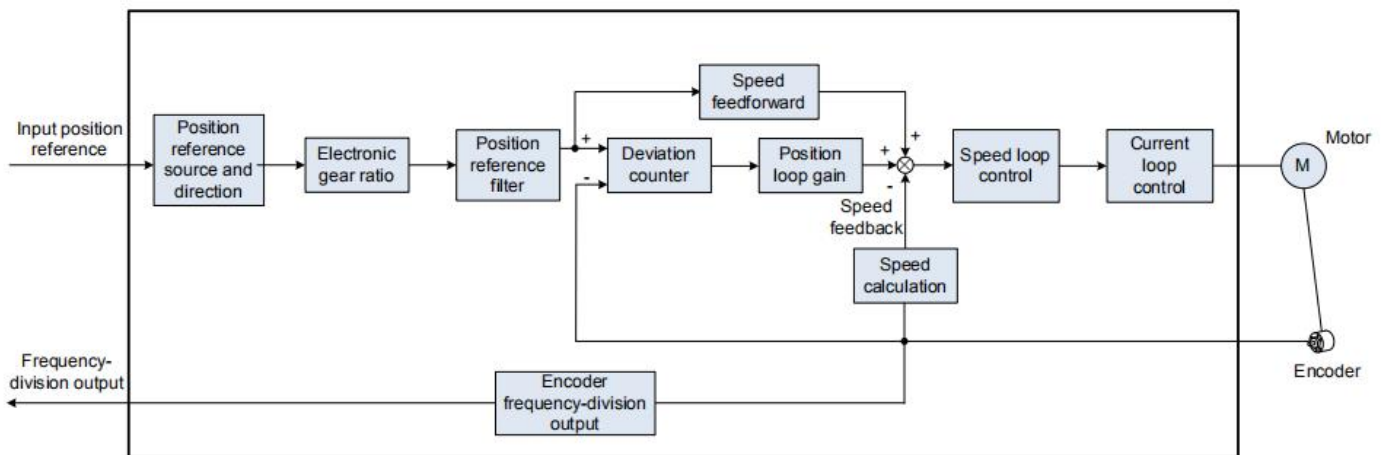
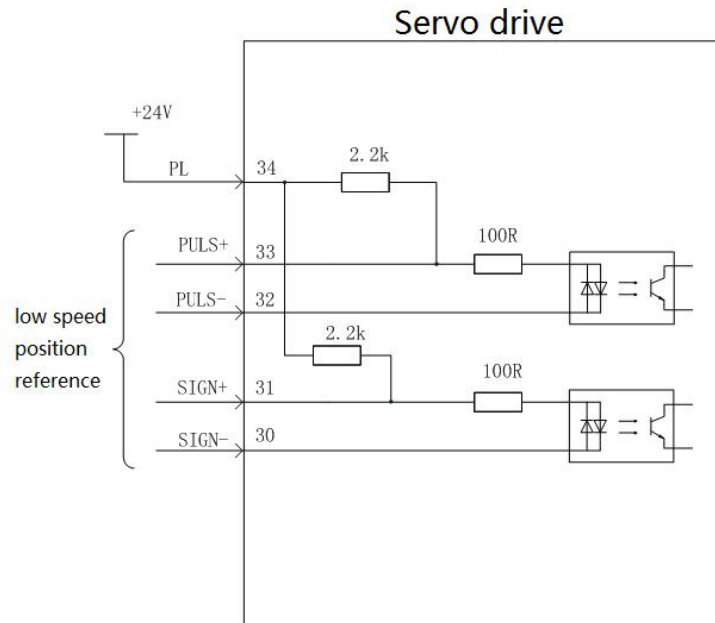


Figure 6-2 Position control diagram

### 6.2.1 Position Reference Input Setting

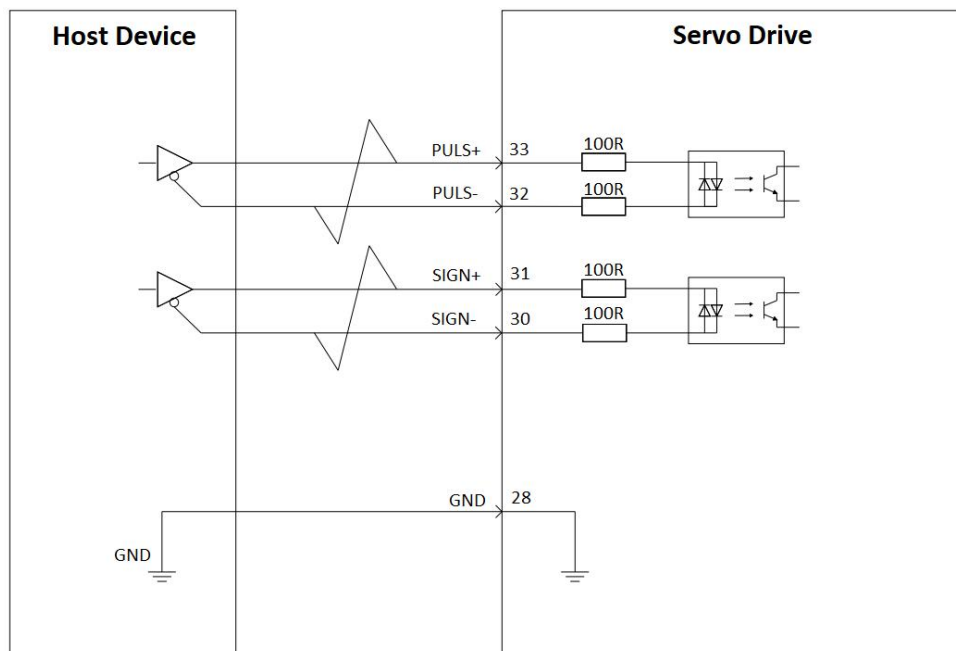
The servo drive has 1 set of pulse input terminals for receiving position pulse input (through the CN2 terminal of the drive)



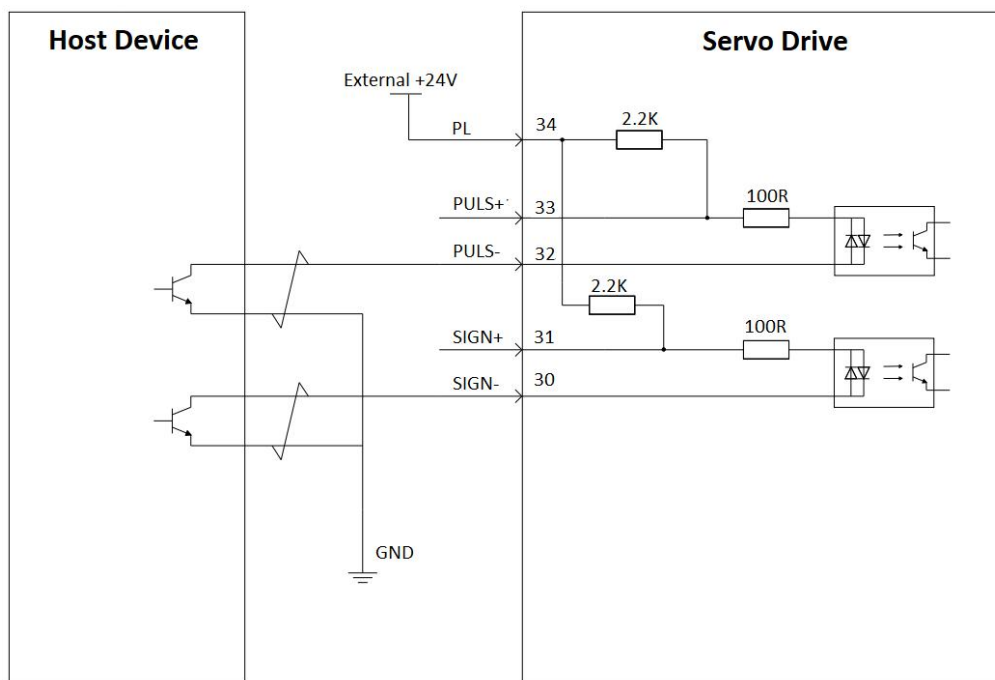
The reference from the host controller could be differential output or open collector output. The maximum input frequency is shown in **the following table**:

Pulse Type	Differential	Open collector
Max. frequency	500k	200k
Voltage	5V	24V

**(a) Low-speed Pulse Input**  
Differential drive mode



(b) OC mode



(1) Position pulse selection

The servo drive supports three pulse input formats:

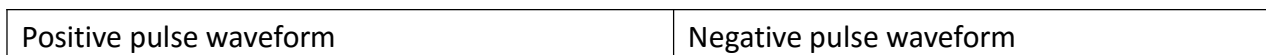
Direction + pulse (positive logic), Phase A + phase B quadrature pulse (4-frequency multiplication), CW + CCW

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-12	Position pulse type selection	At stop	Power-on again	0~2	0:Direction + pulse (positive logic) 1:CW/CCW 2:Phase A + phase B quadrature pulse (4-frequency multiplication)	-	0

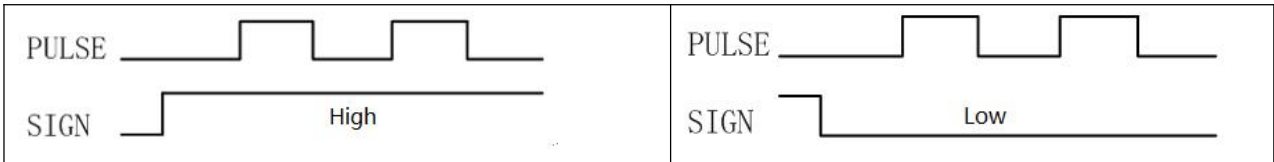
The corresponding pulse waveform is as follows:

(a) [P0-12]=0 (Direction + pulse(positive logic))

**PULSE:**Pulse                      **SIGN:**Signal

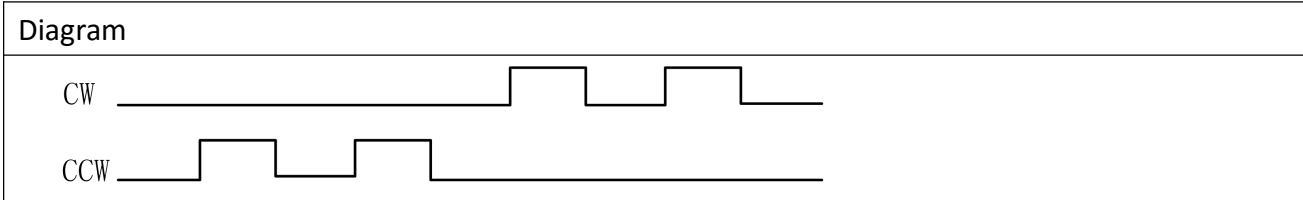






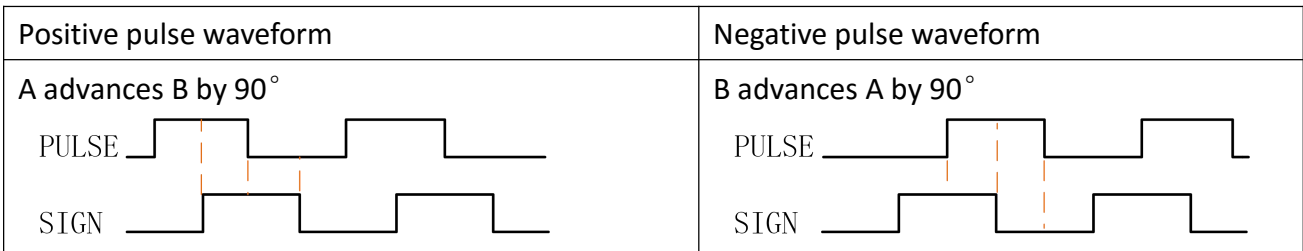
(b) [P0-12]=1 (CW/CCW)

PULSE: Pulse                      SIGN: Signal



(c) [P0-12]=2 (Phase A + phase B quadrature pulse (4-frequency multiplication))

PULSE(A phase): pulse                      SIGN(B phase): signal



(2) Position pulse frequency and anti-interference level

Filtering time is necessary for the reference input pin to prevent external interference input to the driver and affect the control of the motor. The signal input and output waveforms with filtering enabled are shown in the following figure:

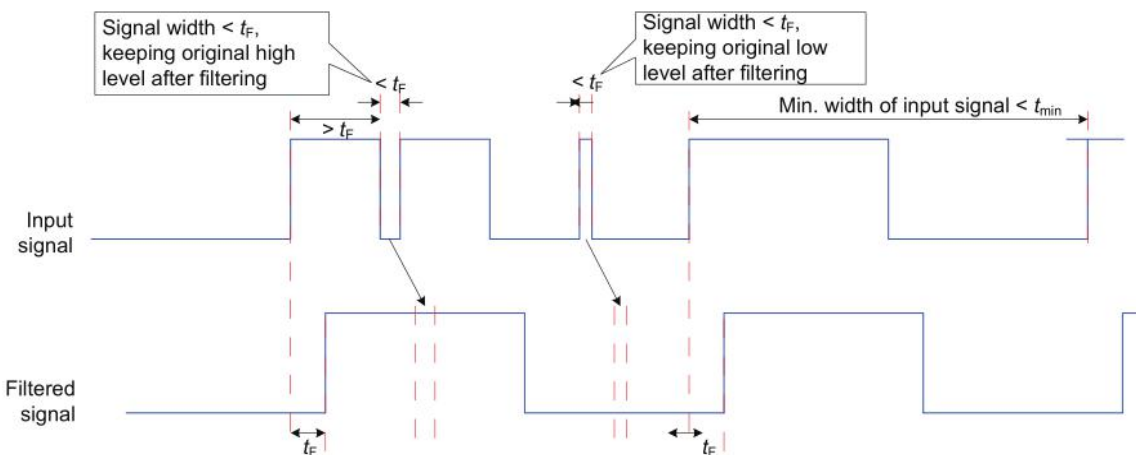


Figure 6-3 Filtering signal waveform

The input pulse frequency refers to the frequency of the input signal, and the frequency of the input pulse command could be modified through the function code [P0-13]. If the actual input frequency is greater than [P0-13], it may cause pulse loss or alarm. The function code [P0-14] could adjust the

position pulse anti-interference level, the greater the value, the greater the depth of the filter.

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-13	Position pulse frequency	At stop	Power-on again	1~500	Set the maximum pulse frequency	kHz	300
P0-14	Position pulse anti-interference level	At stop	Power-on again	1~3	Set the pulse anti-interference level. 1:Low anti-interference level. (0.1) 2: Medium (0.25) 3: High (0.4)	-	2

## 6.2.2 Electronic Gear Ratio

### [Glossary]

**Reference unit:** It means the minimum value the host controller input to the servo drive.

**Encoder unit:** It means that the value from the input reference processed with the electronic gear ratio.

### [Electronic gear ratio definition]

In position control mode, the input position reference (reference unit) defines the load displacement. the motor position reference (encoder unit) defines the motor displacement. The electronic gear ratio is used to indicate the relationship between input position reference and motor position reference. By dividing (electronic gear ratio < 1) or multiplying (electronic gear ratio > 1) the electronic gear ratio, the actual motor rotating or moving displacement within the input

position reference of one reference unit could be set.

### [Setting range of electronic gear ratio]

The setting range of the electronic gear ratio should meet **the following conditions:**

$$0.01 < \frac{\text{Electronic gear ratio numerator}}{\text{Electronic gear ratio denominator}} < 100$$

Otherwise, it would display [Er. 35] "Electronic gear ratio setting over limit" fault.

### Electronic gear ratio setting Flowchart:

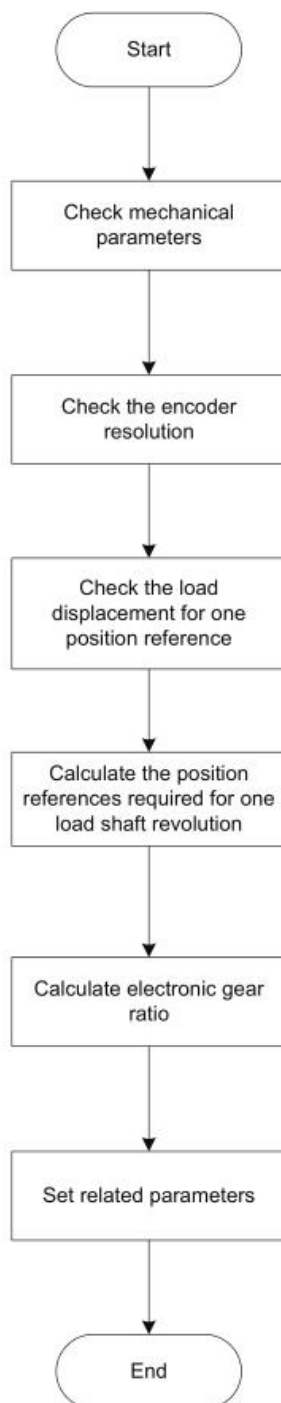


Figure 6-4 Electronic gear ratio setting flowchart

Firstly, confirm the mechanical parameters, including confirming the reduction ratio, ball screw lead, gear diameter in gear transmission, pulley diameter in pulley transmission, etc. Confirm the resolution of the servo motor encoder used.

Confirm the parameters such as machine specifications and positioning accuracy, and determine the load displacement corresponding to the position command output by the host computer. Combine information including the mechanical parameters and the load displacement corresponding to one position command to calculate the position command value required for one rotation of the load shaft.

Electronic gear ratio = encoder resolution / position command (command unit) required for one revolution of the load shaft × reduction ratio, Set the function code parameters according to the calculated electronic gear ratio value.

In addition to use the electronic gear ratio function, you could also use [P0-16] (the number of command pulses for one rotation of the motor). Both gear ratio 1 and electronic gear ratio 2 are invalid when [P0-16] is not zero.

#### Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-16	pulse number per revolution	At stop	Power-on again	0~10000	Set the pulse number of per rotation Only when P0-16=0 then P0-17,P0-18,P0-19,P0-20 would take effect	pulse	10000
P0-17	Electronic gear 1 numerator	During running	Immediate	1~32767	Set the numerator of the first group electronic gear ratio. It is valid when P0-16=0	-	1
P0-18	Electronic gear 1 denominator	During running	Immediate	1~32767	Set the denominator of the first group electronic gear ratio. It is valid when P0-16=0	-	1
P0-19	Electronic gear 2 numerator	During running	Immediate	1~32767	Set the numerator of the first group electronic gear ratio. It is valid when P0-16=0	-	1
P0-20	Electronic gear 2 denominator	During running	Immediate	1~32767	Set the denominator of the first group electronic gear ratio. It is valid when P0-16=0	-	1

### 6.2.3 Position Reference Filter

This function filters the position references (encoder unit) divided or multiplied by the electronic gear ratio. It involves the first-order filter and average filter.

#### It is applicable to the following conditions:

- (1) Acceleration/Deceleration is absent on the position references from the host controller.
- (2) The pulse frequency is too low.
- (3) The electronic gear ratio is larger than 10.

Properly setting the position loop filter time constant could run the motor more smoothly, so that the motor speed would not overshoot before it stabilizes. This setting has no effect on the number

of command pulses.

The filter time is not as long as possible. The longer the filter time, the longer the delay time and the longer the response time.

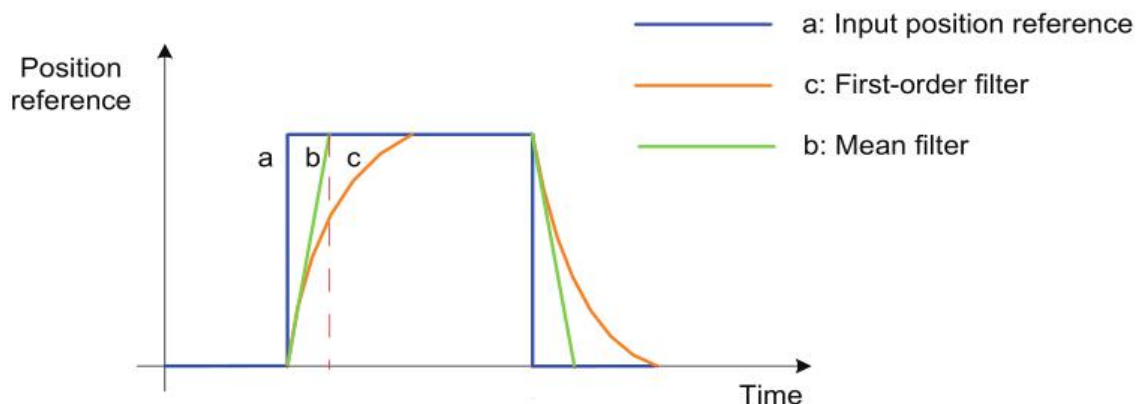


Figure 6-5 position reference filter

Relevant parameters:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P4-1	Pulse command filtering mode	At stop	Immediate	0~1	0: first-order low-pass filtering 1: average filter	-	0
P4-2	Position command first-order low-pass filter	At stop	Immediate	0~128	For pulse command input filtering	ms	0
P4-3	Position command average filtering time constant	At stop	Immediate	0~100 0	For pulse command input filtering	ms	20

#### 6.2.4 Position Deviation Clear

Position deviation = Position reference – Position feedback (encoder unit)

The position deviation clear function refers to the function that the drive clears the deviation register in the position mode. The function of clearing position deviation could be realized through DI terminal.

### 6.2.5 Frequency-Division Output

The encoder pulse is output as a quadrature differential signal after divided by the internal circuit of the servo driver. The phase and frequency of the frequency-divided signal could be set by parameters. The source of frequency division output could be set by function code, and the setting of different sources makes the function of frequency division output more widely used.

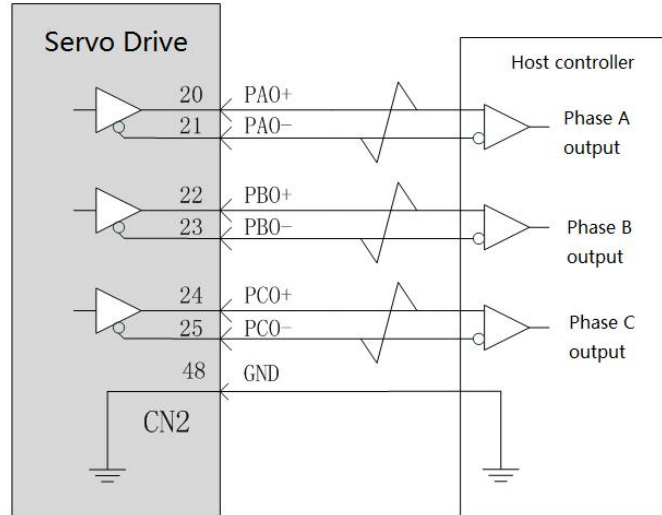


Figure 6-6 diagram of frequency division output wiring

**The frequency-division output is a differential signal output:**

**Phase A pulse:** PAO +, PAO-, differential output, the maximum output pulse frequency is 2Mpps

**Phase B pulse:** PBO +, PBO-, differential output, the maximum output pulse frequency is 2Mpps

**Phase Z pulse:** PZO +, PZO-, differential output, the maximum output pulse frequency is 2Mpps

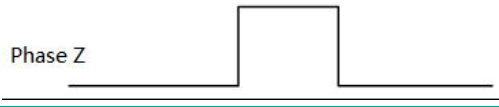
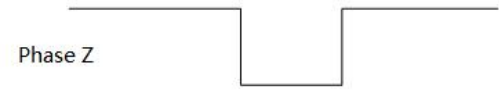
The frequency division pulse output direction could be set through the function code [P0-21]. The waveform diagram of the encoder frequency division pulse output is **as follows:**

P0-21	Forward rotation, pulse output waveform	Reverse rotation, pulse output waveform
0	Phase A Phase B	Phase A Phase B
1	Phase A Phase B	Phase A Phase B

In addition, the Z pulse output polarity could be set through function code P0-23, as shown in **the following figure:**

**P0-23(Z pulse output polarity)**

**pulse waveform (forward / reverse)**

0	Phase Z 
1	Phase Z 

Function code P0-22(the number of output pulses per revolution of the motor) is used to set the number of output pulses of the A and B phases of the motor, and changing the function code could set the frequency division of the output.

**Relevant parameters:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-21	frequency-dividing output direction	At stop	Power-on again	0~1	Quadrature pulse output. 0: When the motor rotation direction is CW, A advances B 1: When the motor rotation direction is CCW, B advances A	-	0
P0-22	Encoder ppr	At stop	Power-on	10~10000	Quadrature output. Set the number of output pulses of phase A and phase B for each rotation of the motor	Pulse	2500
P0-23	Z pulse output OZ polarity	At stop	again	0~1	0-Z Active when pulse is high 1-Z Active when pulse is low	-	0

**6.2.6 Position-relevant DO output function**

The feedback value of the position command is compared with different thresholds, and the DO signal could be output for the host controller to use.

(1) Positioning completed/near output

The internal command completion function means that when the multi position reference within the servo is zero, it could be considered that the command transmission is completed. At this time, the servo drive could output the internal command completion signal, and the host computer could confirm that the multi-segment position command within the servo drive has been sent.

The positioning completion function means that the position deviation meets the conditions set by the [P5-12], and it could be considered that the positioning is completed in the position control mode. At this time, the servo driver could output the positioning completion signal, and the host controller could confirm that the positioning of the servo driver is completed after receiving this signal.

**The functional schematic diagram is as follows:**

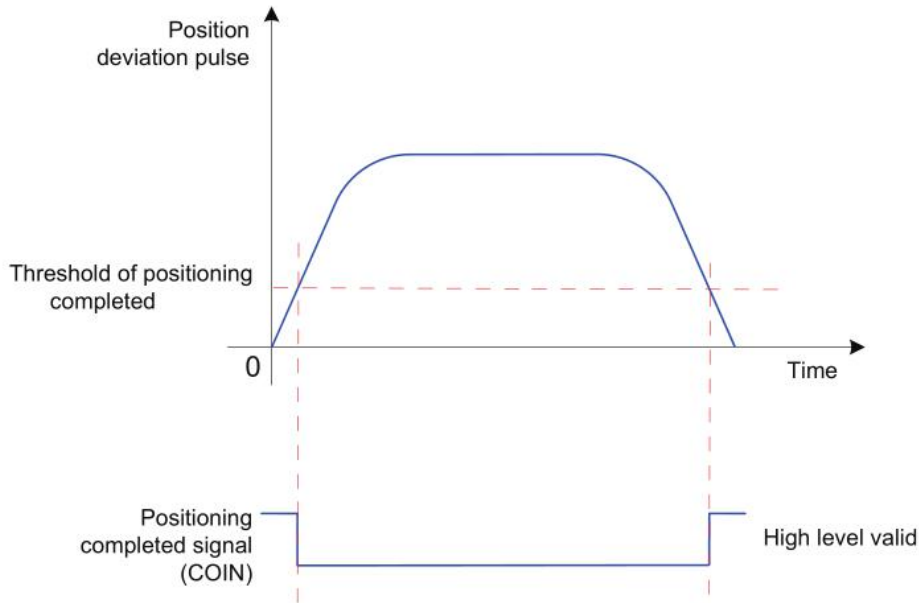


Figure 6-7 positioning completed diagram

When using the positioning completion / proximity function, you could also set positioning completion, positioning proximity conditions, window, and hold time. The diagram of window filtering time is shown in **the figure below**:

Diagram of positioning completed time window and holding time

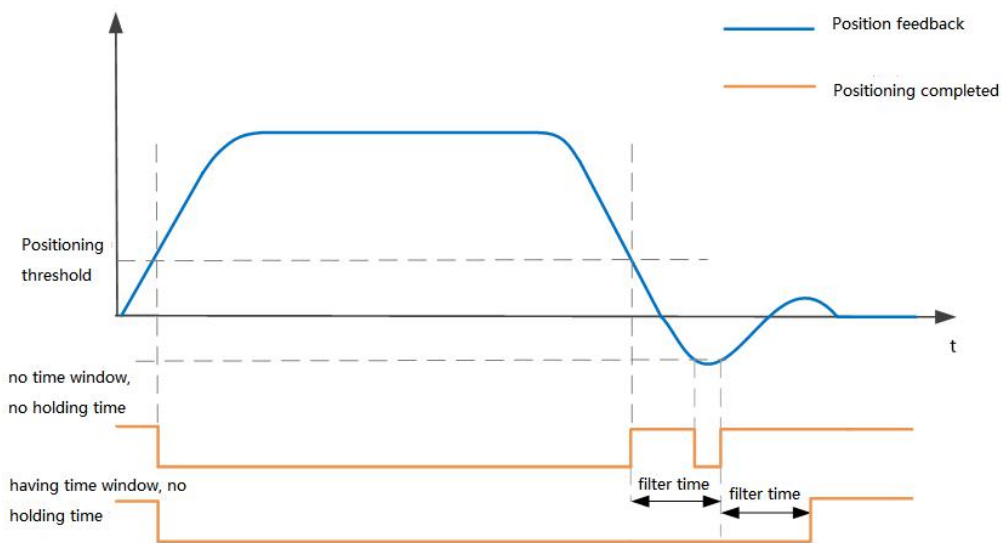


Figure 6-8 diagram of positioning completion signal output with window filtering time

**Relevant parameters:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-11	Positioning completed,	During running	Immediate	1~3	Output signal judging conditions for positioning	-	0



	positioning near setting				<p>completed and positioning near</p> <p>0:The output is valid when the absolute value of the position deviation is less than the positioning completion threshold / location near threshold.</p> <p>1:The absolute value of the position deviation is less than the positioning completion threshold / positioning near threshold, and the input position command is 0 then the output is valid</p> <p>2:The absolute value of the position deviation is smaller than the positioning completion threshold / positioning approach threshold, and the input position command filter value is 0 then the output is valid</p> <p>3:The absolute value of the position deviation is less than the positioning completion threshold / positioning approach threshold, the input position command filter value is 0, and the positioning detection time window is continued then the output is valid</p>		
P5-12	Positioning completed threshold	During running	Immediate	1~65535	Positioning completion threshold	Pulse	800
P5-13	Positioning approach threshold	During running	Immediate	1~65535	Positioning near threshold	Pulse	5000
P5-14	Positioning detection time	During running	Immediate	0~20000	Set the positioning completion detection time window	ms	10

	window						
P5-15	Positioning signal hold time	During running	Immediate	0~20000	Set the hold time of positioning completion output	ms	100

To use the positioning completion function, the DO terminal of the servo drive should be assigned as the positioning completion function and determine the valid logic. Take the DO1 terminal as an example, **the relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P6-26	DO_1 function selection	During running	Power-on again	128~142	129-RDY Servo Ready 130-ALM Alarm 131-WARN Warning 132-TGON Motor rotation output 133-ZSP Zero speed signal 134-P-COIN Positioning completed 135-P-NEAR Positioning near 136-V-COIN Speed consistent 137-V-NEAR Speed near 138-T-COIN Torque reached 139-T-LIMIT Torque limit 140-V-LIMIT Speed limit 141-BRK-OFF Solenoid brake 142-SRV-ST Enable Servo status output	-	131
P6-27	DO_1 logic selection	During running	Power-on again	0~1	Output logic function selection. ★ 1. Set to 0: When the signal is valid, the output transistor is on. When the signal is invalid, the output transistor is off. 2. Set to 1: When the signal is valid, the output transistor is off. When the signal is invalid, the	-	0

					output transistor is on.		
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### 6.3 Speed Control Mode

Speed control refers to control the speed of the machine through the speed reference. Through internal digital setting, analog voltage or communication, the servo drive could achieve fast and precise control of the mechanical speed. Therefore, the speed control mode is mainly used to control the rotation speed, or use the host controller to realize the position control, and the host controller output is used as the speed reference, such as analog engraving and milling machine.

The speed control block diagram is as follows:

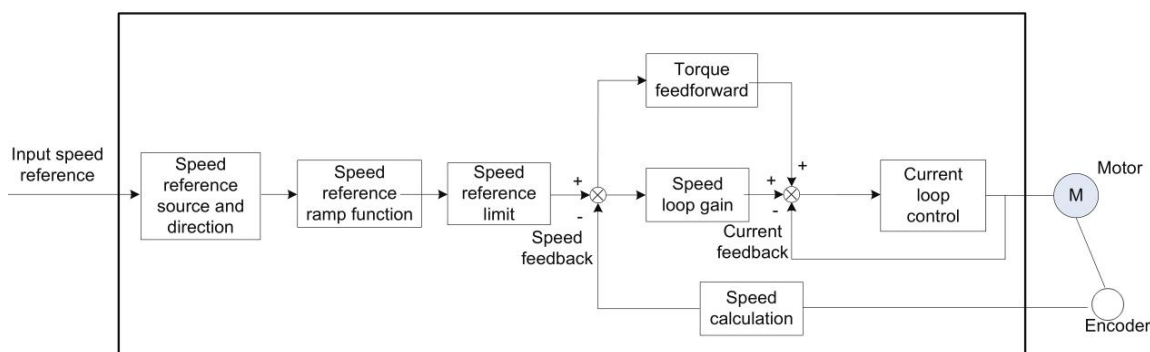


Figure 6-9 speed control diagram

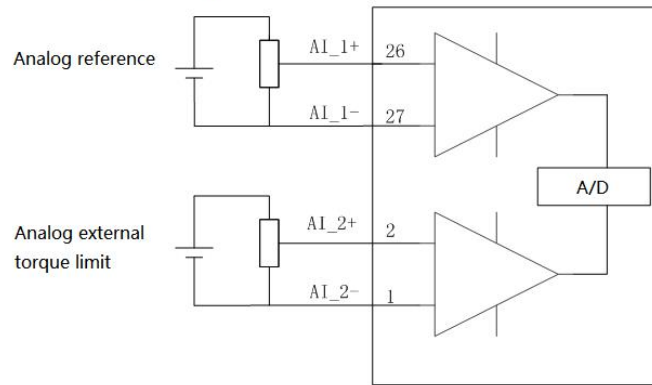
Set the parameter P0-1 to 2 through the panel or debugging tool on PC to make the servo drive work in speed control mode.

Relevant function code:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P0-1	Control mode (default setting)	At stop	Power-on again	1~10	1: Position control mode 2: Speed control mode 3: Torque control mode	-	1

#### 6.3.1 Speed Reference Input Setting

Analog signal speed control mode wiring



(1) Speed Reference Source

There are two sources of speed reference in speed control mode, which could be set by [P1-1].

Relevant function code:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-1	Speed command source	At stop	Immediate	0~1	0: Internal speed command (set in P1-3). 1: AI_1 analog input.	-	0

(a) Internal speed reference

Set the speed value through the function code [P1-2] as the speed reference.

Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-2	Internal speed command	During running	Immediate	-3000~3000	Internal speed command	rpm	100

(b) Analog voltage input as a reference

Take the analog voltage signal output by the host controller or other equipments, processed as a speed reference.

Analog voltage setting method:

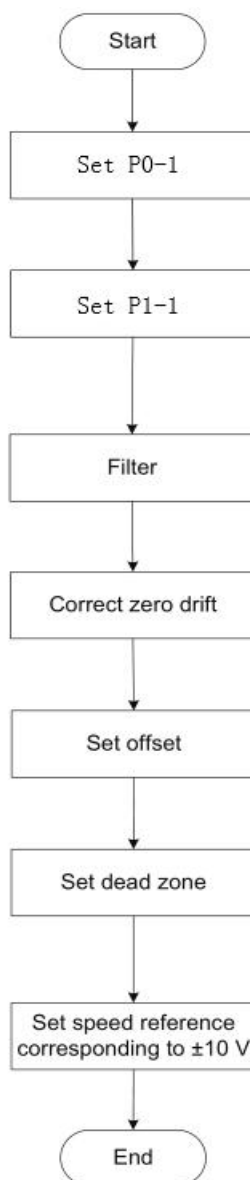


Figure 6-10 flowchart of setting speed reference by analog voltage

**Glossary:**

**Zero drift:** Value of the servo drive sampling voltage relative to GND when the input voltage of the analog channel is zero.

**Offset:** Input voltage value of the analog channel when the sampling voltage is zero after zero drift correction.

**Dead zone:** Input voltage range of the analog channel when the sampling voltage is zero.

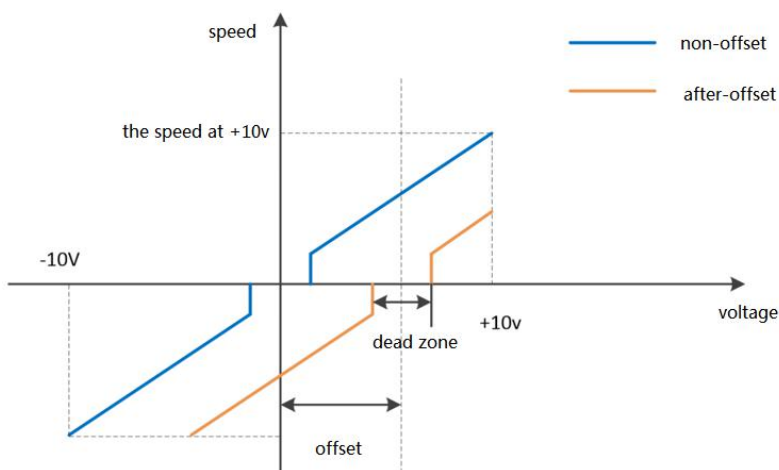


Figure 6-11 Analog signal after-offset

After completing the correct settings, you could view the input voltage values of AI<sub>1</sub> and AI<sub>2</sub> through U0-21 and U0-22

Code	Function	Unit	Format
U0-21	AI1 input voltage value	V	decimal(3 decimal digits)
U0-22	AI2 input voltage value	V	decimal(3 decimal digits)

#### Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-1	AI <sub>1</sub> input bias	During running	Immediate	-5000~500 0	Set AI <sub>1</sub> channel analog offset value	mv	0
P5-2	AI <sub>1</sub> Input filter constant	During running	Immediate	0~65535	AI <sub>1</sub> channel input first-order low-pass filtering time constant	ms	200
P5-3	AI <sub>1</sub> dead zone	During running	Immediate	0~1000	Set AI <sub>1</sub> channel analog dead zone value	mv	20
P5-4	AI <sub>1</sub> zero drift	During running	Immediate	-500~500	Automatic calibration zero drift inside the driver.	mv	0
P5-5	AI <sub>2</sub> input bias	During running	Immediate	-5000~500 0	Set AI <sub>2</sub> channel analog offset value	mv	0
P5-6	AI <sub>2</sub> Input filter constant	During running	Immediate	0~65535	AI <sub>2</sub> channel input first-order low-pass filtering	ms	200

					time constant		
P5-7	AI_2 dead zone	During running	Immediate	0~1000	Set AI_1 channel analog dead zone value	mv	20
P5-8	AI_2 zero drift	During running	Immediate	-500~500	Automatic calibration zero drift value inside the driver	mv	0
P5-9	Analog 10V for speed value	At stop	Immediate	1000~4500	Set the speed value corresponding to analog 10V	rpm	3000
P5-10	Analog 10V for torque value	At stop	Immediate	0~3000	Set the torque value corresponding to analog 10V	0.1%	1000

### 6.3.2 Acceleration and deceleration time setting

The acceleration/deceleration time setting refers to convert a speed command with a relatively high acceleration into a speed command with a relatively gentle acceleration, so as to achieve the purpose of controlling the acceleration.

In the speed control mode, excessive acceleration of the speed command would cause the vibration. At this time, increase the acceleration or deceleration time to achieve a smooth speed change of the motor and avoid mechanical damage caused by the above situation.

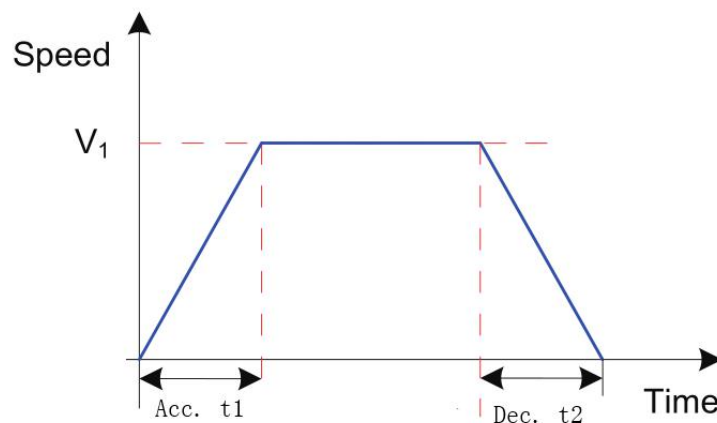


Figure 6-12 diagram of acc. and dec. time

Actual acceleration time  $T1 = \text{speed reference} / 1000 * \text{acceleration time}$

Actual deceleration time  $T2 = \text{speed reference} / 1000 * \text{deceleration time}$

**Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-3	Acc. time	During running	Immediate	0~65535	Acceleration time from 0 to 1000rpm in speed command mode	ms	50
P1-4	Dec. time	During running	Immediate	0~65535	Deceleration time from 1000 to 0 rpm in speed command mode	ms	50

### 6.3.3 Speed Reference Limitation

The servo drive could display the value of the speed reference in speed mode.

Sources of speed instruction limits include:

**[P1-10]:** Set the maximum speed limit value

**[P1-12]:** Set forward speed limit value

**[P1-13]:** Set the reverse speed limit value

**Maximum motor speed:** determined according to the model of the motor

| The amplitude of the forward speed reference |  $\leq \min \{ \text{Max. motor speed, P1-10, P1-12} \}$

| The amplitude of the negative speed reference |  $\leq \min \{ \text{Max. speed of the motor, P1-10, P1-13} \}$

**Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-10	Max speed threshold	During running	Immediate	0~5000	Set the maximum speed limit value.	rpm	3600
P1-12	Forward speed threshold	During running	Immediate	0~3000	Set forward speed limit	rpm	3000
P1-13	Reverse speed threshold	During running	Immediate	0~3000	Set reverse speed limit	rpm	3000

### 6.3.4 Zero Speed Clamp Function

Zero speed clamping function means that when the zero speed clamping signal (ZCLAMP) is valid, when the absolute value of the speed reference is lower than the zero speed clamping speed value,



the servo motor is in the locked state. At this time, the servo drive is in position lock mode, and the speed reference is invalid.

**Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-21	Zero speed clamp function selection	During running	Immediate	0~3	Set the zero speed clamp function. In speed mode: 0: Force speed to 0. 1: Force the speed to 0, and keep the position locked when the actual speed is less than [P1.22]. 2: When the speed reference is less than [P1-22], force the speed to 0 and keep the position locked. 3: Invalid, ignore the zero speed clamp input.	-	0
P1-22	Speed threshold for zero	During running	Immediate	0~1000	Set the speed threshold of the zero speed clamp function	rpm	20

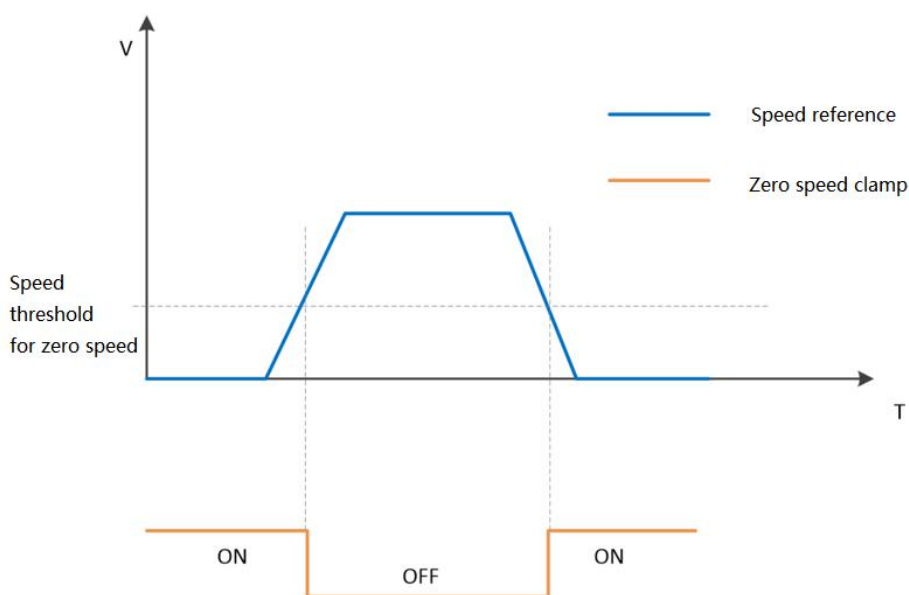


Figure 6-13 Zero Speed Clamp waveform

### 6.3.5 Speed-relevant DO Signals

Different DO signals are output to the host controller based on comparison between the speed

feedback after filter and different thresholds. We need to assign different function for the DO terminals and set the valid logic.

### (1) Motor Rotation DO Signal

After the speed reference is filtered, the absolute value of the actual speed of the servo motor reaches [P5-16] (rotation detection speed threshold), then the motor is considered to be rotating. At this time, the DO terminal of the servo drive could output a rotation detection signal. Conversely, when the actual rotation speed of the servo motor does not reach [P5-16], it is considered that the motor is not rotating.

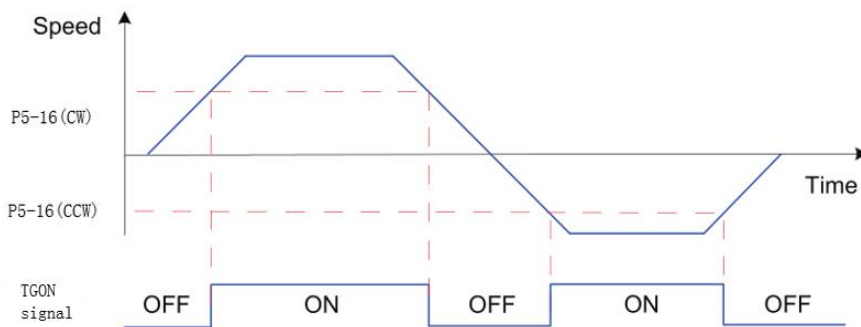


Figure 6-14 motor rotation DO signal

#### Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-16	Rotation detection speed threshold	During running	Immediate	0~1000	Set motor rotation signal judgment threshold	rpm	20
P6-26	DO_1 function selection	During running	Immediate	128~142	132-TGON rotation detection	-	131

### (2) Zero speed signal

The absolute value of the actual speed of the servo motor is less than a certain threshold [P5-19], it is considered that the servo motor stops rotating, and the DO terminal of the servo drive could output a zero speed signal at this time. Conversely, if the absolute value of the actual speed of the servo motor is not less than this value, it is considered that the motor is not at a standstill and the zero speed signal is invalid.

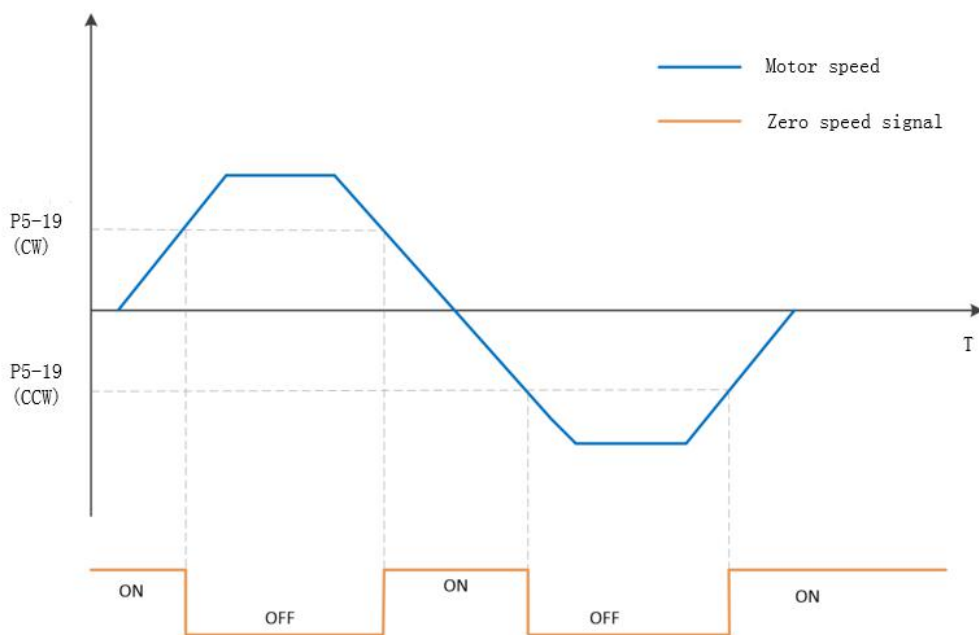


Figure 6-15 zero speed signal waveform

Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-19	Zero speed output signal threshold	During running	Immediate	0~6000	Zero speed output signal threshold	rpm	10
P7-18	DO_1 function selection	During running	Power on again	128~142	133-ZSP zero speed signal	-	132

(3) Speed Consistent DO Signal

In speed control, when the absolute value of the difference between the motor speed after filter and the speed reference satisfies the setting of [P5-17], the actual motor speed is considered to reach the speed reference. At this moment, the servo drive outputs the speed consistent signal. When the absolute value of the difference between the motor speed after filter and the speed reference exceeds the setting of [P5-17], the speed consistent signal is inactive.

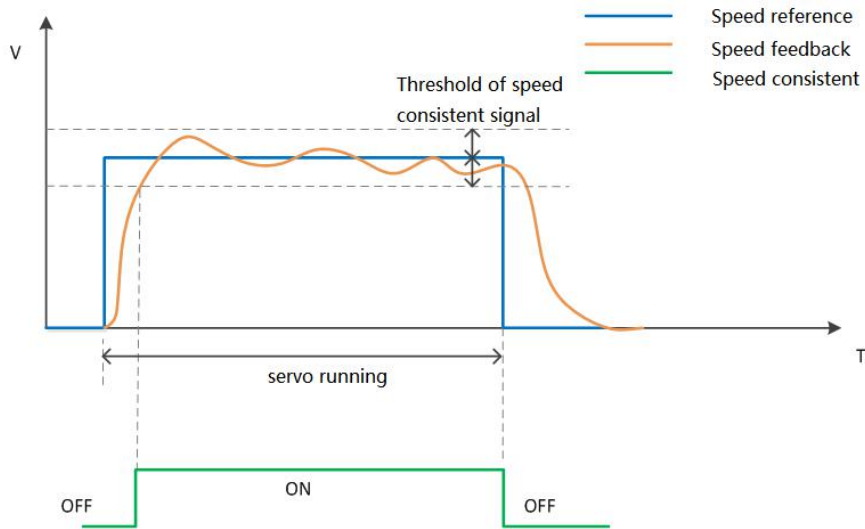


Figure 6-16 Speed Consistent Waveform

Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-17	Speed consistent signal threshold	During running	Immediate	0~100	Set the speed consistent signal threshold	rpm	10
P7-18	DO_1 function selection	During running	Immediate	128~142	135-V-COIN speed consistent	-	135

(4) Speed Reached DO Signal

When the absolute value of the motor speed after filter exceeds the setting of[P4-16],the motor speed is considered to reach the desired value. At this moment, the servo drive outputs the speed reached signal. When the absolute value of the motor speed after filter is smaller than or equal to the setting of[P4-16], the speed reached signal is inactive.

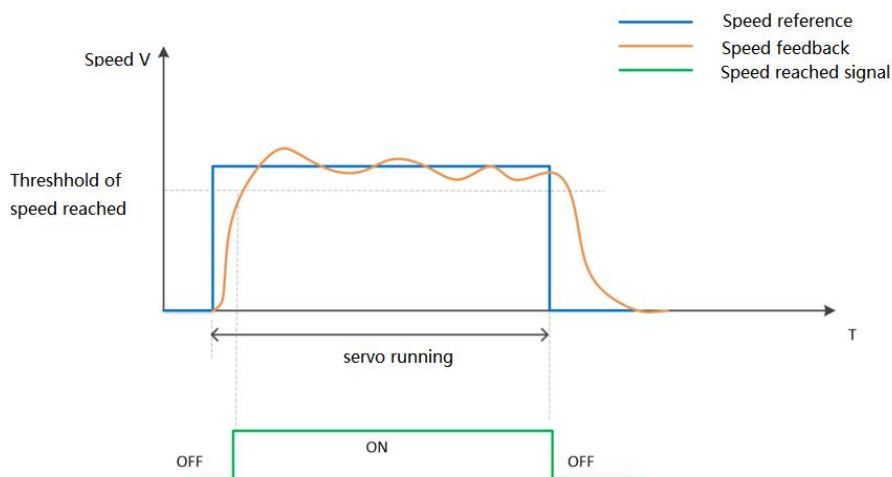


Figure 6-17 Speed reached signal waveform

Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-18	Speed approaching signal threshold	During running	Immediate	10~6000	Speed reached signal threshold	rpm	100
P7-18	DO_1 function selection	During running	Power on again	128~142	136-V-NEAR speed near	-	136

### 6.4 Torque Control Mode

The current of the servo motor has a linear relationship with the torque. Therefore, the control of the current could achieve the control of the torque. Torque control refers to controlling the output torque of the motor through a torque reference. Torque reference could be given by internal command and analog voltage. **The torque control block diagram is as follows:**

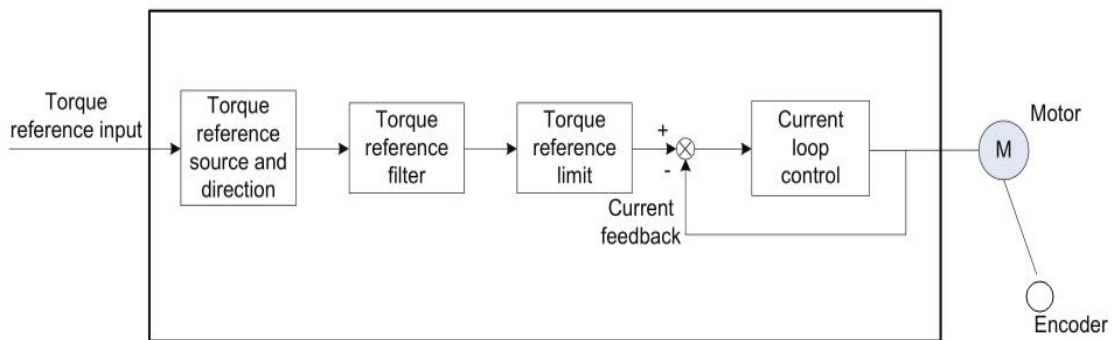
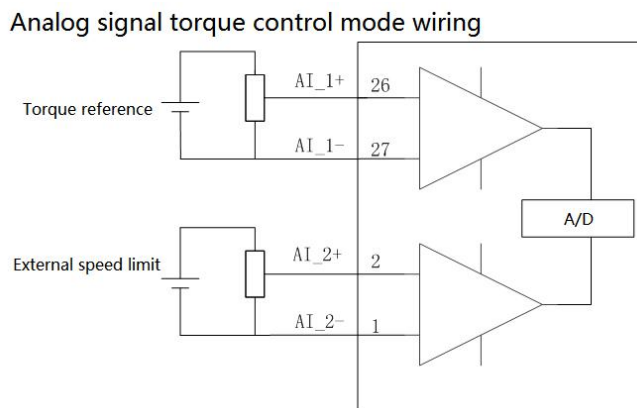


Figure 6-18 torque mode block diagram

#### 6.4.1 Torque Reference Input Setting



(1) Torque reference source

In the torque control mode, there are two sources of torque reference, which could be set through [P1-7]. **Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-7	Torque reference source	At stop	Immediate	0~1	0: Internal torque command. 1: AI_1 analog input.	-	0

(a) Digital setting

The source of the torque reference is an internal command, which is set through function code [P1-8]. **Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-8	Torque reference keyboard set value	During running	Immediate	-3000~3000	-300.0%~300.0%	0.1%	0

(b) Analog voltage setting

Take the analog voltage signal outputs by the host controller or other equipment as a speed reference.

**Operation flowchart of setting torque reference by analog voltage:**

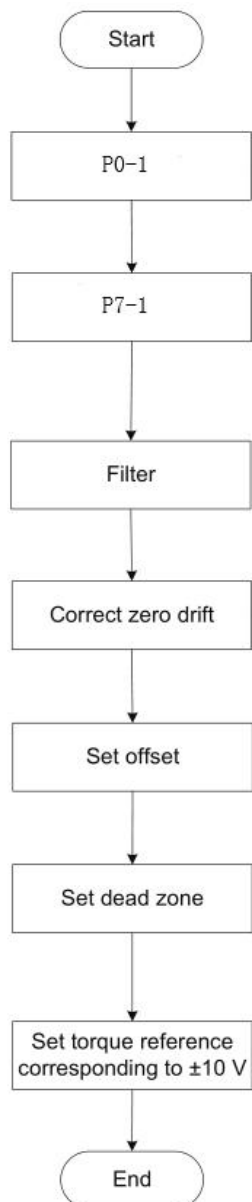


Figure 6-19 flowchart of setting torque reference by analog voltage

**Zero drift:** value of the servo drive sampling voltage relative to GND when the input voltage of the analog channel is zero

**Offset:** input voltage value of the analog channel when the sampling voltage is zero after zero drift correction

**Dead zone:** input voltage range of the analog channel when the sampling voltage is zero

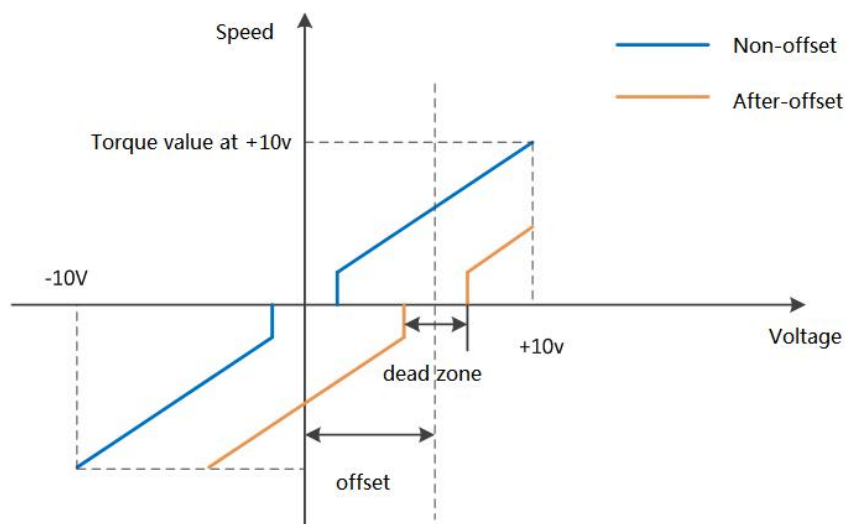


Figure 6-20 Analog signal waveform after-offset

After completing the correct settings, user could view the input voltage values of AI\_1 and AI\_2 through [U0-21] and [U0-22]

Code	Function	Unit	Format
U0-21	AI1 input voltage value	V	decimal(3 decimal digits)
U0-22	AI2 input voltage value	V	decimal(3 decimal digits)

#### Relevant function codes:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-1	AI_1 input bias	During running	Immediate	-5000~5000	Set AI_1 channel analog offset value	mv	0
P5-2	AI_1 Input filter constant	During running	Immediate	0~65535	AI_1 channel input first-order low-pass filtering time constant	ms	200
P5-3	AI_1 dead zone	During running	Immediate	0~1000	Set AI_1 channel analog dead zone value	mv	20
P5-4	AI_1 zero drift	During running	Immediate	-500~500	Automatic calibration zero drift inside the driver.	mv	0
P5-5	AI_2 input bias	During running	Immediate	-5000~5000	Set AI_2 channel analog offset value	mv	0
P5-6	AI_2 Input filter constant	During running	Immediate	0~65535	AI_2 channel input first-order low-pass filtering time constant	ms	200



P5-7	AI_2 dead zone	During running	Immediate	0~1000	Set AI_1 channel analog dead zone value	mv	20
P5-8	AI_2 zero drift	During running	Immediate	-500~500	Automatic calibration zero drift value inside the driver	mv	0
P5-9	Analog 10V for speed value	At stop	Immediate	1000~4500	Set the speed value corresponding to analog 10V	rpm	3000
P5-10	Analog 10V for torque value	At stop	Immediate	0~3000	Set the torque value corresponding to analog 10V	0.1%	1000

### 6.4.2 Torque Reference Filter

In the torque mode, the servo drive could realize low-pass filtering of the torque command, which reduces the vibration of the servo motor.

**Relevant function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P4-4	Torque filter time constant	During running	Immediate	10~2500	When [Auto-tuning mode] is set as 1, or 2, this parameter is set automatically	0.01	0.5

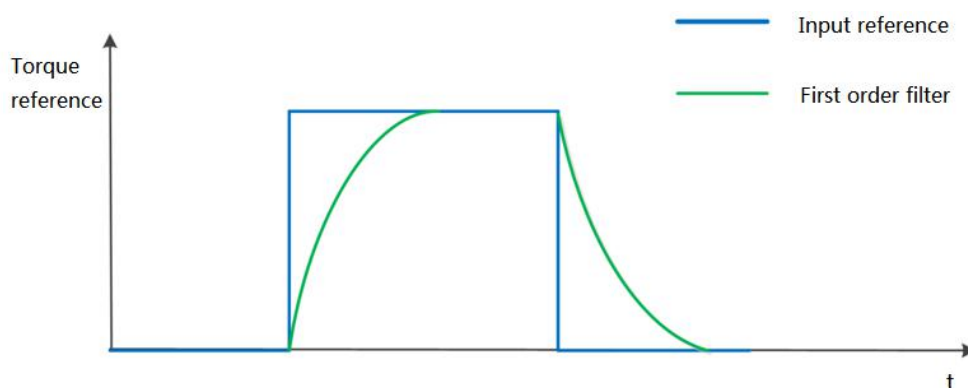


Figure 6-21 Diagram of torque reference first-order filter

If the setting value of the filter time constant is too large, the responsiveness would be reduced. Please set it while confirming the responsiveness.

### 6.4.3 Torque Reference Limit

When the absolute value of the torque reference input from the host controller or output by the speed regulator is larger than the absolute value of the torque reference limit, the actual torque reference of the servo drive is restricted to the torque reference limit. Otherwise, the torque reference input from the host controller or output by the speed regulator is used.

Only one torque reference limit is valid at a moment. Both positive and negative torque limits does not exceed the maximum torques of the servo drive and motor and  $\pm 300.0\%$  of the rated torque.

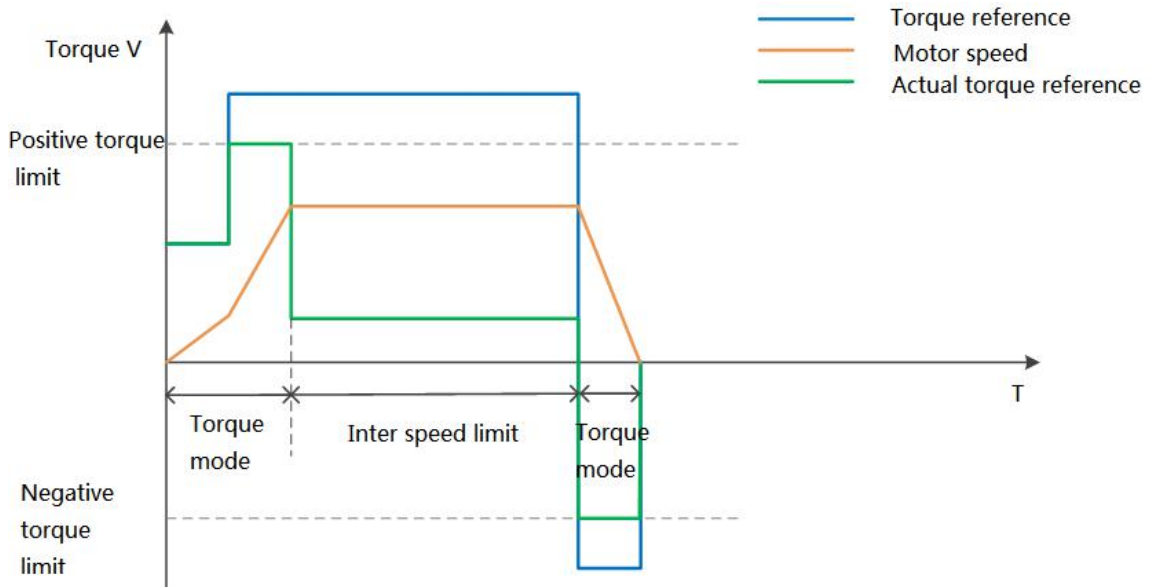


Figure 6-22 Torque setting and limit

#### (1) Torque Limit Source

The torque limit source is set in[P1-14]. After the torque limit is set, the servo drive torque reference is restricted to be within the torque limit. After the torque reference reaches the limit, the motor runs according to the torque limit. The torque limit must be set according to the load conditions. If the setting is very small, it may cause longer acceleration/deceleration time of the motor, and the actual motor speed may not reach the required value at constant speed running.

**Relevant code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P1-14	Torque limit source	At stop	Immediate	0~1	0: Internal value 1: AI_2 analog input	-	0

When [P1-14]= 0: internal torque limit

The torque reference limit value is determined by the internal function codes [P1-15] and [P1-16]

**Relevant code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
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P1-15	Forward rotation torque limit	during	Immediate	0~300 0	When [P1-14] selects internal torque limit, this function code value is used as the forward torque limit value	0.1%	3000
P1-16	Reverse torque limit	during	Immediate	0~300 0	When [P1-14] selects internal torque limit, this function code value is used as the reverse torque limit value	0.1%	3000

(a) Torque Limit DO Signal

When the torque reference reaches the torque limit value, the driver outputs a torque limit signal (138-T-LIMIT torque limit) to the host controller and determines the DO terminal logic.

**Relevant code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P6-26	DO_1 function selection	During running	Power on again	128~142	138-T-LIMIT torque limit	-	138

#### 6.4.4 Torque related DO output function

The feedback value of the torque reference is compared with different thresholds, and the DO signal could be output to the host controller to use. Assign the DO terminals of the servo drive to different functions and set the valid logic.

(1) Torch reach signal

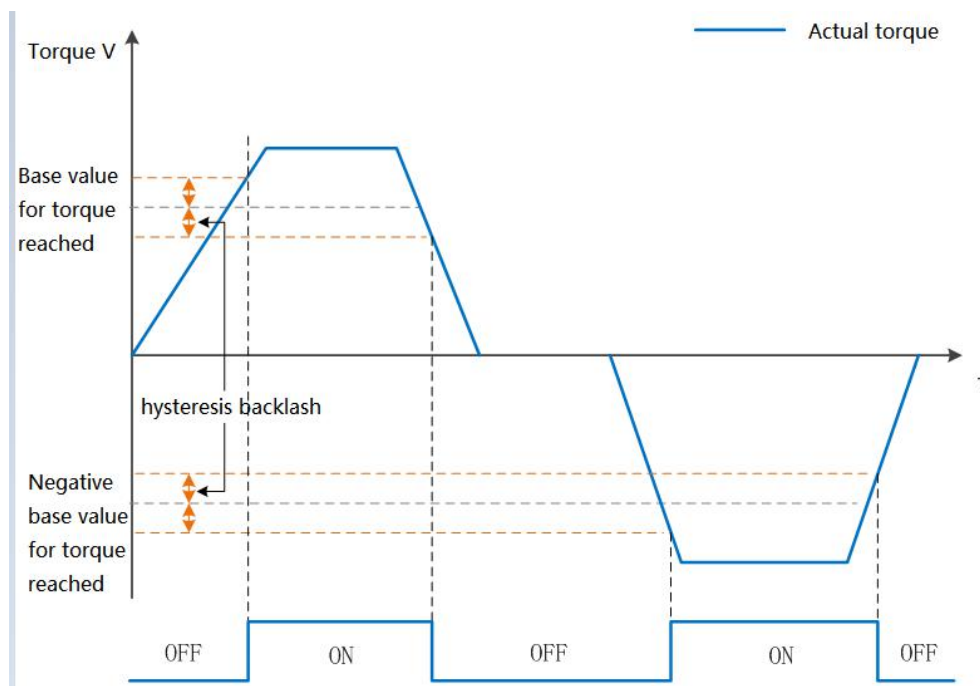


Figure 6-23 Torch reach signal waveform

Relevant function code:

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P5-20	Torque reached threshold	During running	Immediate	0~300	<p>The torque reached threshold needs to be used in conjunction with [torque reached hysteresis value]:</p> <p>When the actual torque reaches [torque reached threshold] + [torque reaches hysteresis], the torque reached DO becomes effective.</p> <p>When the actual torque decreases below [Torque reached threshold] + [Torque reached hysteresis], the torque reached DO becomes invalid.</p>	%	100
P5-21	Torque reached hysteresis	During running	Immediate	10~20	[Torque reached hysteresis value] Need to be used together with [Torque reached	%	10

					threshold]		
P6-26	DO_1 function selection	During running	Immediate	128~14 2	138-T-COIN Torch reach	-	138

# 7. Adjustment

## 7.1 Overview

The servo drive is required to run the motor in least time delay and as faithful as possible against references from the host controller or internal setting. Gain adjustment needs to be performed to meet the requirements.

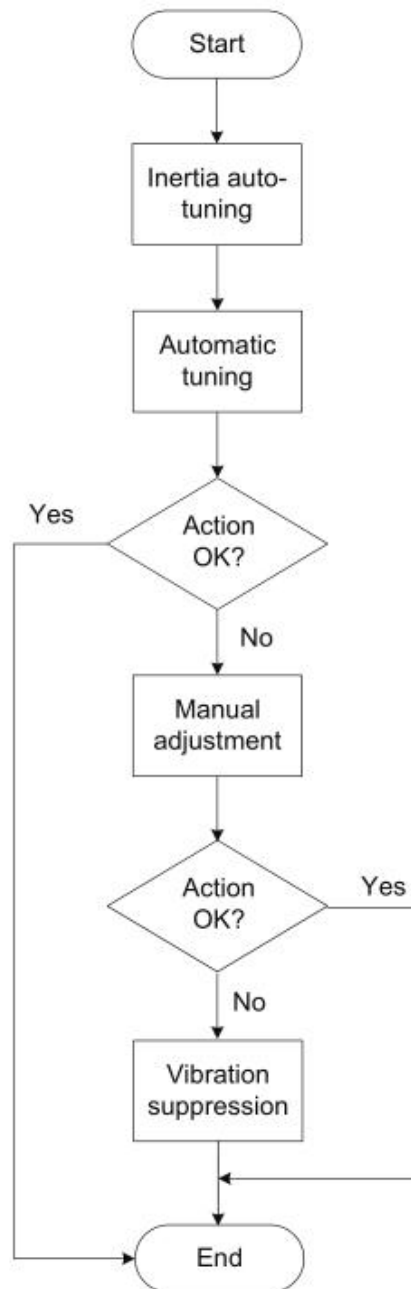


Figure 7-1 Gain adjustment flowchart

Servo gain is adjusted by setting multiple parameters (including position loop gain, speed loop gain,

filter and inertia ratio) that affect each other. Ensure these parameters have a balanced relationship during setting.

The following table shows the general gain adjustment description:

Gain Adjustment Procedure			Function	Section to Refer
1	Inertia auto-tuning	online	Use the debugging tool(running in pc) to perform inertia identification. self-inertia identification function, the drive automatically calculates the load inertia ratio	7.2.1
2	Automatic gain adjustment		The drive automatically gives the gain parameters to match the inertia ratio (it should be set correctly).	7.3.1
3	Manual gain adjustment	Basic gain	If the automatic gain adjustment result is not satisfactory, perform fine manual adjustment.	7.3.2
		Feedforward gain	Enable this function to improve the follow-up characteristics.	7.3.3
4	Vibration suppression	Mechanical resonance	Enable the notch function to suppress mechanical resonance.	7.4.1

## 7.2 Inertia ratio

The inertia ratio [P3-1] is:

$$\text{Inertia ratio} = \frac{\text{Total load inertia of machine}}{\text{Motor rotor inertia}}$$

The inertia ratio is an important parameter of the servo system, and quick commissioning could be implemented with the correct setting of this parameter.

It could be set manually or auto-tuned automatically by the servo drive itself.

Before performing online auto-tuning, **the following conditions should be met:**

- (1) The maximum speed of the motor should be greater than 300rpm.
- (2) The actual inertia ratio is between 0.00 and 100.00.
- (3) The load torque is stable without dramatic change.
- (4) The backlash of the load transmission mechanism is within a certain range.
- (5) The movement travel of the motor should meet the following requirements.
  - (a) The movement travel of above one revolution in either forward or reverse direction is available between the mechanical limit switches. To make sure the limit switches have been installed, the required movement travel is reserved to prevent the condition that the motor senses the limit switches, it maybe cause accidents during auto-tuning.
  - (b) [P3-5] (Motor revolutions for an inertia auto-tuning) **is met:** Ensure the movement travel for the motor in the stop position is larger than [P3-5]. if not, decrease [P3-6](maximum speed of

inertia identification).

During inertia auto tuning, if vibration occurs, the auto tuning should be stopped immediately.

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P3-1	Load inertia ratio	At stop	Immediate	0~10000	Set load inertia ratio, 0.00 - 100.00 times	0.01	500
P3-5	Number of inertia identification cycles	At stop	Immediate	1~2	Offline load inertia identification process, motor rotation number setting	revolution	2
P3-6	Maximum speed of inertia identification	At stop	Immediate	300~2000	Set the maximum allowed motor speed command in offline inertia identification mode.	rpm	1000
P3-7	rotation direction parameter	At stop	Immediate	0~2	0: forward and backward rotation 1: forward-forward one-way rotation 2: backward-backward one-way rotation	-	0

## 7.3 Gain adjustment

In order to optimize the response of the servo drive, it is necessary to adjust the servo gain. The servo gain is defined by several parameters. Therefore, the adjustment of the servo gain should take into account the relationship between the various parameters.

In general, high-rigidity machinery could improve the response performance by increasing the servo gain. However, for machines with low rigidity, when the servo gain is increased, vibration may occur, which in turn affects the increase in gain. Therefore, selecting a suitable servo gain parameter could achieve stable performance while achieving a high response.

The servo supports automatic gain adjustment and manual gain adjustment. It is recommended to use automatic gain adjustment.

### 7.3.1 Automatic Gain Tuning

Automatic gain tuning means that the servo drive automatically produces the matching gain parameters based on the setting of [P3-2] (rigidity level selection) to achieve fast response and stability.

Servo rigidity refers to the ability of the motor rotor to resist load inertia, that is, the self-locking



ability of the motor rotor. The stronger the servo rigidity, the greater the position loop gain and speed loop gain, the faster the system response speed.

**Note: before adjusting the rigidity level, set the proper load inertia ratio [P3-1] correctly!**

The setting range of [P3-2] is 0–31. The level 0 indicates the weakest stiffness and lowest gain and level 31 indicates the strongest stiffness and highest gain. The following table lists the stiffness levels for different load types.

Recommended Stiffness Level	Type of Load Mechanism
Level 4 to level 8	Large-scale machinery
Level 8 to level 15	Applications with low stiffness such as belt
Level 15 to level 20	Applications with high stiffness such as ball screw and direct-connected motor

When the function code [P3-3] is set to 0, the gain parameter is stored in the first gain by modifying the rigidity level.

During actual commissioning, it could be used for automatic rigidity level determination with the debug tool. It is used to select a suitable rigidity level as the operating parameter. **The operation steps are as follows:**

- (1) Confirm that the servo is in the ready state, the panel displays rdy, and the communication line is connected.
- (2) Open the debugging tool software, go to the run interface, set the corresponding parameters, and click "Servo On".
- (3) Click the "Forward" or "Reverse" button to confirm the travel range of the servo operation.
- (4) After the "auto tuning" lights up, click "auto tuning" to perform inertia recognition
- (5) After the auto gain tuning is completed, click "Save Inertia Value".
- (6) Click "Next" on the lower right to go to the parameter adjustment interface, and click "Parameter Measurement" to start parameter measurement.

**(Note: There may be a mechanical noise during the test. Generally, the servo would automatically stop the test. If it does not automatically stop or other abnormal conditions occur, you could click the "servo off" button on the interface to turn off the servo or power off the machine!)**

- (7) After the parameter measurement is completed, the debug tool would pop up a confirmation window for parameter writing and saving.

**!!! Note: For detailed operation of the debug tool, please refer to the "Wecon Servo Debugging Platform User Manual".**

**Related function codes:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P3-3	Auto-tuning mode	During running	Immediate	0~2	0: Rigidity level auto-tuning mode. according to the rigidity level setting,	-	1

	<p>selection</p>			<p>position loop gain, speed loop gain, speed loop integration time constant, and torque filter parameter settings are automatically</p> <p>1:Manual setting. users need to manually set the position loop gain, speed loop gain, speed loop integration time constant, and torque filter parameter settings. adjusted.</p> <p>2:Online automaticparameter auto-tuning mode (not implemented yet).</p>		
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### 7.3.2 Manual Gain Adjustment

When the automatic gain adjustment result is not satisfactory, execute fine manual gain adjustment to achieve better result.

The servo system consists of three control loops, namely, position loop, speed loop, and current loop from external to internal. The following figure shows the basic control block diagram.

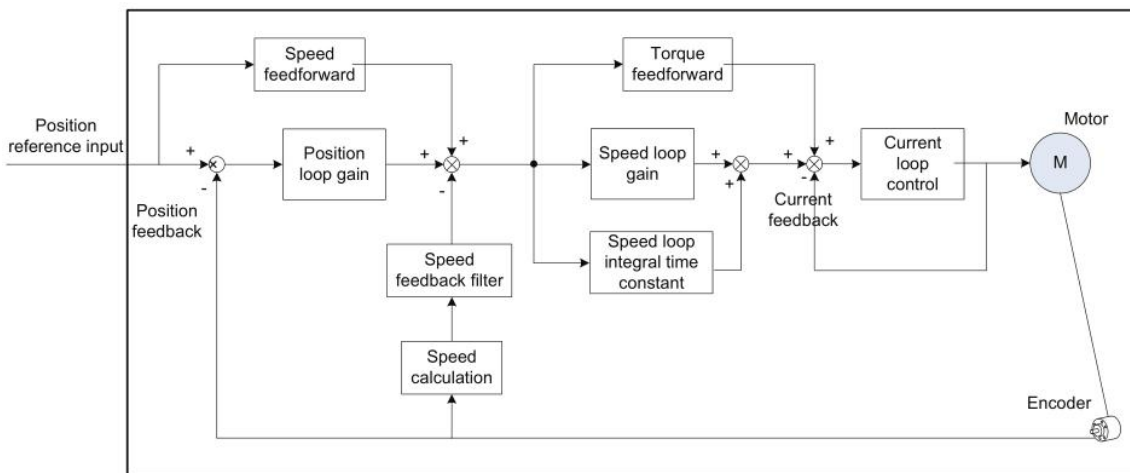


Figure 7-2 Basic control block diagram of manual gain adjustment

The most internal loop must have the highest response. The default current loop gain of the servo drive ensures the response, and need not be adjusted. You only need to adjust the position loop gain, speed loop gain and other auxiliary gains. When executing gain adjustment in the position control mode, increase the speed loop gain as well after increasing the position loop gain, and ensure the response of the position loop is lower than that of the speed loop to keep the system stable.

This servo drive has two sets of position loop and speed loop gain parameters. The user could switch between 2 sets of gain parameters according to the method corresponding to the setting

value of the second gain switching mode in [P2-7]. Usually use external DI to switch.

**Relevant parameters:**

Code	Function
P2-1	1st position loop gain
P2-2	1st speed loop gain
P2-3	1st speed loop integral time constant
P2-4	2nd position loop gain
P2-5	2nd speed loop gain
P2-6	2nd speed loop integral time constant
P4-4	Torque filter time constant

**(1) Speed loop gain**

Within the range of no vibration or noise in the mechanical system, the greater the speed loop gain setting value, the better the response of the servo system and the better the speed followability.

When noise occurs in the system, the speed loop gain should be reduced.

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P2-2	1st speed loop gain	During running	Immediate	0~35000	Set the speed loop gain to determine the response of the speed loop.	0.1Hz	65
P2-5	2nd speed loop gain	During running	Immediate	0~35000	Set the speed loop gain to determine the response of the speed loop.	0.1Hz	65

**(2) Speed loop integral time constant**

Speed loop integral time constant is used to eliminate speed loop deviation. Decreasing the integral time constant of the speed loop could increase the speed of the speed following, but the set value is too small would easily cause speed overshoot or vibration. when the time constant is set too large, the integral effect would be weakened, resulting in the deviation of the speed loop.

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P2-3	1st speed loop integration time	During running	Immediate	100~65535	Set the speed loop integral constant. The smaller the set value, the stronger the integral	0.1ms	1000

	constant				effect.		
P2-5	2nd speed loop integration time constant	During running	Immediate	100~65535	Set the speed loop integral constant. The smaller the set value, the stronger the integral effect.	0.1ms	1000

### (3) Position loop gain

Determine the highest frequency that the position loop could follow changing position reference. Increasing this parameter could speed up the positioning time and improve the ability of the motor to resist external disturbances when it is stationary. However, if the value is set too high, the system may be unstable .

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P2-1	1st position loop gain	During running	Immediate	0~6200	Set the position loop gain to determine the responsiveness of the position control system.	0.1Hz	400
P2-4	2nd position loop gain	During running	Immediate	0~6200	Set the position loop gain to determine the responsiveness of the position control system.	0.1Hz	400

### (4) Torque reference filter time

Choosing an appropriate torque filter time constant could suppress mechanical vibration. The larger the value of this parameter, the stronger the suppression ability, but if the setting value is too large, the response frequency of the current loop would decrease, causing vibration.

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P4-4	Torque filter time constant	During running	Immediate	10~2500	When [Auto-tuning mode] is set as 1, or 2, this parameter is set automatically	0.01	50

## 7.3.3 Feedforward gain

**Summary:** During position control and full-closed control, the speed control reference required for the operation is calculated from the internal position reference, and get the speed feedforward by comparing speed reference with the position feedback to get the speed feedforward, which could reduce more position deviation and improve response.

additionally, the torque reference required for operation is calculated from the speed control reference, and the torque feed-forward obtained by comparing the torque reference with the speed feedback could improve the response of the speed control system.

**Relevant function code(speed Feedforward Gain):**

Code	Function	Description
P2-9	Speed feedforward gain	When the speed feedforward filter is set to 50 (0.5 ms), gradually increase the speed feedforward gain to make the speed feedforward effective. The position deviation during operation under a certain speed state becomes smaller according to the value of the speed feedforward gain as the following formula. Position deviation [reference unit] = reference speed [unit / s] / position loop gain [1 / s] × (100 – speed feedforward gain [%]) / 100
P2-10	Speed feedforward filter	

**Relevant function code (torque Feedforward Gain):**

Code	Function	Description
P2-11	Torque feedforward gain	Increase the torque feed-forward gain, because the position deviation during certain acceleration and deceleration could be close to 0, so under the ideal condition that the external disturbance torque does not operate, when driving under the trapezoidal speed model, the position deviation could be close to 0. In fact, there should be external disturbance torque, so the position deviation could not be zero. In addition, like the speed feedforward, although the greater the torque feedforward filter constant, the smaller the operating noise, but the greater the position deviation of the acceleration change point.
P2-12	Torque feedforward filter	

## 7.4 Vibration Suppression

### 7.4.1 Suppression of Mechanical Resonance

Resonance may occur at vicinity of the mechanical resonance frequency when the servo gain is increased, making the gain could not be increased further.

**Mechanical resonance could be suppressed in the following two methods:**

(1) Torque reference filter

By setting the filter time constant so that it suppresses gain near the resonance frequency. The cutoff frequency of the torque reference filter could be calculated using the following formula. Filter cutoff frequency (Hz).

$$f_c = 1 / [2\pi \times \text{setting parameter value} \times 0.001]$$

(2) Notch:

The notch reduces the gain at certain frequencies to suppress mechanical resonance. After resonance is suppressed with correct setting of the notch, attempt to increase the gain gradually. The following figure shows the resonance

suppression principle of the notch.

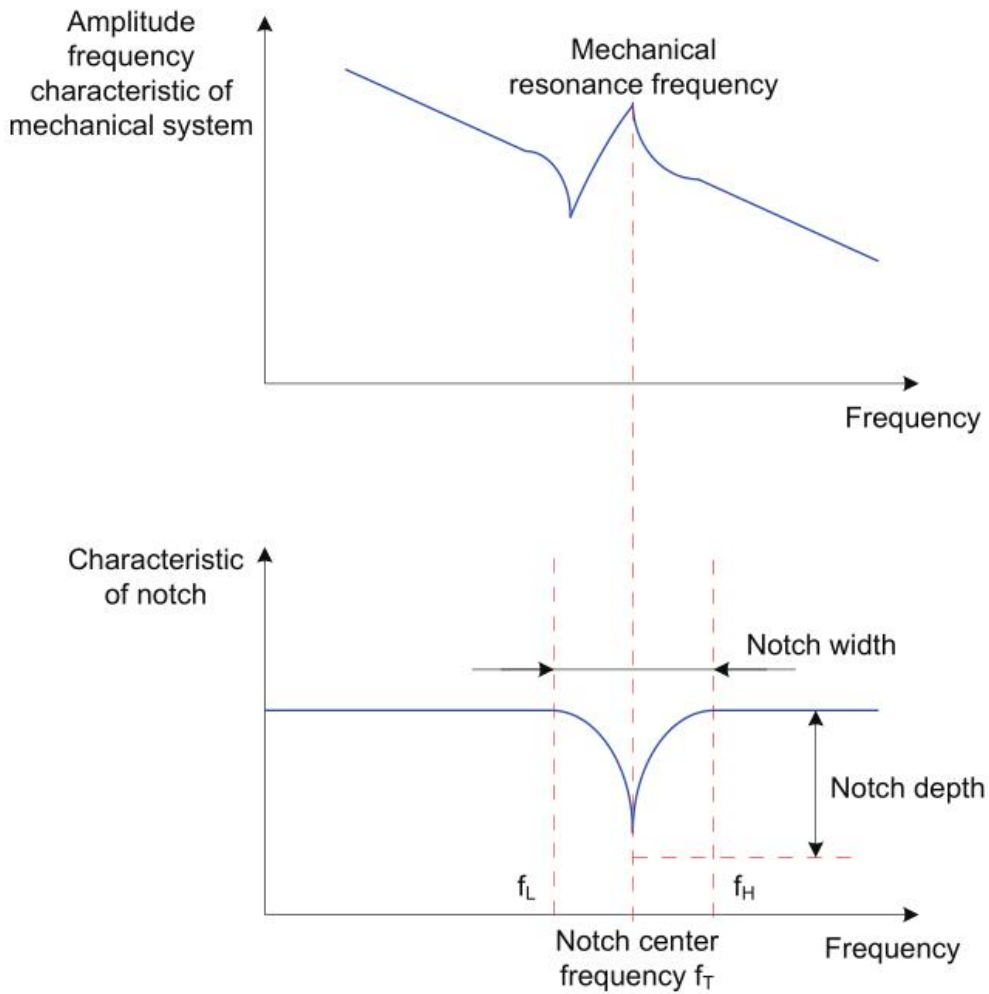


Figure 7-3 Resonance suppression principle of the notch

There are 2 sets of notches in the servo drive. Each notch has 3 parameters, which are the frequency, width level and depth level.

**(a)Notch Width Level**

The notch width level indicates the ratio of the notch width to **the notch center frequency**:

$$\text{Notch width level} = \frac{f_H - f_L}{f_T}$$

**Where:**

$f_T$ :Notch center frequency, that is, mechanical resonance frequency

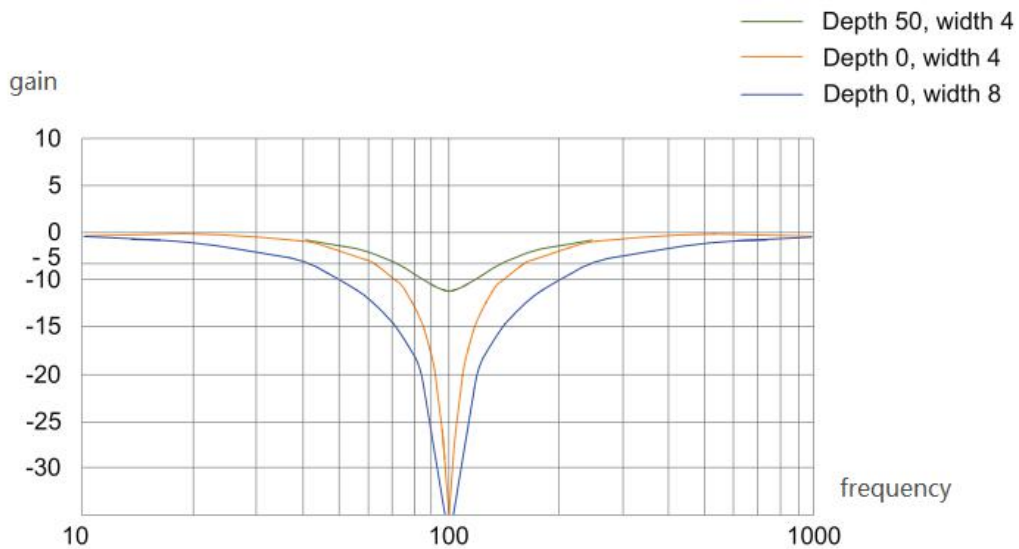
$f_H - f_L$ :Notch width, indicating the ratio of -3dB attenuation frequency band with respective to the notch center frequency

The corresponding relationship is shown in the figure below. Generally keep the default value of 4.

**(b)Notch Depth Level**

The notch depth level indicates the ratio of input to output at center frequency.

The input is completely shut with depth level 0 and fully received with depth level 100 at the center frequency. A smaller notch depth level indicates larger notch depth, which produces stronger resonance suppression and makes the system instable. Pay attention to this during use. The specific relationship is **shown below**:



**Figure 7-4 Frequency characteristic curve of notch**

**Relevant function code:**

Code	Parameter Name	Property	Effective Time	Range	Function	Unit	Default
P4-5	First notch frequency	During running	Immediate	250~5000	Set the center frequency of the 1st notch filter. When the setting value is 5000, the function of the notch filter is disabled.	Hz	300
P4-6	First notch depth level	During running	Immediate	0~100	0: all blocked 100: all passed	-	100
P4-7	First notch width level	During running	Immediate	0~12	0: 0.5 x bandwidth 4: 1x bandwidth 8: 2 times the bandwidth 12: 4 times the bandwidth	-	4
P4-8	Second notch frequency	During running	Immediate	250~5000	Set the center frequency of the second notch filter. When the setting value is 5000, the function of the	Hz	500

					notch filter is disabled.		
P4-9	Second notch depth level	During running	Immediate	0~100	0: all blocked 100: all passed	-	100
P4-10	Second notch width level	During running	Immediate	0~12	0: 0.5 x the bandwidth 4: 1x bandwidth 8: 2 times the bandwidth 12: 4 times the bandwidth	-	4



## 8. Communication

The servo drive supports Modbus communication. Users could modify or view parameters and monitor servo drive status on the host controller configured with the debug tool.

### 8.1 Modbus communication

#### 8.1.1 Hardware connection

The servo drive has a set of RS485 interface to support modbus communication. CN4 on the front panel is the communication interface. The signal description is shown in **the figure**:

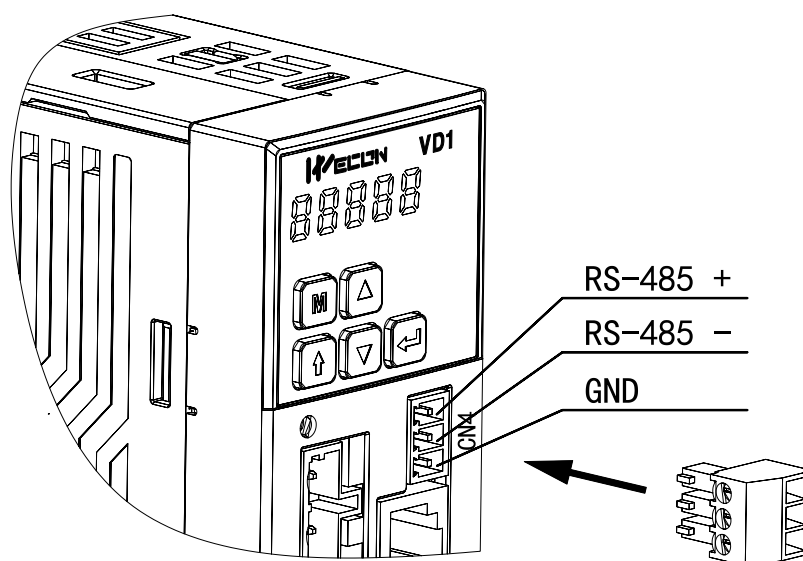


Figure 8-1 RS485 connection diagram

The servo drive adopts half-duplex communication method of RS485. The 485 bus must adopt a hand-in-hand structure rather than a star structure or a bifurcated structure. The star structure or the bifurcated structure would generate a reflected signal, which affects the 485 communication.

The wiring must be shielded twisted pair, and stay away from strong electricity and not parallel with the power cord, nor tied together.

It should be noted that in a half-duplex connection, only one servo drive could communicate with the host controller at a time. If two or more servo drives upload data at the same time, bus contention would occur. Not only would it cause communication failure, but it may also cause some components to generate large currents, causing component damage.

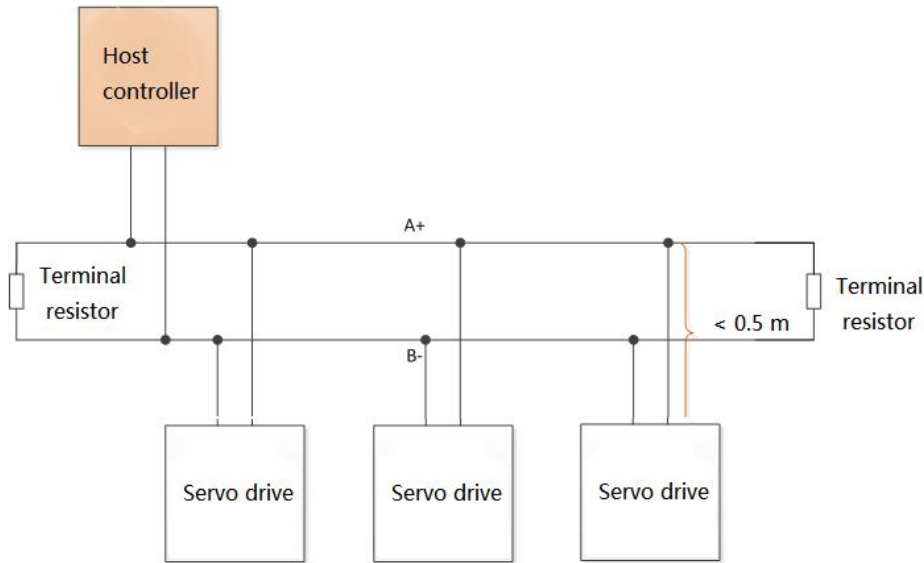


Figure 8-2 RS485 communication network wiring diagram

The terminal of RS485 network should use 120Ω terminal resistance to weaken the signal reflection. Termination resistors couldnot be used in the middle of network.

No point in the RS485 network could be directly grounded. All equipment in the network must be well grounded through its own ground terminal. It should be noted that the ground wire couldnot form a closed loop under any circumstances.

When wiring, consider the drive capability of the computer / PLC and the distance between the computer / PLC and the servo drive. If the driving capacity is insufficient, a repeater needs to be added.

## 8.2 Modbus communication protocol

### 8.2.1 Modbus data frame format

The servo currently supports the RTU communication format. The typical data frame format is as follows:

The beginning should have a message interval of not less than 3.5 characters	<b>address</b>	<b>Function code</b>	<b>data</b>	<b>CRC checksum</b>
	1 byte	1 byte	N bytes	2 bytes

### 8.2.2 Function code

The host controller reads/writes servo through the Modbus RTU format (03, 06 function code). The corresponding modbus function code is explained as follows:

Activity	Command Code
----------	--------------

Read 16-bit function code	0x03
Write16-bit function code	0x06

### (1) Read function code:0x03

#### Request format:

address	Function code	starting address (high byte)	starting address (low byte)	Read number (high byte)	Read number (low byte)	CRC checksum
1 byte	03	1 byte	1 byte	1 byte	1 byte	2 bytes

#### Correct response format:

address	Function code	return data Byte number	Register 1 High byte	Register 1 low byte	...	CRC checksum
1 byte	03	1 byte	1 byte	1 byte	1 byte	2 bytes

### (2) Write function code:0x06

#### Request format:

address	Function code	Register address (high byte)	Register address (low byte)	Data high byte	Data low byte	CRC checksum
1 byte	06	1 byte	1 byte	1 byte	1 byte	2 bytes

#### Response format:

address	Function code	Register address (high byte)	Register address (low byte)	Data high byte	Data low byte	CRC checksum
1 byte	06	1 byte	1 byte	1 byte	1 byte	2 bytes

If the setting is successful, the original text is returned

## 8.2.3 CRC Checksum

The servo adopts 16-bit CRC checksum, the host controller should use the same check rule, otherwise the CRC check would fail. The servo drive uses 16-bit CRC with low byte before high byte.

The CRC function is as follows:

```

    Uint16 CRC16_Calc(Uint8 *pBuf, Uint16 uLen)
    {
        Uint16 crc = 0xffff.
    }
    
```

```

    Uint16 i.

    while(uLen--)
    {
        crc ^=(Uint16) *pBuf++.
        for(i=0. i<8. i++)
        {
            if(crc & 0x0001)
            {
                crc = (crc >> 1) ^ 0xa001.
            }
            else
            {
                crc = crc >> 1.
            }
        }
    }

    return crc.
}
    
```

### 8.2.4 Error response frame

address	function	Error code	CRC checksum
1 byte	Command code+0x80	Error code	2 bytes

When an error occurs, set the function code bit7 issued by the host controller to 1, and return (such as 0x03 returns 0x83, 0x06 returns 0x86). the error code is described **as follows**:

Error code	Code description
0x0001	illegal command code
0x0002	Illegal data address
0x0003	Illegal data
0x0004	Slave device fault

### 8.2.5 Communication Example

[03 function code]

Read the value of [U0-31] (bus voltage), the address of the modbus register corresponding to variable 7711 (0x1E1F)

**Request format:**

address	Function code	Starting address high byte	Starting address low byte	Read number (high byte)	Read number (low byte)	CRC low byte	CRC high byte
01	03	1E	1F	00	01	B3	E4

**The slave response:**

address	Function code	Byte number	data high byte	data low byte	CRC low byte	CRC high byte
01	03	02	0C	26	3C	9E

The read value is 0x0C26, representing a voltage of 311.0V.

[06 function code]

[P1-10]The maximum speed threshold is set to 3000 rpm. This variable corresponds to the modbus address is 266 (0x010A)

**Request format:**

address	Function code	Register address (high byte)	Register address (low byte)	Data high byte	Data low byte	CRC low byte	CRC high byte
01	06	01	0A	0B	B8	AF	76

**The slave response:**

address	Function code	Register address (high byte)	Register address (low byte)	Data high byte	Data low byte	CRC low byte	CRC high byte
01	06	01	0A	0B	B8	AF	76

### 8.3 Servo communication parameter setting

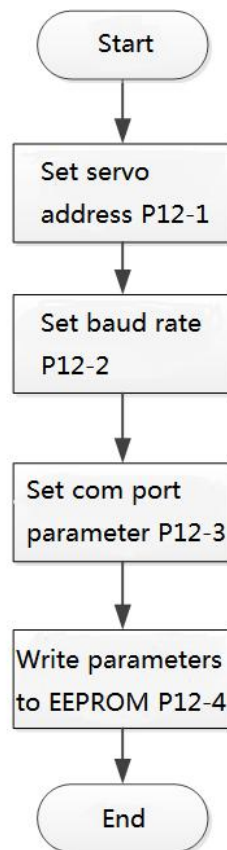


Figure 8-3 Modbus communication parameter setting process

(1) Set the station number of servo[P12-1]

When multiple servos are used together, each servo could only have a unique address, otherwise it would cause communication exception.

**0:**Broadcast address

**1~247:**slave address

(2) Set the serial port baud rate[P12-2]

The baud rate set in the servo drive must be the same as that in the host controller. Otherwise,communication would fail.

(3) Modbus data format[P12-3]

**data check format:**

- odd
- even
- none

**stop bit:**1 stop bit and 2 stop bits

The data format set in the servo drive must be the same as that in the host controller. Otherwise,communication would fail.

(4) Set whether to store Modbus parameter modification to EEPROM [P12-4]

When the host changes the servo function code through communication, it could choose to store it in EEPROM in real time, which has the function of saving after power-off.

If the value of the function code only needs to be changed once, and the value would be used afterwards, then we should enable “write into the EEPROM” function.

If you need to frequently change the value of the function code, it is recommended to disable this function, otherwise the EEPROM life would be reduced due to frequent erasure of the EEPROM.

After the EEPROM is damaged, the servo would have a non-resettable fault!

#### Relevant function code:

Code	name	property	Effective time	range	Defination	unit	Default setting
P12-1	Servo station No.	During running	Immediate	0~247	Set the station address of the servo drive.	-	1
P12-2	Baud rate	During running	Immediate	0~5	0-2400bps. 1-4800bps. 2-9600bps. 3-19200bps. 4-38400bps. 5-57600bps	-	2
P12-3	Modbus data format	During running	Immediate	0~3	0:1stop bit, none 1:1stop bit, odd 2:1stop bit, even 3:2 stop bits, none	-	0
P12-4	Update function code values written via communication to EEPROM	During running	Immediate	0~1	0-not write to EEPROM, volatile. 1-write to EEPROM, non-volatile	-	0

## 8.4 Modbus communication variable address and description

### 8.4.1 Variable address

Modbus registers are divided into two categories,

- ✧ The first type is the servo function code parameters (**address:** 0x0001 ~ 0x0D08), this part of the register is readable and writable (ie. supports 0x03 and 0x06)

- ✧ The second type is the monitoring register of the servo (**address:** 0x1E01 ~ 0x2010), this part of the register is only readable (supports 0x03 function).

**Servo function code form:** PXX-YY

**That:**

**XX:** Represents the function code group number,

**YY:** Represents the offset within the function code group.

During servo communication, the communication address of the function code is a 16-bit address, which is composed of the function code group number (higher 8 bits) + offset within the group (lower 8 bits). For example, the modbus address corresponding to P12-1 (servo address) is 0x0C01.

**Modbus monitoring register form:**Uxx-yy

**That:**

**xx:** Represents the monitoring register group number.

**yy:** Represents the offset within the monitoring quantity group.

During modbus communication, the starting address of the monitoring register is 0x1E01, and the conversion relationship of the address is similar to the representation of the function code.

For example, the corresponding modbus address of [U0-01] (servo status) is 0x1E01.

In order to facilitate practical use, the manual provides both decimal and hexadecimal address identification, **the table format is as follows:**

Code	Modbus address (hex)	Modbus address (dec)	category	function
P0-1	0x0001	1	Basic setting	Control mode

For detailed parameter address, please refer to the Chapter 11.

## 8.4.2 Value type description

When signed function codes (16-bit and 32-bit) are written, the pre-written data needs to be converted into hexadecimal. **The conversion rule is as below:**

- ✧ **Data is positive or 0:** complement = true form
- ✧ **Data is negative:** complement = 0xFFFF – complement of data absolute value + 0x0001

**Example:**

**16-bit signed positive +100:** the true form is 0x0064, and the complement is also 0x0064.

**16-bit signed negative -100:** the hexadecimal complement is: 0xFFFF – 0x0064 + 0x0001 = FF9C

If it is an unsigned number, the source code is directly converted into a hexadecimal number. For example decimal 32768 is 0x8000.

## 8.4.3 Value unit description

Some values have units and decimals, such as 0.1%, 0.1Hz, 0.01ms. When reading and writing, the corresponding value conversion must be performed. **The representation method is as follows:**

**When the unit is 0.1%:** 1 represents 0.1%, 10 represents 1.0%, 1000 represents 100.0%,



Therefore, writing 1000 means setting as 100.0%. otherwise, if reading value is 1000, it means the value is 100.0%.

**When the unit is 0.01ms:** 1 represents 0.01ms, 50 represents 0.5ms, and 10000 represents 100ms.

Therefore, writing 1000 means setting as 10.00ms. otherwise, if reading value is 1000, it means the value is 10.00ms.

Other unit could be deduced in the same way.

## 9. Parameter

Wecon VD1 series Servo drive provides rich monitoring and setting function for the users. The specific display and setting areas are shown in **the following table**:

ID	Function	Block	Section
1	Basic setting	P0	P0-1- P0-25
2	Control parameter	P1	P1-1- P1-25
3	Gain adjustment	P2	P2-1- P2-25
4	Self-tuning parameters	P3	P3-1- P3-25
5	Vibration inhibition	P4	P4-1- P4-25
6	IO signal	P5	P5-1- P5-25
7	DI/DO configuration	P6	P6-1- P6-25
8	auxiliary function	P10	P10-1- P10-25
9	communication parameter	P12	P12-1- P12-25
10	Virtual input terminal	P13	P13-1- P13-25
11	Monitoring display	U0	U0-1-U0-53
12	Alarm display	U1	U1-1-U1-27
13	Device information	U2	U2-1-U2-16

### Notes:

- 1) Explanation of parameter names  
When the parameter name is [Reserved], it indicates that it is occupied internally. Do not configure this parameter.
- 2) Parameter units  
When the unit of the parameter is [-], it means that the parameter has no unit.
- 3) Explanation of control mode  
**P**: Position control mode  
**S**: Speed control mode  
**T**: Torque control mode  
**A(ALL)**: Fits for position control mode, speed control mode and torque control mode
- 4) Effective time of parameter modification  
 [○]: needs to stop Servo drive to set parameter and takes effect after restart.  
 [△]: sets when Servo drive is running and takes effect after restart.  
 [●]: needs to stop Servo drive to set parameter and takes effect right away  
 [▲]: sets when Servo drive is running and takes effect right away.

## 9.1 Basic Setting

Code	Function	Effective time	Defulat	Range	Description	Unit	Control mode
P0-1	Control mode	○	1	1-3	1: Position control mode 2: Speed control mode 3: Torque control mode	—	—
P0-4	Rotation direction	○	0	0-1	Forward rotation: facing the motor shaft 0: Standard setting (CW is forward rotation) 1: Reverse mode (CCW is forward rotation)	—	—
P0-5	Servo stop method	●	0	0-1	0: Free stop, motor shaft remains free. 1: Zero speed stop, motor shaft remains free.	—	—
P0-9	Regenerative resistor setting	●	0	0-3	0: Use built-in regenerative resistor. 1: Use external regenerative resistor and cool naturally. 2: Use external regenerative resistor and forced air cooling. (Not settable) 3: No regenerative resistor is used, it's all absorbed by the capacitor. (Not settable)	—	—
P0-10	External regenerative resistor resistance	●	50	0-65535	Used to set the external regenerative resistor resistance of a certain type of driver.	Ω	—
P0-11	Power of external regenerative resistor	●	100	0-65535	Used to set the power of the external regenerative resistor of a certain type of driver.	W	—
P0-12	pulse type selection	○	0	0-2	0: direction+pulse(Positive logic) 1: CW/CCW 2: A, B phase quadrature pulse (4 times frequency)	—	P
P0-13	Pulse frequency	○	300	1-500	Set the maximum pulse frequency KHz	kHz	P
P0-14	pulse anti-interference level	○	2	1-3	Set the pulse anti-interference level. 1: low anti-interference level. (0.1) 2: Medium (0.25) 3: high (0.4)	—	P

P0-16	pulse number per revolution	○	10000	0-10000	Set the pulse number of per rotation Only when P0-16=0 then P0-17,P0-18,P0-19,P0-20 would take effect	Pul	P
P0-17	Electronic gear 1 numerator	▲	1	1-32767	Set the numerator of the first group electronic gear ratio. It is valid when P0-16=0	—	P
P0-18	Electronic gear 1 denominator	▲	1	1-32767	Set the denominator of the first group electronic gear ratio. It is valid when P0-16=0	—	P
P0-19	Electronic gear 2 numerator	▲	1	1-32767	Set the numerator of the first group electronic gear ratio. It is valid when P0-16=0	—	P
P0-20	Electronic gear 2 denominator	▲	1	1-32767	Set the denominator of the first group electronic gear ratio. It is valid when P0-16=0	—	P
P0-21	frequency-dividing output direction	○	0	0-1	Quadrature pulse output. 0: When the motor rotation direction is CW, A advances B 1: When the motor rotation direction is CCW, B advances A	—	P
P0-22	Encoder ppr	○	2500	10-10000	Quadrature output. Set the number of output pulses of phase A and phase B for each rotation of the motor	Pul	P
P0-23	Z pulse output OZ polarity	○	0	0-1	0-Z Active when pulse is high 1-Z Active when pulse is low	—	P
P0-25	Position deviation limitation	○	60000	0-65535	0: Ignore position deviation fault. Other values: Position deviation exceeds this setting range and report position [Er. 36] Excessive deviation fault	Pul	P

## 9.2 Control Parameter

Code	Function	Effective time	Defulat	Range	Description	Unit	Control mode
P1-1	Speed command source	●	0	0-1	0: Internal speed command (set in P1-3). 1: AI_1 analog input.	-	S
P1-2	Internal speed command	▲	100	-3000-3000	Internal speed command	rpm	S
P1-3	Acc. time	▲	50	0-65535	Acceleration time from 0 to	ms	S

					1000rpm in speed command mode		
P1-4	Dec. time	▲	50	0-65535	Deceleration time from 1000 to 0 rpm in speed command mode	ms	S
P1-7	Torque command source	●	0	0-1	0: Internal torque command. 1: AI_1 analog input.	-	T
P1-8	Torque command keyboard set value	▲	0	-3000-3000	-300.0%-300.0%	0.1%	T
P1-9	Source of speed Limit in torque mode	●	0	0-1	0: Internal forward and reverse limit 1: AI_2 analog input	-	T
P1-10	Max speed threshold	▲	3600	0-5000	Set the maximum speed limit value. If it exceeds this value, an overspeed fault is reported.	rpm	A
P1-11	Warning speed threshold	▲	3300	0-4500	Set the alarm speed threshold. If this value is exceeded, an overspeed warning would be reported.	rpm	A
P1-12	Forward speed threshold	▲	3000	0-3000	Set forward speed limit	rpm	A
P1-13	Reverse speed threshold	▲	3000	0-3000	Set reverse speed limit	rpm	A
P1-14	Torque limit source	●	0	0-1	0: Internal value 1: AI_2 analog input	-	A
P1-15	Forward rotation torque limit	▲	3000	0-3000	When [P1-14] selects internal torque limit, this function code value is used as the forward torque limit value	0.1%	A
P1-16	Reverse torque limit	▲	3000	0-3000	When [P1-14] selects internal torque limit, this function code value is used as the reverse torque limit value	0.1%	A
P1-19	Torque saturation timeout	▲	1000	0-65535	When the torque is limited by the setting value of [P-15] or [P-16] and exceeds this set time, the driver reports a "torque saturation abnormal" fault. Note: When the value of this function code is set to 0, no torque saturation timeout fault detection is performed, and this fault is ignored.	ms	A
P1-21	Zero speed clamp function selection	▲	0	0-3	Set the zero speed clamp function. In speed mode:	rpm	S

					0: Force speed to 0. 1: Force the speed to 0, and keep the position locked when the actual speed is less than [P1.22]. 2: When the speed reference is less than [P1-22], force the speed to 0 and keep the position locked. 3: Invalid, ignore the zero speed clamp input.		
P1-22	Speed threshold for zero	▲	20	0-1000	Set the speed threshold of the zero speed clamp function	rpm	S

### 9.3 Gain Parameter

Code	Function	Effective time	Default	Range	Description	Unit
P2-1	1st position loop gain	▲	400	0-6200	Set the position loop gain to determine the responsiveness of the position control system.	0.1Hz
P2-2	1st speed loop gain	▲	65	0-35000	Set the speed loop gain to determine the response of the speed loop.	0.1Hz
P2-3	1st speed loop integration constant	▲	1000	100-65535	Set the speed loop integral constant. The smaller the set value, the stronger the integral effect.	0.1ms
P2-4	2nd position loop gain	▲	35	0-6200	Set the position loop gain to determine the responsiveness of the position control system.	0.1Hz
P2-5	2nd speed loop gain	▲	65	0-35000	Set the speed loop gain to determine the response of the speed loop.	0.1Hz
P2-6	2nd speed loop integration constant	▲	1000	0-65535	Set the speed loop integral constant. The smaller the set value, the stronger the integral effect.	0.1ms
P2-7	Second switching mode gain	▲	0	0-3	0: DI terminal. 1: Speed command change rate is too large. 2: Position deviation is large. 3: Reserved	-
P2-9	Speed feedforward gain	▲	0	0-1000	0.0%-100.0%	0.1%
P2-10	Speed feedforward filter	▲	50	0-10000	Set the time constant of the primary delay filter related to the speed feedforward input	0.01ms
P2-11	Torque feedforward gain	▲	0	0-2000	0.0%-200.0%	0.1%
P2-12	Torque feedforward filter	▲	50	0-10000	Set the time constant of the primary delay filter associated with the torque feedforward input.	0.01ms

## 9.4 Auto-tuning Parameter

Code	Function	Effective time	Defulat	Range	Description	Unit
P3-1	Load inertia ratio	▲	500	0-10000	Set load inertia ratio, 0.00 - 100.00 times	0.01
P3-2	rigidity selection for load level	▲	12	0-31	Selection of rigidity	-
P3-3	Auto-tuning mode selection	▲	0	0-2	0: Rigidity level auto-tuning mode. according to the rigidity level setting, position loop gain, speed loop gain, speed loop integration time constant, and torque filter parameter settings are automatically 1: Manual setting. users need to manually set the position loop gain, speed loop gain, speed loop integration time constant, and torque filter parameter settings. adjusted. 2: Online automatic parameter auto-tuning mode (not implemented yet).	-
P3-4	Online inertia identification sensitivity	▲	0	0-2	0:slow change (not implemented yet) 1: General changes (not implemented yet) 2: Fast change (not implemented yet)	-
P3-5	Number of inertia identification cycles	●	2	1-2	Offline load inertia identification process, motor rotation number setting	revolution
P3-6	Maximum speed of inertia identification	●	1000	300-2000	Set the maximum allowed motor speed command in offline inertia identification mode. The greater the speed of inertia identification, the more accurate the identification result, usually keep the default value.	rpm
P3-7	rotation direction parameter	●	0	0-2	0: forward and backward rotation 1: forward-forward one-way rotation 2: backward-backward one-way rotation	-
P3-8	Parameter identification waiting time	●	1000	300-1000 0	Time interval between two consecutive speed commands during offline inertia recognition	ms

## 9.5 Vibration Inhibition

Code	Function	Effective time	Defulat	Range	Description	Unit	Control mode
P4-1	Pulse command filtering mode	●	0	0-1	0: first-order low-pass filtering 1: average filter	-	P
P4-2	Position command first-order low-pass filter	●	20	0-1000	For pulse command input filtering	ms	P
P4-3	Position command average filtering time constant	●	20	0-128	For pulse command input filtering	ms	P
P4-4	Torque filter time constant	▲	50	10-2500	When [Auto-tuning mode] is set as 1, or 2, this parameter is set automatically	0.01	
P4-5	First notch frequency	▲	300	250-5000	Set the center frequency of the 1st notch filter. When the setting value is 5000, the function of the notch filter is disabled.	Hz	
P4-6	First notch depth level	▲	100	0-100	0: all blocked 100: all passed	-	
P4-7	First notch width level	▲	4	0-12	0: 0.5 x bandwidth 4: 1x bandwidth 8: 2 times the bandwidth 12: 4 times the bandwidth	-	
P4-8	Second notch frequency	▲	500	250-5000	Set the center frequency of the second notch filter. When the setting value is 5000, the function of the notch filter is disabled.	Hz	
P4-9	Second notch depth level	▲	100	0-100	0: all blocked 100: all passed	-	
P4-10	Second notch width level	▲	4	0-12	0: 0.5 x the bandwidth 4: 1x bandwidth 8: 2 times the bandwidth 12: 4 times the bandwidth	-	



## 9.6 Signal Input/Output Parameter

Code	Function	Effective time	Default	Range	Description	Unit	Control mode
P5-1	AI_1 input bias	▲	0	-5000-5000	Set AI_1 channel analog offset value	mV	
P5-2	AI_1 Input filter constant	▲	200	0-60000	AI_1 channel input first-order low-pass filtering time constant	0.01 ms	
P5-3	AI_1 dead zone	▲	20	0-1000	Set AI_1 channel analog dead zone value	mV	
P5-4	AI_1 zero drift	▲	0	-500-500	Automatic calibration zero drift inside the driver.	mV	
P5-5	AI_2 input bias	▲	0	-5000-5000	Set AI_2 channel analog offset value	mV	
P5-6	AI_2 Input filter constant	▲	200	0-60000	AI_2 channel input first-order low-pass filtering time constant	0.01 ms	
P5-7	AI_2 dead zone	▲	20	0-500	Set AI_1 channel analog dead zone value	mV	
P5-8	AI_2 zero drift	▲	0	-500-500	Automatic calibration zero drift value inside the driver	mV	
P5-9	Analog 10V for speed value	●	3000	1000-4500	Set the speed value corresponding to analog 10V	rpm	
P5-10	Analog 10V for torque value	●	1000	0-3000	Set the torque value corresponding to analog 10V	0.1 %	
P5-11	Positioning completed, positioning setting near	▲	0	0-3	<p>Output signal judging conditions for positioning completed and positioning near</p> <p>0: The output is valid when the absolute value of the position deviation is less than the positioning completion threshold / location near threshold.</p> <p>1: The absolute value of the position deviation is less than the positioning completion threshold / positioning near threshold, and the input position command is 0 then the output is valid</p> <p>2: The absolute value of the position deviation is smaller than the positioning completion threshold / positioning approach threshold, and the input position command filter value is 0 then the output is valid</p> <p>3: The absolute value of the position deviation is less than the positioning completion threshold / positioning approach threshold, the input position command filter</p>	-	P

					value is 0, and the positioning detection time window is continued then the output is valid		
P5-12	Positioning completed threshold	▲	800	1-65535	Positioning completion threshold	Pul	P
P5-13	Positioning approach threshold	▲	5000	1-65535	Positioning near threshold	Pul	P
P5-14	Positioning detection time window	▲	10	0-20000	Set the positioning completion detection time window	ms	P
P5-15	Positioning signal hold time	▲	100	0-20000	Set the hold time of positioning completion output	ms	P
P5-16	Rotation detection speed threshold	▲	20	0-1000	Set motor rotation signal judgment threshold	rpm	S
P5-17	Speed consistent signal threshold	▲	10	0-100	Set the speed consistent signal threshold	rpm	S
P5-18	Speed approaching signal threshold	▲	100	10-6000	Set speed approach signal threshold	rpm	S
P5-19	Zero speed output signal threshold	▲	10	0-6000	Set the zero-speed output signal judgment threshold	rpm	S
P5-20	Torque reached threshold	▲	100	0-300	<p>The torque reached threshold needs to be used in conjunction with [torque reached hysteresis value]:</p> <p>When the actual torque reaches [torque reached threshold] + [torque reaches hysteresis], the torque reached DO becomes effective.</p> <p>When the actual torque decreases below [Torque reached threshold] + [Torque reached hysteresis], the torque reached DO becomes invalid.</p>	%	T
P5-21	Torque reached hysteresis	▲	10	10-20	[Torque reached hysteresis value] Need to be used together with [Torque reached threshold]	%	T

## 9.7 DI/DO Configuration

Code	Function	Effective time	Default	Range	Description	Unit
P6-01	High-speed DI port filtering time	○	50	0-10000	Filter time for high-speed ports DI7 and DI8	1us
P6-02	DI_1 function selection	△	1	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-
P6-03	DI_1 logic selection	△	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-04	DI_1 input source selection	▲	0	0-1	0: Hardware DI1 1: VDI1	-
P6-05	DI_2 function selection	△	2	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch	-

					13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	
P6-06	DI_2 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-07	DI_2 input source selection	▲	0	0-1	0: Hardware DI2 1: VDI2	-
P6-08	DI_3 function selection	Δ	3	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-
P6-09	DI_3 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-10	DI_3 input source selection	▲	0	0-1	0: Hardware DI3 1: VDI3	-
P6-11	DI_4 function selection	Δ	4	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch	-

					5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	
P6-12	DI_4 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-13	DI_4 input source selection	▲	0	0-1	0: Hardware DI4 1: VDI4	-
P6-14	DI_5 function selection	Δ	7	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-
P6-15	DI_5 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed).	-

					1: Normal closed input. Active when on (switch open).	
P6-16	DI_5 input source selection	▲	0	0-1	0: Hardware DI5 1: VDI5	-
P6-17	DI_6 function selection	Δ	11	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-
P6-18	DI_6 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-19	DI_6 input source selection	▲	0	0-1	0: Hardware DI6 1: VDI6	-
P6-20	DI_7 function selection	Δ	-	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1	-

					14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	
P6-21	DI_7 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-22	DI_7 input source selection	▲	0	0-1	0: Hardware DI7 1: VDI7	-
P6-23	DI_8 function selection	Δ	-	0-16	1: SON, Servo ON 2: A-CLR, Fault and warning clear 3: POT, Forward limit switch 4: NOT, Reverse limit switch 5: ZCLAMP, Zero speed clamp 6: CL, Clear the position deviation 7: C-SIGN, Instruction negation 8: E-STOP, Emergency stop 9: GEAR-SEL, Electronic gear switching 1 10: GAIN-SEL, Gain switch 11: INH, Position reference inhibited 12: VSSEL, Damer control switch 13: INSPD1, Internal speed command selection 1 14: INSPD2, Internal speed command selection 2 15: INSPD3, Internal speed command selection 3 16: J-SEL, Inertia ratio switch	-
P6-24	DI_8 logic selection	Δ	0	0-1	DI port input logic validity function selection. 0: Normal open input. Active when off (switch closed). 1: Normal closed input. Active when on (switch open).	-
P6-25	DI_8 input source selection	▲	0	0-1	0: Hardware DI8 1: VDI8	-

P6-26	DO_1 function selection	Δ	132	128~142	129-RDY Servo Ready 130-ALM Alarm 131-WARN Warning 132-TGON Motor rotation output 133-ZSP Zero speed signal 134-P-COIN Positioning completed 135-P-NEAR Positioning near 136-V-COIN Speed consistent 137-V-NEAR Speed near 138-T-COIN Torque reached 139-T-LIMIT Torque limit 140-V-LIMIT Speed limit 141-BRK-OFF Solenoid brake 142-SRV-ST Enable Servo status output	-
P6-27	DO_1 logic selection	Δ	0	0~1	Output logic function selection. ★ 1. Set to 0: When the signal is valid, the output transistor is on. When the signal is invalid, the output transistor is off. 2. Set to 1: When the signal is valid, the output transistor is off. When the signal is invalid, the output transistor is on.	-
P6-28	DO_2 function selection	Δ	130	128~142	129-RDY Servo Ready 130-ALM Alarm 131-WARN Warning 132-TGON Motor rotation output 133-ZSP Zero speed signal 134-P-COIN Positioning completed 135-P-NEAR Positioning near 136-V-COIN Speed consistent 137-V-NEAR Speed near 138-T-COIN Torque reached 139-T-LIMIT Torque limit 140-V-LIMIT Speed limit 141-BRK-OFF Solenoid brake 142-SRV-ST Enable Servo status output	-
P6-29	DO_2 logic selection	Δ	0	0~1	Output logic function selection. ★ 1. Set to 0: When the signal is valid, the output transistor is on. When the signal is invalid, the output transistor is off. 2. Set to 1:	-



					When the signal is valid, the output transistor is off. When the signal is invalid, the output transistor is on.	
P6-30	DO_3 function selection	Δ	129	128~142	129-RDY Servo Ready 130-ALM Alarm 131-WARN Warning 132-TGON Motor rotation output 133-ZSP Zero speed signal 134-P-COIN Positioning completed 135-P-NEAR Positioning near 136-V-COIN Speed consistent 137-V-NEAR Speed near 138-T-COIN Torque reached 139-T-LIMIT Torque limit 140-V-LIMIT Speed limit 141-BRK-OFF Solenoid brake 142-SRV-ST Enable Servo status output	-
P6-31	DO_3 logic selection	Δ	0	0~1	Output logic function selection. ★ 1. Set to 0: When the signal is valid, the output transistor is on. When the signal is invalid, the output transistor is off. 2. Set to 1: When the signal is valid, the output transistor is off. When the signal is invalid, the output transistor is on.	-
P6-32	DO_4 function selection	Δ	134	128~142	129-RDY Servo Ready 130-ALM Alarm 131-WARN Warning 132-TGON Motor rotation output 133-ZSP Zero speed signal 134-P-COIN Positioning completed 135-P-NEAR Positioning near 136-V-COIN Speed consistent 137-V-NEAR Speed near 138-T-COIN Torque reached 139-T-LIMIT Torque limit 140-V-LIMIT Speed limit 141-BRK-OFF Solenoid brake 142-SRV-ST Enable Servo status output	-
P6-33	DO_4 logic selection	Δ	0	0~1	Output logic function selection. ★ 1. Set to 0: When the signal is valid, the output	-

					transistor is on. When the signal is invalid, the output transistor is off. 2. Set to 1: When the signal is valid, the output transistor is off. When the signal is invalid, the output transistor is on.	
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★: Explanation of output logic selection (take P6-27 as an example)

1) When P6-27 is set to 0

- If the function of P6-26 is selected as [fault signal], it means when DO-1 appears a fault signal, the output transistor is turned on. when DO-1 does not appear a fault signal, the output transistor is turned off.
- If the function selection of P6-26 is [Positioning completed], it means that: when the positioning of DO-1 is completed, the output transistor is turned on. when the positioning of DO-1 is not completed, the output transistor is turned off.

Similarly:

2) When P6-27 is set to 1

- If the function of P6-26 is selected as [fault signal], it means when DO-1 appears a fault signal, the output transistor is turned off. when DO-1 does not appear a fault signal, the output transistor is turned on.
- If the function selection of P6-26 is [Positioning completed], **it means that:**when the positioning of DO-1 is completed, the output transistor is turned off. when the positioning of DO-1 is not completed, the output transistor is turned on.

## 9.8 Auxiliary Function Parameter

Code	Function	Effective time	Default	Range	Description	Unit
P10-1	JOG speed	▲	100	0-3000	JOG speed	rpm
P10-2	Restore factory setting	●	0	0-1	Write 1 to restore setting	-
P10-4	Motor overload protection time coefficient	▲	100	50-300	According to the heating condition of the motor, modifying this value could make the overload protection time float up and down from the reference value, 50 corresponds to 50%, that is, the time is reduced by half. 300 corresponds to 300%, that is, the time is extended to 3 times.	%

## 9.9 Communication Parameter

Code	Function	Effective time	Default	Range	Description
P12-1	RS485 station NO.	▲	1	1-247	Servo RS485 communication station number and address
P12-2	Baud rate	▲	0	0-5	0: 2400bps. 1: 4800bps. 2: 9600bps. 3: 19200bps. 4: 38400bps. 5: 57600bps
P12-3	Serial port data format	▲	0	0-3	0: 1 STOP bit, No check 1: 1 stop bit, odd check 2: 1 stop bit, even check 3: 2 stop bit, no check
P12-4	Write modbus communication data to EEPROM	▲	0	0-1	0: Not write to EEPROM, volatile. 1: write to EEPROM, non-volatile.

## 9.10 VDI Parameter

Code	Function	Effective time	Default	Range	Description
P13-1	Virtual value VDI_1 input	▲	0	0-1	VDI1 input level: 0: low level. 1: high level.
P13-2	Virtual value VDI_2 input	▲	0	0-1	VDI2 input level: 0: low level. 1: high level.
P13-3	Virtual value VDI_3 input	▲	0	0-1	VDI3 input level: 0: low level. 1: high level.
P13-4	Virtual value VDI_4 input	▲	0	0-1	VDI4 input level: 0: low level. 1: high level.
P13-5	Virtual value VDI_5 input	▲	0	0-1	VDI5 input level: 0: low level. 1: high level.
P13-6	Virtual value VDI_6 input	▲	0	0-1	VDI6 input level: 0: low level. 1: high level.
P13-7	Virtual value VDI_7 input	▲	0	0-1	VDI7 input level: 0: low level. 1: high level.
P13-8	Virtual value VDI_8 input	▲	0	0-1	VDI8 input level: 0: low level. 1: high level.

## 6.11 Monitoring Parameter

Code	Type	Function	Unit	Data format
U0-01	General	Servo state	-	int16_t
U0-02	General	Servo motor speed	rpm	int16_t
U0-03	General	Enter speed command	rpm	int16_t
U0-04	General	Speed corresponding to input position reference	rpm	int16_t
U0-05	General	Pulse deviation	Pul	int32_t
U0-07	General	Pulse deviation *10000	Pul	int32_t
U0-09	General	input pulse number	Pul	int32_t
U0-11	General	input pulse number *10000	Pul	int32_t
U0-13	General	Encoder accumulative position	Pul	int32_t
U0-15	General	Encoder accumulative position *10000	Pul	int32_t
U0-17	General	DI input signal state	-	uint32_t
U0-19	General	DO output signal state	-	uint32_t
U0-21	General	AI1 input voltage value	V	int16_t
U0-22	General	AI2 input voltage value	V	int16_t
U0-23	General	Vibration frequency	Hz	uint16_t
U0-24	General	Vibration amplitude	rpm	uint16_t
U0-25	General	Forward torque limitation	%	int16_t
U0-26	General	Backward torque limitation	%	int16_t
U0-27	General	Forward speed limitation	rpm	int16_t
U0-28	General	Backward speed limitation	rpm	int16_t
U0-29	General	Mechanical angle	°	int16_t
U0-30	General	Electric angle	°	int16_t
U0-31	General	Bus voltage	V	uint16_t
U0-32	General	Module temperature	°C	int16_t
U0-33	General	Instantaneous output power	W	int32_t
U0-35	General	Total power-on time: hour	h	uint32_t
U0-37	General	Total power-on time:min	min	uint16_t
U0-38	General	Total power-on time:sec	s	uint16_t
U0-39	General	Output load percentage	%	uint16_t
U0-40	General	Power-on time: hour	h	uint32_t
U0-42	General	Power-on time: min	min	uint16_t
U0-43	General	Power-on time: sec	s	uint16_t
U0-44	General	Instantaneous braking resistance power	W	uint32_t
U0-46	General	Average braking resistance power	W	uint32_t
U0-48	Device	Power-on times	times	uint32_t
U0-50	Device	Motor cumulative turns (x1)	Revolution	uint16_t
U0-51	Device	Motor cumulative turns (x10e4)	Revolution	uint16_t
U0-52	Device	Motor cumulative turns (x10e8)	Revolution	uint16_t

U0-53	Device	Motor model code	-	uint16_t
U1-01	Alarm	Current fault code	-	uint16_t
U1-02	Alarm	Current alarm code	-	uint16_t
U1-03	Alarm	phase U current upon displayed fault	A	int16_t
U1-04	Alarm	phase V current upon displayed fault	A	int16_t
U1-05	Alarm	Bus voltage upon displayed fault	V	uint16_t
U1-06	Alarm	IGBT temperature upon displayed fault	°C	int16_t
U1-07	Alarm	Torque component when fault occurred	%	int16_t
U1-08	Alarm	Excitation component when fault occurred	%	int16_t
U1-09	Alarm	Position deviation when fault occurred	Pul	int32_t
U1-11	Alarm	Speed value when fault occurred	rpm	int16_t
U1-12	Alarm	the time when fault occurred	s	uint32_t
U1-14	Alarm	Number of faults	-	uint16_t
U1-15	Alarm	Number of warnings	-	uint16_t
U1-16	Alarm	Total number of historical faults	-	uint16_t
U1-17	Alarm	Total number of historical alarm	-	uint16_t
U1-18	Alarm	Last 2nd fault code	-	uint16_t
U1-19	Alarm	Last 3rd fault code	-	uint16_t
U1-20	Alarm	Last 4th fault code	-	uint16_t
U1-21	Alarm	Last 5th fault code	-	uint16_t
U1-22	Alarm	Last 6th fault code	-	uint16_t
U1-23	Alarm	Last 2nd alarm code	-	uint16_t
U1-24	Alarm	Last 3rd alarm code	-	uint16_t
U1-25	Alarm	Last 4th alarm code	-	uint16_t
U1-26	Alarm	Last 5th alarm code	-	uint16_t
U1-27	Alarm	Last 6th alarm code	-	uint16_t
U2-01	Device	Product series	-	uint16_t
U2-02	Device	model	-	uint16_t
U2-03	Device	Model	-	uint16_t
U2-04	Device	Firmware version	-	uint16_t
U2-05	Device	Hardware version	-	uint16_t
U2-06	Device	date of manufacture:year	Year	uint16_t
U2-07	Device	date of manufacture:month	month	uint16_t
U2-08	Device	date of manufacture:day	Day	uint16_t
U2-09	Device	Device serial number 1	-	uint16_t
U2-10	Device	Device serial number 2	-	uint16_t
U2-11	Device	Device serial number 3	-	uint16_t
U2-12	Device	Device serial number 4	-	uint16_t
U2-13	Device	Device serial number 5	-	uint16_t
U2-14	Device	Device serial number 6	-	uint16_t
U2-15	Device	Device serial number 7	-	uint16_t
U2-16	Device	Device serial number 8	-	uint16_t

# 10. Troubleshooting

## 10.1 Alarm and Fault during Startup

### 10.1.1 Position Control Mode

During startup	Fault	Reason	Solution
Connect control power L1C/L2C and main power L1/ L2 and L3.	The LED display or green indicator is off (bus voltage indicator)	L1C and L2C are not well connected	Re-wiring: connect L1C / L2C cable with the socket.
		The control power voltage is abnormal.	Measure AC voltage between L1C and L2C
		The Servo drive is faulty	Contact an agent or Wecon customer service.
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Set the S-ON signal to ON.	Shaft of Servo Motor is in free running status.	The S-ON signal is invalid.	Check whether the Servo enable signal is set and the terminal logic is valid.
		Selection of control mode is incorrect.	Check P0-1 value
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Input position reference	Servo Motor does not rotate.	Input reference pulse counter (U0-09) is 0.	Position reference is not entered: Whether DI_3 is set as forward drive prohibition or DI_4 is set as reverse drive prohibition. Check if the DI command pulse inhibit function set by accident.
Servo motor jitters at low speed	Motor speed is not steady.	The gain is set improperly.	Adjust the gain
	Motor shaft vibrates left and right.	The load inertia ratio is too large.	Perform inertia auto-tuning and then perform automatic gain tuning.

Servo system runs normally.	Positioning inaccurate	Unsatisfactory position deviation generated.	<p>The pulse received(U0-09) is not consistent with the actual position machine.</p> <p>Whether the equipment is vibrating, adjust by gain.</p> <p>Check the coupling at the motor shaft locked well.</p>
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### 10.1.2 Speed Control Mode

During Startup	Fault	Cause	Solution
Connect control power L1C/L2C and main power L1/ L2 and L3.	The LED display or green indicator is off (bus voltage indicator)	L1C and L2C are not well connected	Re-wiring: connect L1C / L2C cable with the socket.
		The control power voltage is abnormal.	Measure AC voltage between L1C and L2C
		The Servo drive is faulty	Contact an agent or Wecon customer service.
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Set the S-ON signal to ON.	Shaft of Servo Motor is in free running status.	The S-ON signal is invalid.	Check whether the Servo enable signal is set and the terminal logic is valid.
		Selection of control mode is incorrect.	Check P0-1 value
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Input speed reference	Servo motor does not rotate or the speed is not as expected	Speed reference (U0-03) is 0.	<p>The analog interface wiring is incorrect. Refer to Chapter 4 for correct wiring. No speed reference:</p> <ol style="list-style-type: none"> <li>Whether DI_3 is set as forward drive prohibition or DI_4 is set as reverse drive prohibition.</li> <li>Whether the reference pulse inhibit input function of DI is used.</li> <li>Check if the P1-1 speed reference source setting is correct.</li> <li>When using the internal speed reference, check if P1-2 internal speed command is 0.</li> </ol>

Servo motor jitters at low speed	Motor speed is not steady.	The load inertia ratio is too large.	Adjust the gain
	Motor shaft vibrates left and right.	The load inertia ratio is too large.	perform inertia auto-tuning and then perform automatic gain tuning

### 10.1.3 Torque Control Mode

During Startup	Fault	Cause	Solution
Connect control power L1C/L2C and main power L1/ L2 and L3.	The LED display or green indicator is off (bus voltage indicator)	L1C and L2C are not well connected	Re-wiring: connect L1C / L2C cable with the socket.
		The control power voltage is abnormal.	Measure AC voltage between L1C and L2C
		The Servo drive is faulty	Contact an agent or Wecon customer service.
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Set the S-ON signal to ON.	Shaft of Servo Motor is in free running status.	The S-ON signal is invalid.	Check whether the Servo enable signal is set and the terminal logic is valid.
		Selection of control mode is incorrect.	Check P0-1 value
	LED display Er.xx	Refer to 7.2 Faults and Alarms information, find the cause and troubleshoot.	
Input torque reference	Servo motor does not rotate or the speed is not as expected	Internal torque reference (U0-03) is 0.	The analog interface wiring is incorrect. Refer to Chapter 4 for correct wiring. No speed reference: <ol style="list-style-type: none"> <li>1) Whether DI_3 is set as forward drive prohibition or DI_4 is set as reverse drive prohibition.</li> <li>2) Whether the reference pulse inhibit input function of DI is used.</li> <li>3) Check if the P1-1 speed reference source setting is correct.</li> <li>4) When using the internal speed reference, check if P1-2 internal speed command is 0.</li> </ol>



Servo motor jitters at low speed	Motor speed is not steady.	The load inertia ratio is too large.	Adjust the gain
	Motor shaft vibrates left and right.	The load inertia ratio is too large.	Perform inertia auto-tuning and then perform automatic gain tuning

## 10.2 Fault and Warning Code during Running

Type	Name	Description	Code	Troubleshooting
Type 1	Parameter is damaged	EEPROM couldnot read and write	Er.01	The hardware interface couldnot read and write parameters. Please contact the manufacturer to check whether the hardware is damaged.
Type 1	Parameter storage error	Internal parameters stored version, total number, range, etc. The possible reasons are: 1. The driver has been software upgraded. 2. A momentary power failure occurred during parameter storage. 3. Frequent writing of parameters.	Er.02	1. If the parameter storage is abnormal due to the program update, please update the parameters by restoring the factory default parameters and power on again. 2. Power on again and reset the parameters after restoring the factory settings. 3. Check whether the host computer frequently writes parameters and modify the corresponding parameter writing method.
Type 1	ADC reference source failure	The internal analog reference source of the driver is not accurate	Er.03	Please power on again to determine whether the fault is eliminated. if the error still occurs, please contact the manufacturer.
Type 1	AD current sampling conversion error	Current sampling zero drift or current sensor error	Er.04	Please power on again to determine whether the fault is eliminated. if the error still occurs, please contact the manufacturer.
Type 1	FPGA communication abnormal	FPGA communication failure	Er.05	Please power on again to determine whether the fault is eliminated. if the error still occurs, please contact the manufacturer.
Type 1	FPGA program version is incorrect	FPGA program version is incorrect	Er.06	Please power on again to determine whether the fault is eliminated. if the error still occurs, please contact the manufacturer.
Type 1	Clock abnormal	The internal clock of the drive is disturbed or abnormal	Er.07	Please power on again to determine whether the fault is eliminated. if the error still occurs, please contact the manufacturer.

Type 2	Overcurrent	<p>The driver has detected an overcurrent. The possible reasons are:</p> <ol style="list-style-type: none"> <li>1. Motor power lines U, V, W are shorted to ground.</li> <li>2. Short circuit among motor power line U, V, W phase.</li> <li>3. The motor power cables U, V, W have poor contact.</li> <li>4. Internal damage of the motor.</li> <li>5. The encoder wire is aging and loose.</li> <li>6. Excessive fluctuations in control power.</li> </ol>	Er.20	<ol style="list-style-type: none"> <li>1. Please check whether the motor power line wiring is correct.</li> <li>2. Whether the motor power line wiring is loose or short-circuited.</li> <li>3. Replace the motor power line.</li> <li>4. Replace the motor.</li> <li>5. Replace the encoder cable.</li> <li>6. If the above methods still could not eliminate the fault, please contact the manufacturer.</li> </ol>
Type 2	Main power is undervoltage	<p>Driver bus voltage is below the limit:</p> <p>(1) 220V driver: normal bus voltage is 310V, undervoltage threshold is 200V.</p> <p>(2) 380V driver: normal bus voltage is 540V, undervoltage threshold is 400V.</p> <p>Possible reasons for undervoltage of the main power supply are:</p> <ol style="list-style-type: none"> <li>(1) The main power source is not connected.</li> <li>(2) The input voltage is low, or the voltage drops.</li> <li>(3) The internal main power relay is damaged.</li> </ol>	Er.21	<ol style="list-style-type: none"> <li>1. Check if the input voltage of the driver is too low. If it is too low, please increase the voltage or wait for the power supply to be normal, then power on again and see if the fault is cleared.</li> <li>2. Check the input power voltage of the driver to see if the voltage drops due to the power load change.</li> </ol>
Type 2	Main power is overvoltage	<p>The driver detects that the bus voltage is too high. The possible reasons are:</p> <ol style="list-style-type: none"> <li>1. Check whether the input voltage is normal:</li> </ol> <p>(1) 220V driver power supply voltage range: -10% - + 10% (198V - 242V)</p> <p>(2) 380V driver power supply voltage range: -10% - + 10% (342V -</p>	Er.22	<ol style="list-style-type: none"> <li>1. Check whether the mains input voltage is too high.</li> <li>2. Check whether the regenerative resistor resistance is reasonable.</li> <li>3. Extend the acceleration / deceleration time and choose a regenerative resistor with a lower resistance value.</li> </ol>

		<p>418V)</p> <p>2. The regenerative resistor resistance is too large, resulting in the braking energy not being absorbed in time.</p> <p>3. The load inertia is large and the motor accelerates and decelerates too quickly, and the maximum braking energy exceeds the absorbable value.</p> <p>4. Excessive deviation of bus voltage detection</p>		
Type 2	Regenerative resistor is not connected	<p>1. When using the internal regenerative resistor, the jumper between C and D should be disconnected.</p> <p>2. When using an external regenerative resistor, the resistor is not connected.</p> <p>3. The regenerative resistor status detection circuit is abnormal.</p>	Er.23	<p>1. If using internal regenerative resistor, please confirm whether the short-circuit jumper between C / D is normal.</p> <p>2. If using an external regenerative resistor, make sure that the external regenerative resistor is connected securely.</p> <p>3. If an external regenerative resistor is used, please confirm whether the resistance of the regenerative resistor is reasonable.</p> <p>4. If above methods still could not eliminate the fault, please contact the manufacturer.</p>
Type 2	Regenerative resistor turned on abnormally	<p>The brake resistor vent is turned on, but no feedback signal is detected. The possible reasons are:</p> <p>1. Failed to open the regenerative resistor.</p> <p>2. Brake resistor feedback detection failure.</p>	Er.24	The brake relief circuit may be damaged, please contact the manufacturer
Type 2	Regenerative resistor resistance is too large	The regenerative resistor is turned on, but the actual bus voltage is still increasing. It may be that the regenerative resistor resistance is too large.	Er.25	Please confirm whether the resistance of the regenerative resistor is reasonable.
Type 2	Motor model error	Motor model error	Er.26	Check if the motor model function code is set correctly
Type 2	Incremental encoder is disconnected	Encoder cable is disconnected	Er.27	<p>1. Check whether the wiring of the motor encoder cable is loose. If it is loose, tighten it.</p> <p>2. Replace the encoder cable and power on again.</p>

Type 2	Encoder Z phase pulse is lost	No Z-pulse signal appears when the motor rotates more than 1 turn. The possible reasons are: 1. Motor model is wrong. 2. The motor encoder is disturbed or damaged.	Er.28	1. Check whether the motor model matches the model of the driver. 2. Replace the motor and power on again.
Type 2	Incremental encoder AB count value is not equal to the number of ppr * 4	The incremental encoder AB count value is not equal to the ppr * 4. The possible reasons are: 1. Motor model is wrong. 2. Motor encoder is disturbed or damage.	Er.29	1. Check whether the motor model matches the model of the driver. replace the motor model that matches the driver.
Type 2	Encoder UVW signal error	Motor encoder UVW signal error	Er.30	Check if the motor model matches the driver model. replace with the motor model that matches the driver
Type 2	Power line disconnected	Motor power line is loose or disconnected	Er.31	1. Check if the motor power line wiring is loose, and tighten it if it is loose. 2. Change the power cable of the motor, and then power on again.
Type2	Exceed the maximum speed of the motor	Exceeds the maximum speed threshold of function code P1-10. Possible reasons are: 1. U / V / W phase sequence of motor power line is wrong. 2. Motor model is wrong. 3. Motor power line error. 4. Motor encoder line error.	Er.32	1. Please check whether the motor power line is correctly connected. 2. Confirm whether the motor model is correct. 3. Use the correct power cable and encoder cable to connect the wiring.
Type 2	power module is overheated	The power module temperature exceeds the normal value. The possible reasons are: 1. The cooling fan fails. 2. The ambient temperature is too high. 3. The installation of the driver is not reasonable, and the interval is too small then cause abnormal heat dissipation.	Er.33	1. Check if the cooling fan is running normally. If not, replace the drive. 2. Improve the ambient temperature. 3. Install the Servo driver according to the standard.

Type 2	Motor overload protection	<p>The drive has detected that the motor is overloaded. The possible reasons are:</p> <ol style="list-style-type: none"> <li>1. The load is too large, and the motor works for a long time in a state exceeding the rated torque.</li> <li>2. Large load inertia and frequent acceleration and deceleration.</li> <li>3. The speed and position loop gain parameters are not set properly.</li> <li>4. Locked rotor occurs in the motor.</li> <li>5. Servo drive failure.</li> </ol>	Er.34	<ol style="list-style-type: none"> <li>1. Check whether the load of the motor is too large. If the load is too large, please replace the motor and driver with higher power.</li> <li>2. Increase the acceleration / deceleration time.</li> <li>3. Use the host computer software to observe the actual torque and observe whether there is obvious speed overshoot. Adjust appropriate loop gain parameters.</li> <li>4. Check the mechanical connection and troubleshoot.</li> <li>5. Replace the Servo driver.</li> </ol>
Type 2	Electronic gear ratio exceeded	<p>In the electronic gear ratio setting, the numerator / denominator ratio is less than 0.01, or greater than 100.</p>	Er.35	<p>Check whether the setting value of the electronic gear numerator and denominator of the function codes P0-16 - P0-19 meets the following conditions: the numerator / denominator is within the range of [0.01 - 100], and then power on again after modification.</p>
Type 2	Excessive position deviation	<p>The deviation of the current position pulse exceeds the setting value of [P0-26] (Position deviation limit). The possible reasons for this failure are:</p> <ol style="list-style-type: none"> <li>1. The U / V / W line of the motor is not connected or disconnected.</li> <li>2. The phase sequence of U / V / W wire of the motor is wrong.</li> <li>3. The motor is overloaded or stalled.</li> <li>4. The driver gain setting is unreasonable.</li> <li>5. The position reference speed changes too fast.</li> </ol>	Er.36	<ol style="list-style-type: none"> <li>1. Check whether the wiring of the motor power line U / V / W is normal.</li> <li>2. Check the load of the motor. If the load is too large, please replace the driver and motor with higher power. if the stall occurs, please check the machinery.</li> <li>3. Adjust the gain parameters according to the method in the chapter 6.3 in the user manual.</li> <li>4. When the change of the position reference speed is too large, the ramp time could be appropriately increased to reduce the speed change rate.</li> </ol>

Type 2	Torque saturation abnormal	<p>The torque reached the maximum torque limit value and exceeds the setting time of the [P1-19] function code. The possible reasons are:</p> <ol style="list-style-type: none"> <li>1. If the load is too large, the driver would output at the maximum torque and still couldnot reach the target speed within the predetermined time.</li> <li>2. Whether the maximum forward torque limit and maximum reverse torque limit are set too small.</li> <li>3. The motor stalls.</li> <li>4. [P1-19] The set torque limit time is too short.</li> </ol>	Er.37	<ol style="list-style-type: none"> <li>1. Check whether the load is too large.</li> <li>2. Modify the forward torque limit and maximum reverse torque limit to appropriate values according to the actual application.</li> <li>3. Check whether the machine stalls.</li> <li>4. Confirm whether the setting of function code [P1-19] is reasonable.</li> </ol>
Type 2	reserved		Er.38	
Type 2	Emergency stop	The drive received an emergency stop command	Er.39	<ol style="list-style-type: none"> <li>1. Check whether it is artificial emergency shutdown protection. If it is, then power on again after other system faults are cleared.</li> <li>2. If it is a false trigger, please check whether the wiring and function configuration of the DI terminal is normal.</li> </ol>
Type 3	ADC conversion is not completed	ADC conversion is not completed	Er.60	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 3	Internal software failure	Torque loop error	Er.61	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 3	Internal software failure	Speed loop error	Er.62	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 3	Internal software failure	Illegal instruction	Er.63	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 3	Internal software failure	Internal RAM parameters are corrupted	Er.64	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 3	Internal software failure	Internal function code parameters are corrupted	Er.65	Please power on again to determine whether the fault is eliminated. if the abnormality still occurs, please contact the manufacturer.
Type 4	Overspeed alarm	Speed exceeds alarm limit	A-81	Check whether the setting value of function code P1-14 is too small, and then check whether the speed reference is too high.
Type 4	overload	Motor overload alarm	A-82	Check whether the load of the motor is too large. If the load is too large, please replace

				the motor and driver with higher power.
Type 4	Brake resistor overheated or overload	<p>1. When the regenerative resistor is selected as the internal regenerative resistor, it means overheat.</p> <p>2. When the regenerative resistor is externally connected, it represents overload.</p>	A-83	<p>1.Please confirm whether the load inertia is too large.</p> <p>2.Please confirm whether it is frequently started and stopped and whether the speed is too high.</p> <p>3.Please check whether the actual resistance value is larger than the set value.</p>
Type 4	Parameters that required restart	Modify the parameters that need to be powered on to take effect again	A-84	Power on again or clear the alarm to make the alarm disappear.
Type 4	Receive position pulse when Servo is OFF	Receive pulse command in Servo non-SON state or non-position mode	A-85	Please check the timing sequence of the control signal from the host device. The pulse is still being sent when the Servo stops or is in non-position mode.
Type 4	Input pulse frequency is too high	The speed of the input reference is too high	A-86	Check whether the input frequency of the pulse and the number of pulses per round (P0-15) or the electronic gear ratio (P0-16 - P0-19) of the motor are set properly.
Type 4	reserved	reserved	A-87	reserved
Type 4	Instantaneous power failure of main circuit	The input voltage of the main circuit is momentarily low	A-88	Check whether there is voltage on the mains input, and then restart or clear the alarm. if the mains circuit voltage is normal, this alarm still exists, please contact the manufacturer.
Type 4	DI port configuration is duplicated	Different DI ports are set to the same function	A-89	Check the function code [DIDO Configuration], check the DI channel function selection: DI_1 channel function selection (P6-02) - DI_8 channel function selection (P6-23), and check whether there is any duplication of the 8 DI channel function selections. If you set the unwanted channels to off, power off and then power on again.
Type 4	DO port configuration is duplicated	Different DO ports are set to the same function	A-90	Check the function code [DIDO Configuration], check the DO channel function selection: DO_1 channel function selection (P6-26) - DO_4 channel function selection (P6-32), and check whether there is any duplication of the four DO channel function selections. If you set the unwanted channels to off, power off and then power on again.
Type 4	Parameters are modified too frequently	The frequency of communication to modify function code parameters is too frequent	A-91	Check whether the host computer frequently writes parameters and modify the corresponding parameter writing method
Type 4	reserved		A-92	
Type 4	reserved		A-93	

# 11 Modbus Register Address

## 11.1 Basic Setting

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P0-1	0x0001	1	Contral mode	-	16
P0-4	0x0004	4	Rotation direction	-	16
P0-5	0x0005	5	Servo stop mode at S-ON off	-	16
P0-9	0x0009	9	Regenerative resistor setting	-	16
P0-10	0x000A	10	External regenerative resistor resistance	Ω	16
P0-11	0x000B	11	External regenerative resistor power	W	16
P0-12	0x000C	12	Position pulse type selection	-	16
P0-13	0x000D	13	Position pulse frequency	kHz	16
P0-14	0x000E	14	Position pulse anti-interference level	-	16
P0-16	0x0010	16	Number of pulses per revolution of the motor	Pul	16
P0-17	0x0011	17	Electronic gear 1 numerator	-	16
P0-18	0x0012	18	Electronic gear 1 denominator	-	16
P0-19	0x0013	19	Electronic gear 2 numerator	-	16
P0-20	0x0014	20	Electronic gear 2 denominator	-	16
P0-21	0x0015	21	Pulse frequency division output direction	-	16
P0-22	0x0016	22	Number of output pulses per revolution of the motor	Pul	16
P0-23	0x0017	23	OZ polarity of Z pulse output	-	16
P0-25	0x0019	25	Position deviation limit	Pul	16

## 11.2 Control Parameter

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P1-1	0x0101	257	Speed reference source	-	16
P1-2	0x0102	258	Internal speed command	rpm	16
P1-3	0x0103	259	Acc. time	ms	16
P1-4	0x0104	260	Dec. time	ms	16
P1-7	0x0107	263	Torque reference source	-	16
P1-8	0x0108	264	Keypad setting value of torque reference	0.1%	16
P1-9	0x0109	265	Source of Speed Limit in Torque Mode	-	16



P1-10	0x010A	266	Maximum speed threshold	rpm	16
P1-11	0x010B	267	Warning speed threshold	rpm	16
P1-12	0x010C	268	Forward speed threshold	rpm	16
P1-13	0x010D	269	Backward speed threshold	rpm	16
P1-14	0x010E	270	Torque limit source	-	16
P1-15	0x010F	271	Forward rotation torque limit	0.1%	16
P1-16	0x0110	272	Backward rotation torque limit	0.1%	16
P1-19	0x0113	275	Torque saturation timeout	ms	16
P1-21	0x0115	277	Zero speed clamp function selection	rpm	16
P1-22	0x0116	278	Zero speed clamp speed threshold	rpm	16

### 11.3 Gain Adjustment

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P2-1	0x0201	513	1st position loop gain	0.1Hz	16
P2-2	0x0202	514	1st speed loop gain	0.1Hz	16
P2-3	0x0203	515	1st speed loop integration time constant	0.1ms	16
P2-4	0x0204	516	2nd position loop gain	0.1Hz	16
P2-5	0x0205	517	2nd speed loop gain	0.1Hz	16
P2-6	0x0206	518	2nd speed loop integration time constant	0.1ms	16
P2-7	0x0207	519	Second gain switching mode	-	16
P2-9	0x0209	521	Speed feedforward gain	0.1%	16
P2-10	0x020A	522	Speed feedforward filter	0.01ms	16
P2-11	0x020B	523	Torque feedforward gain	0.1%	16
P2-12	0x020C	524	Torque feedforward filter	0.01ms	16

### 11.4 Auto-tuning Parameter

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P3-1	0x0301	769	Load inertia ratio	0.01	16
P3-2	0x0302	770	Load level rigidity selection	-	16
P3-3	0x0303	771	Auto-tuning mode selection	-	16
P3-4	0x0304	772	Online inertia identification sensitivity	-	16
P3-5	0x0305	773	Number of inertia identification cycles	Revolution	16
P3-6	0x0306	774	Maximum speed of inertia identification	rpm	16
P3-7	0x0307	775	Parameter identification rotation direction	-	16
P3-8	0x0308	776	Parameter identification waiting time	ms	16

## 11.5 Vibration Inhabitation

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P4-1	0x0401	1025	Pulse reference filtering method	-	16
P4-2	0x0402	1026	Position reference first-order low-pass filter	ms	16
P4-3	0x0403	1027	Position reference average filter time constant	ms	16
P4-4	0x0404	1028	Torque filter time constant	0.01	16
P4-5	0x0405	1029	1st notch frequency	Hz	16
P4-6	0x0406	1030	1st notch depth	-	16
P4-7	0x0407	1031	1st notch width	-	16
P4-8	0x0408	1032	2nd notch frequency	Hz	16
P4-9	0x0409	1033	2nd notch depth	-	16
P4-10	0x040A	1034	2nd notch width	-	16

## 11.6 Signal Input/Output

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P5-1	0x0501	1281	AI_1 input bias	mV	16
P5-2	0x0502	1282	AI_1 input filter constant	0.01ms	16
P5-3	0x0503	1283	AI_1 dead zone	mV	16
P5-4	0x0504	1284	AI_1 zero shift	mV	16
P5-5	0x0505	1285	AI_2 input bias	mV	16
P5-6	0x0506	1286	AI_2 input filter constant	0.01ms	16
P5-7	0x0507	1287	AI_2 dead zone	mV	16
P5-8	0x0508	1288	AI_2 zero shift	mV	16
P5-9	0x0509	1289	the speed value corresponding to analog 10V	rpm	16
P5-10	0x050A	1290	the torque value corresponding to analog 10V	0.1%	16
P5-11	0x050B	1291	Positioning complete, positioning approach condition setting	-	16
P5-12	0x050C	1292	Positioning completion threshold	Pul	16
P5-13	0x050D	1293	Positioning approach threshold	Pul	16
P5-14	0x050E	1294	Set the positioning completion detection time window	ms	16
P5-15	0x050F	1295	Set the hold time of positioning completion output	ms	16
P5-16	0x0510	1296	Rotation speed detection threshold	rpm	16
P5-17	0x0511	1297	Speed consistent signal threshold	rpm	16
P5-18	0x0512	1298	Speed approaching signal threshold	rpm	16

P5-19	0x0513	1299	Zero speed output signal threshold	rpm	16
P5-20	0x0514	1300	Torque reached threshold	%	16
P5-21	0x0515	1301	Torque reached hysteresis	%	16

## 11.7 DI/DO Configuration

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P6-01	0x0601	1537	High-speed DI port filtering time	1us	16
P6-02	0x0602	1538	DI_1 Channel function selection	-	16
P6-03	0x0603	1539	DI_1 Channel logic selection	-	16
P6-04	0x0604	1540	DI_1 Input source selection	-	16
P6-05	0x0605	1541	DI_2 Channel function selection	-	16
P6-06	0x0606	1542	DI_2 Channel logic selection	-	16
P6-07	0x0607	1543	DI_2 Input source selection	-	16
P6-08	0x0608	1544	DI_3 Channel function selection	-	16
P6-09	0x0609	1545	DI_3 Channel logic selection	-	16
P6-10	0x060A	1546	DI_3 Input source selection	-	16
P6-11	0x060B	1547	DI_4 Channel function selection	-	16
P6-12	0x060C	1548	DI_4 Channel logic selection	-	16
P6-13	0x060D	1549	DI_4 Input source selection	-	16
P6-14	0x060E	1550	DI_5 Channel function selection	-	16
P6-15	0x060F	1551	DI_5 Channel logic selection	-	16
P6-16	0x0610	1552	DI_5 Input source selection	-	16
P6-17	0x0611	1553	DI_6 Channel function selection	-	16
P6-18	0x0612	1554	DI_6 Channel logic selection	-	16
P6-19	0x0613	1555	DI_6 Input source selection	-	16
P6-20	0x0614	1556	DI_7 Channel function selection	-	16
P6-21	0x0615	1557	DI_7 Channel logic selection	-	16
P6-22	0x0616	1558	DI_7 Input source selection	-	16
P6-23	0x0617	1559	DI_8 Channel function selection	-	16
P6-24	0x0618	1560	DI_8 Channel logic selection	-	16
P6-25	0x0619	1561	DI_8 Input source selection	-	16
P6-26	0x061A	1562	DO_1 Channel function selection	-	16
P6-27	0x061B	1563	DO_1 Channel logic selection	-	16
P6-28	0x061C	1564	DO_2 Channel function selection	-	16
P6-29	0x061D	1565	DO_2 Channel logic selection	-	16
P6-30	0x061E	1566	DO_3 Channel function selection	-	16
P6-31	0x061F	1567	DO_3 Channel logic selection	-	16

P6-32	0x0620	1568	DO_4 Channel function selection	-	16
P6-33	0x0621	1569	DO_4 Channel logic selection	-	16

## 11.8 Auxiliary Function

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P10-1	0x0A01	2561	JOG sped	rpm	16
P10-2	0x0A02	2562	Restore factory setting	-	16
P10-4	0x0A04	2564	Motor overload protection time coefficient	%	16

## 11.9 Communication Parameter

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P12-1	0x0C01	3073	Servo station number	-	16
P12-2	0x0C02	3074	baudrate	-	16
P12-3	0x0C03	3075	Serial data format	-	16
P12-4	0x0C04	3076	Write modbus communication data to EEPROM	-	16

## 11.10 VDI

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
P13-1	0x0D01	3329	VDI_1 input value	-	16
P13-2	0x0D02	3330	VDI_2 input value	-	16
P13-3	0x0D03	3331	VDI_3 input value	-	16
P13-4	0x0D04	3332	VDI_4 input value	-	16
P13-5	0x0D05	3333	VDI_5 input value	-	16
P13-6	0x0D06	3334	VDI_6 input value	-	16
P13-7	0x0D07	3335	VDI_7 input value	-	16
P13-8	0x0D08	3336	VDI_8 input value	-	16

## 11.11 Monitoring Parameter

Code	Modbus Address		Function	Unit	Bits
	Hex	Decimal			
U0-01	0x1E01	7681	Servo state	-	16
U0-02	0x1E02	7682	Servo motor speed	rpm	16
U0-03	0x1E03	7683	Enter speed command	rpm	16
U0-04	0x1E04	7684	Speed corresponding to input position reference	rpm	16
U0-05	0x1E05	7685	Pulse deviation	Pul	32
U0-07	0x1E07	7687	Pulse deviation *10000	Pul	32
U0-09	0x1E09	7689	input pulse number	Pul	32
U0-11	0x1E0B	7691	input pulse number *10000	Pul	32
U0-13	0x1E0D	7693	Encoder accumulative position	Pul	32
U0-15	0x1E0F	7695	Encoder accumulative position *10000	Pul	32
U0-17	0x1E11	7697	DI input signal state	-	32
U0-19	0x1E13	7699	DO output signal state	-	32
U0-21	0x1E15	7701	AI1 input voltage value	V	16
U0-22	0x1E16	7702	AI2 input voltage value	V	16
U0-23	0x1E17	7703	vibration frequency	Hz	16
U0-24	0x1E18	7704	Vibration amplitude	rpm	16
U0-25	0x1E19	7705	forward torque limitation	%	16
U0-26	0x1E1A	7706	backward torque limitation	%	16
U0-27	0x1E1B	7707	forward speed limitation	rpm	16
U0-28	0x1E1C	7708	backward speed limitation	rpm	16
U0-29	0x1E1D	7709	Mechanical angle	°	16
U0-30	0x1E1E	7710	Electric angle	°	16
U0-31	0x1E1F	7711	Bus voltage	V	16
U0-32	0x1E20	7712	Module temperature	°C	16
U0-33	0x1E21	7713	Instantaneous output power	W	32
U0-35	0x1E23	7715	total power-on time: hour	h	32
U0-37	0x1E25	7717	total power-on time:min	min	16
U0-38	0x1E26	7718	total power-on time:sec	s	16
U0-39	0x1E27	7719	Output load percentage	%	16
U0-40	0x1E28	7720	Power-on time: hour	h	32
U0-42	0x1E2A	7722	Power-on time: min	min	16
U0-43	0x1E2B	7723	Power-on time: sec	s	16
U0-44	0x1E2C	7724	Instantaneous braking resistance power	W	32
U0-46	0x1E2E	7726	Average braking resistance power	W	32

U0-48	0x1E30	7728	Power-on times	Times	32
U0-50	0x1E32	7730	Motor cumulative turns (x1)	Revolution	16
U0-51	0x1E33	7731	Motor cumulative turns (x10e4)	Revolution	16
U0-52	0x1E34	7732	Motor cumulative turns (x10e8)	Revolution	16
U0-53	0x1E35	7733	Motor model code	-	16
U1-01	0x1F01	7937	Current fault code	-	16
U1-02	0x1F02	7938	Current alarm code	-	16
U1-03	0x1F03	7939	phase U current upon displayed fault	A	16
U1-04	0x1F04	7940	phase V current upon displayed fault	A	16
U1-05	0x1F05	7941	Bus voltage upon displayed fault	V	16
U1-06	0x1F06	7942	IGBT temperature upon displayed fault	°C	16
U1-07	0x1F07	7943	Torque component when fault occurred	%	16
U1-08	0x1F08	7944	Excitation component when fault occurred	%	16
U1-09	0x1F09	7945	Position deviation when fault occurred	Pul	32
U1-11	0x1F0B	7947	Speed value when fault occurred	rpm	16
U1-12	0x1F0C	7948	the time when fault occurred	s	32
U1-14	0x1F0E	7950	Number of faults	-	16
U1-15	0x1F0F	7951	Number of warnings	-	16
U1-16	0x1F10	7952	Total number of historical faults	-	16
U1-17	0x1F11	7953	Total number of historical alarm	-	16
U1-18	0x1F12	7954	Last 2nd fault code	-	16
U1-19	0x1F13	7955	Last 3rd fault code	-	16
U1-20	0x1F14	7956	Last 4th fault code	-	16
U1-21	0x1F15	7957	Last 5th fault code	-	16
U1-22	0x1F16	7958	Last 6th fault code	-	16
U1-23	0x1F17	7959	Last 2nd alarm code	-	16
U1-24	0x1F18	7960	Last 3rd alarm code	-	16
U1-25	0x1F19	7961	Last 4th alarm code	-	16
U1-26	0x1F1A	7962	Last 5th alarm code	-	16
U1-27	0x1F1B	7963	Last 6th alarm code	-	16
U2-01	0x2001	8193	Product series	-	16
U2-02	0x2002	8194	model	-	16
U2-03	0x2003	8195	Model	-	16
U2-04	0x2004	8196	Firmware version	-	16
U2-05	0x2005	8197	Hardware version	-	16
U2-06	0x2006	8198	date of manufacture:year	year	16
U2-07	0x2007	8199	date of manufacture:month	Month	16
U2-08	0x2008	8200	date of manufacture:day	day	16
U2-09	0x2009	8201	Device serial number 1	-	16

U2-10	0x200A	8202	Device serial number 2	-	16
U2-11	0x200B	8203	Device serial number 3	-	16
U2-12	0x200C	8204	Device serial number 4	-	16
U2-13	0x200D	8205	Device serial number 5	-	16
U2-14	0x200E	8206	Device serial number 6	-	16
U2-15	0x200F	8207	Device serial number 7	-	16
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